PROMOTING MENTAL HEALTH AT WORK: NEW INSIGHTS AND PRACTICAL IMPLICATIONS

EDITED BY: Elisabeth Schramm, Claas Lahmann, Christine Allwang, Kai G. Kahl and Undine E. Lang

PUBLISHED IN: Frontiers in Psychiatry

frontiers Research Topics

ISSN 1664-8714
ISBN 978-2-88971-306-6
DOI 10.3389/978-2-88971-306-6

About Frontiers

Frontiers is more than just an open-access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers Journal Series

The Frontiers Journal Series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the Frontiers Journal Series operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to Quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews.
Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact

PROMOTING MENTAL HEALTH AT WORK: NEW INSIGHTS AND PRACTICAL IMPLICATIONS

Topic Editors:
Elisabeth Schramm, University of Freiburg Medical Center, Germany
Claas Lahmann, University of Freiburg Medical Center, Germany
Christine Allwang, Technical University of Munich, Germany
Kai G. Kahl, Hannover Medical School, Germany
Undine E. Lang, University Psychiatric Clinic Basel, Switzerland

Citation: Schramm, E., Lahmann, C., Allwang, C., Kahl, K. G., Lang, U. E., eds. (2021). Promoting Mental Health at Work: New Insights and Practical Implications. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88971-306-6

Table of Contents

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 03 September 2019
doi: 10.3389/fpsyt.2019.00622

Investigating the Role of Stress-Preventive Leadership in the Workplace Hospital: The Cross-Sectional Determination of Relational Quality by Transformational Leadership

Felicitas Stuber[1], Tanja Seifried-Dübon[1], Monika A. Rieger[2], Contributors of the SEEGEN Consortium, Stephan Zipfel[1], Harald Gündel[3] and Florian Junne[1]*

[1] Department of Psychosomatic Medicine and Psychotherapy, Medical University Hospital Tübingen, Tübingen, Germany, [2] Institute of Occupational and Social Medicine and Health Services Research, University Hospital Tübingen, Tübingen, Germany, [3] Department of Psychosomatic Medicine and Psychotherapy, Ulm University Medical Center, Ulm, Germany

OPEN ACCESS

Edited by:
Claas Lahmann, Freiburg University Medical Center, Germany

Reviewed by:
Loredana Lucarelli, University of Cagliari, Italy
Mirjam Körner, University of Freiburg, Germany
Christine Allwang, Technical University of Munich, Germany

***Correspondence:**
Felicitas Stuber
felicitas.stuber@med.uni-tuebingen.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *25 April 2019*
Accepted: *05 August 2019*
Published: *03 September 2019*

Citation:
Stuber F, Seifried-Dübon T, Rieger MA, Contributors of the SEEGEN Consortium, Zipfel S, Gündel H and Junne F (2019) Investigating the Role of Stress-Preventive Leadership in the Workplace Hospital: The Cross-Sectional Determination of Relational Quality by Transformational Leadership. Front. Psychiatry 10:622. doi: 10.3389/fpsyt.2019.00622

Introduction: A good relationship quality between leaders and staff members promotes mental health and prevents stress. To improve the relationship quality, it is important to identify variables which determine relationship quality at the workplace. Therefore, this study aims to identify specific leadership characteristics which support the development of a positive relationship between hospital leaders and staff members.

Methods: A cross-sectional study design was applied. A total number of 1,137 leaders (n = 315) and staff members (n = 822) of different professions (physicians, nursing staff, therapeutic professionals, administration staff, IT staff, clinical services, office assistants, scientists, others) working at a tertiary hospital in Germany assessed transformational leadership style as a staff-oriented leadership style and leader–member relationship quality by self-report questionnaires [integrative leadership questionnaire (FIF), leader–member exchange (LMX-7) questionnaire]. The data were statistically analyzed by mean comparisons and a multiple linear regression analysis.

Results: Leaders rated their own transformational leadership style (M = 3.98, SD = 0.43) systematically higher than staff members assessed their leader (M = 2.86, SD = 1.04). Evaluation of relationship quality showed similar results: leaders evaluated their relationship quality to one exemplary staff member higher (M = 4.06, SD = 0.41) than staff members rated their relationship quality to their direct leader (M = 3.15, SD = 0.97). From the staff members' perspective, four sub-dimensions of transformational leadership, that is, "individuality focus," "being a role model," "fostering innovations," and "providing a vision" showed large effect sizes in the regression analysis of relationship quality (R^2 = 0.79, F (14,690) = 189.26, $p < 0.001$, f = 1.94).

Discussion: The results of our study are in line with previous investigations in other working contexts and point to a profession-independent association as the professional

group of participants did not contribute to the variance explanation of the regression analysis. The exploration of potential determinants of relationship quality at work can, for example, support the development of leadership training programs with a focus on transformational leadership style. This might be an opportunity to foster high relationship quality between leaders and staff members and consequently might represent one strategy to prevent stress in the health care sector.

Keywords: transformational leadership, relationship quality, health care sector, staff members, leaders

INTRODUCTION

Considering the maintenance of employees' mental health as an operational task, and thus as a leader's task, has indeed an ethical aspect and is also a legal imperative in Germany. In 2012, the legal obligation of German employers to assess and reduce psychological health risks at the workplace was substantiated by an amendment of the respective German occupational health and safety act (1). Accordingly, the employer has to judge the risk to which employees are exposed to at their workplace including psychological stress at work and to determine which measures of occupational safety and health are necessary to reduce this risk. With regard to psychological stress at work, working conditions as well as social relationships (e.g., workplace bulling and harassment) and the working culture have to be addressed (2), with leadership being one important aspect.

Empirically, leadership has been found to be an important variable in relation to job performance (3, 4) as well as employees' health (5, 6). That is, different leadership styles are differentially associated with employees' job performance and mental health. Destructive leadership is defined as a deleterious behavior against a person and/or an organization in an active or passive way (7). It reduces productivity and has detrimental effects on the health of staff members (8), whereas appreciative leadership behavior leads to a higher work satisfaction (9), higher intention to stay at the present workplace (10), and higher well-being of staff members (11–13) as well as to improvements in leaders' own well-being (14).

A unifying characteristic of all these staff-oriented leadership behaviors is the importance of the relationship between leaders and staff members. A leadership approach that elaborates on this dyadic relation between direct leaders and their staff members is the leader–member exchange (LMX) approach [for an overview, see (15)]. The LMX approach targets the specific and individual dyad between one leader and one staff member. Thus, relationship quality between a leader and his/her various staff members can differ (16) and the development of the dyadic relationship can be described as a continuous process [e.g., Refs. (15, 17)].

A mature relationship has been positively related to several positive health and performance-oriented outcomes for staff members: for example, job performance (18), procedural distributive justice (19), and general job satisfaction (20). On the other hand, mature relationships were negatively related to turnover intention and role conflicts at work (3). Consequently, a mature relationship between leader and staff member is preferable at the workplace, although high relationship quality can be perceived as a rather abstract construct without clear recommendations on how to establish such relationships on a behavioral basis (21). Thus, research has tried to reveal factors that contribute to a mature leader–staff member relationship at the workplace on the part of staff members and leaders (3, 21). Although good relationships at the workplace are not only stress preventive for staff members but also for leaders, we decided to concentrate in this study on stress preventive implications for staff members (22).

In this study, we focused on behavioral leadership characteristics which have been found to be subject to change (23) and could explain a substantial variance of the quality of the leader–member relationship (3). The leadership style that has been found to be associated with mature leader–member relationships (3) is known as transformational leadership (24). Transformational leadership behavior is an appreciative and toward personal growth-oriented leadership style aiming to motivate staff members through, for example, long-term aims and adjustment of values. It supports staff members to focus not only on individual goals but also on group and organizational goals (25). Transformational leadership comprises six different core behaviors (25–27), which have been labelled as "fostering innovation," "team spirit development," "performance development," "individuality focus," "providing a vision," and "being a role model" (28).

Empirically, transformational leadership behavior shows robust relations to performance-oriented and health-oriented outcomes. Specifically, transformational leadership is associated with increased job performance (27, 29), work-related satisfaction, and motivation [e.g., Refs. (29, 30)], attachment to the leader (31), fewer days of absence due to sickness, and fewer critical incidents at the hospital [e.g., Ref. (32)], as well as less perceived stress and higher well-being [e.g., Refs. (33–36)].

Although the association of transformational leadership in general with improved quality of the leader–member relationship (LMX) seems well supported by the current literature (37–39), the specific sub-dimensions of the transformational leadership approach that foster the quality of the leader–member relationship have not been well researched to date. Furthermore, evidence is lacking especially with regard to specific working contexts and professional groups, such as at the workplace hospital.

To explore determinants that could be associated with higher relationship quality between leaders and staff members at the workplace hospital seems to be an important point as

relationship quality between the direct leader and her staff members is one of the few working conditions which can be influenced by leaders and staff members themselves and therefore constitutes an opportunity for stress prevention (33). As the workplace hospital is a psychologically demanding workplace where studies showed an increasing burnout and depression level in physicians (40) and where chronical work overload was also associated with poorer patient care (41, 42), maintaining psychological health, e.g., by strengthening relationship quality is of particular importance. Although professional groups within the workplace hospital differ in their every day work, they are unified by the fact of social interaction and relationships between leaders and staff members. Thus, further research is needed to clarify the specific determinants, as part of the transformational leadership behavior, that lead to improved leader–member relationships at this specific organization [for an overview on the relevance of context see Ref. (43)].

Therefore, this study was conducted in the context of a tertiary hospital in Germany to examine the association between transformational leadership sub-dimensions with the quality of the perceived leader–member relationship.

The study aims to answers the following research questions:

1. How do leaders perceive the quality of their relationship with staff members and vice versa?
2. Does the perception of transformational leadership differ between leaders and staff members?
3. In which way are the sub-dimensions of transformational leadership behavior associated with the quality of leader–member relationships from the view of staff members in the workplace hospital?

MATERIALS AND METHODS

Implementation

A cross-sectional online survey was conducted from May 23, 2018, to July 18, 2018, and was approved by the ethics committee of the University Hospital and Medical Faculty of Tübingen (622/2017BO2) as well as by the chief executive board and the employees' council of the tertiary hospital. Completion time for the online survey was about 10 min. Overall, N = 10,101 employees received the survey invitation and the response rate was 11.26%.

Materials

We created an online survey with questions on transformational leadership behavior and relationship quality using validated standardized instruments delivered *via* the Unipark survey software (QuestBack GmbH). Questions on both aspects were asked either from the leaders' or the staff members' perspective. That is, leaders evaluated their own leadership behavior, whereas staff members assessed their direct supervisor. To discriminate participating employees according to their hierarchy level, employees had to define themselves either as leaders or as staff members. Yet, there was no possibility to assess leaders and their directly associated team due to data protection requirements.

Questionnaire Assessing Transformational Leadership

The questionnaire used to assess the sub-dimensions of transformational leadership was the "integrative leadership" questionnaire (Fragebogen zur Integrativen Führung, FIF) (28), a standardized instrument which measures leadership and communication style in four modules. In our survey, we applied transformational leadership as one part of the "integrative leadership" questionnaire. The construct of transformational leadership in the questionnaire draws on the concept of Heinitz and Rowold (26) and Ref. (25), see **Figure 1** for more details). Participants were asked to rate 32 statements using a five-point Likert scale from 1 (agree not at all) to 5 (totally agree). The item ratings can be summarized in six different scale scores or in one overall transformational leadership score. The scales of transformational leadership show a sufficient internal consistency with Cronbach's α = 0.83–0.92 for the staff members' assessment provided by the manual (28) and Cronbach's α = 0.86–0.94 for the staff members' assessment by our study. In addition, Cronbach's α = 0.75–0.83 for the leaders' assessment provided by the manual (28) and Cronbach's α = 0.67–0.81 for the leaders' assessment by our study. The convergent validity of the transformational leadership scale of the FIF was confirmed by high correlations with the frequently used questionnaire Transformational Leadership Inventory (TLI) (25, 26).

Questionnaire Assessing the Quality of the Leader–Member Relationship

The LMX-7 questionnaire (15, 44) in its German version is based on the LMX model (15) which represents the relationship quality between leaders and staff members. It is a standardized unidimensional scale with seven items. Participants are asked to rate seven questions and statements on a five-point Likert scale from 1 (low relationship quality) to 5 (high relationship quality) either in a version for leaders to assess the relationship quality to one exemplary staff member or in a version for staff members to assess the relationship quality to their direct leader. Graen and Uhl-Bien (15) postulated that the LMX-7 measures the three highly correlated relationship aspects respect, trust, and obligation as one LMX dimension. The ratings of the participants can be summarized and presented through one overall LMX score. The LMX-7 has shown high internal consistency for staff members' ratings (Cronbach's α = 0.89 and α = 0.92), whereas internal consistence was not reported for leaders' rating (44). In our study, LMX-7 showed an internal consistency of α = 0.74 for leaders and α = 0.93 for staff members.

Statistical Analyses

For the description of the participants as well as for descriptive specifications of leadership behavior and relationship quality, mean (M), percentage (%) and distribution in the form of standard deviation (SD) were applied. To compare leaders' and staff members' ratings, we used *t*-tests as the data satisfied the

FIGURE 1 | Description of transformational leaderships sub-dimensions (translated by the authors from the description by 28, pp. 8–9).

condition of normal distribution. To determine the effect size of mean comparisons, Cohen's d was applied. A result of $d \leq 0.2$ can be interpreted as a small, $d \leq 0.5$ as a medium, and $d \leq 0.8$ as a large effect size (45). Moreover, a multiple linear regression was conducted to explore the association between transformational leadership subdimensions and LMX overall score. Assumptions of multiple regressions (linearity, normality, homoscedasticity, and independence of residuals) were checked, and *f* was reported for the effect size. A result of $f \leq 0.10$ can be interpreted as a small, $f \leq 0.25$ as a medium and $f \leq 0.40$ as a large effect (46). The level of significance was set for all analyses to $\alpha = 0.05$, and all analyses were conducted by using IBM SPSS version 25. For multiple comparisons, we adjusted alpha levels by Bonferroni correction. Total scores of transformational leadership behavior and relationship quality were only calculated when no missing values occurred in sub-dimensions. Concerning the linear multiple regression, cases were only included when no values of subdimensions and total scores were missing. As the variable *Professional Group* was categorial with the categories: physicians, nursing staff, therapeutic professionals, administration staff, IT staff, clinical services, office assistants, scientists, and other professions, dummy coding was used for the linear multiple regression. For the baseline group, the category Administration staff was chosen as this professional group was the largest.

A dummy variable is defined in our linear multiple regression as the difference in relationship quality perception for the administration staff and one other professional group [either physicians or nursing staff or therapeutic professionals or IT staff or clinical services or office assistants or scientists or other professions; for a detailed description of dummy coding, see Ref. (47), p. 208–215].

RESULTS

Population

A total of 1,137 employees of a tertiary hospital in Germany participated in the study, with 315 (27.7%) identifying themselves as leaders and 822 (72.3%) as staff members without leadership responsibilities. Of the staff members, 554 (74.8%) were female and 187 (25.2%) were male, whereas in the leader group 174 (59.6%) were female and 118 (40.4%) were male. One hundred four participants provided no information on their gender. For detailed information on the characteristics of the participants, see **Tables 1**–**2**.

TABLE 1 | Age group frequencies depending on hierarchy level.

Age groups in years	Hierarchical group			
	Staff members		Leaders	
	%	n	%	n
<20–24	3.7	30	0.3	1
25–30	15.1	123	3.5	11
31–35	11.2	91	9.3	29
36–40	12.6	103	12.2	38
41–45	8.6	70	15.1	47
46–50	13.7	112	13.5	42
51–54	15.1	123	17.6	55
>55	20.1	164	28.5	89

%, percent; n, number of participants; n = 6 staff members and n = 3 leaders didn't provide information on their age, N = 1128.

Transformational Leadership Behavior at the Hospital

Leaders (M = 3.98, SD = 0.43, n = 275) and staff members (M = 2.86, SD = 1.04, n = 737) differed significantly in their perception of the total transformational leadership score at their workplace [t (1,000.31) = −24.21, $p < .001$, $d = 1.23$]. Leaders assessed themselves as leading more transformational than the staff members evaluated their direct leaders. This result was seen for all sub-dimensions as well: leaders rated themselves in all dimensions higher than staff members evaluated their leaders (see **Table 3**). Expect one sub-dimension (performance development) which revealed a medium size effect, all other sub-dimensions showed a high effect size.

LMX at the Hospital

Leaders and staff members perceived the relationship quality between leaders and staff members at the hospital in significantly different ways [t (1054.83) = −21.68, $p < .001$]. Leaders (M = 4.06, SD = 0.41, n = 293) rated the relationship quality they offered to one exemplary staff members higher than the subordinates rated their relationship quality with their direct leaders (M = 3.15, SD = 0.97, n = 777).

Sub-Dimensions of Transformational Leadership as Potential Determinants of Relationship Quality from a Staff Members' Perspective

vLinear multiple regression analysis was applied to assess the extent to which the sub-dimensions of transformational leadership behavior determine the variance of the perceived relationship quality at the hospital from a staff members' perspective. Professional groups of the staff members (see **Table 2**) were also entered as dummy variables into the linear multiple regression to control potential professional related differences in the association of transformational leadership and relationship quality. All assumptions of multiple regression analysis were met, and predictors were all entered simultaneously

TABLE 2 | Proportion of professional groups depending on hierarchy level and depending on professional groups overall.

Professional groups	Hierarchical level				Overall	
	Staff members		Leaders			
	%	n	%	n	%	n
Physicians	53.8	84	46.2	72	13.7	156
Nursing staff	67.6	142	32.4	68	18.5	210
Therapeutic professionals[a]	80.8	59	19.2	14	6.4	73
Administration	70.4	157	29.6	66	19.6	223
IT	78.9	56	21.1	15	6.2	71
Clinical services[b]	72.7	8	27.3	3	1.0	11
Office assistants	89.3	100	10.7	12	9.9	112
Scientists	77.0	87	23.0	26	9.9	113
Others	76.8	129	23.2	39	14.8	168

%, percent; n, number of participants, N = 1137.

[a]*e.g. physiotherapist, psychotherapist.*

[b]*e.g. caretaker service, catering.*

TABLE 3 | Leaders' and subordinates' ratings of transformational leadership sub-dimensions.

Sub-dimensions of TFL	Staff members			Leaders					
	M	*SD*	*n*	*M*	*SD*	*n*	*t(df)*	*p*	*d*
Fostering innovations	3.15	1.10	811	4.27	0.50	307	(1,082.34) = −23.38	<.001	1.15
Team spirit development	2.84	1.18	805	4.07	0.60	304	(1,017.23) = −22.69	<.001	1.17
Performance development	2.89	1.09	794	3.66	0.73	300	(799.81) = −13.30	<.001	0.77
Individuality focus	2.78	1.22	805	4.02	0.61	307	(1,038.91) = −22.41	<.001	1.14
Providing a vision	2.55	1.17	798	3.57	0.74	306	(872.58) = −17.26	<.001	0.96
Being a role model	3.00	1.30	803	4.35	0.55	299	(1,085.18) = −24.26	<.001	1.18

TFL, transformational leadership; M, mean; SD, standard deviation; n, number of included participants; t, t-test statistic; df, degrees of freedom; p, p-value; d, Cohen's d.

into the model (see **Table 4** for correlations of continuous variables). The result of the linear multiple regression analysis is presented below in **Table 5**.

The total variance of relationship quality that could be explained by this model was 79% [$R^2 = 0.79$, F (14,690) = 189.26, $p < .001$] which corresponded to a large effect ($f = 1.94$). The sub-dimensions "fostering innovation," "individuality focus," "providing a vision," and "being a role model" were included as significant determinants of the variance explanation. Standardized beta values (β) revealed that on a single factor level the sub-dimensions "individuality focus" and "being a role model" made the strongest contribution to explain the variance of relationship quality.

DISCUSSION

To our knowledge, this is the first study which investigates sub-dimensions of transformational leaderships and the quality of leader–member relationships across all professions in the workplace hospital from leaders' and staff members' point of view. Leaders and staff members' perception of

TABLE 4 | Intercorrelations of transformational leadership sub-dimensions and relationship quality from a staff members' perspective.

Variables	1	2	3	4	5	6	7
1. Staff members' total LMX	—	0.78***	0.76***	0.66***	0.84***	0.77***	0.80***
2. Fostering innovations		—	0.78***	0.70***	0.75***	0.77***	0.77***
3. Team spirit development			—	0.71***	0.74***	0.74***	0.78***
4. Performance development				—	0.62***	0.75***	0.70***
5. Individuality focus					—	0.74***	0.73***
6. Providing a vision						—	0.78***
7. Being a role model							—

*Pearson correlations for staff members (n = 705) are presented above the diagonal. *** p < .001.*

TABLE 5 | Linear multiple regression analysis for staff members' perception of relationship quality.

Sub-dimensions	*B*	*SE(B)*	β	*t*	*p*	*CI(B)*
Constant	0.93	0.06	—	14.49	<0.001	0.80–1.05
Admin. vs Physicians	−0.11	0.07	−0.04	−1.70	0.09	−0.24 to 0.02
Admin. vs nursing staff	−0.12	0.06	−0.04	−1.92	0.06	−0.22 to 0.00
Admin. vs Therapeutic professionals	−0.02	0.07	−0.06	−0.32	0.75	−0.17 to 0.12
Admin. vs IT staff	−0.02	0.08	−0.01	−0.24	0.81	−0.18 to 0.13
Admin. vs Clinical services	0.11	0.23	0.01	0.50	0.62	−0.34 to 0.56
Admin. vs Office assistants	−0.08	0.06	−0.03	−1.24	0.22	−0.20 to 0.05
Admin. vs Scientists	−0.04	0.07	−0.01	−0.056	0.58	−0.17 to 0.09
Admin. vs Other professions	0.04	0.06	0.02	0.69	0.49	−0.07 to 0.15
Fostering innovation	0.11	0.03	0.13	3.66	<0.001	0.05–0.17
Team spirit development	0.05	0.03	0.07	1.96	0.05	0.00–0.11
Performance development	0.02	0.03	0.02	0.63	0.53	−0.03 to 0.07
Individuality focus	0.35	0.02	0.43	14.52	<0.001	0.30 to 0.39
Providing a vision	0.08	0.03	0.09	2.62	<0.01	0.02 to 0.13
Being a role model	0.19	0.03	0.25	7.55	<0.001	0.14 to 0.24

B, unstandardized coefficient; SE, standard error of B; β, standardized coefficient Beta; t, t-test; p = p-value; CI, confidence interval of B, n = 705 subordinates; Admin., Administration staff, $R^2 = 0.79$, F (14,690) = 189.26, $p < .001$.

transformational leadership and relationship quality at the workplace hospital differed significantly on an overall basis and at a dimensional level. That is, leaders rated transformational leadership behavior and relationship quality higher than the staff members of the same hospital did. Furthermore, the results provide insight into the association between the sub-dimensions of transformational leadership and relationship quality from a staff members' point of view: The sub-dimensions "individuality focus," "being a role model," "fostering innovations," and "providing a vision" explained 79% of the variance of the perceived relationship quality, whereas the professional group of staff members could not contribute to the variance explanation.

When comparing our rating results of transformational leadership to the results of a representative sample of German leaders and subordinates provided by the manual of the questionnaire of integrative leadership (FIF) (28), the ratings of our sample can be located in the lower half of the average range. That is, transformational leadership was perceived as average in our sample with a tendency to lower staff members' ratings.

Relationship quality has been examined with the here used questionnaire LMX-7 in the health sector before (48). Research showed scale values for staff members' perception of LMX relating to their direct leader in the medium range between 3.34 and 3.36 (21) and 3.32 (49). Our results are comparable to these study results with the tendency to lower staff members' ratings parallel to the ratings of transformational leadership. Although our rating results seem at least comparable to other study results, taking into account relationship qualities' impact on staff members' well-being (50) and the potential improvement through transformational leadership with regard to fewer undesirable patient outcomes (e.g., medication errors), more job satisfaction (30), and higher occupational and patient safety culture in hospitals (51) an increasing rate of transformational leadership behavior and relational quality might be seen as desirable for the workplace hospital.

According to the rating discrepancy between leaders and staff members previous studies discussed that employees tended to rate their job performance more positively and less variably in self-assessments compared with other sources (e.g., peers, supervisors, subordinates) because of more indulgence and less discriminant validity (52). This result seems in line with our findings where leaders rated their transformational leadership behavior more positively and had less variance in their assessments than staff members showed in their ratings of transformational leadership behavior of their direct leaders. The ratings of the participating leaders in our sample could be contaminated by social desirability, similar to the results of Sarros et al. (53) who found significant correlations between personality characteristics (e.g. courage, compassion) and social desirability in leaders' self-assessments.

Aside from this potential bias, it is worthwhile to discuss the meaning of such different perceptions of leaders and staff members concerning transformational leadership on an organizational level. Aarons et al. (54) interpreted these different perceptions as clues to the organizational culture quality. The results of their study showed an association between transformational leadership rating and organizational culture: the higher the rating discrepancy between leaders and staff members, the worse the organizational culture was, especially when leaders rated themselves as better than their staff members did. This shows the need to shorten the rating distance between leaders and staff members, although leaders' and staff members' rating cannot be related to each other directly.

To get a better understanding of what leaders can contribute to relationship quality from a staff members' perspective, we ran a regression analysis with the result that four sub-dimensions of transformational leadership behavior ("individuality focus," "being a role model," "fostering innovations," and "providing a vision") significantly determined the relationship quality between leaders and staff members, whereas the professional group of the staff members did not contribute to the variance explanation. These findings may support the theoretical assumptions and empirical approaches of previous research that transformational leadership is associated positively with the LMX model (15, 20, 24, 38).

To discuss and classify the impact of the four sub-dimensions of transformational leadership on relationship quality a comparison to other study results concerning the dimensions "individuality focus," "being a role model" and "providing a vision" is possible whereas the dimension "forstering innovation" has not been found to determine relationship quality before. That is, the explanation for the impact of the dimension fostering innovation is rather speculative. The effect of the dimension "fostering innovation" could be explained by the health care sector as study context: Employees working there could show a higher affinity to innovations in general as improving patient care through innovative treatment methods can be seen as one important part of medical advance which is important for employees' every day work in the health care sector. Although the association of "fostering innovations" and relationship quality has not been explained explicit yet, this dimension has been associated significantly positive to other staff-oriented variables like job satisfaction, affective commitment and organizational citizenship behavior (28).

The dimensions "individuality focus" and "being a role model" could explain a considerable higher part of variance than "fostering innovations" in the performed regression analysis. Both aspects could be seen as a part of high employee orientation and are in line with other empirical approaches. Deluga (55) examined the relationship of transformational leadership and relationship quality on a sub-dimensional level as well. He found on the basis of the four factorial transformational leadership model (56) the sub-dimension "charisma" [corresponding to parts of the sub-dimension "providing a vision" and "being a role model" in our study; see Ref. (28)] and "individual consideration" [corresponding to the sub-dimension "individuality focus" in our study; see Ref. (28)] as two predictors for relationship quality in the military context. Yukl et al. (57) showed in their study that the transformational leadership sub-dimensions "leading by example" [corresponding to the sub-dimension "being a role

model" in our study; see Ref. (28)] could explain parts of the variance of relationship quality.

Our results revealed comparable sub-dimensions of transformational leadership related to relationship quality for the hospital context as Deluga (55) found for the context of the U.S. Navy. This concordance has been shown despite very different working contexts and thereby could lead to the assumption that the relation of transformational leadership subdimensions and relationship quality could be quite independent of the working context. The idea of generalization is also supported by the result of our regression analysis that the professional group of staff members did not contribute to the variance explanation of relationship quality. The association between transformational leadership and relationship quality is independent of the professional group in our study. Future investigations could examine this aspect further by including first and secondary care hospitals or focusing on other sectors. For example, the economic sector where leaders have more direct access to monetary resources, as studies have shown that transformational leadership style is especially relevant when leaders have no direct access to monetary reward systems (29) and when workplaces are more hierarchically structured (36), which are both applicable for our study as well as for Deluga's (55) study context but won't fit to the economic sector in the same way.

Further research is needed to investigate the effect level of sub-dimensions of transformational leadership behavior (e.g. individual level, dyadic level, group level or organizational level). Seltzer and Bass (58) assumed that the sub-dimension "charisma" and thus also the sub-dimension e.g., "providing a vision" mainly have an effect on a dyadic level as well as the outcome variable relationship quality. We assume that "individuality focus" and "being a role model" could also show an effect on a dyadic level as they can be perceived as the relationship-based sub-dimensions of transformational leadership.

Limitations

First, ratings of leaders and staff members cannot be associated directly with each other (the leaders rated by staff members might not be the ones that have participated in the study). That is, it could be possible that the most transformational leaders and the most unsatisfied staff members participated and distorted the survey results in the respective directions. Future studies should aim to enable the connection between a leader's self-ratings and the ratings of their actual respective staff members. Second, future investigations need to use more than just one measurement method (e.g., self report questionnaires and qualitative data from outside observers). As the exclusive use of self-report tools is an important limitation of our study. Third, we had a low response rate, and participation in our survey was voluntary, which may also have rendered the sample less representative with, for example, the more motivated employees participating. Fourth, the cross-sectional design hinders causal inference from the study results but gave the opportunity to consider the relation of transformational leadership sub-dimensions and relationship quality without adding any temporal variables in this early stage of study (59). Another point is the high proportion of variance explanation in the regression analysis which could be a hint for overestimation of the relation between the sub-dimensions of transformational leadership and relationship quality although the two constructs can be distinguished by their theoretical background: Whereas transformational leadership focuses on leadership behavior, the model of relationship quality refers to the relationship between leaders and staff members. Despite this potential overestimation, the investigated association can be seen as one important part of relationship quality research besides other examined determinants like subordinates' characteristics, interactional characteristics, and context variables (60).

To sum up, the hypotheses that can be raised from our results may well justify future studies that employ interventional longitudinal designs to enlighten the effects of transformational leadership on relationship quality as well as the by now theoretical based assumption that there is an opportunity to prevent stress by fostering relationship quality.

Practical Implication

This study explored specific determinants of relationship quality in the workplace hospital to explore opportunities to enhance relationship quality. Based on our results first, leaders should remember that their transformational leadership behavior could have an impact on the relationship quality with their staff members. And that by fostering the relationship quality, an opportunity to prevent stress in their staff members comes along. Second, leaders should get the opportunity to participate in leadership training programs to reflect, develop, and improve their transformational leadership skills. Studies have already shown that transformational leadership can be improved by leadership interventions (61, 62).

The next step should be to assess whether this can lead to a change in perceived relationship quality as an important working condition regarding staff members' well-being in the health care sector. Besides other important measures (e.g. reduction of high quantitative demands, improving personnel shortage, addressing the hazardous of working with critical ill patients), this ultimately might represent one of the promising strategies to prevent stress-related disorders in the health workforce.

CONTRIBUTORS OF THE SEEGEN CONSORTIUM

Eva Rothermund, Nadine Mulfinger, Mark Jarczok, Department of Psychosomatic Medicine and Psychotherapy Ulm University Medical Center, Ulm, Germany; Peter Angerer, Institute of Occupational and Social Medicine University Hospital Düsseldorf, Düsseldorf, Germany; Imad Maatouk, Clinic of General Internal Medicine and Psychosomatic, Heidelberg, Germany; Andreas Müller, Faculty of Educational Science Work and Organizational Psychology, Essen, Germany; Bernd Puschner, Department of Psychiatry and Psychotherapy II Ulm

University and Bezirkskrankenhaus Günzburg, Ulm, Germany; Jochen Schweitzer-Rothers, Institute for Medical Psychology University Hospital Heidelberg, Heidelberg, Germany; Stefan Süß, Department of Business Administration, in particular Work, Human Resource Management and Organization Studies Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany; Ute Ziegenhain, Clinic of Child- and Adolescents Psychiatry/ Psychotherapy University Hospital Ulm, Ulm, Germany.

DATA AVAILABILITY

The implementation of this study had to be approved by the chief executive board and the employees' council of the tertiary hospital. This approval required that raw data were only made available to direct project associates.

ETHICS STATEMENT

The study was approved by the ethics committee of the University Hospital and Medical Faculty of Tübingen (622/2017BO2) named Ethik-Kommission an der Medizinischen Fakultät der Eberhard-Karls-Universität und am Universitätsklinikum Tübingen and was carried out in accordance with the recommendations of the ICH-GCP-guidelines, Declaration of Helsinki. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

FS, TS-D, and FJ planned and conducted the study. MR, SZ and HG as well as the contributors of the SEEGEN Consortium gave feedback and support during the writing process of the manuscript.

FUNDING

The study was partly funded by the Federal Ministry of Education and Research within the "SEEGEN"-study (FKZ 01GL1752C) and by the institutions own financial resources.

ACKNOWLEDGMENTS

The work of the Institute of Occupational and Social Medicine and Health Services Research Tuebingen is supported by an unrestricted grant of the employers' association of the metal and electric industry Baden-Württemberg (Südwestmetall). We acknowledge additional financial support from the German Research Foundation and the Open Access Publishing Fund of the University of Tuebingen, and the administrative support by the DLR Project Management Agency. This study is also part of the lead author's (FS) work toward a doctoral degree. FS receives a PhD grant by the "Konrad-Adenauer-Stiftung" (Konrad Adenauer Foundation).

REFERENCES

1. Federal Ministry of Labour and Social Affairs. Act on the Implementation of Measures of Occupational Safety and Health to Encourage Improvements in the Safety and Health Protection of Workers at Work (2013).
2. Beck D, Berger S, Breutmann N, Fergen A, Gregersen S, Morschhäuser M, et al. *Arbeitsschutz in der Praxis. Empfehlungen zur Umsetzung der Gefährdungsbeurteilung psychischer Belastung*. 2. ed. Berlin: Bundesministerium für Arbeit und Soziales (2016).
3. Dulebohn JH, Bommer WH, Liden RC, Brouer RL, Ferris GR. A meta-analysis of antecedents and consequences of Leader-Member Exchange: integrating the past with an eye toward the future. *J Manag* (2011) 38(6):1715–59. doi: 10.1177/0149206311415280
4. Gottfredson RK, Aguinis H. Leadership behaviors and follower performance: deductive and inductive examination of theoretical rationales and underlying mechanisms. *J Organ Behav* (2017) 38(4):558–91. doi: 10.1002/job.2152
5. Morsiani G, Bagnasco A, Sasso L. How staff nurses perceive the impact of nurse managers' leadership style in terms of job satisfaction: a mixed method study. *J Nurs Manag* (2017) 25(2):119–28. doi: 10.1111/jonm.12448
6. Skakon J, Nielsen K, Borg V, Guzman J. Are leaders' well-being, behaviours and style associated with the affective well-being of their employees? A systematic review of three decades of research. *Work Stress* (2010) 24(2):107– 39. doi: 10.1080/02678373.2010.495262
7. Thoroughgood CN, Tate BW, Sawyer KB, Jacobs R. Bad to the bone: empirically defining and measuring destructive leader behavior. *J Leadersh Organ Stud* (2012) 19(2):230–55. doi: 10.1177/1548051811436327
8. Schyns B, Schilling J. How bad are the effects of bad leaders? A meta-analysis of destructive leadership and its outcomes. *Leadersh Q* (2013) 24(1):138–58. doi: 10.1016/j.leaqua.2012.09.001
9. Winkler E, Busch C, Clasen J, Vowinkel J. Changes in leadership behaviors predict changes in job satisfaction and well-being in low-skilled workers: a longitudinal investigation. *J Leadersh Organ Stud* (2014) 22(1):72–87. doi: 10.1177/1548051814527771
10. Cowden T, Cummings G, Profetto-McGrath J. Leadership practices and staff nurses' intent to stay: a systematic review. *J Nurs Manag* (2011) 19(4):461–77. doi: 10.1111/j.1365-2834.2011.01209.x
11. Finne LB, Christensen JO, Knardahl S. Psychological and social work factors as predictors of mental distress: a prospective study. *PLoS One* (2014) 9(7) e102514. doi: 10.1371/journal.pone.0102514
12. Kuoppala J, Lamminpaa A, Liira J, Vainio H. Leadership, job well-being, and health effects–a systematic review and a meta-analysis. *J Occup Environ Med* (2008) 50(8):904–15. doi: 10.1097/JOM.0b013e31817e918d
13. Schmidt B, Herr RM, Jarczok MN, Baumert J, Lukaschek K, Emeny RT, et al. Lack of supportive leadership behavior predicts suboptimal self-rated health independent of job strain after 10 years of follow-up: findings from the population-based MONICA/KORA study. *Int Arch Occup Environ Health* (2018) 91(5):623–31. doi: 10.1007/s00420-018-1312-9
14. Luk LA. Assessment of a leadership enhancement program for nursing managers of an acute general hospital in Hong Kong. *Open Nurs J* (2018) 12:133–41. doi: 10.2174/1874434601812010133
15. Graen GB, Uhl-Bien M. Relationship-based approach to leadership: development of leader-member exchange (LMX) theory of leadership over 25 years: applying a multi-level multi-domain perspective. *Leadersh Q* (1995) 6:219–47. doi: 10.1016/1048-9843(95)90036-5
16. Martin R, Thomas G, Legood A, Dello Russo S. Leader–member exchange (LMX) differentiation and work outcomes: conceptual clarification and critical review. *J Organ Behav* (2017) 39(2):151–68. doi: 10.1002/job.2202
17. Schyns B, Day D. Critique and review of leader-member exchange theory: issues of agreement, consensus, and excellence. *Eur J Work Organ Psychol* (2010) 19(1):1–29. doi: 10.1080/13594320903024922
18. Schriesheim CA, Castro SL, Cogliser CC. Leader-member exchange (LMX) research: a comprehensive review of theory, measurement, and

data-analytic practices. *Leadersh Q* (1999) 10(1):63–113. doi: 10.1016/S1048-9843(99)80009-5
19. Kivimäki M, Elovainio M, Vahtera J, Ferrie J. Organisational justice and health of employees: prospective cohort study. *J Occup Environ Med* (2003) 60(1):27–34. doi: 10.1136/oem.60.1.27
20. Gerstner CR, Day DV. Meta-analytic review of leader–member exchange theory: correlates and construct issues. *J Appl Psychol* (1997) 82(6):827. doi: 10.1037//0021-9010.82.6.827
21. Gregersen S, Vincent-Höper S, Nienhaus A. Job-related resources, leader–member exchange and well-being—A longitudinal study. *Work Stress* (2016) 30(4):356–73. doi: 10.1080/02678373.2016.1249440
22. Junne F, Michaelis M, Rothermund E, Stuber F, Gündel H, Zipfel S, et al. The role of work-related factors in the development of psychological distress and associated mental disorders: differential views of human resource managers, occupational physicians, primary care physicians and psychotherapists in Germany. *Int J Environ Res Public Health* (2018) 15(3):559. doi: 10.3390/ijerph15030559
23. Kelloway EK, Barling J, Helleur J. Enhancing transformational leadership: the roles of training and feedback. *Leadership Org Dev* (2000) 21(3):145–9. doi: 10.1108/01437730010325022
24. Bass BM. Two decades of research and development in transformational leadership. *Eur J Work Organ Psychol* (1999) 8:9–32. doi: 10.1080/135943299398410
25. Podsakoff PM, MacKenzie SB, Moorman RH, Fetter R. Transformational leader behaviors and their effects on followers' trust in leader, satisfaction, and organizational citizenship behaviors. *Leadersh Q* (1990) 1:107–42. doi: 10.1016/1048-9843(90)90009-7
26. Heinitz K, Rowold J. Gütekriterien einer deutschen adaptation des Transformational Leadership Inventory (TLI) von Podsakoff. *Zeitschrift für Arbeits- und Organisationspsychologie A&O* (2007) 51(1):1–15. doi: 10.1026/0932-4089.51.1.1
27. Podsakoff PM, MacKenzie SB, Bommer WH. Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship behaviors. *J Manag* (1996) 22(2):259–98. doi: 10.1177/014920639602200204
28. Rowold J, Poethke U. *Fragebogen zur Integrativen Führung. FIF*. Bern: Hogrefe (2017).
29. Judge TA, Piccolo RF. Transformational and transactional leadership: a meta-analytic test of their relative validity. *J Appl Psychol* (2004) 89(5):755–68. doi: 10.1037/0021-9010.89.5.755
30. Boamah SA, Spence Laschinger HK, Wong C, Clarke S. Effect of transformational leadership on job satisfaction and patient safety outcomes. *Nurs Outlook* (2018) 66(2):180–9. doi: 10.1016/j.outlook.2017.10.004
31. Molero F, Moriano JA, Shaver PR. the influence of leadership style on subordinates' attachment to the leader. *Span J Psychol* (2013) 16:E62. doi: 10.1017/sjp.2013.67
32. Lee D, Coustasse A, Sikula A, Sr. Transformational leadership and workplace injury and absenteeism: analysis of a national nursing assistant survey. *Health Care Manag Rev* (2011) 36(4):380–7. doi: 10.1097/HMR.0b013e3182100bf7
33. Montano D, Reeske A, Franke F, Hüffmeier J. Leadership, followers' mental health and job performance in organizations: a comprehensive meta-analysis from an occupational health perspective. *J Organ Behav* (2017) 38(3):327–50. doi: 10.1002/job.2124
34. Nielsen K, Randall R, Yarker J, Brenner S-O. The effects of transformational leadership on followers' perceived work characteristics and psychological well-being: a longitudinal study. *Work Stress* (2008) 22(1):16–32. doi: 10.1080/02678370801979430
35. Sosik JJ, Goldshalk V. Leadership styles, mentoring functions received, and job-related stress: a conceptual model and preliminary study. *J Organ Behav* (2000) 21(4):365–90. doi: 10.1002/(SICI)1099-1379(200006)21:4<365::AID-JOB14>3.0.CO;2-H
36. Zwingmann I, Wegge J, Wolf S, Rudolf M, Schmidt M, Richter P. Is transformational leadership healthy for employees? a multilevel analysis in 16 nations. *Ger J Res Hum Resour Manag* (2014) 28(1–2):24–51. doi: 10.1177/239700221402800103
37. Howell JM, Hall-Merenda KE. The ties that bind: the impact of leader-member exchange, transformational and transactional leadership, and distance on predicting follower performance. *J Appl Psychol* (1999) 84(5):680. doi: 10.1037//0021-9010.84.5.680
38. Lee J. Effects of leadership and leader-member exchange on innovativeness. *J Manag Psychol* (2008) 23(6):670–87. doi: 10.1108/02683940810894747
39. Piccolo RF, Colquitt JA. Transformational leadership and job behaviors: the mediating role of core job characteristics. *Acad Manag J* (2006) 49(2):327–40. doi: 10.5465/amj.2006.20786079
40. Petrie K, Crawford J, Baker STE, Dean K, Robinson J, Veness BG. Interventions to reduce symptoms of common mental disorders and suicidal ideation in physicians: a systematic review and meta-analysis. *Lancet Psychiatry* (2019) 6(3):225–34. doi: 10.1016/S2215-0366(18)30509-1
41. Leistner R. Personalmangel in Krankenhäusern. *Krankenhaushygiene up2date* (2014) 08:53–64. doi: 10.1055/s-0034-1365026
42. Michalsen A, Hillert A, Schießl A, Hinzmann D. Burnout in der Intensivmedizin. [Burnout in Intensive Care]. *Dtsch Med Wochenschr* (2018) 143(01):21–6. doi: 10.1055/s-0043-109258
43. Johns G. Advances in the treatment of context in organizational research. *Annu Rev Organ Psychol Organ Behav* (2018) 5:21–46. doi: 10.1146/annurev-orgpsych-032117-104406
44. Schyns B. Überprüfung einer deutschsprachigen skala zum leader-member-exchange-ansatz. [Evaluation of a German scale for the assessment of leader-member exchange.]. *Zeitschrift für Differentielle und Diagnostische Psychologie* (2002) 23(2):235–45. doi: 10.1024//0170-1789.23.2.235
45. Cohen J. *Statistical power analysis for the behavioral sciences*. 2 ed. New York Lawrence Erlbaum Associates (1988).
46. Cohen J. A power primer. *Psychol Bull* (1992) 122(1):155–9. doi: 10.1037//0033-2909.112.1.155
47. Field A. *Discovering Statistics Using SPSS*. 2 ed. London: SAGE Publications (2005).
48. Chen C-HV, Wang S-J, Chang W-C, Hu C-S. The effect of LMX, trust, supervisor support on organizational citizenship behavior in nurses. *J Nurs Res* (2008) 16(4):321–8. doi: 10.1097/01.JNR.0000387319.28010.5e
49. Vincent-Höper S, Stein M, Gregersen S, Nienhaus A. Messung gesundheitsförderlicher führung in gesundheitsdienst und wohlfahrtspflege. *Arbeitsmedizin, Sozialmedizin, Umweltmedizin, Zeitschrift für medizinische Prävention* (2018) 53:46–53. doi: 10.17147/ASU.2018-01-04-04
50. Gregersen S, Vincent-Höper S, Nienhaus A. Health-relevant leadership behaviour: a comparison of leadership constructs. *Zeitschrift für Personalforschung* (2014) 28(1/2):117–38. doi: 10.1177/239700221402800107
51. Wagner A, Hammer A, Manser T, Martus P, Sturm H, Rieger MA. Do occupational and patient safety culture in hospitals share predictors in the field of psychosocial working conditions? findings from a cross-sectional study in German University Hospitals. *Int J Environ Res Public Health* (2018) 15(10):2131. doi: 10.3390/ijerph15102131
52. Thornton GC. Psychometric properties of self-appraisals of job performance. *Pers Psychol* (1980) 33(2):263–71. doi: 10.1111/j.1744-6570.1980.tb02348.x
53. Sarros JC, Cooper BK, Hartican AM. Leadership and character. *Leadership Org Dev J* (2006) 27(8):682–99. doi: 10.1108/01437730610709291
54. Aarons GA, Ehrhart MG, Farahnak LR, Sklar M, Horowitz J. Discrepancies in leader and follower ratings of transformational leadership: relationship with organizational culture in mental health. *Adm Policy Ment Health Ment Health Serv Res* (2017) 44(4):480–91. doi: 10.1007/s10488-015-0672-7
55. Deluga RJ. The relationship of leader-member exchange with laissez-faire, transactional, and transformational leadership in naval environments. *Impact Leadersh* (1992) 237–47.
56. Bass BM. From transactional to transformational leadership: learning to share the vision. *Organ Dyn* (1990) 18:19–31. doi: 10.1016/0090-2616(90)90061-S
57. Yukl G, O'Donnell M, Taber T. Influence of leader behaviors on the leader-member exchange relationship. *J Manag Psychol* (2009) 24(4):289–99. doi: 10.1108/02683940910952697
58. Seltzer J, Bass BM. Transformational leadership: beyond initiation and consideration. *JManag*(1990)16(4):693–703.doi:10.1177/014920639001600403
59. Spector PE. Do not cross me: optimizing the use of cross-sectional designs. *J Bus Psychol* (2019) 34(2):125–37. doi: 10.1007/s10869-018-09613-8

60. Martin R, Epitropaki O, Thomas G, Topakas A. A critical review of leader-member relationship (LMX) research: future prospects and directions. *Int Rev Ind Organ Psychol* (2010) 25:61–91. doi: 10.1002/9780470661628.ch2
61. Abrell C, Rowold J, Weibler J, Moenninghoff M. Evaluation of a long-term transformational leadership development program. *Ger J Hum Resour Manag* (2011) 25(3):205–24. doi: 10.1177/239700221102500307
62. Saravo B, Netzel J, Kiesewetter J. The need for strong clinical leaders–Transformational and transactional leadership as a framework for resident leadership training. *PLoS One* (2017) 12(8):e0183019. doi: 10.1371/journal.pone.0183019

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

REVIEW
published: 27 February 2020
doi: 10.3389/fpsyt.2020.00066

Adverse Psychosocial Work Environments and Depression—A Narrative Review of Selected Theoretical Models

Johannes Siegrist[1]* *and Natalia Wege*[2]

[1] Centre for Health and Society, Heinrich-Heine University Düsseldorf, Düsseldorf, Germany, [2] Clinic for Psychiatry and Psychotherapy, Heinrich-Heine University Düsseldorf, Düsseldorf, Germany

Far-reaching progress of treatment and prevention of depressive disorders is still limited, mainly due to the multifactorial determinants of these disorders and the restricted knowledge of their aetiology. Stressful socio-environmental conditions represent one of the multifactorial determinants, and in view of the centrality of work and employment for human well-being, research on health-adverse psychosocial work environments turned out to be a promising line of scientific inquiry. During the past three decades, respective research focused mainly on three theoretical models of adverse psychosocial work and their measurement in prospective epidemiologic studies, termed "demand-control," "effort-reward imbalance," and "organizational injustice." This report provides a review of current evidence on their associations with depression, based on several systematic reviews and updated by most recent publications. Moreover, it discusses the conceptual and methodological strengths and weaknesses of these associations. In summary, the results of more than 40 cohort studies from a variety of Western modern societies confirm that stressful work in terms of these models is associated with a moderately increased risk of subsequent onset of depression. While this knowledge is considered robust enough to instruct efforts of primary and secondary prevention, several methodological challenges still need to be resolved by future research.

Keywords: psychosocial work environment, depression, scientific evidence, demand-control, effort-reward imbalance, organizational injustice

OPEN ACCESS

Edited by:
Elisabeth Schramm, University of Freiburg Medical Center, Germany

Reviewed by:
Raphael M. Herr, Heidelberg University, Germany
Loredana Lucarelli, University of Cagliari, Italy
Andreas Johann Hillert, Schön Klinik Roseneck, Germany

***Correspondence:**
Johannes Siegrist
siegrist@uni-duesseldorf.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *30 October 2019*
Accepted: *27 January 2020*
Published: *27 February 2020*

Citation:
Siegrist J and Wege N (2020) Adverse Psychosocial Work Environments and Depression—A Narrative Review of Selected Theoretical Models. Front. Psychiatry 11:66. doi: 10.3389/fpsyt.2020.00066

INTRODUCTION

In a global perspective, depressive disorders are a leading cause of years of life lost to disability (1). Due to their prevalence, severity, and associated direct and indirect costs, these disorders provide a major challenge to health care systems (2). Although the definition and classification of depression continues to be debated (3) epidemiologic studies offer solid estimates of their prevalence, at least in modern Western societies. For instance, in the USA, the 12-month prevalence of a major depressive episode was estimated as 6.6% (4). A similar rate of 6.9% was observed in a study of 17 European countries (5). Given the public health relevance of depression, efforts of prevention and intervention are required. Yet, as this disease seems to be caused by an interaction of genetic, biological,

psychological, and socio-environmental conditions (6), the success of such efforts is still limited, and intense research continues to tackle this problem. One promising line of recent research has focused on an adverse psychosocial work environment in advanced economies as a social determinant of depression. This research relies on distinct theoretical concepts derived from social and behavioral sciences and their standardized measurement, and it generates its findings in the frame of prospective epidemiologic investigations. During the past three decades, a considerable body of scientific knowledge resulted from this approach. Therefore, a review of its conceptual and methodological strengths and limitations seems justified. Here, we set out to meet this aim.

STRESS-THEORETICAL APPROACHES AND EMPIRICAL EVIDENCE

As depression is a mental disorder, it was proposed that altered functioning of distinct brain areas and related neurotransmitter release is involved in its development (7). More specifically, stress-physiological mechanisms elicited by the brain reward system and operating through a dysregulation of neurotransmitter and hormone release (e.g., serotonin and cortisol) may contribute to the manifestation of biological, affective, cognitive, and behavioral symptoms of this disorder (8, 9). To strengthen this hypothesis, it is important to delineate those socio-environmental conditions that are associated with increased risks of incident depression, acting as extrinsic stressors that trigger the proposed psychobiological mechanisms. Extrinsic stressors act as single or recurrent challenges that tax or exceed the person's coping capacities, thus inducing intense experiences of threat or loss of control and reward related to core desiderata. In modern working life, several such threats and losses are widely prevalent, and given the centrality of work and employment for people's self and their social standing, they are likely to affect their functioning and wellbeing. Yet, an important question remains to be answered: How can these extrinsic stressors at work be identified? To this end, the development and test of a theoretical model derived from social and behavioral sciences is required.

Three Theoretical Models of a Health-Adverse Psychosocial Work Environment

A theoretical model in this domain delineates selective features of a demanding and threatening work environment such that they can be generalized to explain associations of stressful work with health in a wide range of occupations. Given their selective focus, several such theoretical concepts were proposed [for review, e.g., (10)]. Yet, three approaches received prominence in recent years, as documented in a substantial number of empirical studies performed in occupational epidemiology, sociology and psychology.

The first approach is termed "*demand-control* (or *job strain*) model" (11). It posits that stressful experience at work results from exposure to a distinct job task profile defined by the combination of two dimensions, the psychological demands put on the working person, and the degree of control available to perform the required task. Jobs with high demand and low control are stressful because they limit the individual's autonomy and sense of control while generating continued pressure (high strain). In this model, low control manifests itself as a lack of decision authority and/or as a lack of opportunity to use one's skills (e.g., monotonous work). A further distinction points to the role of social support at work. If people exposed to high demand and low control at work additionally suffer from social isolation and lack of social support, the level of stress is further increased (12). So far, this model has received its broadest implementation on a global scale, and has generated a large amount of evidence (see below). At the same time, this conceptualization was developed during a stage of economic development where industrial production prevailed, with inherent forms of division of labor in hierarchically structured organizations. Additional concepts may address more recent developments of work and employment.

"*Effort-reward imbalance*" is one such complementary theoretical model focusing on a basic notion of the work contract, the norm of social reciprocity. It maintains that a lack of reciprocity in terms of high effort spent at work by employed people, and low reward provided in turn by employers, acts as an extrinsic stressor. In this exchange, three basic types of reward are transmitted: salary or wage, career promotion and job security, and esteem or recognition (13). According to this approach, failed reciprocity at work occurs frequently in modern labor markets, given a growth of insecure and precarious employment, short-term contracts, and new forms of flexible job arrangements. Moreover, rising income inequality and a large proportion of working poor point to the relevance of this notion. Effort-reward imbalance is frequent if workers have no alternative choice in the labor market and if jobs are characterized by heavy competition. Moreover, this model integrates an important element of the working person, the pattern of coping with extrinsic obligations. Overcommitted people are at elevated risk of experiencing this imbalance and its health-adverse effects (14).

As a third model, "*organizational injustice*" is dealing with perceived inequities of people's behaviors in formal organizations. It was developed in the context of organizational psychology and management sciences in the 1970s and 1980s, being largely based on Adam's inequity theory (15, 16). Four types of injustice are usually distinguished. Procedural injustice points to the perceived deviance from established rules of decision-making and of judging the performance of employees. Relational or interactional injustice describes the unequal treatment of persons within organizations, e.g., with regard to respect and communication. With informational injustice the unequal access to and share of relevant information within organizations is emphasized. Finally, distributive injustice delineates the perceived inequity of an organization's distribution of valuable goods, resources, and services to its members. According to this approach, each type of inequity can evoke stressful experience, and thus act as health-adverse psychosocial work environment (17).

Although a minor overlap between these concepts can be observed (e.g., between "demand" and "effort"; between "reward" addressing intrapersonal justice of exchange and "distributive

injustice," addressing interpersonal inequity), each theoretical model has identified a distinct psychological need whose fulfillment is essential for personal flourishing and well-being, and whose suppression results in emotional suffering and recurrent arousal of stress responses. The experience of personal control and self-efficacy in productive activities describes the focal element in the first model. In the second model, the experience of appreciation and self-esteem emanating from one's achievements is the core element. Experiencing recurrent trust, fairness, and a sense of belonging within a stable social network is central to the third model. What happens to mental health and well-being if these crucial needs remain unmet, or are even denied in everyday working life? Before we turn to this question, important methodological problems need to be addressed.

Methodological Challenges

The first challenge of this research concerns the measurement of the theoretical models and of the health outcome, i.e., depression. These two tasks differ to some extent, as the assessment of depression is part of clinical decision making, whereas the measurement of a theoretical construct originating in the social and behavioral sciences usually relies on quantitative research methods, and more specifically on psychometrically validated scales of self-assessed questionnaires. These scales operationalize the single dimensions of the construct by a set of standardized items. While there are different response options to the items, Likert-scaled items are most often applied, where answers range, e.g., from "strongly disagree" to "strongly agree," with varying number of answer categories. Sum scores of the ratings of each scale are assumed to represent a quantitative estimate of the dimension under study. Scale development is a first fundamental step of assessing a theoretical model. Yet, each single scale represents one factor only of a more complex construct. Therefore, in a second step, the dimensional structure of the model has to be examined, using confirmatory factor analysis. The results of this analysis indicate how well the combination of the single factors represents the underlying concept. Structural equation modeling is an appropriate statistical approach allowing an assessment of the goodness of model fit, i.e., the degree of congruence between observed data and postulated theoretical structure.

This second step is not trivial. For instance, in case of the demand-control model, different results are obtained, depending on whether the two main scales, "demand" and "control" are included, or whether the third variable "social support" is additionally examined (18). The effort-reward imbalance model offers an even more complex structure as it is composed by a first-order construct representing the three scales "effort," "reward," and "overcommitment," and a second-order construct including the three subdimensions of "reward," "esteem," "job security," and "job promotion prospects" (19). In this latter case, the goodness of the model fit based on the second-order construct should be better than the one based on the first-order construct. This has been repeatedly documented (20).

Each review of studies testing the contribution of these theoretical models towards explaining elevated risks of depression is faced with the problem that in some studies, findings are restricted to single model scales, whereas other investigations use a summary measure of the model to estimate its explanatory contribution. For instance, with regard to the demand-control model, several publications provide results for the scale "job control," rather than for a combined measure representing the joint effect of demand and control, termed "job strain." Similarly, in case of "organizational injustice," results indicate associations with single dimensions rather than with an overall measure of the model (21) (see below). This fact compromises the comparability of study findings. In addition, it points to the statistical problem of representing a multifactorial concept by a single summary indicator, such as "job strain" (a combination of the scales "demand" and "control") or "effort-reward imbalance," a ratio of the scales "effort" and "reward," adjusted for unequal number of items (see Discussion).

As in every scientific discipline, the reliability and validity of data represent crucial quality criteria of reported findings. Whereas researchers examine the reliability of questionnaire data by established procedures, the validity of self-reported information is often challenged, given a lack of objective standard of reference. Several strategies were developed to deal with this problem. To mention just three common strategies, the first one refers to the control of reporting bias due to distinct personality characteristics by respective statistical adjustment. A second approach uses triangulation of subjective data with objective information (e.g., by comparing self-reported data of participants with observer-based or administrative data. Third, individual data are aggregated to the group level to reduce variability of subjective evaluations (e.g., by applying mean scale scores at work-unit level rather than individual scale scores as predicting variables). In fact, the validity of respective results has been improved by applying these strategies [e.g., (22, 23)]. However, one should recognize that the working people's own experience is a core source of information in any research dealing with psychosocial exposures and their psychological and biological effects.

The problem of validity concerns the measurement of depression, the outcome criterion, as well. In psychiatry, the Composite International Diagnostic Interview (CIDI) is considered a well-tested approach to diagnose clinically relevant depression (usually termed "major depression") (24). Yet, in epidemiologic studies of large cohorts, clinical assessments are often not feasible, and are replaced by validated questionnaires. The Centre for Epidemiologic Studies Depression Scale (CES-D) is one such widely applied questionnaire, among several others (25, 26). These scales assess depressive symptoms rather than a binary variable of clinical depression, and they equally have to deal with the challenge of limited validity as they use self-reported data from study participants. There are pros and cons of using questionnaire data on depression. On the positive side, large-scale information offers robust estimates of disease incidence, and assessing depressive symptoms rather than manifest clinical depression enables

researchers to identify the burden of subclinical mental disorder, which is relevant in a public health perspective (27). In addition to psychiatric interviews and questionnaires, administrative data are used to identify people with depression, e.g., based on records from health insurance or from hospitals. Again, any review of available evidence faces the problem of limited comparison of study results, given the different ways of operationalizing depression or depressive symptoms.

An important further methodological challenge relates to the study design. Prospective observational studies of large cohorts of working people are the best available approach, whenever experimental designs are not feasible to assess a causal relationship. In epidemiologic cohort studies, the exposure (in our case, work stress) is assessed prior to the incidence of the disease (in our case, depression), and a dose-response relationship between level of exposure and strength of its association with disease risk can be examined, with regression adjustment for confounders in multivariable statistical analysis. Yet, support of the notion of a causal association in epidemiologic studies depends on additional criteria. They include the consistency of findings by recurrent independent replication, the provision of biological data or other mediating information that substantiate some pathway leading from exposure to disease development. Moreover, reducing exposure through intervention is expected to minimize subsequent disease risk. Below, we will discuss to what extent research on the three theoretical models and their association with depression meets these methodological challenges.

Summary of Study Findings

The aim of this contribution is to provide a summary of main findings on associations of an adverse psychosocial work environment, as measured by three prominent theoretical models, with depression, and to discuss the conceptual and methodological strengths and limitations of this knowledge. To this end, published systematic reviews and meta-analyses are a major source of reference. Here, we include the following systematic reviews: (21, 26, 28–30). Information derived from these reviews is supplemented by results from publications that were published after the appearance of these reviews.

The Demand-Control Model

In addition to four previously published reports (31–33), two recent systematic reviews of associations between job strain (or the components "demand" and "control") and depression provide a solid empirical basis of assessing this relationship, one from Sweden (26) and one from Denmark (28). These latter reviews not only update the evidence-base, but they also apply quality assessments of the included studies, and, in one case, integrate the findings from a series of unpublished studies. We therefore focus our report on these recent reviews, supplementing them, where needed, with previous and more recent findings. The two reviews differ in several regards. First, the study by Theorell et al. (26) includes a broader range of exposures (different psychosocial work stress models, physical and chemical work stressors), while Madsen et al. (28) restrict their analysis to the job strain model. Second, the latter report focuses on clinical depression, whereas the former refers to questionnaire-based data on depressive symptoms or interview data. Third, in the Danish study, estimated relative risks of the association are based on adjustments for core sociodemographic variables and for baseline depressive symptoms, thus offering a more robust confounder control.

In the Theorell et al. (26) review, prospective cohort studies published between 1990 and June 2013 were included, where the exposure was defined in terms of job strain in 14 studies, in terms of psychological demands in ten studies, and in terms of job control in 19 studies. In addition, social support at work was assessed in 17 studies, although this variable is not included in the theoretically core construct of job strain. In a majority of cases, job strain was defined by the procedure of median split half of scores of the two scales "demand" and "control," identifying the exposure group as experiencing "high demand and low control" at work. The Danish review was based on a protocol published before the start of data analysis, thus reducing reporting bias. The protocol described the measurement of core variables and confounders. Original or proxy measures of job strain and its subscales were measured in a similar way across the published and unpublished study, using the split half approach mentioned in a majority of cases. Some exceptions were the use of the quadrant of the combinations of demand and control and the interaction test of the two subscales. Depression was assessed by clinical data in the six published studies and by administrative data on hospital-treated depression in the 14 unpublished investigations included in the review (28). In the meta-review by Harvey et al. (30), no additional relevant findings were identified.

The main findings of the Swedish systematic review and meta-analysis are summarized as follows: Job strain, assessed in 14 studies, was associated with a weighted odds ratio of 1.74 [95% Confidence Intervals (CI) 1.54; 1.96] of depressive symptoms, compared to the group without this exposure. High control at work, as a protective factor, was associated with a weighted odds ratio of 0.73 (95% CI 0.68; 0.77) of incident depressive symptoms in the 19 reports included, compared to those with low control at work. Both findings resulted from studies whose quality was rated as high. However, findings on a link between high demand and depression were inconsistent and generally of lower quality. It is of interest to note that low support at work as well as passive job (low demand and low control) were also related to an increased risk of depression (26).

In the Danish systematic review and meta-analysis, results were given separately for published and unpublished studies. For the first group, the adjusted odds ratio of clinical depression due to job strain was 1.77 (95% CI 1.47; 2.13) compared to those without job strain. This estimate was virtually unchanged if high quality studies only entered the analysis. Interestingly, two investigations reported two subsequent exposure assessments, and in line with the assumption of a dose-response relationship the relatively highest risk was observed in the group with two subsequent work stress exposures [odds ratio (OR) 1.56 (95% CI 0.99; 2.45]. In the unpublished studies, a hazard ratio (HR) of 1.27 (95% CI 1.04; 1.55) was observed, based on a prevalence of

job strain of 16.6% (28). Alternative formulations of the demand-control model did not reveal consistent findings, except for the quadrant defining "passive job," which was related to elevated risk of depression.

In summary, the two reviews confirm previous evidence that job strain is associated with a moderately increased risk of depression, and the subscale of low job control plays a decisive role in these associations. Yet, in a recent critical appraisal it was argued that possible bias due to reverse causation and residual confounding was not convincingly addressed so far (34). Therefore, these authors contributed own findings from a new study, the UK National Child Development Study, where the risk of incident common mental disorder (not specifically depression) over a 5-year observation period was analyzed according to job strain, assessed in a group of 6.870 men and women at age 45. To control for the bias mentioned, a number of additional confounding factors, specifically from childhood, were included, and lifetime psychiatric history was assessed to minimize reverse causation. The findings demonstrated significantly elevated odds ratios for job strain [OR 2.22 (95% CI 1.59; 3.09)], high demand [OR 1.70 (95% CI 1.25; 2.32)], and low control [OR 1.89 (95% CI 1.29; 2.77)]. Thus, we can conclude that job strain is a validated predictor of a moderately elevated risk of developing relevant depressive symptoms or manifest clinical depression.

The Effort-Reward Imbalance Model

Compared with the demand-control model, fewer studies were conducted so far using the complementary effort-reward imbalance model of stressful work. A recent review identified eight eligible cohort studies, encompassing 84.963 persons and 2.897 new cases of depressive disorders (29). Previous reviews were based on a lower number of studies, and due to the paucity of findings, the evidence supporting a positive relationship between effort-reward imbalance and depression was judged to be limited (26, 31, 32, 35). The new systematic review was preceded by a published study protocol. To be included studies had to provide a quantitative baseline assessment of the exposure, effort-reward imbalance (ERI), using either the original instrument (19) or a proxy measure. This information was reported as a binary variable (effort-reward ratio yes/no), as a categorical variable, or as a continuous variable. Depression was measured by psychiatric diagnostic interview, physician-based diagnosis, register data, or validated questionnaire (29). In one study, the outcome was defined by register data on purchased antidepressants (36), although the choice of this indicator received serious criticism (37). The results indicated that in seven out of eight studies ERI predicted depressive disorders, with estimates ranging from 1.49 (95% CI 1.22; 1.81) to 2.32 (95% CI 1.14; 4.73), if groups with the highest exposure to ERI were compared to respective reference groups. The study defining depression by use of antidepressants showed no association. When the eight most-adjusted study-specific estimates were pooled in a random-effects meta-analysis, an odds ratio of 1.49 (95% CI 1.23; 1.80) was observed (29). In two studies, a dose-response association was obvious, and one investigation demonstrated similar associations, independent of whether ERI scores were aggregated to the work-unit level or were analyzed at individual level. Results did not change when fixed- rather than random-effects meta-analysis was performed. Moreover, pooled estimates were similar when comparing studies with high or moderate quality vs. studies with low quality, or when comparing studies using the original ERI measure vs. those applying proxy measures. The study authors discussed the controversial use of purchased antidepressants as indicator of depression and, due to this problematic measure, repeated sensitivity analyses by excluding this study with negative results. After exclusion, pooled estimates were all in the range of 1.56 to 1.66 (29).

To summarize, this systematic review of eight prospective studies from Europe, Canada, and the US demonstrated that ERI was associated with a 1.5-fold increased risk of depressive disorders. This conclusion is supported by the meta-review of Harvey et al. (30) although based on a less comprehensive number of studies. Since the publication of the Rugulies et al. review, three new prospective studies on this association were published. In the first investigation from Japan, an odds ratio of 1.56 (95% CI 1.25; 1.96) of depression due to effort-reward imbalance at work was documented (38). In the second one, a large panel study from Germany, gender-specific estimates of work stress in terms of ERI were performed to assess risks of incident doctor-diagnosed depression during a 2-year follow-up period (39). Although work stress levels were higher among men, the risk ratios (RR) of depression due to ERI were similar across gender, with an adjusted RR of 1.88 (95% CI 1.51; 2.33) in women, and of 1.82 (95% CI 1.36; 2.44) in men. In this sample of 6.693 participants estimates were adjusted for age, marital status, education, income, employment, smoking, alcohol consumption, physical activity, BMI at baseline, and any chronic disease at baseline. It is of interest to note that in addition to this summary measure of the effort-reward ratio, significant associations were observed for all single components of the ERI model (39). A recent study on Swedish national panel survey data analyzed bidirectional relationships between psychosocial work characteristics and depressive symptoms with fixed effects (40). Whereas no evidence for a reverse causation from depression to psychosocial work stress was found, high effort at work was prospectively associated with depressive symptoms 2 years later. The remaining dimensions of the three work stress models included displayed short-term associations only.

In line with the conclusion drawn from the meta-analyses based on the job strain model, we can state that effort-reward imbalance at work is associated with a moderately increased risk of developing a depressive disorder.

The Organizational Injustice Model

The synthesis of evidence related to the organizational injustice model is somewhat more problematic than in the previous two cases because the main systematic review did not include a meta-analysis of study findings with related forest plots (21). Moreover, this work included three different health outcomes, i.e., indicators of mental health, sickness absence data, and data

on subjective well-being. The review identified prospective studies published between 1990 and 2012 with measures of organizational injustice as exposures and with data on one or several of the health outcomes mentioned. Having identified 403 studies from systematic literature search, the authors selected 11 studies that met all inclusion criteria. As the concept of organizational injustice is composed by four dimensions, these studies varied by the extent to which these dimensions were measured. Thus, relational injustice was assessed in ten of the 11 studies, procedural injustice in eight studies, and distributive injustice in three studies. Data on interactional injustice were not available. Here, we restrict the summary of results to studies that used mental health indicators as outcomes, assessed either as clinically validated depression or as questionnaire-based depressive symptoms.

Findings on associations of relational injustice with reduced mental health were retrieved from seven studies, with odds ratios ranging from 1.2 to 1.6. Importantly, in five of these studies, observed effects remained statistically significant after adjusting for the alternative work stress models of demand-control or effort-reward imbalance. One of the investigations analyzed change over time in organizational injustice and its association with change in mental health. Here, deterioration of injustice was related to an increased risk of reporting minor psychiatric morbidity. Related odds ratios were 1.81 (95% CI 1.48; 2.21) among men and 1.74 (95% CI 1.31; 2.37) among women (21). Procedural injustice was explored with regard to mental health in six studies, and five reported odds ratios, whereas one presented coefficients of path analysis. In all six studies, significant associations were observed, with odds ratios ranging from 1.4 to 1.9. In some cases, effects were adjusted for alternative models of work stress. Finally, one longitudinal study only tested the relationship of distributive injustice with mental health, using path analysis. Distributive justice was associated with reduced depressive symptoms after one year, adjusting for baseline level of these symptoms. A direct path was statistically significant, but no alternative work stress model was included in this analysis (21). The meta-review by Harvey et al. (30) also highlighted organizational justice as a relevant construct influencing mental health although the quality of the above systematic review was rated low.

Taken together, results support the notion that two components of organizational injustice, relational and procedural injustice, are associated with a moderately increased risk of poor mental health. However, the evidence base is less extensive than in previous cases, and the presentation of findings is limited due to missing meta-analysis and lack of inclusion of quality assessment. Following the publication of this systematic review, we identified four further recent publications on the topic. One study analyzed long-term sickness absence due to depression or anxiety disorders among Finnish public sector employees and observed a 25%–30% lower odds of sickness absence due to anxiety disorders, but not due to depression, among those experiencing interactional justice at work (41). In a second report, multiwave data on organizational justice and depressive symptoms were analyzed, where significant findings were mainly restricted to a protective effect of organizational justice among men who exhibited depressive symptoms (42). Third, in a Finnish cohort study on public employees, relational and procedural justice were associated with reduced risk of disability pension due to depression. However, after adjusting for the effects of effort-reward imbalance and demand-control, effects lost their statistical significance (43). Finally, a Danish prospective study assessed aggregated work-unit data of procedural and relational injustice at work, related to onset of new depression over a 2-year period (44). In this study of 4.237 public employees, the adjusted odds ratio of depression due to procedural injustice was 2.50 (95% CI 1.06; 5.88), and the odds ratio due to relational injustice was 3.14 (95% CI 1.37; 7.19). In summary, the above conclusion is strengthened further by integrating these recent findings.

DISCUSSION

In this report, we observed a moderately elevated risk of developing clinical depression or depressive symptoms following exposure to an adverse psychosocial work environment, as measured by three complementary theoretical models. Evidence was relatively strongest for demand-control,followed by effort-reward imbalance and organizational injustice. Each model represents a distinct perspective on work by emphasizing the job task profile, the employment contract, or the social relationships within organizations, respectively. Although statistical adjustment for alternative models was performed in a limited number of studies only, the reported findings offer three explanatory frameworks of the association under study. The current state of knowledge is nevertheless limited to some extent, as reports on health effects often relied on selected subcomponents rather than on a summary measure of the model. Moreover, implementation of a standard measurement of the underlying theoretical construct is desirable to advance cumulative knowledge.

An important conceptual and empirical question remains unanswered so far: How do these three models interact with risk of depression? Is there an additive or a cumulative effect if workers are exposed simultaneously to all three exposures? To our knowledge, one recent publication has tackled this problem. In a longitudinal study of disability pensions due to depression among 41.862 Finnish employees followed over a mean 3.1 years, the following results were obtained (45): Compared to the group without any exposure, those with comanifestation of all three exposures were 4.7 times more likely to experience a disability pension due to depression. The hazard ratio of 4.70 (95% CI 2.26; 7.79) was adjusted for a comprehensive set of confounding factors. Of interest, hazard ratios were 2.47 (job strain), 1.87 (effort-reward imbalance), and 1.66 (organizational injustice) if one exposure only was considered. This study calls for further research on clusters of work stress rather than single models, aiming at an identification of particularly "toxic" constellations of stressful work.

At the methodological level, future research is expected to clarify to what extent the observed prospective associations are representing a causal link. As mentioned, observational studies offer limited evidence on causality. This even holds true if the

criteria supporting a causal relationship in epidemiologic research, as developed by Bradford Hill (46), are applied, such as consistency of results, strength of association, dose-response relationship, control of confounding and reverse causation, provision of data on mediating pathways, and reduction of effect following reduction of exposure.

The results of this review illustrate an impressive amount of consistency, as more than 40 prospective investigations reported positive findings of an association of stressful work, in terms of the three models, with depression, despite some heterogeneity of exposure measures. The strength of associations is moderate across all studies. This observation points to the multifactorial nature of depressive disorders, where it is obvious that socio-environmental exposures in general, and psychosocial work-related exposures in particular, provide a modest contribution only to the overall risk estimation of depression. For instance, in one study it was estimated that a population-attributable fraction of 14% of new cases of common mental disorders could have been theoretically prevented by eliminating high job strain (34). Dose-response as a further criterion of causality has not yet been analyzed to a sufficient extent. Studies with multiple exposure data over time or with different degrees of exposure intensity are required to this end. Up to now, most published studies offer data on one exposure assessment at baseline that has been linked to the subsequent probability of disease onset. Moreover, rigorous statistical approaches to multiwave data are required, such as a recently conducted fixed effects analysis, applying dynamic panel models with data on work stress and depressive symptoms from four waves (40).

Observed and unobserved confounding is considered a major challenge to epidemiological research in general. In case of our research question, substantial concern was devoted to the inclusion of relevant confounders in multivariable regression analyses, adjusting for their effects in a majority of studies. However, despite poor evidence, reverse causation cannot be excluded, specifically with regard to depression. This disorder often becomes manifest in early adulthood, and its recurrence at later stages is relatively frequent. Moreover, people's increased mental vulnerability in earlier stages of their life course may shape occupational trajectories to some extent, putting them at higher risk of ending up in a less privileged work place (34).

The aetiology of depressive disorders is still not well known, and the same holds true for proposed stress-biological mechanisms acting as potential pathways from exposure to disease development. Altered functioning of the hypothalamic-pituitary-adrenal axis and increased endogenous inflammation were proposed as two promising markers of such pathways (8, 9). In fact, for all three models of an adverse psychosocial work environment, associations with altered cortisol secretion and/or increased inflammation were demonstrated (47–49). These preliminary data support a mediating role of stress-biological mechanisms linking exposure to the development of depressive disorders, although longitudinal evidence on these pathways is still missing. Finally, the criterion of health improvement as a result of exposure reduction has been dealt with in the frame of theory-based intervention studies. Again, for all three models of stressful work, company-based worksite - health promotion programs documented beneficial effects on mental health (50, 51). For instance, in three quasi-experimental intervention studies in Canada, the components of the demand-control and the effort-reward imbalance model were addressed by organizational changes, resulting in significant reductions of burn out or psychological distress. In one study, beneficial effects on burnout were manifest even 3 years after onset of intervention (52). Thus, the findings of these intervention studies point to the relevance of these theoretical models for targeted programs of primary and secondary prevention of mental disorders in occupational settings.

This discussion reveals substantial progress of research on psychosocial work-related exposures and risk of depression. In particular, conceptual and methodological developments in the frame of three theoretical models resulted in the generation of a substantial body of empirical evidence. At the same time, unresolved questions and challenges were identified that require further scientific inquiry.

Limitations of this Review

This paper represents a meta-review perspective on a relevant body of recent research that already received a number of systematic reviews. Its aim was to assess strengths and weaknesses of current knowledge and to identify theoretical and methodological challenges that deserve further research. Pursuing this aim, nevertheless, results in several limitations. First, rather than following proposed recommendations for meta-synthesis data integration (30, 53), the report is restricted to a narrative presentation of its main messages. Second, we focused our review on three theoretical models, thus neglecting additional concepts of a health-adverse psychosocial work environment (e.g., "demand-resources" (54) or single psychosocial work-related factors (e.g., workplace bullying, 26), long working hours (55). The main reason for this selection was the availability of a cumulative body of empirical findings that reflects a significant interest of the research community in these theoretical approaches. Future reviews may represent a more comprehensive range of concepts and measures. For instance, the systematic review by Harvey et al. (30) proposed three integrative broad categories that include elements of all three models, termed imbalanced job design, occupational uncertainty, and lack of value and respect in the workplace. Third, as most studies discussed were conducted in high-income countries of the Western world, we do not justice to a globally relevant problem of work-related population health. There is an urgent need to extend this research to rapidly developing country. Finally, as one of the authors is the originator of one of the three models mentioned, there is a risk of reporting bias. However, every attempt was made to balance the presentation of findings. Importantly, this author was not involved in the systematic review on effort-reward imbalance and depression, the major source of reference in this respect.

Implications for Practice

As a first practical implication, this new knowledge can be integrated into efforts of identifying people at risk for

developing depression. This is an important extension of psychiatrists' and psychotherapists' task of recognizing and treating psychosocial risks among their patients. Several risk prediction assessments were developed, in line with the notion of the multifactorial nature of this disorder [e.g., (56)]. Specifying these assessments by including core information on adverse psychosocial work environments is an important further step towards targeting working people at risk. Once such assessments have been established in organizations and businesses, occupational physicians, and other health professionals can use this information, observing strict data protection policies. Based on available information, the development and implementation of measures of primary prevention provides an important second practical implication. This implementation has to take into account available, specifically qualified personnel and appropriate settings of program delivery. Several such programs were already successfully applied with the aim of strengthening employed people's resources of coping with stress at work (57). They usually contain nonspecific elements, such as relaxation, meditation, anger management, or self-assertiveness. More specific measures, derived from the abovementioned work stress models, include group discussions on the reorganization of work tasks and schedules, supported team meetings with managers to improve communication, leadership and appreciation, or the preparation of workshops devoted to the elaboration of career and skill development (52, 58).

A third practical implication concerns secondary prevention, i.e., the improvement of return to work following treated manifest depression. As health-promoting psychosocial work environments were shown to increase rates of return to work in the chronically ill, structural and interpersonal measures of work-related stress reduction may exert favorable effects on depressive patients who are able and motivated to return to work.

Conclusion

In conclusion, this review documents substantial progress of research on psychosocial work-related exposures and risk of depression. In particular, conceptual and methodological developments in the frame of the three theoretical models demand-control, effort-reward imbalance, and organizational injustice resulted in the generation of a substantial body of new empirical evidence. The robustness of findings calls for their recognition by psychiatrists and psychotherapists in diagnosing and treating patients. Moreover, they can instruct measures and programs of primary and secondary prevention of depressive disorders. At the same time, unresolved questions and challenges were identified that require further scientific inquiry.

AUTHOR CONTRIBUTIONS

JS conceptualized and wrote the manuscript. NW contributed by systematic literature search and by critically commenting and improving the final version of the manuscript.

FUNDING

This work was supported by a senior professorship awarded to JS by the faculty of medicine, Heinrich-Heine University of Düsseldorf, Germany.

REFERENCES

1. Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the global burden of disease study 2015. *Lancet* (2016) 388(10053):1459–544. doi: 10.1016/S0140-6736(16)31012-1
2. Kessler RC. The costs of depression. *Psychiatr Clin North Am* (2012) 35(1):1–14. doi: 10.1016/j.psc.2011.11.005
3. Vanheule S. *Psychiatric diagnosis revisited: from DSM to clinical case formulation*. Cham: Springer (2017).
4. Kessler RC, Berglund P, Demler O, Jin R, Koretz D, Merikangas KR, et al. The epidemiology of major depressive disorder: results from the national comorbidity survey replication (NCS-R). *JAMA* (2003) 289(23):3095–105. doi: 10.1001/jama.289.23.3095
5. Wittchen HU, Jacobi F. Size and burden of mental disorders in Europe - a critical review and appraisal of 27 studies. *Eur Neuropsychopharmacol* (2005) 15(4):357–76. doi: 10.1016/j.euroneuro.2005.04.012
6. Kendler KS, Gardner CO, Prescott CA. Toward a comprehensive developmental model for major depression in men. *Am J Psychiatry* (2006) 163(1):115–24. doi: 10.1176/appi.ajp.163.1.115
7. Pariante CM, Lightman SL. The HPA axis in major depression: classical theories and new developments. *Trends Neurosci* (2008) 31(9):464–8. doi: 10.1016/j.tins.2008.06.006
8. Gold PW. The organization of the stress system and its dysregulation in depressive illness. *Mol Psychiatry* (2015) 20(1):32–47. doi: 10.1038/mp.2014.163
9. Stetler C, Miller GE. Depression and hypothalamic-pituitary-adrenal activation: a quantitative summary of four decades of research. *Psychosom Med* (2011) 73(2):114–26. doi: 10.1097/PSY.0b013e31820ad12b
10. Cartwright S, Cooper CL eds. *The Oxford handbook of organizational well-being*. Oxford: Oxford University Press (2009).
11. Karasek R. Job demands, job decision latitude, and mental strain: implications for job redesign. *Admin Sci Q* (1979). 24(2):285–308. doi: 10.2307/2392498
12. Karasek R, Theorell T. *Healthy work: stress, productivity, and the reconstruction of working life*. New York: Basic Books (1990).
13. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* (1996) 1(1):27–41. doi: 10.1037/1076-8998.1.1.27
14. Siegrist J. A theoretical model in the context of economic globalization. In: Siegrist J, Wahrendorf M, editors. *Work stress and health in a globalized economy: The model of effort-reward imbalance*. Cham: Springer International Publications (2016). p. 3–19.
15. Adams JS. Inequity in social exchange. In: Leonard B, editor. *Advances in experimental social psychology*. New York: Academic Press (1965). p. 267–99.
16. Greenberg J, Cohen JR eds. *Equity and justice in social behaviour*. New York: Academic Press (1982).
17. Elovainio M, Kivimaki M, Vahtera J. Organizational justice: evidence of a new psychosocial predictor of health. *Am J Public Health* (2002) 92(1):105–8. doi: 10.2105/ajph.92.1.105
18. Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. *J Occup Health Psychol* (1998) 3(4):322. doi: 10.1037/1076-8998.3.4.322

19. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, et al. The measurement of effort-reward imbalance at work: european comparisons. *Soc Sci Med* (2004) 58(8):1483–99. doi: 10.1016/S0277-9536(03)00351-4
20. Siegrist J, Wahrendorf M, Goldberg M, Zins M, Hoven H. Is effort-reward imbalance at work associated with different domains of health functioning? Baseline results from the French constances study. *Int Arch Occup Environ Health* (2019) 92(4):467–80. doi: 10.1007/s00420-018-1374-8
21. Ndjaboué R, Brisson C, Vezina M. Organisational justice and mental health: a systematic review of prospective studies. *Occup Environ Med* (2012) 69 (10):694–700. doi: 10.1136/oemed-2011-100595
22. Theorell T. Working conditions and health. In: Berkman LF, Kawachi I, editors. *Social Epidemiology*. New York: Oxford University Press (2000). p. 95–117.
23. Juvani A, Oksanen T, Salo P, Virtanen M, Kivimaki M, Pentti J, et al. Effort-reward imbalance as a risk factor for disability pension: the Finnish Public Sector Study. *Scand J Work Environ Health* (2014) 40(3):266–77. doi: 10.5271/sjweh.3402
24. Kessler RC, Abelson J, Demler O, Escobar JI, Gibbon M, Guyer ME, et al. Clinical calibration of DSM-IV diagnoses in the World Mental Health (WMH) version of the World Health Organization (WHO) Composite International Diagnostic Interview (WMH-CIDI). *J Int J Methods Psychiatr Res* (2004) 13(2):122–39. doi: 10.1002/mpr.169
25. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* (1977) 1(3):385–401. doi: 10.1177/014662167700100306
26. Theorell T, Hammarstrom A, Aronsson G, Traskman Bendz L, Grape T, Hogstedt C, et al. A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health* (2015) 15:738. doi: 10.1186/s12889-015-1954-4
27. Alonso J, Angermeyer MC, Bernert S, Bruffaerts R, Brugha TS, Bryson H, et al. Use of mental health services in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatr Scand Suppl* (2004)(420), 47–54. doi: 10.1111/j.1600-0047.2004.00330.x
28. Madsen IEH, Nyberg ST, Magnusson Hanson LL, Ferrie JE, Ahola K, Alfredsson L, et al. Job strain as a risk factor for clinical depression: systematic review and meta-analysis with additional individual participant data. *Psychol Med* (2017) 47(8):1342–56. doi: 10.1017/S003329171600355X
29. Rugulies R, Aust B, Madsen IE. Effort-reward imbalance at work and risk of depressive disorders. A systematic review and meta-analysis of prospective cohort studies. *Scand J Work Environ Health* (2017) 43(4):294–306. doi: 10.5271/sjweh.3632
30. Harvey SB, Modini M, Joyce S, Milligan-Saville JS, Tan L, Mykletun A, et al. Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occup Environ Med* (2017) 74(4):301–10. doi: 10.1136/oemed-2016-104015
31. Bonde JP. Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occup Environ Med* (2008) 65 (7):438–45. doi: 10.1136/oem.2007.038430
32. Netterstrøm B, Conrad N, Bech P, Fink P, Olsen O, Rugulies R, et al. The relation between work-related psychosocial factors and the development of depression. *Epidemiol Rev* (2008) 30:118–32. doi: 10.1093/epirev/mxn004
33. Siegrist J. Chronic psychosocial stress at work and risk of depression: evidence from prospective studies. *Eur Arch Psychiatry Clin Neurosci* (2008) 258 Suppl 5:115–9. doi: 10.1007/s00406-008-5024-0
34. Harvey SB, Sellahewa DA, Wang MJ, Milligan-Saville J, Bryan BT, Henderson M, et al. The role of job strain in understanding midlife common mental disorder: a national birth cohort study. *Lancet Psychiatry* (2018) 5(6):498–506. doi: 10.1016/S2215-0366(18)30137-8
35. Stansfeld S, Candy B. Psychosocial work environment and mental health–a meta-analytic review. *Scand J Work Environ Health* (2006) 32(6):443–62. doi: 10.5271/sjweh.1050
36. Nielsen MB, Madsen IE, Aust B, Burr H, Rugulies R. Effort-reward imbalance at work and the risk of antidepressant treatment in the Danish workforce. *J Affect Disord* (2016) 196:248–51. doi: 10.1016/j.jad.2016.02.038
37. Theorell T. On effort-reward imbalance and depression. *Scand J Work Environ Health* (2017) 43(4):291–3. doi: 10.5271/sjweh.3642
38. Nigatu YT, Wang J. The combined effects of job demand and control, effort-reward imbalance and work-family conflicts on the risk of major depressive episode: a 4-year longitudinal study. *Occup Environ Med* (2018) 75(1):6–11. doi: 10.1136/oemed-2016-104114
39. Wege N, Li J, Siegrist J. Are there gender differences in associations of effort-reward imbalance at work with self-reported doctor-diagnosed depression? Prospective evidence from the German Socio-Economic Panel. *Int Arch Occup Environ Health* (2018) 91(4):435–43. doi: 10.1007/s00420-018-1293-8
40. Ahlin JK, LaMontagne AD, Magnusson Hanson LL. Are there bidirectional relationships between psychosocial work characteristics and depressive symptoms? A fixed effects analysis of Swedish national panel survey data. *Occup Environ Med* (2019) 76(7):455–61. doi: 10.1136/oemed-2018-105450
41. Elovainio M, Linna A, Virtanen M, Oksanen T, Kivimäki M, Pentti J, et al. Perceived organizational justice as a predictor of long-term sickness absence due to diagnosed mental disorders: results from the prospective longitudinal Finnish Public Sector Study. *J Soc Sci Med* (2013) 91:39–47. doi: 10.1016/j.socscimed.2013.05.008
42. Hjarsbech PU, Christensen KB, Bjorner JB, Madsen IE, Thorsen SV, Carneiro IG, et al. A multi-wave study of organizational justice at work and long-term sickness absence among employees with depressive symptoms. *Scand J Work Environ Health* (2014) 40(2):176–85. doi: 10.5271/sjweh.3401
43. Juvani A, Oksanen T, Virtanen M, Elovainio M, Salo P, Pentti J, et al. Organizational justice and disability pension from all-causes, depression and musculoskeletal diseases: a Finnish cohort study of public sector employees. *Scand J Work Environ Health* (2016) 42(5):395–404. doi: 10.5271/sjweh.3582
44. Grynderup MB, Mors O, Hansen ÅM, Andersen JH, Bonde JP, Kærgaard A, et al. Work-unit measures of organisational justice and risk of depression—a 2-year cohort study. *J Occup Environ Med* (2013) 70(6):380–5. doi: 10.1136/oemed-2012-101000
45. Juvani A, la Oksanen T, Virtanen M, Salo P, Pentti J, Kivimaki M, et al. Clustering of job strain, effort-reward imbalance, and organizational injustice and the risk of work disability: a cohort study. *Scand J Work Environ Health* (2018) 44(5):485–95. doi: 10.5271/sjweh.3736
46. Hill AB. The environment and disease: association or causation? *Proc R Soc Med* (1965). 58(5):295–300
47. Eddy P, Wertheim EH, Hale MW, Wright BJ. A systematic review and meta-analysis of the effort-reward imbalance model of workplace stress and hypothalamic-pituitary-adrenal axis measures of stress. *Psychosom Med* (2018) 80(1):103–13. doi: 10.1097/PSY.0000000000000505
48. Elovainio M, Ferrie JE, Singh-Manoux A, Gimeno D, De Vogli R, Shipley M, et al. Organisational justice and markers of inflammation: the Whitehall II study. *Occup Environ Med* (2010) 67(2):78–83. doi: 10.1136/oem.2008.044917
49. Maina G, Bovenzi M, Palmas A, Larese Filon F. Associations between two job stress models and measures of salivary cortisol. *Int Arch Occup Environ Health* (2009) 82(9):1141–50. doi: 10.1007/s00420-009-0439-0
50. Nyberg A. *The impact of managerial leadership on stress and health among employees*. Stockholm: Department of Public Health Sciences, Karolinska Institutet (2009).
51. Bourbonnais R, Brisson C, Vezina M. Long-term effects of an intervention on psychosocial work factors among healthcare professionals in a hospital setting. *Occup Environ Med* (2011) 68(7):479–86. doi: 10.1136/oem.2010.055202
52. Brisson C, Gilbert-Ouimet M, Duchaine C, Trudel X, Vézina M. Workplace interventions aiming to improve psychosocial work factors and related health. In: Siegrist J, Wahrendorf M, editors. *Work Stress and Health in a Globalized Economy*. Cham: Springer (2016). p. 333–63.
53. Ryan RE, Kaufman CA, Hill SJ. Building blocks for meta-synthesis: data integration tables for summarising, mapping, and synthesising evidence on interventions for communicating with health consumers. *BMC Med Res Methodol* (2009) 9:16. doi: 10.1186/1471-2288-9-16
54. Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. *J Appl Psychol* (2001) 86(3):499–512. doi: 10.1037/0021-9010.86.3.499
55. Virtanen M, Jokela M, Madsen IE, Magnusson Hanson LL, Lallukka T, Nyberg ST, et al. Long working hours and depressive symptoms: systematic review and meta-analysis of published studies and unpublished individual participant data. *Scand J Work Environ Health* (2018) 44(3):239–50. doi: 10.5271/sjweh.3712
56. King M, Walker C, Levy G, Bottomley C, Royston P, Weich S, et al. Development and validation of an international risk prediction algorithm for episodes of major depression in general practice attendees: the PredictD

study. *Arch Gen Psychiatry* (2008) 65(12):1368–76. doi: 10.1001/archpsyc.65.12.1368

57. Martin A, Shann C, LaMontagne AD. Promoting workplace mental wellbeing: a rapid review of recent intervention research. In: Bültmann U, Siegrist J, editors. *Handbook of Disability, Work and Health. 1*. Springer: Cham (2020).
58. Limm H, Gundel H, Heinmuller M, Marten-Mittag B, Nater UM, Siegrist J, et al. Stress management interventions in the workplace improve stress reactivity: a randomised controlled trial. *Occup Environ Med* (2011) 68 (2):126–33. doi: 10.1136/oem.2009.054148

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 17 March 2020
doi: 10.3389/fpsyt.2020.00168

Workplace-Related Interpersonal Group Psychotherapy to Improve Life at Work in Individuals With Major Depressive Disorders: A Randomized Interventional Pilot Study

Daryl Wayne Niedermoser[1,2], Nadeem Kalak[1], Anna Kiyhankhadiv[1], Serge Brand[1,3,4,5,6], Corinna Walter[1], Nina Schweinfurth[1] and Undine E. Lang[1]*

[1] University Psychiatric Clinics (UPK), University of Basel, Basel, Switzerland, [2] Departement of Business, Kalaidos University of Applied Sciences, Zurich, Switzerland, [3] Substance Abuse Prevention Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran, [4] Department of Sport, Exercise and Health, University of Basel, Basel, Switzerland, [5] School of Medicine, Tehran University of Medical Sciences, Tehran, Iran, [6] Sleep Disorders Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

OPEN ACCESS

Edited by:
Takeshi Terao,
Oita University, Japan

Reviewed by:
Sam Cortese,
University of Southampton, United Kingdom
Roumen Kirov,
Institute of Neurobiology (BAS), Bulgaria

***Correspondence:**
Daryl Wayne Niedermoser
daryl.niedermoser@upk.ch

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *31 October 2019*
Accepted: *21 February 2020*
Published: *17 March 2020*

Citation:
Niedermoser DW, Kalak N, Kiyhankhadiv A, Brand S, Walter C, Schweinfurth N and Lang UE (2020) Workplace-Related Interpersonal Group Psychotherapy to Improve Life at Work in Individuals With Major Depressive Disorders: A Randomized Interventional Pilot Study. Front. Psychiatry 11:168. doi: 10.3389/fpsyt.2020.00168

Objectives: Individuals suffering from major depressive disorder (MDD) often report workplace-related stress as the major cause of their disorder. Accordingly, workplace-related stress was established as a fifth psychosocial problem area of Interpersonal Psychotherapy (workplace-related Interpersonal Psychotherapy, W-IPT). The aim of the study was to investigate the influence of W-IPT on depressive symptoms and on workplace-related issues in individuals with MDD compared to a treatment-as-usual (TAU) condition.

Methods: A total of 27 individuals with MDD (mean age = 43 years, 48% males) were randomly assigned either to eight weekly group sessions of W-IPT or to the TAU condition. At baseline, 8 weeks later at the end of the intervention, and 20 weeks later at follow-up, the Hamilton Rating Scale for Depression was conducted. In addition, the participants completed the Beck Depression Inventory, the Work Ability Index (WAI), the Return to Work Attitude (RTW-SE), and the Insomnia Severity Index (ISI).

Results: Symptoms of depression in experts' ratings as well as in self-rated ratings decreased over time, but more so in the W-IPT condition compared to the TAU condition [experts rating: large effect size (d = 1.25) and self-assessment: large effect sizes (d = 0.94)]. The subjective ability to work (WAI) [medium effect size (d = 0.68)], self-efficacy to returning to work RTW-SE [medium effect size (d = 0.57)], and subjective symptoms of insomnia (ISI) [large effect size (d = 1.15)] increased over time, but again more so in the W-IPT condition compared to the TAU condition. The effects of the intervention remained stable from the end of the intervention to follow-up.

Conclusions: The pattern of results of this pilot study suggests that a newly established fifth IPT focus on workplace-related stress appeared to be particularly efficient in

individuals with MDD due to work-related stress in reducing depressive symptoms and reducing sleep complaints as well as in improving occupational outcomes.

Keywords: workplace-related stress, interpersonal psychotherapy, depression, ability to work, self-efficacy to returning to work, sleep

INTRODUCTION

Major depressive disorder (MDD) is a common and disabling psychiatric disorder associated with an increase in disability and mortality (1). Based on the data using the disability-adjusted-life-years to assess "the sum years lost due to premature mortality and years lived with disability adjusted for severity," Murray and Lopez (2) estimated that MDD will be the third leading cause of burden worldwide by 2020. By contrast, Jorm et al. (3) claimed that the epidemiologic prevalence rates of MDD did not increase within the 30 years, while the social awareness of depression did.

Standard treatments of moderate and severe MDD consist mainly on the administration of antidepressants, *i.e.*, serotonin-reuptake inhibitors. More recent reviews and meta-analyses questioned the efficacy of antidepressants and the unpleasant side effects might be a reason why people with MDD often quit antidepressant medication (4–8). Other evidence-based treatment options are neuromodulation (9–11), cognitive–behavioral interventions (12, 13), or regular physical activity (14–17).

Treatment guidelines (AWMF, NICE) recommend antidepressants and/or psychotherapy to treat moderate and severe MDD. Individuals with major depressive disorders often report stressful issues related to the workplace. Job strain, low job control, low social support, high psychological demands, effort–reward imbalance, and high job insecurity were confirmed as predictors particularly for depression (18–23). Several studies (24–27) show that, compared to healthy individuals, individuals with MDD are at an increased risk to lose their current job position (24, 25, 27), to have more difficulties to go back to their workplace (24, 25, 27), to find a new job, once they have been dismissed, and to keep their job position, when they return to their job after a period of illness-related unemployment. Furthermore, data on health costs show that, compared to an accident-related absence from work, depression-related absence from work cause higher economic burden for the individual (25, 27), the employer (27–29), and the public (24, 26, 27, 30). In addition, losing a job position or experiencing difficulties to go back to work turned out to be a risk factor for further relapses of MDD (24).

In this context, specific interventions to reduce workplace-related stress in individuals with MDD might both reduce the economic costs for the public and the burden for the individual (24, 26, 27, 29, 30).

Here we present the influence of the newly developed workplace-related Interpersonal Psychotherapy (W-IPT) which is a specific intervention to influence the workplace-related dimensions of symptoms of individuals with MDD. The original IPT concept was developed as a brief psychotherapeutic treatment aiming at the symptoms of an acute depressive disorder and current interpersonal problems and its effectiveness for the treatment of MDD has been widely demonstrated in numerous controlled trials [cf. meta-analysis from Cuijpers et al. (31)].

The W-IPT focuses on issues occurring in the context of the work role (32) such as social and interpersonal problems at work, mobbing, interpersonal conflicts, role transition, role confusion, burnout, boreout, job strain, low social support, effort–reward imbalance, job demand–control imbalance, and work–life imbalance.

The following three hypotheses and one research question were formulated and each of these is considered in turn. First, following Knekt et al. (33), Hange et al. (34), and Hallgren et al. (35), we expect that, compared to the TAU condition, the workplace-related dimensions of (a) the ability to work and (b) the self-efficacy in returning to work increased over time. The second hypothesis was in the context of empirical evidence (12, 31, 36, 37). We expect that the W-IPT treatment has positive effects on depressive symptoms when compared to the TAU condition. The symptoms of depression will improve in the experts' rating and in the self-rating. Following the second hypothesis and combining it with those of Santor and Kusumakar (38) and Lemmens et al. (37), we formulated the following exploratory research question. If there is a benefit in the W-IPT group, is the effect stable over a 3-month period measured at follow-up? Third, following Göder et al. (39) and Dombrovski et al. (40), we expected that, compared to the TAU condition, the W-IPT treatment will decrease the symptoms of insomnia.

METHOD

Procedure

We conducted a monocentric, randomized, controlled trial comparing W-IPT *versus* TAU condition in a group format in outpatients with major depression related to workplace-related issues between April 2018 and September 2019. The regional ethics commission (Ethikkommission Nordwest- und Zentralschweiz) approved the study (application number 2017-01-489). The eligible patients were fully informed about the study and signed the written informed consent at the first meeting. Moreover, all procedures were in line with the ethical standards of the Declaration of Helsinki (41) and its later amendments and with the ethical code of conduct of the American Psychological Association.

There was a total of one individual screening before the baseline and three data collections. The Hamilton Experts' Rating Scale for Depression (HRSD-24) was conducted in the screening part before the baseline as an information guide whether to include or exclude participants and to train (and

explain) the questions. At baseline, the HRSD-24 was conducted and all questionnaires were filled out by the participants. The same procedure was applied at the last meeting (8 weeks after the start of the intervention) and at 12 weeks after the end of the treatment (follow-up at 20 weeks after randomization) (see **Figure 1** and **Table 1**).

Sample

In-patients and out-patients were recruited through either a media announcement or a licensed practitioner. A total of 56 interested participants were clarified after a quick telephone/e-mail screening. They were invited to an extended interview [interview, informed consent, Structured Clinical Interview for Disorders on the axis I (SCID-I), and HRSD-24]. A total of 28 (50.0%) of the 56 patients fulfilled the inclusion criteria. The inclusion criteria were (1) being between 18 and 65 years of age, (2) major depressive disorder (SCID-I), (3) issues at or with the workplace (*e.g.*, mobbing, effort–reward imbalance, and few social support), (4) fluent in German, (5) signed written informed consent, (6) complying with the study conditions, and (7) no or stable psychopharmacological and psychotherapeutic treatments 4 weeks before the study and throughout the study. The exclusion criteria were (1) HRSD-24 < 18), (2) acute suicidality, (3) psychotic symptoms or bipolar disorder, (4) primary diagnosis of another mental illness, (5) substance use disorder, (6) personality disorder, and (7) applied (or already accepted) disability pension.

Of the 28 eligible participants, there was one non-starter and 27 started (mean age = 43 years, SD = 10.2, 48% males) participating in the present study. There were 14 participants assigned to the W-IPT and 13 to the TAU condition (see **Figure 1**, CONSORT flow chart).

Randomization

A psychologist not otherwise involved in the study performed the randomization. A total of 15 blue and 15 red chips were put

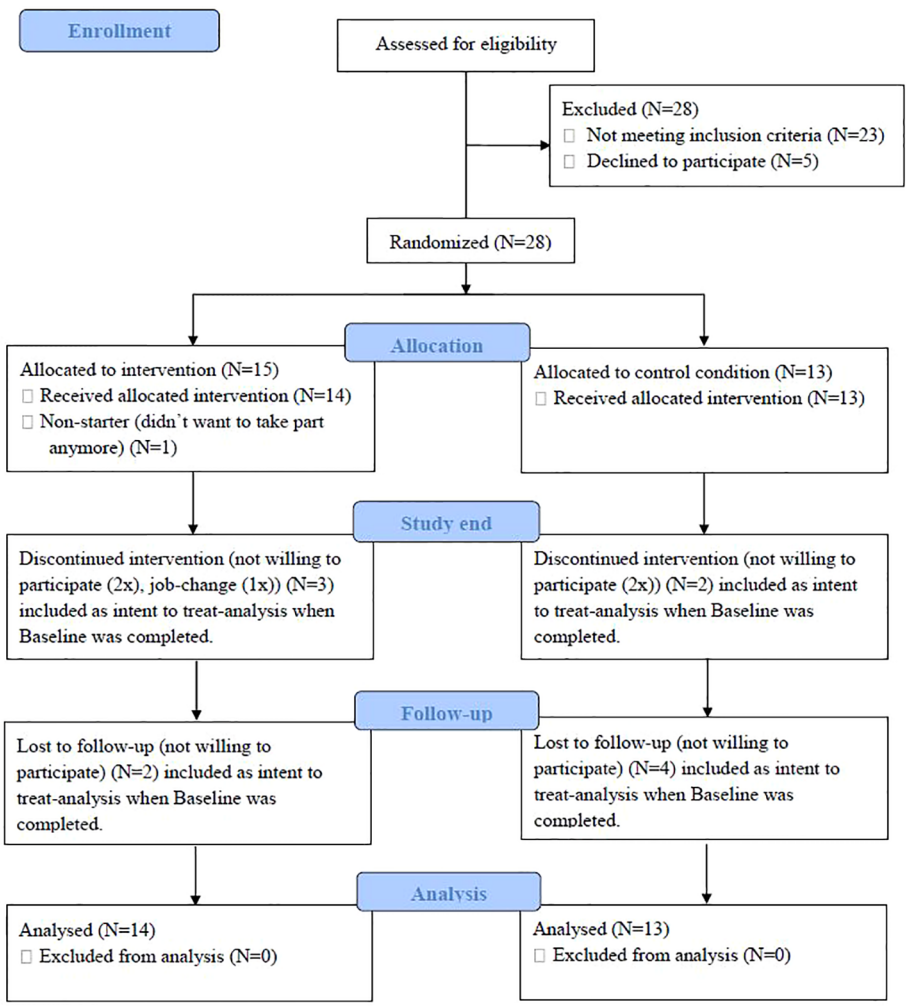

FIGURE 1 | CONSORT flow diagram.

TABLE 1 | Overview of use and use of the questionnaires.

Questionnaires	Prestart	Start	Study-end	Follow-up
SCID-I	X			
Informed Consent	X			
Sociodemographics	X			
Hamilton 24	X	X	X	X
Becks Depression Inventory		X	X	X
Work Ability Index		X	X	X
Return to Work		X	X	X
Insomnia Severity Index		X	X	X

Prestart = initial consultation, SCID-I, Structured Clinical Interview DSM-IV.

in an opaque ballot box and stirred. The psychologist draws a chip and assigned the participant to the study condition. Then, the chip was put aside. To make sure that the blinding procedure is still clear, the participants were informed not to tell the psychologist anything about their treatment. After having taken part in the TAU condition, the participants were given the option to participate in a W-IPT group. The two groups did not differ as regards to age range, gender, civil status, employment, highest educational qualifications, antidepressants use, or in- and outpatient (see **Table 2**).

Measurements

To test our hypothesis, we used internationally recognized and well-established questionnaires in German. For several hypotheses, we used a few less-known questionnaires. These have been translated and translated back to ensure that the content is queried correctly. Mental disorders were assessed by means of the SCID-I based on DSM-IV (42, 43).

Depression Questionnaires

Experts' Rating

The Hamilton Rating Scale for Depression (44) consisted of 24 items, asking on low mood, suicidality, irritability, tension, loss of appetite, loss of interests, and other somatic symptoms. Answers were given on rating scales differing from three-, four-, or five-point ratings. Higher sum scores reflect more marked depressive symptoms. Additionally, the scores were categorized as follows: 0–7, no depressive symptom/ remission; 8–17, mild; 18–24, moderate; 25 and more, severe depressive disorder (Cronbach's alpha = 0.71).

Self-Rating

The Beck's Depression Inventory (BDI-II) examines the depressive symptomatology from a self-perspective (45). The BDI-II is a widely established self-assessment tool with 21 items. It captures the affective, cognitive, and behavioral dimensions as well as the somatic symptoms of depression. The test quality criteria, such as internal consistency, validity, and test–retest reliability, are most satisfactory in both clinical and non-clinical subjects (46) (Cronbach's alpha = 0.89).

Workplace-Related Questionnaires

The Work Ability Index (47) is a measurement tool that uses a questionnaire to calculate an index value for assessing the ability to work. This index value indicates the extent to which an employee is able to carry out his/her work on the basis of his/her personal circumstances and existing working conditions (Cronbach's alpha= 0.70).

Return to Work Self-Efficacy (RTW-SE) is the belief in one's own ability to meet the demands required to return to work. The "return to work attitude" questionnaire (48) contains 11 questions on self-efficacy in managing demands at work (Cronbach's alpha = 0.66).

Subjective Sleep Quality

Sleep Complaints Measured With the Insomnia Severity Index

The questionnaire is in part in line with the DSM-IV insomnia criteria and measures current perception (within the last 2 weeks) in terms of symptom severity, stress, and impairment. These include severity of onset and persistence of sleep (mid-morning and early morning wake disorder), satisfaction with the current sleep pattern, daily life impairment, occurrence of impairments due to sleep problem, and concern about sleep disorders [see Morin et al. (49) and Gerber et al. (50)] (Cronbach's alpha = 0.77).

TABLE 2 | Sociodemographic and illness-related information, separately for participants in W-IPT and TAU condition.

	Groups		Statistics
	W-IPT	TAU	
N	14	13	
Age range in years	24–55	28–55	
Age in years M (SD)	40.86 (11.29)	45.77 (8.438)	$t(25) = -1.279$, $p = .213$
Gender (female/male)	7/7	7/6	$X^2(N=27\ df = 1) = 0.04$, $p = .84$
Civil status (single/married)	10/4	9/4	$X^2(N=27,\ df = 1) = 0.16$, $p = .90$
Current job position (yes/no)	11/3	9/4	$X^2(N=27,\ df = 1) = 0.31$, $p = .58$
Educational level (high school/diploma/university degree)	1/6/7	1/5/7	$X^2(N=27,\ df = 2) = 0.05$, $p = .97$
Antidepressants (yes/no)	10/4	7/6	$X^2(N=27,\ df = 1) = 1.82$, $p = .18$
Participants (In-/Outpatient)	7/7	4/9	$X^2(N=27,\ df = 1) = 0.93$, $p = .34$

Intervention

Work-Related Interpersonal Psychotherapy

The W-IPT condition followed a guideline (51, manuscript in preparation). W-IPT focuses on the work context by adding specific elements to the regular IPT strategies: identifying work-related stress factors using an individual stress and resource profile, creating a balance between performance values and interpersonal values, teaching mindfulness and coping strategies for work-related stress (including social support), and practicing social communication skills at work to cope with conflict and role changes. By applying those strategies, we address social and interpersonal problems at work, such as mobbing, interpersonal conflicts, role transition, role confusion, burnout, boreout, job strain, low social support, and work–life imbalance (for more details, see **Table 3**). The intervention includes one weekly group session of 90 min for six to eighr participants over 8 weeks in addition to the TAU condition. Trained psychotherapists, certified in IPT treatment, conducted the group sessions.

TAU Condition

The participants randomized to the TAU condition received no further intervention during the study period and were encouraged to continue with attending appointments with their clinicians. In order to compensate for non-participation in the W-IPT condition, the patients in the TAU condition were offered to participate in the W-IPT program after their follow-up evaluation.

Statistical Analysis

Following Julious (52), a caseload of 12 individuals per group in pilot studies is reasonable to start with. A series of t-tests and Pearson's correlations was performed to compare socio-demographic, workplace-related, depression-related, and sleep complaints information between the two groups.

To assess changes over time and between and within the two groups, a series of ANOVAs for repeated measures was performed with the factors time (start, study end, and follow-up), group (intervention and TAU), and the time by group interaction and with symptoms of depression (experts' ratings and self-ratings), work-related information, and subjective sleep complaints as dependent variables. Due to the deviation of sphericity, the ANOVAs were performed using Greenhouse–Geisser corrected degrees of freedom, although the original degrees of freedom are reported with the relevant Greenhouse–Geisser epsilon value (ϵ). All computations were performed with the intention-to-treat analysis, with the last observation carried forward method. For ANOVAs, the effect sizes were reported as partial eta squared (η_p^2), with $0.01 < \eta_p^2 < 0.059$ indicating small (S), $0.06 < \eta_p^2 < 0.139$ indicating medium (M), and $\eta_p^2 > 0.14$ indicating large (L) effect sizes. In addition, we followed Becker (53) and reported effect sizes for t-tests within and between the groups for all time points. To classify the effect sizes, we followed Cohen (54): effect sizes can be evaluated as trivial (T; d = 0–0.19), small (S; d = 0.20–0.49), medium (M; d = 0.50–0.79), or large (L; d = 0.80 and greater). The level of significance was set at alpha $p \leq .05$. All statistical calculations were performed with SPSS® 25.0 (IBM Corporation, Armonk, NY, USA) for Windows®.

RESULTS

All descriptive, inferential, and statistical indices are reported in **Tables 4–6**, and **Figure 2**. **Table 4** shows the descriptive statistics, **Table 5** shows the inference statistics, **Table 6** shows the effect size comparisons, and **Figure 2** shows the work ability index.

Symptoms of Depression: Experts' Ratings

Experts' rated symptoms of depression decreased over time (large effect size), but more so in the W-IPT group compared to the TAU condition (medium effect size). Experts' rated symptoms of depression was lower in the W-IPT group (medium effect size). Within the W-IPT group, the symptoms of depression decreased from baseline to the end

TABLE 3 | Content of the sessions on workplace-related interpersonal psychotherapy.

Sessions	Content of sessions
One	Introducing members, identify work-related stress and dysbalances in the context of depression, theory and information, mindfulness exercise, providing handouts and homework
Two	Reflecting and discussing the homework, thoughts and feelings, introduction to self-care and mindfulness, role play exercise, and quick meditation, providing handouts and homework
Three	Reviewing homework, interpersonal stress and conflicts, introducing the Kiesler circle model, role play exercise, do not fall victim, mindfulness meditation, providing handouts and homework
Four	Staying in the present, mindfulness exercise of the body scan, communication at the workplace, how to solve conflicts at the workplace (using the Kiesler model), discussing the homework, providing handouts and homework
Five	Reflecting and discussing the homework, define and identify the living values, handout and discussion of what's important to me, building a supportive network, work–life balance, self-compassion exercise, providing handouts and homework
Six	Mindfulness exercise, reviewing the homework, role play, to ask for help, providing handouts and homework
Seven	Mindfulness exercise, implementation of the values at the workplace, change and acceptance, providing handouts and homework
Eight	Reviewing and discussion of the homework, balance between acceptance and change, applying what was learned, conducting a survey of the course, conclusion and finishing the course along with last contemplation

TABLE 4 | Descriptive overview of the descriptive statistics, separately for assessment time (start, study-end, and follow-up) and group (W-IPT vs. TAU condition).

	Assessment times					
	Baseline		Study-end (+ 8 weeks)		Follow-up (Total of 20 weeks)	
	W-IPT (*N*=14) M (SD)	TAU (*N*=13) M (SD)	W-IPT M (SD)	TAU M (SD)	W-IPT M (SD)	TAU M (SD)
Hamilton 24	25.5 (4.88)	27.46 (12.18)	16.36 (9.16)	23.85 (15.88)	16.29 (10.62)	22.39 (14.38)
Becks Depression Inventory	24.07 (8.11)	28.23 (12.23)	16.14 (8.74)	21.92 (13.81)	15.71 (10.74)	20.85 (12.50)
Work Ability Index	27.14 (10.48)	26.58 (7.80)	30.64 (10.12)	28.08 (10.22)	33.75 (9.58)	27.54 (9.50)
Return to Work	28.21 (5.22)	27.62 (6.23)	31 (4.56)	27 (6.30)	31.79 (5.45)	28.15 (6.89)
Insomnia Severity Index	14 (5.19)	14.67 (5.71)	8.64 (4.11)	13.31 (7.25)	7.79 (5.37)	12.23 (7.11)

TABLE 5 | Inferential statistics of depression, work, and sleep, with the factors Time (start, study-end & follow-up), Group (intervention vs. TAU), and the Time × Group interaction.

	Factors						
	Time		Group		Time × Group		Greenhouse–Geisser
	F	η_p^2	*F*	η_p^2	*F*	η_p^2	Epsilon
Hamilton 24	12.048***	0.325 [L]	1.610	0.060 [M]	1.618	0.061 [M]	.995
Becks Depression Inventory	15.083***	0.376 [L]	1.674	0.063 [M]	0.133	0.005 [S]	.854
Work Ability Index	3.904*	0.135 [M]	4.981*	0.166 [L]	2.159	0.079 [M]	.976
Return to Work	3.120	0.111 [M]	1.843	0.069 [M]	2.571	0.093 [M]	.955
Insomnia Severity Index	12.616***	0.335 [L]	2.676	0.097 [M]	3.032	0.108 [M]	.706

*Degrees of freedom—Time: (2, 25), Group: (1, 25), Time × Group (1, 25). S, small effect size; M, medium effect size; L, large effect size. S > 0.01, M > 0.06, L < 0.14. *p < 0.05; ***p < 0.001.*

TABLE 6 | Effect sizes for mean comparisons form pre- to post-assessment within the groups (intervention group and TAU group).

Group	Start to study-end		Start to follow-up		Study-end to follow-up	
	W-IPT	TAU	W-IPT	TAU	W-IPT	TAU
	Cohen's d	Cohen's d	Cohen's d	Cohen's d	Cohen's d	Cohen's d
Hamilton 24	1.246 [L]	0.255 [S]	1.115 [L]	0.381 [S]	0.007 [T]	0.096 [T]
Becks Depression Inventory	0.940 [L]	0.484 [S]	0.878 [L]	0.597 [M]	0.044 [T]	0.082 [T]
Work Ability Index	0.680 [M]	0.165 [S]	0.658 [M]	0.111 [T]	0.315 [S]	0.055 [T]
Return to Work	0.569 [M]	0.099 [S]	0.671 [M]	0.081 [T]	0.157 [T]	0.174 [T]
Insomnia Severity Index	1.145 [L]	0.212 [S]	1.177 [L]	0.382 [S]	0.179 [T]	0.150 [T]

T, trivial effect size; S, small effect size; M, medium effect size; L, large effect size.

of the study (large effect size) and from baseline to follow-up (large effect size); from the end of the study to follow-up, the symptoms of depression remained stably low (trivial effect size). Within the TAU group, the symptoms of depression decreased from baseline to the end of the study (small effect size) and from baseline to follow-up (small effect size); from the end of the study to follow-up, the symptoms of depression remained stably low (trivial effect size).

Symptoms of Depression: Self-Ratings

The self-rated symptoms of depression decreased in both groups over time (large effect size), but in the W-IPT group, the symptoms of depression decreased more compared to those of the TAU condition (small effect size). The self-rated symptoms of depression were lower in the W-IPT group (medium effect size). Within the W-IPT group, the symptoms of depression decreased from baseline to the end of the study (large effect size) and from baseline to follow-up (large effect size); from the end of the study to follow-up, the symptoms of depression remained stably low (trivial effect size). Within the TAU group, the symptoms of depression decreased slightly from baseline to the end of the study (small effect size) and from baseline to follow-up (medium effect size); from the end of the study to follow-up, the symptoms of depression remained stably high (trivial effect size).

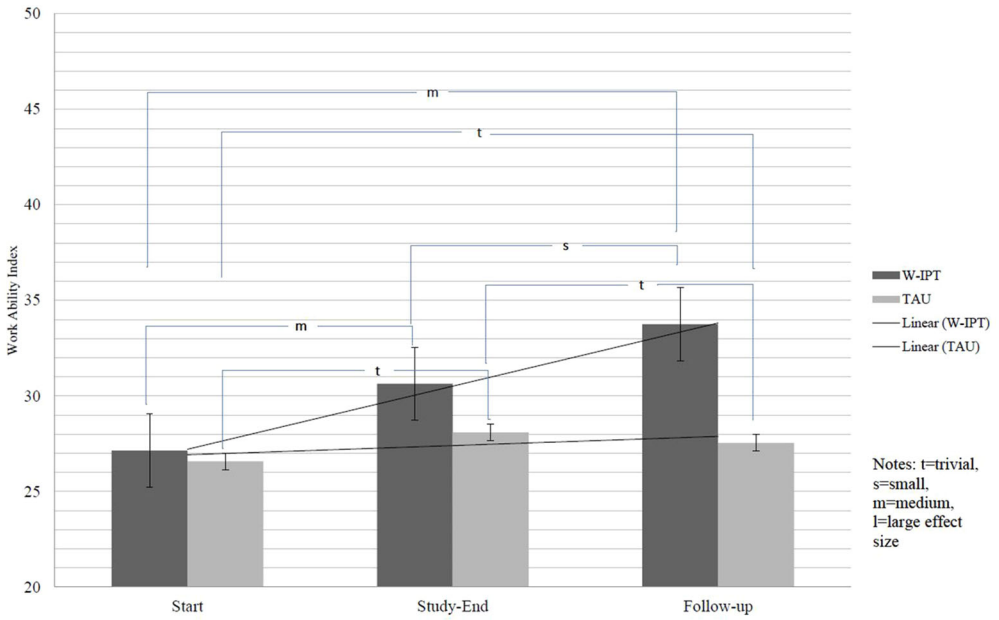

FIGURE 2 | Work Ability Index (WAI).

Ability to Work: Self-Ratings

The self-rated ability to work increased in both groups over time (medium effect size), but in the W-IPT group, the participants reported a higher self-rated ability to work compared to the TAU condition (medium effect size). The self-rated ability to work was higher in the W-IPT group (large effect size). Within the W-IPT group, the self-rated ability to work increased from baseline to the end of the study (medium effect size) and from baseline to follow-up (medium effect size); from the end of the study to follow-up, the ability to work remained stably low (small effect size). Within the TAU group, the self-rated ability to work increased slightly from baseline to the end of the study (small effect size) and from baseline to follow-up (trivial effect size); from the end of the study to follow-up, the ability to work remained stably low (trivial effect size) (cf. **Figure 2**).

Return to Work: Self-Efficacy, Self-Ratings

The self-rated return to work increased in both groups over time (medium effect size), but in the W-IPT group, the self-rated return to work self-efficacy increased more compared to the TAU condition (medium effect size). The self-rated return to work was higher in the W-IPT group (medium effect size). Within the W-IPT group, the self-rated return to work increased from baseline to the end of the study (medium effect size) and from baseline to follow-up (medium effect size); from the end of the study to follow-up, return to work remained stably high (trivial effect size). Within the TAU group, the self-rated return to work increased slightly from baseline to the end of the study (small effect size) and from baseline to follow-up (trivial effect size); from the end of the study to follow-up, return to work remained stably low (trivial effect size).

Subjective Sleep Quality

Insomnia Severity Index: Self-Ratings

The self-rated sleep complaints decreased in both groups over time (large effect size), but more so in the W-IPT group compared to the TAU condition (medium effect size). The self-rated sleep complaints were lower in the W-IPT group (medium effect size). Within the W-IPT group, the self-rated sleep complaints decreased from baseline to the end of the study (large effect size) and from baseline to follow-up (large effect size); from the end of the study to follow-up, the self-rated sleep complaints remained stably low (trivial effect size). Within the TAU group, the self-rated sleep complaints decreased only slightly from baseline to the end of the study (small effect size) and from baseline to follow-up (small effect size); from the end of the study to follow-up, the self-rated sleep complaints remained stably high (trivial effect size)

To summarize, the symptoms of depression (experts' rating) decreased in both groups over time (large effect sizes), but in the W-IPT group, the symptoms of depression decreased more compared to those of the TAU group. The reduction at follow-up led the W-IPT group to an altered assessment of the severity of the depression diagnosis (from moderate to mild), whereas in the TAU condition the

reduction did not lead to a change in the assessment. The symptoms of depression (self-rating) decreased in both groups over time (large effect sizes), but in the W-IPT, the symptoms of depression decreased more compared to those of the TAU group. The work ability index self-rated interpretation gained in both groups over time (medium effect size), but in the W-IPT, the work ability increased more compared to that of the TAU group. The self-efficacy for the return to work gained in both groups over time (medium effect size), but in the W-IPT, the self-efficacy increased more compared to that of the TAU group. The self-rated symptoms of subjective sleep complaints decreased in both groups over time (large effect size), but in the W-IPT group, the sleep complaints decreased more compared to those of the TAU.

DISCUSSION

The key findings of the present study suggest that a specific work-related approach for depressed patients with work stress led to a greater decrease of clinician- and self-rated depressive symptoms compared to TAU. In addition, not only the subjective work ability was higher and the self-efficacy was more improved in the W-IPT group but also the quality of sleep was more increased compared to the TAU condition. Importantly, those effects remained stable over the follow-up time period. The particularly large effect in the W-IPT condition indicates that a job-related focus can help in the short and long terms.

The present study adds to the current literature in an important way because not only is the IPT beneficial for individuals with MDD (31, 55) but also it is especially based on psychosocial and workplace-related issues [see also Schramm and Berger (32)]. Our main study strength is the value of longitudinal research for extending knowledge about the relationship between W-IPT and MDD because of workplace-related stress.

The results are important for clinicians because the newest meta-analysis (8) showed that it is unclear whether the antidepressive treatment is more efficacious than the placebo treatment. There is an obvious necessity to use best evidence-based practices. The psychotherapeutic treatments are well evaluated, especially the cognitive–behavioral aspect, and IPT seems to be the preferred choice. The present study results are in line with the results shown before.

To summarize, all of our hypotheses plus the exploratory research question were fully confirmed. In this respect, comparing the effect of the intervention with those of the previous studies (see "Introduction"), again we hold that the present finding is clinically relevant. Thus, the present finding is in accord with previous results (33–35). We believe that the beneficial influence of W-IPT cannot be explained merely as an effect of time as they outperformed the outcome of the TAU condition.

In terms of comparing the long-term effect sizes of the present study with those of the previous studies, the present finding is in accord with previous results (37, 38).

We expected the work ability in the intervention group to be higher than in the TAU group. Surprisingly, the work ability in the W-IPT condition grew further even after the end of the study and over the follow-up time from originally poor to medium at the end of the intervention and almost good at follow-up, while the TAU condition showed a stable trend of poor work ability.

Despite the intriguing findings, several limitations warrant against overgeneralization of the present results. First, the sample size was small, although we basically relied on effect size calculations which, unlike *p*-values, do not vary with sample size, but since this was a pilot study, the small numbers can be explained. Further, there are increasing concerns about the importance and 'significance' of *p*-values (56). Second, the sample with a broad age range can be seen not only as a possible limitation but also as a strong point. After all, there was a positive influence despite the heterogeneity of the sample.

Further studies might differentiate between specific groups (f.i., gender, age, or comorbidities). Another limitation is the relative short follow-up period of 3 months. A longer follow-up could be helpful, especially in practical uses (employee training). Booster sessions could be provided to ensure sustainable effects. In addition, our study compared the possible effect of a new group program with a TAU condition. We cannot definitively say whether or not it is superior to other evidence-supported psychological treatments such as cognitive behavioral therapy. Furthermore, the inclusion and exclusion criteria were chosen to identify a particular kind of sample. However, comorbidities such as substance use or personality disorders are common in depressive disorders. Lastly, it is possible that further latent but unassessed variables (family members, sleep–quality interaction, and increase in social support) might have biased the results shown (in any given direction possible).

CONCLUSIONS

An 8-week group intervention with W-IPT had improved symptoms of depression, ability to work, self-efficacy regarding return to work, and sleep complaints more than the TAU condition.

We believe that the present results might be of broader interest: First, in terms of the costs for the companies (hiring new employee and absent or less productive employees) and for the employees (health and changing the job). Specifically, costs in employees being less productive or absent will result in several high costs per employee (26, 27, 30, 57). Second, the public health cost should also be mentioned here although we did not calculate the costs. Third, it follows that the benefit of an early investment in individual health should be the main interest of all three partners.

A short efficient treatment in groups seems to be easy to implement and economical. It could be a fixed part of a regular occupational health management (58, 59). The possible uses are (1) companies interested in having a modern occupational health management and (2) individuals experiencing stress and problems at the workplace for secondary or tertiary prevention.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservations, to any qualified researchers.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethikkommission Nordwest- und Zentralschweiz (EKNZ)—application number 2017-01-489. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DN, NK, AK, SB, CW, NS, and UL wrote the proposal and designed the study and completed the final draft. DN, NK, AK, SB, CW, and NS were involved in data gathering and data entering. DN, NK, and SB performed the statistical analysis and wrote the draft. CW, NS, and UL commented on the second draft. All authors commented on the final manuscript, which was completed by DN, NK, AK, SB, CW, NS, and UL.

FUNDING

This study was supported by the Thomi Hopf Stiftung, Oberwilerstrasse 65, 4123 Allschwil, Switzerland (www.thomi-hopf-stiftung.ch).

ACKNOWLEDGMENTS

The authors thank Marielle Koenig (UPK) and Vladimir Djurdjevic (UPK) for the much appreciated support and planning. Further, we thank Vivien Ankli (University of Basel) for helping us in data gathering and entry. Finally, we thank Claudia Züger (University of Basel) for proofreading as well as to all who have contributed to this project.

REFERENCES

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders 5th edition: DSM 5*. Arlington VA: American Psychiatric Association (2013).
2. Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet* (1997) 349:1436–42. doi: 10.1016/S0140-6736(96)07495-8
3. Jorm AF, Patten SB, Brugha TS, Mojtabai R. Has increased provision of treatment reduced the prevalence of common mental disorders? Review of the evidence from four countries. *World Psychiatry* (2017) 16:90–9. doi: 10.1002/wps.20388
4. Boesen K, Paludan-Muller AS, Munkholm K. Network meta-analysis of antidepressants. *Lancet* (2018) 392:1011. doi: 10.1016/S0140-6736(18)31783-5
5. Hengartner MP, Ploderl M. Statistically Significant Antidepressant-Placebo Differences on Subjective Symptom-Rating Scales Do Not Prove That the Drugs Work: Effect Size and Method Bias Matter! *Front Psychiatry* (2018) 9:517. doi: 10.3389/fpsyt.2018.00517
6. Hengartner MP. Scientific debate instead of beef; challenging misleading arguments about the efficacy of antidepressants. *Acta Neuropsychiatr* (2019) 31:235–6. doi: 10.1017/neu.2019.23
7. Hengartner MP, Ploderl M. Newer-Generation Antidepressants and Suicide Risk in Randomized Controlled Trials: A Re-Analysis of the FDA Database. *Psychother Psychosom* (2019) 88:1–2. doi: 10.1159/000501215
8. Munkholm K, Paludan-Muller AS, Boesen K. Considering the methodological limitations in the evidence base of antidepressants for depression: a reanalysis of a network meta-analysis. *BMJ Open* (2019) 9:e024886. doi: 10.1136/bmjopen-2018-024886
9. Gaynes BN, Lloyd SW, Lux L, Gartlehner G, Hansen RA, Brode S, et al. Repetitive transcranial magnetic stimulation for treatment-resistant depression: a systematic review and meta-analysis. *J Clin Psychiatry* (2014) 75:477–89. quiz 489. doi: 10.4088/JCP.13r08815
10. Ren J, Li H, Palaniyappan L, Liu H, Wang J, Li C, et al. Repetitive transcranial magnetic stimulation versus electroconvulsive therapy for major depression: a systematic review and meta-analysis. *Prog Neuropsychopharmacol Biol Psychiatry* (2014) 51:181–9. doi: 10.1016/j.pnpbp.2014.02.004
11. Salehi I, Hosseini SM, Haghighi M, Jahangard L, Bajoghli H, Gerber M, et al. Electroconvulsive therapy (ECT) and aerobic exercise training (AET) increased plasma BDNF and ameliorated depressive symptoms in patients suffering from major depressive disorder. *J Psychiatr Res* (2016) 76:1–8. doi: 10.1016/j.jpsychires.2016.01.012
12. Cuijpers P, Berking M, Andersson G, Quigley L, Kleiboer A, Dobson KS. A meta-analysis of cognitive-behavioural therapy for adult depression, alone and in comparison with other treatments. *Can J Psychiatry* (2013) 58:376–85. doi: 10.1177/070674371305800702
13. Li JM, Zhang Y, Su WJ, Liu LL, Gong H, Peng W, et al. Cognitive behavioral therapy for treatment-resistant depression: A systematic review and meta-analysis. *Psychiatry Res* (2018) 268:243–50. doi: 10.1016/j.psychres.2018.07.020
14. Schuch FB, Vasconcelos-Moreno MP, Borowsky C, Zimmermann AB, Rocha NS, Fleck MP. Exercise and severe major depression: effect on symptom severity and quality of life at discharge in an inpatient cohort. *J Psychiatr Res* (2015) 61:25–32. doi: 10.1016/j.jpsychires.2014.11.005
15. Schuch FB, Morres ID, Ekkekakis P, Rosenbaum S, Stubbs B. A critical review of exercise as a treatment for clinically depressed adults: time to get pragmatic. *Acta Neuropsychiatr* (2016) 29(2):1–7. doi: 10.1017/neu.2016.21
16. Stubbs B, Rosenbaum S, Vancampfort D, Ward PB, Schuch FB. Exercise improves cardiorespiratory fitness in people with depression: A meta-analysis of randomized control trials. *J Affect Disord* (2016) 190:249–53. doi: 10.1016/j.jad.2015.10.010
17. Schuch F, Vancampfort D, Firth J, Rosenbaum S, Ward P, Reichert T, et al. Physical activity and sedentary behavior in people with major depressive disorder: A systematic review and meta-analysis. *J Affect Disord* (2017) 210:139–50. doi: 10.1016/j.jad.2016.10.050
18. Stansfeld S, Candy B. Psychosocial work environment and mental health–a meta-analytic review. *Scand J Work Environ Health* (2006) 32:443–62. doi: 10.5271/sjweh.1050
19. Netterstrøm B, Conrad N, Bech P, Fink P, Olsen O, Rugulies R, et al. The Relation between Work-related Psychosocial Factors and the Development of Depression. *Epidemiologic Rev* (2008) 30:118–32. doi: 10.1093/epirev/mxn004
20. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med* (2010) 60:277–86. doi: 10.1093/occmed/kqq081
21. Ndjaboué R, Brisson C, Vézina M. Organisational justice and mental health: a systematic review of prospective studies. *Occup Environ Med* (2012) 69:694–700. doi: 10.1136/oemed-2011-100595
22. Virtanen M, Nyberg ST, Batty GD, Jokela M, Heikkilä K, Fransson EI, et al. Perceived job insecurity as a risk factor for incident coronary heart disease:

systematic review and meta-analysis. *BMJ : Br Med J* (2013) 347:f4746. doi: 10.1136/bmj.f4746
23. Stuke H, Bermpohl F. Welche Arbeitsbedingungen begünstigen die Entwicklung einer depressiven Störung? *Psychiat Prax* (2016) 43:245–52. doi: 10.1055/s-0035-1552769
24. Lerner D, Adler DA, Chang H, Lapitsky L, Hood MY, Perissinotto C, et al. Unemployment, job retention, and productivity loss among employees with depression. *Psychiatr Serv* (2004) 55:1371–8. doi: 10.1176/appi.ps.55.12.1371
25. Lépine J-P, Briley M. The increasing burden of depression. *Neuropsychiatr Dis Treat* (2011) 7:3. doi: 10.2147/NDT.S19617
26. Evans-Lacko S, Koeser L, Knapp M, Longhitano C, Zohar J, Kuhn K. Evaluating the economic impact of screening and treatment for depression in the workplace. *Eur Neuropsychopharmacol* (2016) 26:1004–13. doi: 10.1016/j.euroneuro.2016.03.005
27. Amos TB, Tandon N, Lefebvre P, Pilon D, Kamstra RL, Pivneva I, et al. Direct and Indirect Cost Burden and Change of Employment Status in Treatment-Resistant Depression: A Matched-Cohort Study Using a US Commercial Claims Database. *J Clin Psychiatry* (2018) 79:1–9. doi: 10.4088/JCP.17m11725
28. Stewart WF, Ricci JA, Chee E, Hahn SR, Morganstein D. Cost of Lost Productive Work Time Among US Workers With Depression. *JAMA* (2003) 289:3135–44. doi: 10.1001/jama.289.23.3135
29. Mcternan WP, Dollard MF, Lamontagne AD. Depression in the workplace: An economic cost analysis of depression-related productivity loss attributable to job strain and bullying. *Work Stress* (2013) 27:321–38. doi: 10.1080/02678373.2013.846948
30. Mccrone P, Rost F, Koeser L, Koutoufa I, Stephanou S, Knapp M, et al. The economic cost of treatment-resistant depression in patients referred to a specialist service. *J Ment Health* (2018) 27:567–73. doi: 10.1080/09638237.2017.1417562
31. Cuijpers P, Van Straten A, Hollon SD, Andersson G. The contribution of active medication to combined treatments of psychotherapy and pharmacotherapy for adult depression: a meta-analysis. *Acta Psychiatrica Scandinavica* (2010) 121:415–23. doi: 10.1111/j.1600-0447.2009.01513.x
32. Schramm E, Berger M. [Interpersonal psychotherapy for work-related stress depressive disorders]. *Nervenarzt* (2013) 84:813–22. doi: 10.1007/s00115-013-3744-5
33. Knekt P, Lindfors O, Laaksonen MA, Raitasalo R, Haaramo P, Järvikoski A. Effectiveness of short-term and long-term psychotherapy on work ability and functional capacity — A randomized clinical trial on depressive and anxiety disorders. *J Affect Disord* (2008) 107:95–106. doi: 10.1016/j.jad.2007.08.005
34. Hange D, Ariai N, Kivi M, Eriksson MC, Nejati S, Petersson E-L. The impact of internet-based cognitive behavior therapy on work ability in patients with depression–a randomized controlled study. *Int J Gen Med* (2017) 10:151. doi: 10.2147/IJGM.S129710
35. Hallgren M, Kraepelien M, Lindefors N, Zeebari Z, Kaldo V, Forsell Y. Physical exercise and internet-based cognitive–behavioural therapy in the treatment of depression: randomised controlled trial. *Br J Psychiatry* (2015) 207:227–34. doi: 10.1192/bjp.bp.114.160101
36. Johnson JE, Price AB, Kao JC, Fernandes K, Stout R, Gobin RL, et al. Interpersonal psychotherapy (IPT) for major depression following perinatal loss: a pilot randomized controlled trial. *Arch Women's Ment Health* (2016) 19:845–59. doi: 10.1007/s00737-016-0625-5
37. Lemmens LH, Galindo-Garre F, Arntz A, Peeters F, Hollon SD, Derubeis RJ, et al. Exploring mechanisms of change in cognitive therapy and interpersonal psychotherapy for adult depression. *Behav Res Ther* (2017) 94:81–92. doi: 10.1016/j.brat.2017.05.005
38. Santor DA, Kusumakar V. Open Trial of Interpersonal Therapy in Adolescents With Moderate to Severe Major Depression: Effectiveness of Novice IPT Therapists. *J Am Acad Child Adolesc Psychiatry* (2001) 40:236–40. doi: 10.1097/00004583-200102000-00019
39. Göder R, Fritzer G, Hinze-Selch D, Huchzermeier C, Koch JM, Seeck-Hirschner M, et al. Sleep in Major Depression: Relation to Memory Performance and Outcome after Interpersonal Psychotherapy. *Neuropsychobiology* (2007) 55:36–42. doi: 10.1159/000103574
40. Dombrovski AY, Cyranowski JM, Mulsant BH, Houck PR, Buysse DJ, Andreescu C, et al. Which symptoms predict recurrence of depression in women treated with maintenance interpersonal psychotherapy? *Depression Anxiety* (2008) 25:1060–6. doi: 10.1002/da.20467
41. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA* (2013) 310:2191–4. doi: 10.1001/jama.2013.281053
42. Saß H, Wittchen H-U, Zaudig M. (1996). Diagnostisches und statistisches Manual psychischer Störungen-DSM-IV. Deutsche Bearbeitung u. Einleitung von H. Sass, H.-U. Wittchen, M. Zaudig.
43. Wittchen H-U, Zaudig M, Fydrich T. *Skid. Strukturiertes klinisches Interview für DSM-IV*. (1997). Göttingen: Hogrefe.
44. Hamilton M. A rating scale for depression. *J Neurology Neurosurgery Psychiatry* (1960) 23:56–61. doi: 10.1037/t04100-000
45. Beck AT, Steer RA, Brown GK, Hautzinger M, Keller F, Kühner C. *Beck Depressionsinventar, 2. Auflage (BDI-II)*. Frankfurt am Main: Pearson Assessment (2006).
46. Beck AT, Steer RA, Garbin GM. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clin Psychol Rev* (1988) 8:77–100. doi: 10.1016/0272-7358(88)90050-5
47. *WAI-Manual* [Online]. (2015). Available: http://www.arbeitsfaehigkeit.uni-wuppertal.de/picture/upload/file/WAI-Manual.pdf [Accessed].
48. Lagerveld SE, Blonk RW, Brenninkmeijer V, Wijngaards-De Meij L, Schaufeli WB. Work-focused treatment of common mental disorders and return to work: a comparative outcome study. *J Occup Health Psychol* (2012) 17:220–34. doi: 10.1037/a0027049
49. Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* (2011) 34:601–8. doi: 10.1093/sleep/34.5.601
50. Gerber M, Lang C, Lemola S, Colledge F, Kalak N, Holsboer-Trachsler E, et al. Validation of the German version of the insomnia severity index in adolescents, young adults and adult workers: results from three cross-sectional studies. *BMC Psychiatry* (2016) 16:174. doi: 10.1186/s12888-016-0876-8
51. Schramm E, Mack S. W-IPT Guideline (in prep).
52. Julious SA. Sample size of 12 per group rule of thumb for a pilot study. *Pharmaceutical Stat* (2005) 4:287–91. doi: 10.1002/pst.185
53. Becker BJ. Synthesizing standardized mean-change measures. *Br J Math Stat Psychol* (1988) 41:257–78. doi: 10.1111/j.2044-8317.1988.tb00901.x
54. Cohen J. A power primer. *psychol Bull* (1992) 112:155. doi: 10.1037/0033-2909.112.1.155
55. Klerman G, Weissman M, Rounsaville B, Chevron E. *"Interpersonal therapy of depression (IPT)"*. New York: Basic Books (1984).
56. Wasserstein RL, Schirm AL, Lazar NA. *"Moving to a world beyond "p< 0.05""*. (2019). The American Statistician. doi: 10.1080/00031305.2019.1583913
57. Evans-Lacko S, Knapp M. Global patterns of workplace productivity for people with depression: absenteeism and presenteeism costs across eight diverse countries. *Soc Psychiatry Psychiatr Epidemiol* (2016) 51:1525–37. doi: 10.1007/s00127-016-1278-4
58. Brand S, Gerber M, Hatzinger M, Beck J, Holsboer-Trachsler E. Evidence for similarities between adolescents and parents in sleep patterns. *Sleep Med* (2009) 10:1124–31. doi: 10.1016/j.sleep.2008.12.013
59. Bajoghli H, Alipouri A, Holsboer-Trachsler E, Brand S. Sleep patterns and psychological functioning in families in northeastern Iran; evidence for similarities between adolescent children and their parents. *J adolescence* (2013) 36:1103–13. doi: 10.1016/j.adolescence.2013.08.016

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

CLINICAL TRIAL
published: 18 March 2020
doi: 10.3389/fpsyt.2020.00193

Interpersonal Psychotherapy vs. Treatment as Usual for Major Depression Related to Work Stress: A Pilot Randomized Controlled Study

Elisabeth Schramm[1†], Simon Mack[1,2†], Nicola Thiel[1], Carolin Jenkner[3], Moritz Elsaesser[1] and Thomas Fangmeier[1]*

[1] Department of Psychiatry and Psychotherapy, Faculty of Medicine, University Medical Center, University of Freiburg, Freiburg, Germany, [2] Hochschule Fresenius, University of Applied Sciences, Heidelberg, Germany, [3] Clinical Trials Unit, Faculty of Medicine, University Medical Center, University of Freiburg, Freiburg, Germany

OPEN ACCESS

Edited by:
Preethi Premkumar, Nottingham Trent University, United Kingdom

Reviewed by:
Padmavati Ramachandran, Schizophrenia Research Foundation, India
Anna Buckell, Nottingham Trent University, United Kingdom

***Correspondence:**
Elisabeth Schramm
elisabeth.schramm@uniklinik-freiburg.de

[†]*These authors share first authorship*

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *18 November 2019*
Accepted: *27 February 2020*
Published: *18 March 2020*

Citation:
Schramm E, Mack S, Thiel N, Jenkner C, Elsaesser M and Fangmeier T (2020) Interpersonal Psychotherapy vs. Treatment as Usual for Major Depression Related to Work Stress: A Pilot Randomized Controlled Study. Front. Psychiatry 11:193. doi: 10.3389/fpsyt.2020.00193

Background: Depressive disorders are among the leading causes of sick leave and long-term work incapacity in most modern countries. Work related stress is described by patients as the most common context of depression. It is vital to know what types of treatments are effective in improving work related problems and occupational health. However, there is only limited evidence on work-focused interventions.

Methods: The aim of our study was to evaluate the feasibility and generate first data on the effectiveness of Interpersonal Psychotherapy (IPT) adapted as a group program to focus on the work context (W-IPT). In total, 28 outpatients (22 women; $M = 49.8$ years old) with Major Depressive Disorder related to work stress were randomized to 8 weekly group sessions of W-IPT or to treatment as usual (TAU; guideline oriented treatment). Primary endpoint was the Hamilton Rating Scale for Depression (HRSD-24) score. Key secondary endpoints were, among others, Beck Depression Inventory (BDI-II), Work Ability Index (WAI), Return to Work Attitude (RTW-SE), and the Effort-Reward-Imbalance (ERI). In addition, we evaluated the participants' overall satisfaction with the W-IPT program by two items. A follow-up assessment was conducted 3 months after end of acute treatment.

Results: W-IPT was significantly more effective than TAU in reducing clinician-assessed depressive symptoms at follow-up (HRSD-24 W-IPT/TAU: $M = 6.6/12.0$, SE: 1.46/2.17, $t_{(df=1)} = -2.24$, $p = 0.035$, $d = 0.79$) and self-assessed depression (BDI-II W-IPT/TAU post-treatment: $M = 8.8/18.8$, SE: 1.69/2.70, $t_{(df=1)} = -3.82$, $p = 0.001$, $d = 1.28$; follow-up: $M = 8.8/16.1$, SE: 1.62/2.26, $t_{(df=1)} = -2.62$, $p = 0.015$, $d = 0.99$). Furthermore, W-IPT was superior in improving work-ability (WAI), return-to-work attitude (RTW-SE), and the effort-reward-ratio (ERI). No dropouts were observed in both groups. The vast majority (89 percent) of participants in the W-IPT condition were "very satisfied" with the program, although wishing for a greater number of sessions (75 percent).

Conclusions: A work-focused IPT program for the treatment of depression associated to work stress was feasible and highly acceptable. W-IPT turned out to be more effective than standard treatment in reducing depression and work-related problems. However, further evidence in a multicenter trial extending this pilot study is necessary.

Keywords: interpersonal psychotherapy, work, stress, depression, work intervention, randomized controlled trial

INTRODUCTION

Unipolar depression is highly prevalent at the workplace with every 10th female and every 20th male worker meeting criteria for major depressive disorder (1–3). Among the U.S. workforce, the prevalence of major depressive disorder has been estimated at 7.6% (4). Depressive disorders have a large impact on social and occupational functioning (5) and on the ability to work, represented in days of sick leave and long-term work incapacity. Administrative data from national health statistics documented a threefold increase (208%) in days of sick leave due to mental disorders, particularly depression, between 1997 and 2018 (6). Work related stress has been described as the most common cause of a depression by patients (7, 8). Job strain, low job control, low social support, high psychological demands, effort–reward imbalance, and high job insecurity were confirmed as predictors for common mental disorder, particularly depression (9–14).

Specific treatment of employees suffering from depression has received increasing attention in recent years. In a Cochrane review (15), 23 studies with depressed patients were found examining work-directed and non-work-directed clinical interventions that included sickness absence as an outcome. Non-work-directed, non-specific clinical interventions included antidepressant medication, psychological clinical interventions (cognitive behavioral therapy), usual primary or occupational care, combination of psychological and pharmacological intervention, strengths exercise, and relaxation. Only four work-directed psychological interventions (three cognitive behavioral therapies/CBT with a focus on work, one special care program) added to a non-specific clinical intervention were identified, showing moderate evidence in reducing sickness absence compared to a clinical intervention alone. In contrary, enhancing primary care with a quality improvement program or with physical exercise did not have a considerable effect on work outcomes. The same applied for comparing one antidepressant medication to another. In addition, a systematic meta-review (16) examining the effectiveness of workplace mental health interventions revealed good effects for interventions with a specific focus on work for depression and/or anxiety, such as CBT-based and problem-focused return-to-work programs. Those approaches had a strong evidence base for improving symptomology and a moderate evidence base for improving occupational outcomes. A recent systematic review analyzed the effects of universal and targeted workplace interventions. While targeted interventions are specifically aimed at employees with acute depressive symptoms, universal interventions include employees broadly at all mental health stages and therefore carry out preventive as well as curative effects in a more heterogeneous group. CBT was the most frequently used method, while approaches combining different therapeutic interventions showed the most promising results in reducing depressive symptoms (17). Most treatments were delivered in group format and resulted in lower attrition rates compared with other delivery formats. A group vs. an individual treatment format may increase the subjective experience of finding support from other group members and sharing the similar problematic work-related patterns such as perfectionism and the lack of being able to set limits. The results must be considered with caution, however, since synthesizing data always requires the reduction of information in order to create clear-cut conclusions. Therefore, data is pooled by commonalities potentially omiting distinct features. Nigatu et al. (18) analyzed interventions focusing on enhancing return to work (RTW) in individuals with a common mental illness. The authors concluded that those programs did not lead to improved RTW rates over control conditions, but reduced the number of sick-leave days.

Overall, these findings demonstrate that there are empirically supported workplace directed interventions which facilitate the recovery of employees diagnosed with depression and produced modest effects on occupational outcomes. However, the small number of controlled studies on the effects of psychotherapy on work-related outcomes in MDD to date makes it difficult to draw final conclusions.

The authors of the Cochrane review (15) assert that there is an urgent need to evaluate work-focused treatments by adapting existing psychotherapeutic interventions to focus on the work context and to include work-related outcomes. The Interpersonal Psychotherapy (IPT) is an evidence based first-line treatment for depression (19) recommended in national and international guidelines such as National Institute of Clinical Excellence, the American Psychiatric Association, and the World Health Organization [for summary see (20)]. The effectiveness of IPT in improving depression has been widely demonstrated in numerous controlled trials (21). As IPT directly relates to psychosocial problems associated with the depressive episode, it seems to be an appropriate fit for the treatment of work problems by focusing on work as a social role. Besides the four standard foci of IPT (interpersonal disputes, role transitions, grief, and social deficits), work stress as a fifth focus has been established over the past years (22).

The aim of the present pilot study was to evaluate the effectiveness of IPT tailored specifically to focus on the work context (W-IPT) by additional integrated modules addressing work problems and work stress. Our primary hypothesis was that W-IPT is more effective in reducing depressive symptoms compared to TAU after termination of the 8-weeks program.

MATERIALS AND METHODS

Trial Design

We conducted a monocentric, randomized controlled trial comparing W-IPT vs. TAU in a group format in outpatients with major depression related to work stress between March 2017 and February 2018. The Research Ethics Board of the University of Freiburg approved the trial. In accordance with the Declaration of Helsinki, participants were informed in detail about the purpose and design of the trial, and provided written consent prior to randomization. This trial was registered in advance with the German Clinical Trials Register (registry number: DRKS00011669).

Participants and Procedure

In total, 28 patients from the area of Freiburg, Germany were randomized to W-IPT or TAU. *Randomization* was conducted according to a central computerized randomization schedule (randomizer.at from Medical University Graz, Austria) stratified with the factor medication intake yes/no and a 1:1 treatment allocation ratio. The randomization method was permuted blocks with a block size of two. Eligible patients had a primary diagnosis of major depression (single-episode or recurrent) according to the Structured Clinical Interview for DSM-IV [SCID-I, (23)], and a score of $\geq$ 20 on the 24-item version of the Hamilton Rating Scale for Depression [HRSD-24, (24)]. Due to recruitment limitations, we allowed to include two patients with a score below 20 on the HRSD-24. The assessments (HRSD-24 and SCID-I) were done by trained clinical psychologists who were blind to the randomization. Eligible patients also fulfilled the criteria for at least one of the following work-related problems: bullying/mobbing, interpersonal conflicts, role transition, role confusion, burnout, boreout, job strain, effort-reward-imbalance, job demand-control imbalance, low decision latitude, high psychological demands, work-life-imbalance, low social support, high job insecurity. All patients were in ongoing medical/psychiatric care, and if pharmacotherapy (antidepressants, no regular use of benzodiazepines) was involved it had to be stable for at least 4 weeks before randomization. Patients were 18–65 years old and fluent in German language. We excluded participants with acute risk of suicide; history of psychotic symptoms, bipolar disorder, or organic brain disorders; a primary diagnosis of another axis I disorder; concurrent diagnosis of substance dependency; antisocial, schizotypal, or borderline personality disorder [SCID-II, (25)]. **Figure 1** displays the patient flow.

The *W-IPT* condition followed a guideline (unpublished manuscript). W-IPT focuses on the work context by adding specific elements to the regular IPT strategies, i.e., identifying work-related stress factors using an individual stress- and resource profile; psychoeducation on the association of work stress and depression; creating a balance between performance values and interpersonal values; teaching mindfulness and other coping strategies for work-related stress (including social support); practicing communication skills at work to cope with interpersonal conflicts and difficult role transitions, return-to-work plans, and organization involvement. By applying those strategies, social and interpersonal problems at work contributing to depression are addressed. The intervention includes 1 weekly group session of 90 min for 6–8 outpatients over 8 weeks in addition to TAU. Before the start of the group, one preliminary session was conducted in which the interpersonal inventory and a treatment contract including individual goals were performed. In addition, the patients and therapist decided if it was indicated to involve the employer and/or a social worker. The group sessions were conducted by two out of three professionally trained psychotherapists, certified in IPT treatment.

Patients randomized to *TAU* were encouraged to continue with guideline oriented treatment (including psychotherapy and/or pharmacotherapy) by a primary care physician, psychiatrist, or licensed psychotherapist during the study period. In order to compensate for non-participation in the W-IPT condition, patients in the TAU condition were offered to participate in the W-IPT program after their follow-up evaluation.

Assessment

All measures were administered at pre-treatment (baseline), posttreatment (8 weeks after baseline), and at follow-up (3 months after posttreatment). Defined pre-specified *primary outcome measure* was the change in the clinician-rated *HRSD-24* (24) from baseline to posttreatment. The HRSD is a clinician-administered clinical interview for the assessment of the severity of depressive symptoms. Scores range from 0 to 54, with higher scores reflecting more depressive symptoms. A score of $<$ 9 is qualified as "normal," 9–16 as "mild," 17–24 as "moderate," and a score $>$ 25 as "severe." Detailed information on psychometric properties of the HRSD-24 can be found elsewhere (26). *Secondary outcome measures* were *remission*, defined as HRSD-24 score of $\leq$ 8, and *response rate*, defined as the reduction in the HRSD-24 score by at least 50% from baseline; and the self-rated *Beck Depression Inventory-II [BDI-II*, (27)] to assess depressive symptoms from patient's perspective. The test quality criteria, such as internal consistency, validity, and test-retest reliability, are most satisfactory in both clinical and non-clinical subjects [Cronbach's alpha = 0.89, (28)]. For work-related measures, we used the *Work Ability Index [WAI*, (29)], a self-evaluation of the subject's estimated capacities and resources at work. Work ability is considered impaired when the WAI score was low (7–27 points) or moderate (28–36 points), and as adequate when the score was good (37–43 points) or excellent (44–49 points). In addition, we used the long version of the *Effort-Reward Imbalance (ERI)* at work (30). The ERI effort scale consists of three items that refer to demanding aspects at work. The reward scale consists of seven items with an underlying three-factorial structure referring to financial, esteem-related and security-/career-related rewards. Published data document satisfactory internal consistency in terms of Cronbach's α (usually $\alpha > 0.70$) of the three scales of effort, reward and over-commitment, and a satisfactory test-retest-reliability (31). The *return-to-work self-efficacy scale* [*RTW-SE*, (32)] was applied to assess the subject's belief in the own ability to meet the

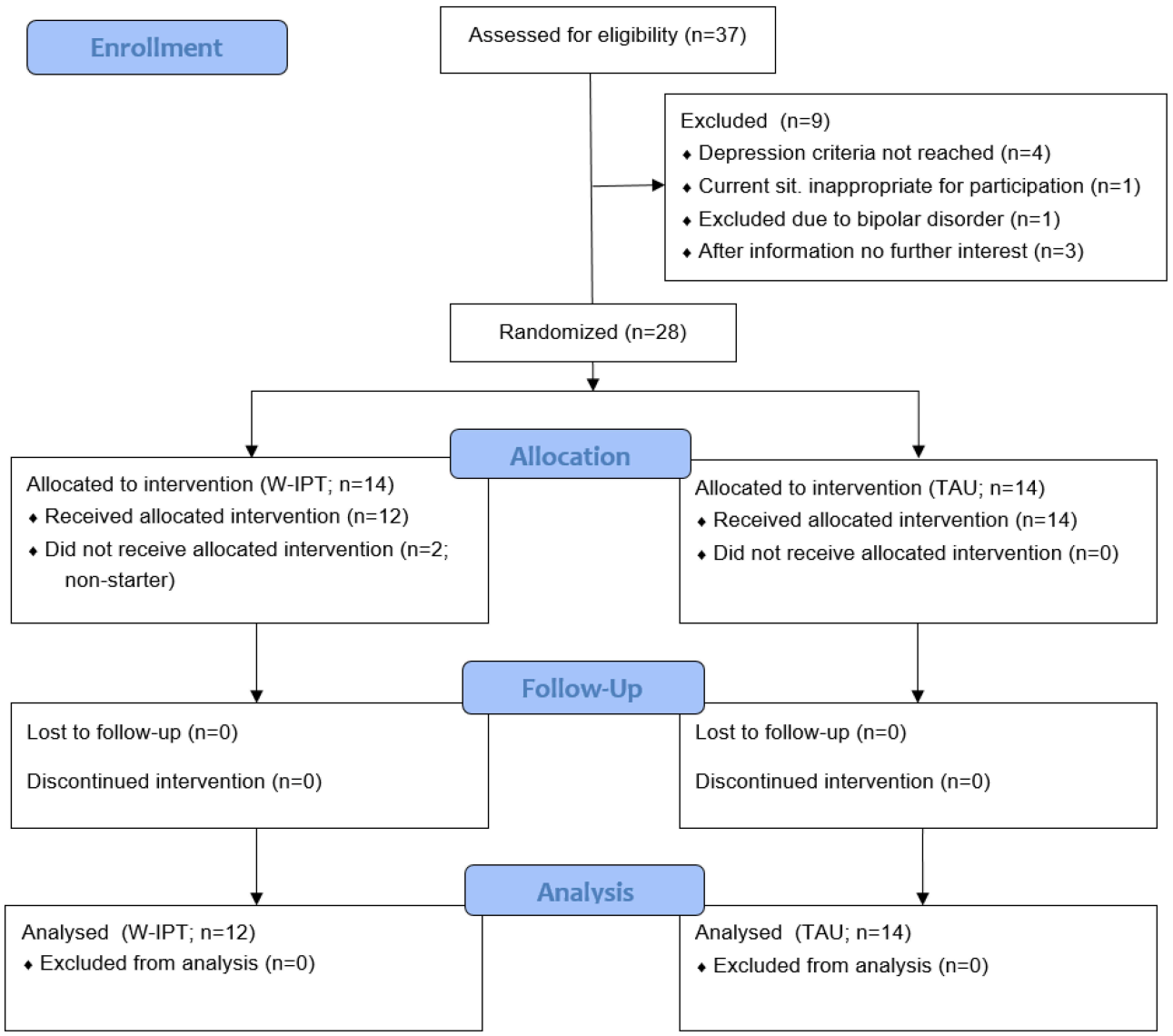

FIGURE 1 | CONSORT flowchart. W-IPT, work-related interpersonal therapy; TAU, treatment-as-usual.

demands at work. The RTW-SE contains 11 questions on self-efficacy in managing work demands. To evaluate the patient's satisfaction with the W-IPT program, we used 2 self-designed items addressing the overall satisfaction with the content (*5-point-scale ranging from 1 = very dissatisfied to 5 = very satisfied*) and with the duration of the program (*rather too short; suitable; rather too long*).

Sample Size

To obtain estimates for the treatment effect and its variance, the primary outcome clinician-rated *HRSD-24* posttreatment was assessed in 24 patients. Julious (33) found that a sample size of 12 per group in pilot studies seems reasonable for generation of pilot data. To account for potential dropouts, 28 patients were assessed for eligibility.

Statistical Methods

The primary efficacy analysis was performed according to the intention-to-treat (ITT) principle and therefore was based on the full analysis set (FAS). The FAS included all randomized patients, and patients were analyzed as belonging to their randomized arm regardless of protocol deviations. Patients for which the therapy was not started were excluded. The primary endpoint (change in HRSD-24 score from baseline to 8 weeks of treatment) was analyzed using linear regression with treatment group as factor and baseline HRSD-24 score as covariate. A conservative estimate of the effect size anticipated for the subsequent confirmative trial was derived from these analyses by a combination of clinical and statistical judgement. We analyzed secondary endpoints descriptively in a similar fashion as the primary outcome, using regression models as appropriate for the respective type of

TABLE 1 | Sample and clinical characteristics at baseline.

	W-IPT ($N = 14$)		TAU ($N = 14$)	
	N	*%*	*N*	*%*
Female sex	11	78.6	11	78.6
Ø age (N, M, SD)	14	47.4 (9.8)	14	52.1 (10.8)
Married or cohabiting	9	64.3	8	57.1
Academic degree (post highschool)	5	35.7	5	35.7
Size of business employer				
Small	1	7.1	0	0.0
Middle	3	21.43	1	7.1
Large	9	64.29	13	92.86
Non self-employed	12	85.71	13	92.86
Sick leave	7	50.0	7	50.0
Pharmacotherapy	11	78.57	8	57.1
Mental health problems mainly caused by				
a) working condition*	14	81.1	14	77.1
b) private situation	14	18.9	14	22.9

**(0–100%); patient's perspective.*

data. Treatment effects were calculated with two-sided 95% confidence intervals. No interim analyses of the efficacy endpoint were performed.

RESULTS

Table 1 presents sample and clinical characteristics of the total study sample ($N = 28$; 79 percent women; average age: 49.8 years). The majority of subjects were women which reflects the distribution of unipolar depression among the genders (2). In both groups, 50 percent were on sick leave at baseline measure. 57.1 percent in the TAU, and 78.6 percent in the W-IPT condition received ongoing psychopharmacological treatment.

Primary Outcome

Figure 2 shows that there was no significant difference between W-IPT and TAU in reducing clinician-assessed depressive symptoms at post-treatment ($p = 0.89$). However, W-IPT was more effective in improving depressive symptoms than TAU at the follow-up 3 months after the end of the intervention (HRSD-24 W-IPT/TAU: $M = 6.6/12.0$, $SE = 1.46/2.17$, $t_{(df=1)} = -2.24$, $p = 0.035$). Cohen's $d = 0.79$ at follow-up; remission rate 66.7 vs. 35.7%; $p = 0.24$ (**Table 2**).

Secondary Outcomes

Figure 3 illustrates the differences of self-rated depression rates between W-IPT and TAU. Group differences were found at posttreatment and follow-up (BDI-II W-IPT/TAU posttreatment: $M = 8.83/18.83$, $SE = 1.69/2.70$, $t_{(df=1)} = -3.82$, $p = 0.001$; BDI-II follow-up: $M = 8.83/16.07$, $SE = 1.62/2.26$, $t_{(df=1)} = -2.62$, $p = 0.015$).

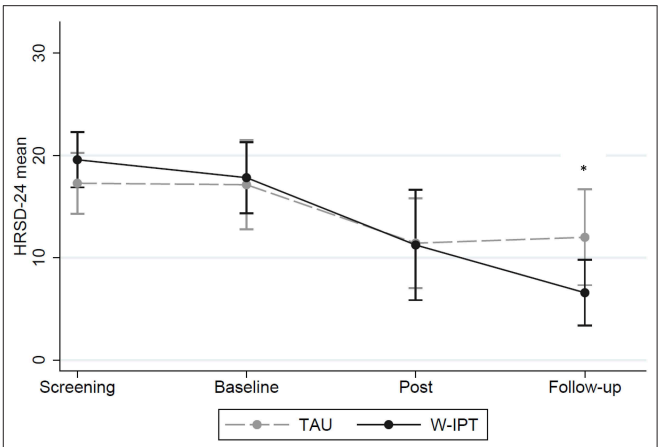

FIGURE 2 | HRSD-24 scores of W-IPT and TAU at screening, baseline, post and follow-up ($N = 24$). *means significant, $p < 0.05$.

TABLE 2 | Response- and Remission rates of W-IPT and TAU.

		W-IPT % (N)	TAU % (N)	$p^{(+)}$	*ES (Cohen's d)*
Response ≥50% HRSD-reduction	Post-treatment	50.0 (6)	42.9 (6)	0.716	-
	Follow-up	75.0 (9)	50.0 (7)	0.248	-
Remission <9 HRSD-score T0 vs. T2	Post-treatment	41.7 (5)	50.0 (7)	0.671	0.02
	Follow-up	66.7 (8)	35.7 (5)	0.238	**0.79**

(+)p-Wert, χ^2-test or Fisher's exact test (n < 5 pro cell). Significant values are bolded.

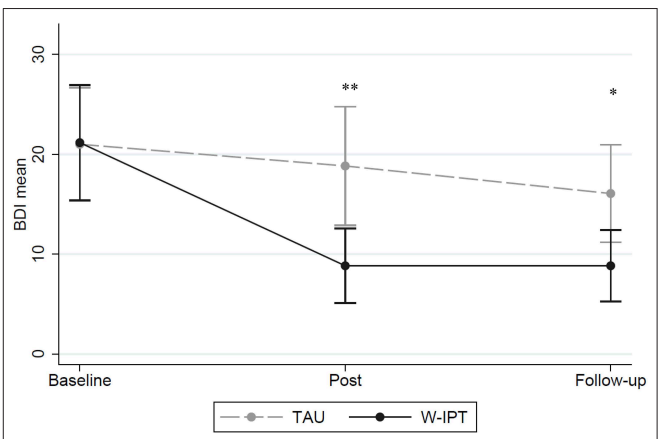

FIGURE 3 | BDI-II scores of W-IPT and TAU at baseline, post and follow-up ($N = 24$). *means significant, $p < 0.05$. **means highly significant, $p < 0.001$.

Figure 4 shows the WAI mean scores of W-ITP and TAU at baseline, post, and follow-up (range: 7–49). Group differences were found at posttreatment and follow-up (W-IPT/TAU post-treatment: $M = 29.5/22.0$, $SE = 1.11/1.97$, $t_{(df=1)} = 3.41$, $p = 0.002$; follow-up: $M = 27.5/23.3$, $SE = 1.00/1.86$, $t_{(df=1)} = 2.32$, $p = 0.029$).

Figure 5 shows the RTW-SE mean scores of W-ITP and TAU at baseline, post, and follow-up suggesting significant group

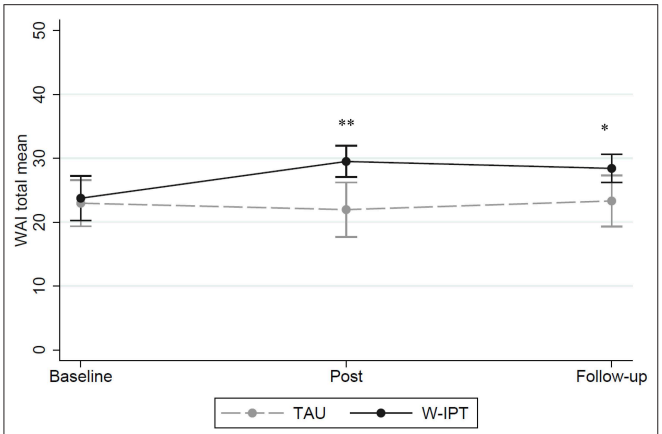

FIGURE 4 | Total WAI mean scores of W-IPT and TAU at baseline, post and follow-up (range: 7–49). *means significant, $p < 0.05$. **means highly significant, $p < 0.001$.

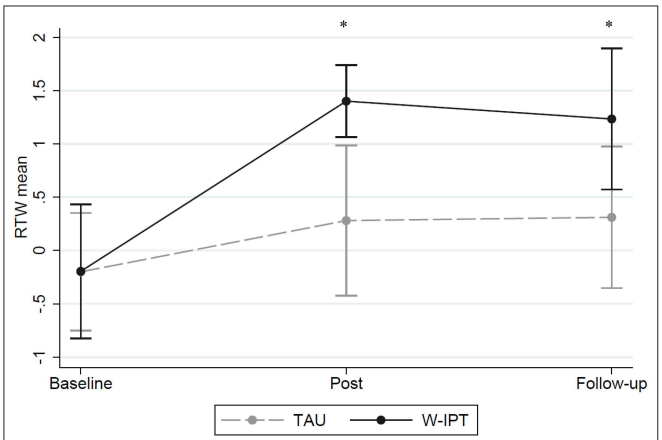

FIGURE 5 | RTW-SE mean scores of W-IPT and TAU at baseline, post and follow-up. *means significant, $p < 0.05$.

differences at posttreatment and follow-up (RTW W-IPT/TAU post-treatment: $M = 0.3/1.4$, $SE = 0.32/0.15$, $t_{(df=1)} = -3.20$, $p = 0.002$; RTW follow-up: $M = 0.3/1.2$, $SE = 0.36/0.33$, $t_{(df=1)} = -1.87$, $p = 0.038$).

In **Table 3**, the effort-reward-imbalance (ERI) subscale scores and the effort-reward-ratio (ERR) are demonstrated for baseline, posttreatment and follow-up. Group differences were identified for reward scores at follow-up, and the effort-reward-ratio differed between groups significantly at post-treatment (ERR W-IPT/TAU: $M = 1.1/1.7$, $SE = 0.79/1.87$, $t_{(df=1)} = -3.13$, $p = 0.007$).

Participant's Program Evaluation

The vast majority (89 percent) of participants in the W-IPT condition (N = 12) were "very satisfied" with the program, although wishing for a greater number of sessions ("rather too short"; 75 percent).

TABLE 3 | Effort-reward-imbalance (ERI) of W-IPT and TAU at baseline, post-treatment, and follow-up.

		W-IPT	TAU
Effort	T0	20.0	18.9
	T1	18.4	19.5
	T2	18.4	16.6
	T0	24.1	22.3
Reward	T1	27.7	21.4
	T2	***27.1**	21.7
	T0	20.5	19.1
Overcommittment	T1	17.5	17.2
	T2	16.7	15.1
	T0	1.5	1.5
Effort-Reward-Ratio	T1	***1.1**	1.7
	T2	1.2	1.3

**means significant, $p < 0.05$. Significant values are bolded.*

DISCUSSION

The aim of the present study was to evaluate the feasibility and generate first data on the effectiveness of W-IPT compared to TAU for major depression related to work stress. A work directed interpersonal group intervention (W-IPT) was more effective than standard treatment (TAU) in reducing clinician rated as well as self-assessed depression 3 months after the intervention, as well as in improving self-assessed depression at the end of the intervention. In the primary outcome measure, the HRSD-24, we detected a between-group standardized effect size of $d = 0.79$ 3 months after treatment. We consider this effect large and clinically meaningful. High response and remission rates were identified for the intervention group with 75 and 66.7%, respectively (vs. 50 and 35.7% in the TAU group) at the naturalistic 3-months follow up. However, those differences did not reach significance, most probably due to the small sample size of this pilot study.

The decrease of depressive symptoms with W-IPT is in line with randomized controlled trials that investigated CBT workplace interventions (16, 17, 34). Compared to a work-related CBT approach (34) including 24 weekly individual sessions which reached an effect size of $d = 1.63$ (pre- to posttreatment), W-IPT showed an effect size of $d = 0.92$ after only 8 weekly group sessions, and $d = 2.14$ at the 3-months follow-up, respectively. In the systematic review of Yunus and others (17), all effect sizes of the 14 targeted interventions at the workplace (mostly CBT or stress management programs) were below the ES reached with the W-IPT program ($d = 0.79$ at 3 months' follow-up).

Considering work-related outcomes, W-IPT was superior to TAU in increasing the work ability from a critically poor to a moderate, yet still impaired functioning. The W-IPT group intervention was also superior over TAU in reducing work stress by improving the effort-reward-ratio. Furthermore, the return-to-work attitude was more optimistic in terms of increased self-efficacy-thinking about work in the W-IPT group than in the

TAU condition. At present, there is limited evidence of other types of tertiary psychological interventions in depressed patients which evaluated work related outcomes other than RTW rates and sickness absence. One study (35) found that work ability was significantly improved according to WAI (15%) during a 3 years follow-up period after different types of psychodynamic or solution-focused therapy. In our sample, WAI scores of the W-IPT group improved by 20 percent (post-measure) and 17 percent (follow-up).

Another main goal of this pilot study was to determine the feasibility and acceptance of the program by the participants. We observed no dropouts in both groups suggesting a high compliance with the intervention among the patients. In addition, the satisfaction with the group intervention appeared to be very positive. The vast majority of participants in the intervention group (89 percent) were "very satisfied" with the intervention program, although wishing a longer duration of the program (75 percent).

There are several limitations of the present study. First, besides the small pilot sample, patients were heterogenous in their work status. Half of them were on sick leave at the beginning of the study whereas the other half continued working, limiting the generalization of the results. Second, depending on the length of sickness absence, not all applied strategies were a good fit for those patients such as a detailed stepwise plan for RTW for patients who continued working. Third, some of the work related measurements were not applicable for those patients on long-term sick leave. Fourth, we did not systematically assess sickness absence throughout the study. All work outcomes were assessed only through self-report. Fifth, we did not evaluate the medication status throughout the study. Multiple analyses have been performed in this trial. As the primary aim of the study was the assessment of the feasibility of the treatment and to generate pilot data for a confirmatory trial, all results have to be interpreted descriptively and with care. Due to the nature of the data, there was no adjustment for multiple testing. Furthermore, reference is made to the gender and age stratification within each group, but data is not compared along these lines and the small sample number would not allow this. In a future randomized, controlled multicenter trial, the current time of sickness absence will be limited to a maximum of 4 weeks. In addition, we will assess the total time of sickness absence as well as the medication status throughout the study.

To our knowledge, this is the first study comparing a work-related IPT approach with a standard treatment including work related outcomes. The findings provide support for using usual IPT strategies combined with mindfulness techniques focused on the work context. The W-IPT program for the treatment of depression associated to work stress was feasible and highly acceptable. W-IPT turned out to be more effective than treatment-as-usual in reducing depression and work-related problems and the results remained stable over the next 3 months. However, further evidence in a multicenter trial extending this pilot study is necessary.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Board of the University of Freiburg. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ES and CJ: had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. ES, NT, TF, and CJ: study concept and design. ES, SM, ME, and TF: acquisition, analysis, or interpretation of data and drafting of the manuscript. SM, CJ, and TF: statistical analysis. ES: obtained funding and administrative, technical, or material support and study supervision. All authors: critical revision of the manuscript for important intellectual content.

FUNDING

This study was funded by the Programm Klinische Studien of the Medizinische Fakultät Freiburg.

REFERENCES

1. Roesler U, Jacobi F, Rau R. Work and mental disorders in a German national representative sample. *Work Stress.* (2006) 20:234–44. doi: 10.1080/02678370601008463
2. Jacobi F, Höfler M, Siegert J, Mack S, Gerschler A, Scholl L, et al. Twelve-month prevalence, comorbidity and correlates of mental disorders in Germany: the mental health module of the German health interview and examination survey for adults (DEGS1-MH). *Int J Methods Psychiatr Res.* (2014) 23:304–19. doi: 10.1002/mpr.1439
3. Mack S, Jacobi F, Gerschler A, Strehle J, Höfler M, Busch MA, et al. Self-reported utilization of mental health services in the adult German population—evidence for unmet needs? results of the DEGS1-mental health module (DEGS1-MH). *Int J Methods Psychiatr Res.* (2014) 23:289–303. doi: 10.1002/mpr.1438
4. Kessler RC, Merikangas KR, Wang PS. The prevalence and correlates of workplace depression in the national comorbidity survey replication. *J Occup Environ Med.* (2008) 50:381–390. doi: 10.1097/JOM.0b013e31816ba9b8
5. Lerner D, Henke RM. What does research tell us about depression, job performance, and work productivity? *J Occup Environ Med.* (2008) 50:401–10. doi: 10.1097/JOM.0b013e31816bae50
6. DAK. *Psychoreport 2019 entwicklung der psychischen erkrankungen im job langzeitanalyse: 1997—2018.* (2019). Available online at: https://www.dak.de/dak/download/190725-dak-psychoreport-pdf-2125500.pdf (accessed February 5, 2020).
7. Hansson M, Chotai J, Bodlund O. Patients' beliefs about the cause of their depression. *J Affect Disord.* (2010) 124:54–9. doi: 10.1016/j.jad.2009.10.032
8. Schneider D, Zobel I, Härter M, Kech S, Berger M, Schramm E. Wirkt die interpersonelle psychotherapie besser bei frauen als bei männern? *Psychother Psych Med.* (2008) 58:23–31. doi: 10.1055/s-2007-970946

9. Stansfeld S, Candy B. Psychosocial work environment and mental health–a meta-analytic review. *Scand J Work Environ Health*. (2006) 32:443–62. doi: 10.5271/sjweh.1050
10. Netterstrøm B, Conrad N, Bech P, Fink P, Olsen O, Rugulies R, et al. The relation between work-related psychosocial factors and the development of depression. *Epidemiol Rev*. (2008) 30:118–32. doi: 10.1093/epirev/mxn004
11. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med*. (2010) 60:277–86. doi: 10.1093/occmed/kqq081
12. Ndjaboué R, Brisson C, Vézina M. Organisational justice and mental health: a systematic review of prospective studies. *Occup Environ Med*. (2012) 69:694–700. doi: 10.1136/oemed-2011-100595
13. Theorell T, Hammarström A, Gustafsson PE, Hanson LM, Janlert U, Westerlund H. Job strain and depressive symptoms in men and women: a prospective study of the working population in Sweden. *J Epidemiol Community Health*. (2014) 68:78–82. doi: 10.1136/jech-2012-202294
14. Stuke H, Bermpohl F. Welche arbeitsbedingungen begünstigen die entwicklung einer depressiven Störung? *Psychiat Prax*. (2016) 43:245–52. doi: 10.1055/s-0035-1552769
15. Nieuwenhuijsen K, Faber B, Verbeek JH, Neumeyer-Gromen A, Hees HL, Verhoeven AC, et al. Interventions to improve return to work in depressed people. *Cochrane Database of Syst Rev*. (2014) 3:CD006237. doi: 10.1002/14651858.CD006237.pub3
16. Joyce S, Modini M, Christensen H, Mykletun A, Bryant R, Mitchell PB, et al. Workplace interventions for common mental disorders: a systematic meta-review. *Psychol Med*. (2016) 46:683–97. doi: 10.1017/S0033291715002408
17. Yunus WMAWM, Musiat P, Brown JSL. Systematic review of universal and targeted workplace interventions for depression. *Occup Environ Med*. (2018) 75:66–75. doi: 10.1136/oemed-2017-104532
18. Nigatu YT, Liu Y, Uppal M, McKinney S, Rao S, Gillis K, et al. Interventions for enhancing return to work in individuals with a common mental illness: systematic review and meta-analysis of randomized controlled trials. *Psychol Med*. (2016) 46:3263–74. doi: 10.1017/S0033291716002269
19. Sakaluk JK, Williams AJ, Kilshaw RE, Rhyner KT. Evaluating the evidential value of empirically supported psychological treatments (ESTs): a meta-scientific review. *J Abnormal Psychol*. (2019) 128:500–9. doi: 10.1037/abn0000421
20. Ravitz P, Watson P. Interpersonal psychotherapy: healing with a relational focus. *FOC*. (2014) 12:275–84. doi: 10.1176/appi.focus.12.3.275
21. Cuijpers P, Andersson G, Donker T, Straten A van. Psychological treatment of depression: results of a series of meta-analyses. *Nord J Psychiatry*. (2011) 65:354–64. doi: 10.3109/08039488.2011.596570
22. Schramm E, Berger M. [Interpersonal psychotherapy for work-related stress depressive disorders]. *Nervenarzt*. (2013) 84:813–22. doi: 10.1007/s00115-013-3744-5
23. First MB, Spitzer RL, Gibbon M, Williams JBW. *Structured clinical interview for DSM-IV-TR axis I disorders, research version, patient edition. (SCID-I/P)*. New York, NY: Biometrics Research; New York State Psychiatric Institute (2002).
24. Hamilton M. A rating scale for depression. *J Neurol Neurosurg Psychiatry*. (1960) 23:56–62. doi: 10.1136/jnnp.23.1.56
25. First MB, Gibbon M, Spitzer RL, Williams JBW, Benjamin, L. S. *Structured clinical interview for DSM-IV axis II personality disorders, (SCID-II)*. Washington, DC: American Psychiatric Press (1997).
26. Trajković G, Starčević V, Latas M, Leštarević M, Ille T, Bukumirić Z, et al. Reliability of the hamilton rating scale for depression: a meta-analysis over a period of 49 years. *Psychiatry Res*. (2011) 189:1–9. doi: 10.1016/j.psychres.2010.12.007
27. Beck AT, Steer RA, Brown GK. *Manual for the beck depression inventory-II*. San Antonio, TX: Psychological Corperation (1996). doi: 10.1037/t00742-000
28. Beck AT, Steer RA, Garbin GM. Psychometric properties of the beck depression inventory: twenty-five years of evaluation. *Clin Psychol Rev*. (1988) 8:77–100. doi: 10.1016/0272-7358(88)90050-5
29. Tuomi K, Ilmarinen J, Jahkola A. *Work Ability Index*. Helsinki: Finnish Institute of Occupational Health (1998).
30. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, et al. The measurement of effort–reward imbalance at work: european comparisons. *Soc Sci Med*. (2004) 58:1483–99. doi: 10.1016/S0277-9536(03)00351-4
31. Siegrist J, Li J, Montano D. Psychometric properties of the effort-reward imbalance questionnaire. *Unpublished mansucript*. Available online at: https://www.uniklinik-duesseldorf.de/fileadmin/Fuer-Patienten-und-Besucher/Kliniken-Zentren-Institute/Institute/Institut_fuer_Medizinische_Soziologie/Dateien/ERI/ERI_Psychometric-New.pdf (accessed May 8, 2019).
32. Lagerveld SE, Blonk RWB, Brenninkmeijer V, Schaufeli WB. Return to work among employees with mental health problems: development and validation of a self-efficacy questionnaire. *Work & Stress*. (2010) 24:359–75. doi: 10.1080/02678373.2010.532644
33. Julious SA. Sample size of 12 per group rule of thumb for a pilot study. *Pharm Stat*. (2005) 4:287–91. doi: 10.1002/pst.185
34. Kröger C, Bode K, Wunsch E-M, Kliem S, Grocholewski A, Finger F. Work-related treatment for major depressive disorder and incapacity to work: preliminary findings of a controlled, matched study. *J Occup Health Psychol*. (2015) 20:248–58. doi: 10.1037/a0038341
35. Knekt P, Lindfors O, Laaksonen MA, Raitasalo R, Haaramo P, Järvikoski A. Effectiveness of short-term and long-term psychotherapy on work ability and functional capacity — a randomized clinical trial on depressive and anxiety disorders. *J Affect Disord*. (2008) 107:95–106. doi: 10.1016/j.jad.2007.08.005

Conflict of Interest: ES received modest book royalties and honoraria for workshops and presentations relating to IPT.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 18 March 2020
doi: 10.3389/fpsyt.2020.00134

Correlations of the "Work–Family Conflict" With Occupational Stress—A Cross-Sectional Study Among University Employees

*Lucia Jerg-Bretzke[1], Kerstin Limbrecht-Ecklundt[1], Steffen Walter[1], Jennifer Spohrs[1] and Petra Beschoner[2]**

[1] Department of Psychosomatic Medicine and Psychotherapy, Medical Psychology, University Medical Centre, Ulm, Germany, [2] Department of Psychosomatic Medicine and Psychotherapy, Ulm University Medical Centre, Ulm, Germany

OPEN ACCESS

Edited by:
Claas Lahmann,
University Medical Center
Freiburg, Germany

Reviewed by:
Michal Elisabeth Schneider,
Monash University, Australia
Warren Mansell,
University of Manchester,
United Kingdom

***Correspondence:**
Petra Beschoner
petra.beschoner@uni-ulm.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: 04 November 2019
Accepted: 14 February 2020
Published: 18 March 2020

Citation:
Jerg-Bretzke L, Limbrecht-Ecklundt K, Walter S, Spohrs J and Beschoner P (2020) Correlations of the "Work–Family Conflict" With Occupational Stress—A Cross-Sectional Study Among University Employees. Front. Psychiatry 11:134. doi: 10.3389/fpsyt.2020.00134

Background: The working conditions at universities and hospitals are reported to be stressful. Several national and international studies have investigated occupational stress in hospitals. However, scientific studies at colleges and universities addressing psycho-social stress factors and their potential consequences are scarce. In this context, the consequences and correlations of the factor of work–family conflict, in particular, are currently uninvestigated. The aim of our study was to assess data on psychosocial stress in the context of the compatibility of work and family.

Methods: Data were gathered through a cross-sectional-study, $N = 844$ (55% female, 41% male), on university staff (42.3% scientists, 14.3% physicians, 19.4% employees in administration, and 19.3% employees in service). Participants filled out questionnaires to provide their personal data and details of their work and private life conditions. For this purpose, we used the Work–Family and Family–Work Conflict Scales, Effort-Reward Inventory and Overcommitment Scale (ERI, OC), Patient Health Questionnaire (PHQ-4), short-form Maslach Burnout Inventory (MBI), and questions on their subjective health. Statistical analyses were performed using SPSS 22.

Results: We found high levels of stress parameters in the total sample: extra work (83%), fixed-term work contracts (53%), overcommitment (OC, 26%), Effort-Reward Imbalance (18%, ERI Ratio > cut-off 0.715), work–family conflict (WFC, 35%), and family–work conflict (FWC, 39%). As hypothesized, we found significant correlations of both WFC and FWC with psychosocial work strain (ERI Ratio) as well as overcommitment (OC). Mental and somatic health parameters also had a significant positive correlation with WFC and FWC. Using a regression analysis ($N = 844$), we identified WFC as a predictor of burnout, while emotional exhaustion, extra work, and overcommitment could be identified as predictors of WFC and FWC.

Discussion: The results of our study point toward deficits in the compatibility of work life and private life in the work fields of science, colleges, and universities. Furthermore, we

found indicators that work–family conflicts (interrole conflicts) have an impact on mental and somatic health. These work–family conflicts should be targets for preventions and interventions with the aim of improving the work-life balance and mental and somatic wellbeing of employees.

Keywords: work–family conflict, working conditions, occupational stress, effort–reward imbalance, mental health, university staff

INTRODUCTION

In our globalized and increasingly digitalized occupational environment, employees are exposed to more and more arduous occupational conditions and occupational stress. This has an impact on their health and well-being (1). Particularly affected are colleges, universities, and university hospitals, since they are confronted with a global competitive environment shaped by the pressure of competition for research funds, personal resources, and students. Combined, this leads to high demands regarding flexibility, mobility, and spatiotemporal adaptability (2). Furthermore, the increasing number of students, which is not accompanied by an adequate increase in teaching professionals (3), educational reforms, harsher competitive conditions, and economization pose new framework requirements in academia (4). In recent years, these structural changes have led to exponential work intensification and occupational stress for university employees (5, 6). For German scientific researchers, the working conditions can be considered precarious. In 2015, nine out of ten university employees were employed with fixed-term contracts, according to a newspaper report (7). Scientific associates are highly qualified and motivated but underpaid, with a considerable amount of unpaid overtime, non-transparent as well as uncertain career perspectives, all in combination with a very high variety of tasks and occupational stress (8, 9). Yet another affected occupational area is university medicine with its associated university hospitals. Multiple studies describe the working conditions in hospitals as arduous and wearisome, demonstrate the link to health impairments, and indicate the working conditions as a central factor determining work performance (10, 11). The weekly hours of work, complemented by shift work, stand-by duty, special services, and time pressure, are considered to be the main stress factors (12, 13). Furthermore, the mental workload in the occupational area of university medicine is extremely high, and the already stressful working conditions are aggravated by aspects such as multi-tasking, high informational complexity, and constant deadline constraints, as well as the pressure of gaining qualifications and a limited scope of action (14).

For a long time, psychiatric disorders have shown the greatest increase in the causation of temporal and long-term absence from work (15). According to a study of the Techniker health insurance fund (1), "work" turns out to be the number one stress factor in Germany and is consequently associated with various consequences of strain, for the individual as well as for the economy. For that matter, subjectively experienced stress, particularly psychosocial occupational stress, poses a high-risk factor for mental and physical health. Mentioned in this regard are an increased susceptibility to infections, cardiovascular diseases, diseases of the musculoskeletal system, depression, anxiety disorders, burnout, and a subjectively experienced poor state of health (1, 16). Related studies indicate differences between the various occupational groups. For instance, national, and international studies have shown that deficient or impairing conditions and psychosocial strain, particularly in the context of medical work, share joint responsibility for mental and physical health discomfort (11, 17). The demands on medical practitioners are explicitly displayed in higher numbers of anxiety and depressive symptoms (18). Dech (5) refers to the high mental workload, which can be particularly acute for scientists, leading to adverse psychological health effects. In this context, he describes multi-tasking, high informational complexity, and constant deadline constraints as well as pressure to gain qualifications as the causes for multiple-stress syndromes, reactions to excessive demands, burnout, and substance abuse.

Different models and instruments exist for assessing psychosocial occupational stress with regard to the impact of its stress-related consequences. For our study, the perspective is to integrate this psychosocial occupational stress into a model of increased risk for physical, mental, and health disorders, which is best covered by the framework of the professional gratification crisis by Johannes Siegrist. His model assesses the experience and perceptions of employees with regard to their effort and the adjunctive reward with the ERI (Effort-Reward Imbalance) questionnaire, and the tendency to overcommit with the Overcommitment questionnaire (19). The ERI ratio is deemed to be an independent predictor for the increased emergence of disorders, for example psychological disorders such as depression, substance abuse, coronary diseases, psychosomatic disorders, and burnout (19–22). Siegrist and Siegrist (19) found that high values for the ERI ratio were especially prevalent in personal, non-productive industries, for example, medical staff. They also discovered that men are more frequently affected than women.

The compatibility of family and work is a challenge that concerns occupational groups. A work–family, or interrole, conflict is defined as an impairment of the different roles (occupational and family-related) in the exertion of their duties (23). The effect can be bidirectional; depending on the direction of the conflict, it is considered a "work-(to)-family conflict" when the occupation impairs the familial or private life, and, vice versa, a "family-(to)-work conflict" when the private life influences the occupation (24, 25). Various studies have furnished evidence for the fact that occupational stress has higher implications on

the family than contrariwise (26). Occupational groups with a high load of labor time, irregular working hours, and unstable working conditions, especially, suffer from this work–family conflict. Physicians and the scientific staff of universities and university hospitals fall into this type of occupational group (9, 11, 27). Studies in varied occupational areas mention primarily high occupational stress, long working hours, excessive overtime, low temporal flexibility, deficient social support and recognition as reasons for the difficulties with balancing work and family life (28, 29). Correlations between an interrole or work–family conflict and mental and physical health have been demonstrated by various studies (30, 31). In 1990, Firth-Cozens (32) reported a significant correlation between a sensed conflict and the presence of depression, which is relevant to the compatibility of occupation and family.

Previous studies on the topic of occupational stress and health stem mainly from the economic and health sectors, rarely from institutions such as universities and colleges. Notably, a comparison between the individual occupational areas at universities is missing. Furthermore, to date, research on occupational stress has neglected the influence of the factor compatibility of occupation and family on the individual occupational stress and health of the employee (26).

The work–family or interrole conflict is considered a predictor of health determinants, according to literature/previous research. The same can also be assumed the other way around. Based on this background, we have deliberately chosen an exploratory approach to investigate the influence of stress and health factors on interrole conflict.

The aim of this study was to assess data on the work–family or interrole conflict in the context of psychosocial occupational stress and health in a university context and to illustrate their indications of interdependencies.

METHODS

The presented results are part of an online survey, which was approved by the ethics committee of Ulm University, application number 246/11, on the 14th of November 2011. Participation was voluntary, and all participants signed an informed consent form. For the quantitative data acquisition, participants filled out demographic questionnaires and replied to individual questions regarding their work situation, such as their contract of employment, overtime, and related occupational stress, etc.

To gather information on the interrole or work–family conflict, meaning the impact that work has on family life and vice versa, we used the Work–Family and Family–Work Conflict Scales (WFC, FWC) (24). The questionnaire has two subscales consisting of five items each. The first one investigates the conflicts that work life may impose on families (WFC), and the second subscale measures the inverse effect (FWC). For example, an item of the WFC scale is: "The requirements at work collide with my private and familial life," and an item of the FWC scale is: "The requirements on the part of my family collide with my professional tasks." Items were scored on a five-point Likert scale ranging from 1 = "no, not at all" to 5 = "yes, exactly. The higher the added scores, the higher the conflict potential. Cronbach's Alpha is 0.88 for the WFC scale and 0.86 for the FWC scale (24).

The Effort-Reward Imbalance Questionnaire (ERI) (33) was deployed to capture the psychosocial workload. The instrument indicates possible imbalances between effort and reward in occupations. For this purpose, six questions coded on a five-point Likert scale, concerning the stressful aspects and 11 items concerning the rewarding aspects of work were assessed. The resulting ERI ratio indicates the proportions of effort and reward. The higher the effort–reward quotient, the higher the disproportion between effort and reward. Lehr and colleagues (34) classify an effort–reward imbalance as ERI ratios equal to or higher than 0.715.

The overcommitment scale (OC) (33) measures excessive performance motivation and tendency to overcommit by means of six items on a four-point Likert scale.

To assess health-related parameters, first, the subjectively experienced physical fitness was determined by means of one question (six-point Likert scale, 1 = very good to 6 = deficient) (35). The Patient Health Questionnaire (PHQ-4) is a short questionnaire with a four-point Likert scale that addresses symptoms of depression and/or anxiety by means of two items each (36).

Burn-out syndrome describes a state of exhaustion that is accompanied by emotional exhaustion (EE), reduced feelings of personal accomplishment (PA), and depersonalization (cynicism) (DP) (37). One of the internationally most elaborated instruments for measuring this is the Maslach Burnout Inventory (MBI) (38). The authorized German translation of the MBI by Büssing and Perrar was shortened by Prof. Dr. Jürgen Glaser (University of Innsbruck) (Glaser, manuscript in preparation). This short version assesses only two factors of the MBI: emotional exhaustion (EE) and depersonalization (cynicism) (DP) with three questions each, coded on a six-point Likert scale.

The statistical analysis of the data generated with the online survey tool EVASYS was carried out with the statistical program SPSS 22. Comparisons between subgroups, for example, males versus females, were analyzed using Chi-Square tests. Further, we conducted correlation analyses to calculate the interdependencies between the different instruments: Pearson's method for nominally and ordinally scaled items, and Spearman's method for interval-scaled items. To determine the linear correlations, we conducted multiple regression analyses using stepwise regression analysis (39).

The study as a whole had a theoretical or literature-guided basis. Due to a lack of longitudinal data, the regression analyses were conducted with an exploratory approach. The factors used were chosen on the basis of pre-calculated significant correlations.

These baseline calculations have already been used in the context of a habilitation thesis.

RESULTS

Demographics

The total sample of $N = 844$ university employees consisted of 55.5% ($N = 468$) women and 40.9% ($N = 345$) men; 3.7% ($N = 31$) did not specify a gender. Split into occupational

TABLE 1 | Sociodemographic data.

	Total sample	
N	844	
Women	468	(55.5%)
Men	345	(40.9%)
Age		
< 30 years	188	(22.3%)
30–40 years	284	(33.6%)
41–50 years	214	(25.4%)
> 50 years	153	(18.1%)
Highest educational attainment		
Lower secondary school	31	(3.7%)
Secondary school	120	(14.2%)
High school	670	(79.4%)
Other	19	(2.3%)
University degree		
Yes	617	(73.1%)
No	214	(25.4%)
Family status		
In a partnership	642	(76.1%)
Single	189	(22.4%)
Children		
Yes	421	(49.9%)
No	417	(49.4%)

groups, 42.3% ($N = 357$) were scientific researchers, 14.3% ($N = 121$) physicians, 19.4% ($N = 164$) administrative employees, and 19.3% ($N = 162$) employees of various services, such as of technical, functional, or central services and/or laboratory technicians, janitors, etc. The age distribution of the total sample had its focal point in the age group between 30 and 40 years old. As the highest educational attainment, 79.4% ($N = 670$) of the total sample stated to have a high school degree, and 73.1% ($N = 617$) had a university degree. In terms of family demographics, 76.1% ($N = 642$) were in a partnership, and 49.9% ($N = 421$) had children (**Table 1**).

For administrative reasons, the data for the staff working in the medical department had to be collected separately. Thus, there were two response rates: the occupational group of research scientists, administrative employees, and employees of various services (33.6%; $N = 537$), and employees of the medical department (22%; $N = 307$).

Working Conditions

Out of the 844 participants interviewed, 68% ($N = 574$) declared that they worked full-time, and more than half of the sample ($N = 449$; 52.9%) had fixed-term contracts. Overtime accounted for 83.3% ($N = 698$) of the respondents, and 19.7% ($N = 166$) of the sample were "always and frequently" stressed (**Table 2**).

Work–Family Conflict

The impact of the professional work on the familial life and the impact of the familial life on the professional work was assessed with the Work–Family Conflict Scale and the Family–Work Conflict Scale (24). The means of the WFC scale ($M = 14.34$; $N = 813$; $SD = 5.81$) and of the FWC-scale ($M = 10.08$; $N = 800$; $SD = 4.40$) were only slightly (ns) below the standard values as defined by Netemeyer and colleagues (WFC Scale: 16.69; FWC Scale: 10.68). These standard values can be used as cut-off values, and more than one third (35.3%) of the respondents ($N = 813$) scored higher than the cut-off for WFC and close to 40% ($N = 800$) scored higher than the cut-off for the FWC, indicating a work–family or, respectively, an interrole conflict. In both categories, men suffered more often (but not significantly) from this conflict than women.

TABLE 2 | Overtime and stress due to overtime.

	Total sample *N* = 838	
Overtime, yes:	698	(83.3%)
Stress due to overtime:	$N = 732$	
Always	38	(4.5%)
Frequently	128	(15.2%)
Sometimes	325	(44.4%)
Rarely	182	(24.9%)
Never	59	(8.1%)

Psychosocial Occupational Stress and Tendency to Overcommit

The psychosocial occupational stress was assessed with the model and measuring instrument Effort-Reward Imbalance (ERI) developed by Siegrist. With a mean of $M = 10.32$ ($N = 799$; $SD = 3.32$), the effort value of the sample was still lower (n.s.) than the mean of the norm sample ($M = 11.57$). However, the average reward value ($M = 37.04$; $N = 668$; $SD = 6.45$) was also lower ($p = 0.000$) than the norm sample ($M = 46.71$). Thus, the ERI ratio, as a value for the proportion between work effort and work-related reward, was used as an index for the psychosocial occupational stress. Here, high effort and little reward go along with a high ratio. A value higher than the cut-off value of 0.715 (34) is considered as posing a risk to health.

On average, the total sample did not reach this cut-off ($M = 0.56$; $N = 649$; SD = 33), but almost a fifth of the sample (17.1% of $N = 649$) scored higher than the cut-off, with considerably more men (18.7%, total $N = 268$) than women (15.7%, total $N = 356$) suffering from this imbalance. For this part of the sample, an imbalance between effort and reward was apparent, meaning that the affected employees subjectively perceived a higher effort in relation to a smaller reward. According to the Effort-Reward Imbalance Model, this imbalance may lead to stress responses and eventually to health impairments.

The Overcommitment Scale measures the individual tendency to overcommit professionally. In connection with an excessive tendency to overcommit, an increased amount of stress reaction and an increased risk of illness is assumed. The mean of the overcommitment scale, $M = 14.4$ ($SD = 3.20$; $N = 806$), was also within the normal range. The cut-off value of 16 was exceeded by more than a quarter (26%) of the respondents ($N = 807$), and women were considerably more often affected than men.

TABLE 3 | Correlations of the Work–Family Conflict Scale and Family–Work Conflict Scale with occupational stress (ERI Ratio), overcommitment (OC), and whether overtime is stressful.

Work–Family Conflict Scale with...	Occupational stress (ERI Ratio)	Overcommitment (OC)	Overtime is stressful+
Total sample	$r = 0.600^{**}$ $N = 634$	$r = 0.508^{**}$ $N = 786$	$r = -0.562^{**}$ $N = 709$
Family–Work Conflict Scale with...			
Total sample	$r = 0.422^{**}$ $N = 629$	$r = 0.334^{**}$ $N = 775$	$r = -0.337^{**}$ $N = 697$

+*Scaling 1 = "always", 2 = "frequently", 3 = "rarely", 4 = "never".*
***Correlations are significant at a level of 0.01 (two-sided).*
**Correlations are significant at a level of 0.05 (two-sided).*

TABLE 4 | Correlations of the Work–Family Conflict Scale/Family–Work Conflict Scale with physical health, mental health, and burnout.

Work–Family Conflict Scale with…	Physical health+	Mental health (PHQ-4)	Burnout (MBI)
Total sample	$r = 0.178^{*}$ $N = 806$	$r = 0.417^{**}$ $N = 800$	$r = 0.497^{**}$ $N = 810$
Family–work Conflict Scale with...			
Total sample	$r = 0.206^{**}$ $N = 793$	$r = 0.259^{**}$ $N = 775$	$r = -0.329^{**}$ $N = 697$

***Correlations are significant at a level of 0.01 (two-sided).*
**Correlations are significant at a level of 0.05 (two-sided).*

Health and Burnout

The subjectively experienced state of health of the sample was between good (2) and satisfactory (3) ($M = 2.56$; $SD = 1.02$; $N = 828$). Of the participants, 43.1% ($N = 830$) described their health status as satisfactory (3), and 42.2% of men (Total $N = 339$) and 44.3% of women (Total $N = 461$) described it as worse (4 = sufficient; 5 = poor; 6 = deficient).

Data on mental health were assessed with the Patient Health Questionnaire (PHQ-4), which contains two questions each to screen for a depressive disorder according to the DSM-IV and a generalized anxiety disorder (36). Higher values indicate higher troubles associated with the depressive or anxiety disorder. A mean higher than 2.5 (cut-off) is considered to be critical in terms of the measured symptoms. With $M = 1.45$ ($SD = 2.21$; $N = 822$), the total sample did not reach this cut-off. However, 7% of the sample ($N = 823$), 6.4% of women, and 7.1% of men scored higher than the cut-off.

The short version of the MBI (Glaser, manuscript in preparation) was used to assess the burnout-related symptoms. The scaling of the MBI is 0 = never, 1 = very rarely, 2 = rather rarely, 3 = sometimes, 4 = rather often, and 5 = very often. The mean of the sample at hand was M = 2.5 ($SD = 0.99$; $N = 832$), which falls between the scale values "very rarely" and "rather rarely." The average values for women ($M = 2.48$; $SD = 0.96$; $N = 462$) and men ($M = 2.53$: $SD = 1.02$; $N = 340$) show no significant difference.

Correlations With Work–Family Conflict

We calculated correlations between the two parameters of the work–family conflict and the occupational stress and the health parameter, respectively. Firstly, we found high positive correlations between the conflictual influence of work on familial life (WFC) and both occupational stress as measured by the ERI ratio and the tendency to overcommit. Furthermore, we found significant high correlations between WFC and the item "overtime is stressful": the more often overtime was perceived as stressful, the higher the work–family conflict (the negative correlations stem from the direction of the scaling of the item "overtime is stressful") (**Table 3**).

A weaker connection was found for the correlation ($p = 0.000$) of the FWC-scale with the ERI ratio, overcommitment, and the item: "overtime is stressful." The more intense the occupational stress was perceived to be, the higher the influence of the family on the professional life was experienced to be (**Table 3**).

The correlations between the health parameters "physical and mental health," burnout, and the WFC and FWC scales were also significant. Here, the correlations between WFC and PHQ-4 and burnout were highest, and FWC correlated most strongly with burnout (**Table 4**). A weaker but still significant correlation ($p = 0.000$) could be found between the subjectively experienced physical health and the FWC and WFC scales (**Table 4**).

Interdependencies of the Work–Family Conflict

Multiple regression analyses were calculated to analyze the functional interdependencies between the work–family or interrole conflict (WFC, FWC) as variables of interest and the occupational stress and health parameters. For the regression analysis of WFC, a corrected $R^2 = 0.313$ was calculated. Thus, 31% of the variance of the work–family conflicts can be explained by the predictors burnout (factor: emotional exhaustion) ($\beta = 0.278$; $p = 0.000$), the sample (affiliation to the university or the university hospital) ($\beta = -0.185$; $p = 0.000$), "overtime is stressful" ($\beta = -0.148$; $p = 002$) (the negative prefix is due to the direction of the scaling of the item – "always" to "never"), gender ($\beta = -0.132$; $p = 0.001$), occupational area ($\beta = -0.111$; $p = 0.014$), and overcommitment ($\beta = 0.102$; $p = 0.031$) (**Table 5**).

The corrected R^2 of the regression analysis with the variable of interest family–work conflict scale (FWC) was $R^2 = 0.154$. The predictors explaining the variance for this scale were: "presence of children" in own household ($\beta = -0.266$; $p = 0.000$), followed by "overtime is stressful" ($\beta = -0.199$; $p = 0.000$), burnout ($\beta = 0.168$; $p = 0.000$), age ($\beta = -0.134$; $p = 0.003$), and gender ($\beta = -0.084$; $p = 0.044$) (**Table 6**).

DISCUSSION

The aim of our study was to collect cross-sectional data on the compatibility of professional life and family with regard to the psychosocial occupational stress and health in a university environment and to present their interdependencies.

TABLE 5 | Results of the regression analysis for the Work–Family Conflict Scale.

	β-coefficient	*t*-value	*p*
(constant)		4.17	0.000
Burnout (MBI):Emot. Exhaustion pfung	0.278	5.68	0.000
Affiliation (1 = UU /2 = UK)	−0.185	−4.12	0.000
Overtime is stressful^{+}	−0.148	−3.14	0.002
Gender (1 = m/2 = f)	−0.132	−3.44	0.001
Occupational area*	−0.111	−2.47	0.014
Overcommitment (OC)	0.102	2.16	0.031

$F_{(6.498)} = 39.262$; $R = 0.567$; corrected $R^2 = 0.313$.
$^{+}$*Scaling: 1 = "always", 2 = "frequently", 3 = "rarely", 4 = "never".*
**Occupational area 1 = "Physicians", 2 = "Scientific researchers", 3 = "Administrative employees", 4 = "Employees of various services".*

TABLE 6 | Results of the regression analysis for the Family–work conflict scale.

	β-coefficient	*t*-value	*p*
(Constant)		12.58	0.000
Children*	−0.266	−5.87	0.000
Overtime is stressful^{+}	−0.199	−4.18	0.000
Burnout (MBI)	0.168	3.53	0.000
Age	−0.134	−2.97	0.003
Gender (1 = m/ 2 = f)	−0.084	−2.02	0.044

$F_{(5.494)} = 19.208$; $R = 0.403$; corrected $R^2 = 0.154$.
$^{+}$*Scaling: 1 = "always", 2 = "often", 3 = "rarely," 4 = "never".*
**Occupational area 1 = "Physicians", 2 = "Scientific researchers", 3 = "Administrative employees", 4 = "Employees of various services".*

The response rates for a complete socio-scientific survey can be considered "good". Even though it was not possible to test for representativeness due to missing comparative data, the data at hand can be used as an example to display the load situation at German universities based on the sample size and the response rate.

Even though the mean survey scores for the applied questionnaires concerning the occupational stress and health of the total sample were within the normal range, the study shows a substantial percentage of employees with above-average stress levels: 83% of the total sample ($N = 698$) worked overtime, and almost 20% felt "always and frequently" stressed by this. Almost 18% of the sample ($N = 649$) scored >1 in the ERI ratio, the indicator for occupational stress, and approximately a quarter (26%) of the sample ($N = 807$) showed an excessive overcommitment, posing a potential risk to their health.

An effort–reward imbalance and related professional gratification crises frequently arise for employees who find few alternative workplaces and for employees in competitive environments (19). University employees often encounter both situations. Due to their specializations, they rarely find alternative workplaces, for example, in free enterprises. Additionally, scientists and physicians are constantly confronted with a high workload and competitive pressure, and their working environments can be described as highly competitive. The imbalance between work effort and the received reward (ERI ratio), as defined by the ERI model, is sometimes evoked by a single disappointing event in the professional context (for example, a refused promotion, dismissal, degradation, etc.) However, more frequently, it is the result of long-standing re-occurring frustrations in the work context, which are accepted, no longer reflected upon, often trivialized, or even become part of the daily routine (40). The working conditions of the university employees alone, namely fixed-term contracts and overtime, offer reason for disappointment and frustration, but various daily stressors come in addition. In the medical working context, for example, the limited budgets that need to be adhered to and the administrative load can be stressful and frustrating. For scientific researchers, increasing competition, quantitative and qualitative pressure to publish, and high requirements for acquiring third-party funds are a daily stressor. Siegrist et al. (33) state that the ERI ratio is often intensified by intrinsic factors, especially when the professional coping mechanisms are dictated by excessive overcommitment. This maladministration is particularly grave for the affected employees, since the refused recognition or reward in this context can be considered a violation of the norm of social reciprocity. This suboptimal combination accounts for more than a quarter (26%) of the employees ($N = 807$). Especially in the scientific and medical occupational field, the consequences of this stress for performance and productivity are serious. For instance, for physicians who are exposed to a high load of psychosocial stress, the quality of the medical care decreases considerably (41, 42). To enable professional, high-level patient care, it is necessary to reduce the workload. High levels of stress in the form of a high ERI value are associated with different health impairments. Specifically, when exceeding the cut-off value of the ERI ratio, the risk for diabetes (43) and arteriosclerosis (44) increases. Furthermore, the risk for coronary heart disease doubles (45), and the prevalence of chronic diseases is increased (46). For overcommitment values above the cut-off, cardiovascular risks have been reported (47, 48). Additionally, multiple psychological implications have been found for an ERI, for example, sleeping disorders (49), alcohol addiction (50), substance abuse (51), and depression (52, 53).

The descriptive results of the health parameters fall widely within the normal range. Of the respondents, 56.9% ($N = 860$) described their state of health as very good or good. This result is below the statistics of the "labor time report" (54), where 62% of the interviewees described their state of health as very good and good. On the other hand, 43.1% of the participants ($N = 860$) described their state of health as merely satisfactory (3) and worse (4 = sufficient, 5 = poor, 6 = deficient). This should definitely be reason for interventions and preventive measures to increase the individual physical health of the employees.

In our study, the parameter "mental health" was operationalized by the survey instrument PHQ-4, which assesses symptoms of depression and anxiety (36). Anxiety disorders and depression present a life-time prevalence of 15–17% and are among the most frequent psychological diseases (55). In the present study, 7% of all the interviewed university employees ($N = 823$) presented a PHQ-4 score higher than the cut-off value of 2.5. Thus, they have "almost every day" "little

of no joy or interest in their activities" and are "not capable of stopping brooding (ruminating or controlling their worries)." This presents a score that allows an initial suspicion for a depression or anxiety disorder. In the research literature, the reasons for this are mainly working conditions and related work–family conflict. Even though a tentative diagnosis can only be made for a comparably small percentage of the respondents, the stress impairments may be particularly grave for the university medical group. Impairments in this group may negatively impact the quality and quantity of the patient care (57). Additionally, since occupational stress is often linked to increased absenteeism, many absent days and high fluctuations may consequentially lead to high costs (56, 58).

There is evidence for gender differences in the prevalence of psychosocial occupational stress (1, 19). However, we could not identify significant gender differences for the measured parameters occupational stress (ERI ratio) and overcommitment (OC), nor for the parameters (stressful) working conditions, fixed-term contracts, overtime, or mobbing. However, it remains unclear why this is the case. For the parameter "subjective evaluation of the state of health," we expected men to rate their physical state of health as higher than women, and we expected women to suffer more frequently from symptoms of depression and anxiety (1, 59). For the total sample of university employees, we could demonstrate that men indeed rated their physical health as better than women; however the difference was not significant. The PHQ-4 for depression and anxiety showed significant gender differences. Here, women display higher average scores. This is in line with the results of a study conducted by Techniker health insurance (1), which concludes that companies and institutes should focus primarily on women in their efforts to prevent mental suffering. Gender differences in the compatibility scales (WFC, FWC) will be discussed subsequently.

The compatibility of work and family is a central socio-political subject, especially due to the fact that the demographic changes and the resulting shortage of specialists can only be compensated for by the employment of women, who to date have been primarily responsible for family-related tasks (childcare and care of the elderly) (60). Thus, in recent years, a number of regulations have been adopted to support families (parental leave, right to day-care, etc.), and various institutional initiatives, such as the provision of care places or the offer of more flexible management of working time, have been initiated. Additionally, integration programs have been established to allow an easier transition back to professional life. However, the current measures are not sufficient to solve the problem, mainly because they have been comprehensively introduced and thus do not meet individual demands (61, 62).

The present study assessed the compatibility problem by means of the Work–Family Conflict Scale and the Family–Work Conflict Scale (24). The cut-off values of WFC and FWC were not exceeded by the total sample; however, more than a third of the respondents ($N = 813$) scored higher than the cut-off values of WFC (35.3%) and FWC (39.3%). For both scales, significantly more men than women suffered from compatibility conflict. WFC and FWC are higher for the male than for the female respondents, with more men scoring higher than the cut-off values of WFC and FWC (40.2% of $N = 331$ and 44.6% of $N = 452$, respectively) than women (31.4% of $N = 452$ and 35.4% of $N = 446$, respectively). Men suffered more frequently from feelings of helplessness in their situation. This may be due to the problem that young fathers, in particular, find it challenging to effectively take their parental leave without any career-related losses in exchange for this "timeout." Additionally, women tend to work part-time more often and potentially perceive the interrole-conflict, particularly, the work–family conflict, as less stressful (63). This still poses a challenge even though increasingly more men and women wish to move away from traditional role models. Moreover, with generation Y, a new generation of fathers emerged who wish to spend more time with their family and who demand a better work-life balance. Studies on the age cohort generation Y indicate a lower willingness to work overtime or long hours or to sacrifice oneself for the job and instead display a shift toward a more equal work–life balance and a demand for the possibility to make work and family life realistically compatible (64).

The stress parameters analyzed (overtime is stressful, occupational stress (ERI ratio) and overcommitment) all correlate with the interrole conflict parameters, WFC and FWC, and with the health parameters physical and mental health and burnout. These correlations indicate that successful compatibility of work and family with a low conflict potential has positive implications for the mentioned occupational stress and health parameters and vice versa.

To assess the predictors for the incidence of work–family conflict and family–work conflict, multiple regression analyses were conducted. The inclusion criteria for the independent variables were the significant correlation analyses conducted beforehand. Additionally, demographic items were included. Both regression analyses revealed that the factors "stress due to overtime" and "gender" (male) served as the main predictors for a conflict between work and family. The regression analysis for work–family conflict (WFC) (the conflictual influence of work on the familial life), illuminated the burnout factor. The main predictors were "emotional exhaustion," "sample" (namely the university hospital), as well as "stress due to overtime" and "gender" (male). Further, "occupational area" and "overcommitment" were calculated as additional predictors for WFC. Predictors for the family–work conflict (FWC) (the conflictual influence the family has on work life) are "children," "overtime," "age" (young people are more affected), and "gender" (male). This finding is in line with previous analyses by Niessen et al. (65), Ford et al. (66), and Demerouti et al. (67). Based on the literature, it is known that the compatibility conflicts (WFC, FWC) correlate with occupational stress (68), burnout (68), and depression (24, 69). Another study describes time pressure as a mechanism that, when employees become parents, may lead to additional psychological stress due to the double burden that parents face (70). The present study could also identify occupational stress in terms of stressful overtime and burnout (emotional exhaustion) as a predictor for the conflict between work and family. Also, both compatibility scales correlated significantly with occupational stress and overcommitment as well as with the health parameters physical and mental health.

If one were to create a "typical" profile for a university employee at risk of experiencing a family–work and, respectively, work–family conflict, if would be a male, already emotionally exhausted employee of the university hospital, stressed by extra work, children, and the tendency to overcommit. This allows the conclusion that the focus of future support for more compatibility of work and family should be directed increasingly toward men with children. Additionally, besides preventive measures, this support should include individual behavior-preventive measures.

How the compatibility between work and family can be improved, particularly at universities, was evaluated by means of a demand analysis within the course of the current study; however, it is not the central subject of this publication.

Compatibility conflicts should constitute a central aspect of future orientations of institutions such as colleges. This can be confirmed by a study by Ernst and Young (71), which interviewed 3500 students on their wishes with regard to their potential future employers: 49% of the female and 29% of the male interviewees named the compatibility of work and family as an important criterion. Demographic changes and the necessity for an increase in female labor participation foster these demands. For universities, family-friendly environments are an important factor in employee loyalty and are thus a key success factor for the competition between the institutions for students and employees.

Limitations: The results described in this study, and particularly the predictors, have been assessed merely on the basis of a cross-section study. The initial intention of a longitudinal study could, to date, not be followed up, even though different calculations, such as regression analyses, and different scientific questions, such as the development of occupational stress and psychological stress over time, could be better substantiated and more exactly addressed in a longitudinal design. Since our study was conceptually designed with a longitudinal design and the intention of evaluating the changes that have already occurred, a follow up is urgently necessary. Regarding the recruitment of the sample, it was unfortunately not possible to recruit all the physicians employed at the university hospital, but only the doctors employed at the medical faculty with a contract with the state. Also, the nursing personnel could not be interviewed. For future follow-ups, it would be desirable to integrate all employees of the university hospital into the survey. Another limitation of the cross-sectional design is the fact that regression analyses could not be calculated with longitudinal data. Age as an influencing factor could not be statistically controlled for, since the requirements by the staff council did not allow any detailed demographic information. For this reason, no precise comparisons between the faculties or specialists or departmental levels could be carried out. Additionally, in the present publication, no detailed comparison between the occupational groups could be computed due to limited space. Since no demographic characteristics were available due to data protection, the present data cannot be tested for representativeness.

The results of the current study indicate a notable need for action regarding the work–life balance and compatibility of work and family for university employees. Especially in connection with the field of occupational stress and health, the results form a solid basis for the starting points of job-specific prevention and intervention measures. To this end, the planned longitudinal survey should urgently be conducted in a follow-up.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All study participants gave their written informed consent for inclusion.

AUTHOR CONTRIBUTIONS

LJ-B and KL-E: conceptualization. LJ-B: statistical analysis. LJ-B and SW: methodology. LJ-B, PB, and JS: writing—original draft preparation.

ACKNOWLEDGMENTS

We would like to thank the university staff for their participation in the studies.

REFERENCES

1. Techniker Krankenkasse. *Bleib locker, Deutschland! – TK-Studie zur Stresslage der Nation.* Dorothee Meusch (Hrsg.) Techniker Krankenkasse Pressestelle (2013). p. 4–42. Available online at: https://portal.dnb.de/opac.htm?method=simpleSearch&cqlMode=true&query=idn%3D1043788476
2. Grigat F. Kommentar: Perspektiven. *Forschung und Lehre*. (2016) 10:861.
3. Nylenna M, Gulbrandsen P, Ford R, Aasland OG. Job satisfaction among norwegian general practitioners. *Scan J Prim Health Care*. (2005) 23:198–202. doi: 10.1080/02813430500311792
4. Polenz W. Gesundheitsförderung an HS für angewandte Wissenschaften-erste Erfahrungen an der HAW Hamburg. In: *Die neue Hochschule -DNH*. Hamburg: Hochschullehrerbund-Bundesvereinigung eV (2013). p. 174–8.
5. Dech H. Stressbelastung und psychische Gesundheit an der Hochschule. In: Hochschullehrerbund- Bundesvereinigung eV. (Hrsg). Die neue Hochschule - DNH (2013) 186–9. Available online at: http://hlb.de/uploads/tx_news/DNH_2013-6.pdf
6. Faller G. Gefährdungsbeurteilung psychischer Belastungen an Hochschulen als Einstieg in die Gesundheitsförderung: eine erste Bestandsaufnahme. In: Hochschullehrerbund- Bundesvereinigung eV. (Hrsg). Die neue Hochschule - DNH. (2013) 178–82. Available online at: http://hlb.de/uploads/tx_news/DNH_2013-6.pdf
7. Spiegel (18.08.2015). *Nach Zwölf Jahren Kommt Das Nichts*. Available online at: https://www.spiegel.de/lebenundlernen/job/wissenschaftlicher-mitarbeiter-erst-ausbeutung-dann-arbeitslosigkeit-a-1042945.html (accessed May 04, 2019).

8. Bundesbericht wissenschaftlicher Nachwuchs (BuWiN). *Statistische Daten und Forschungsbefunde Konsortium Bundesbericht wissenschaftlicher Nachwuchs.* Bertelsmann (2013). Available online at: http://www.buwin.de/site/assets/files/1002/buwin_kurzfassung_barrierefrei.pdf
9. Dorenkamp I, Suess S. Einflussfaktoren des Work-Life-Conflicts in der Wissenschaft. In: Matiaske W, Czaya A (Hrsg). *Periphere Arbeit im Zentrum*. Baden-Baden: Nomos Baden-Baden (2016). p. 119–46. doi: 10.5771/9783845273204-119
10. Angerer P, Weigl M. Physicians' psychosocial work conditions and quality of care: a literature review. *Professions Professionalism*. (2015) 5. doi: 10.7577/pp.960
11. Limbrecht-Ecklundt K, Flaig T, Gündel H, Traue HC, Jerg-Bretzke L. Psychische gesundheit und arbeitsbelastung bei ärztinnen und ärzten: eine studie zur erfassung der effort-reward-imbalance. *Prävention und Gesundheitsförderung*. (2016) 10:11–21. doi: 10.1007/s11553-014-0465-y
12. Zwack J, Abel C, Schweitzer J. Resilienz im arztberuf–salutogenetische praktiken und einstellungsmuster erfahrener ärzte. *PPmP*. (2011) 61:495–502. doi: 10.1055/s-0031-1291276
13. Beschoner P, Limbrecht-Ecklundt K, Jerg-Bretzke, L. Mental health among physicians: burnout, depression, anxiety and substance abuse in the occupational context. *Nervenarzt*. (2019) 90:961–74. doi: 10.1007/s00115-019-0739-x
14. Abele AE. Karriereverläufe und berufserfolg bei medizinnerinnen. In: Dettmer S, Kaczmarczyk G, Bühren A, (Hrsg.). *Karriereplanung für Ärztinnen*. Heidelberg: Springer (2006). p. 35–57. doi: 10.1007/978-3-540-44521-0_3
15. Schulz W, Shin MA, Böhm D, Begerow B, Schmid-Ott G. Rollenqualität und psychische gesundheit bei berufstätigen frauen: wie interagieren die lebensbereiche beruf und familie? - eine explorative studie. *Praxis Klinische Verhaltensmedizin und Rehabilitation*. (2016) 29:80–9.
16. Angerer P, Glaser J, Gündel H, Henningsen P, Lahmann C, Letzel S, Nowak D, (Hrsg.). *Psychische und psychosomatische Gesundheit in der Arbeit. Wissenschaft, Erfahrungen, Lösungen aus Arbeitsmedizin, Arbeitspsychologie und psychosomatischer Medizin*. Heidelberg: Ecomed Medizin (2014). p. 6–35.
17. Weigl M. Beschäftigte im ärztlichen Dienst. In: Angerer P, Glaser J, Gündel H, Henningsen P, Lahmann C, Letzel S, Nowak D, (Hrsg.) *Psychische und psychosomatische Gesundheit in der Arbeit. Wissenschaft, Erfahrungen, Lösungen aus Arbeitsmedizin, Arbeitspsychologie und psychosomatischer Medizin*. Heidelberg: Ecomed Medizin (2014). p. 191–8.
18. Braun M, Schönfeldt-Lecuna C, Kessler H, Beck J, Beschoner P, Freudenmann R. Depression und substanzgebrauch bei deutschen psychiatern und nervenärzten. *Nervenheilkunde*. (2008) 27:800–4. doi: 10.1055/s-0038-1627220
19. Siegrist J, Siegrist K. Stresstheoretische modelle arbeitsbedingter erkrankungen. In: Angerer P, Glaser J, Gündel H, Henningsen P, Lahmann C, Letzel S, Nowak D, (Hrsg.). *Psychische Und Psychosomatische Gesundheit in Der Arbeit. Wissenschaft, Erfahrungen, Lösungen aus Arbeitsmedizin, Arbeitspsychologie und psychosomatischer Medizin*. Heidelberg: Ecomed Medizin (2014). p. 64–74.
20. De Jonge J, Bosma H, Peter R, Siegrist J. Job strain, effort-reward imbalance and employee well-being: a large scale cross-sectional study. *Soc Sci Med*. (2000) 50:1317–27. doi: 10.1016/S0277-9536(99)00388-3
21. Siegrist J, Marmot M. Health inequalities and the psychosocial environment - two scientific challenges. *Soc Sci Med*. (2004) 58:1463–73. doi: 10.1016/S0277-9536(03)00349-6
22. Larisch M, Joksimovic L, Knesebeck O, von dem, Starke D, Siegrist J. Berufliche gratifikationskrisen und depressive symptome. *PPmP*. (2003) 53:223–8. doi: 10.1055/s-2003-38867
23. Knecht-Meier MK. *Work-Life Conflict und Gesundheit. Der Zusammenhang zwischen Formen von Work-Life Conflict und Gesundheitsaspekten bei unterschiedlichen Populationen*. Dissertation ETH. Zürich (2011). Available online at: http://e-collection.library.ethz.ch/eserv/eth:2709/eth-2709--01.pdf
24. Netemeyer RG, Boles JS, McMurrian R. Development and validation of work-family conflict an family-work conflict scales. *J Appl Psychol*. (1996) 81:400–10. doi: 10.1037/0021-9010.81.4.400
25. Mesmer-Magnus JR, Viswesvaran C. Convergence between measures of work-to-family and family-to-work conflict: a meta-analytic examination. *J Vocational Behav*. (2005) 67:215–32. doi: 10.1016/j.jvb.2004.05.004
26. Lukasczik M, Ahnert J, Ströbl V, Vogel H, Donath C, Enger I, et al. Vereinbarkeit von familie und beruf bei beschäftigten im gesundheitswesen als handlungsfeld der versorgungsforschung. *Das Gesundheitswesen*. (2018) 80:511–21. doi: 10.1055/s-0043-101514
27. Jerg-Bretzke L, Traue HC, Kruesmann P, Limbrecht-Ecklundt K. Was ihr wollt – massnahmen zur verbesserung der vereinbarkeit von familie und beruf bei ärztinnen und ärzten. *Gesundheitswesen*. (2016) 78:1–7. doi: 10.1055/s-0041-111842
28. Blum K, Offermanns M, Perner P. *Deutsches Krankenhausinstitut: Krankenhaus Barometer*. Düsseldorf: Umfrage (2008).
29. Fuss I, Nübling M, Hasselhorn HM, Schwappach D, Rieger M. Working conditions and work-family conflict in german hospital physicians: psychosocial and organisational predictors and consquences. *BMC Public Health*. (2008) 8:353. doi: 10.1186/1471-2458-8-353
30. Hämmig O, Knecht MK, Läubli T, Bauer GF. Work-life conflict and muscoskeletal disorders: a cross-sectional study of an unexplored association. *BMC Muscoskeletal Disorders*. (2011) 12:60. doi: 10.1186/1471-2474-12-60
31. Knecht MK, Bauer GF, Klaghofer R, Buddeberg-Fischer B, Stamm M, Hämmig O. Work-life conflicts and health among Swiss physicians: In comparison with other university graduates and with the general Swiss working population. *Swiss Medical Weekly*. (2010) *140*:w13063. doi: 10.1037/e572992012-223
32. Firth-Conzens J. Sources of stress in women junior house officers. *Br Med J*. (1990) 301:89–91. doi: 10.1136/bmj.301.6743.89
33. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, et al. The measurement of effort-reward imbalance at work: European comparisons. *Soc Sci Med*. (2004) 58:1483–99. doi: 10.1016/S0277-9536(03)00351-4
34. Lehr D, Koch S, Hillert A. Where is (im)balance? Necessity and construction of evaluated cut-off pointers for effort-reward imbalance and overcommitment. *J Occupat Organizat Psychol*. (2010) 83:251–61. doi: 10.1348/096317909X406772
35. Kandrack MA, Grant KR, Segall A. Gender differences in health related behaviour: some unanswered questions. *Soc Sci Med*. (1991) 32:579–90. doi: 10.1016/0277-9536(91)90293-L
36. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Int Med*. (2007) 146:317–25. doi: 10.7326/0003-4819-146-5-200703060-00004
37. Jerg-Bretzke L, Novak P, Traue HC. Das burnout-syndrom: differenzialdiagnose und therapie. *Internistische Praxis*. (2004) 44:565–74.
38. Maslach C, Jackson SE, Leiter MP. *Maslach Burnout Inventory*. Palo Alto, CA: Consulting psychologists press (1986).
39. Bühl A, Zöfel P. *SPSS 12. Einführung in die Moderne Datenanalyse Unter Windows 9* Muenchen: Pearson Studium (2005).
40. Siegrist J. Effort-reward imbalance at work and health. In: Perrewe PL, Ganster DC, (Hrsg.). *Research in Occupational Stress and Well Being, Historical and Current Perspectives on Stress and Health,* Vol. 2. New York, NY: JAI-Elsevier (2002) 2:261–91. doi: 10.1016/S1479-3555(02)02007-3
41. Firth-Conzens J. Interventions to improve physicians' well beeing and patient care: a commentary. *Soc Sci Med*. (2001) 52:215–22. doi: 10.1016/S0277-9536(00)00221-5
42. Knesebeck von dem O, Klien J, Frie KG, Blum K, Siegrist J. Psychosocial stress among hospital doctors in surgical fields: results of a nationwide survey in Germany. *Dtsch Ärztebl Int*. (2010) 107:248–53. doi: 10.3238/arztebl.2010.0248
43. Kumari M, Head J, Marmot M. Prospective study of social and other risk factors of incidence of type 2 diabetes in the whitehall study. *Ach Intern Med*. (2004) 164:1873–80. doi: 10.1001/archinte.164.17.1873
44. Xu W, Hang J, Guo I, Zhao Y, Li Z, Gao W. Plasma fibrinogen: a possible link between job stress and cardiovascular disease among chinese workers. *Am J Ind Med*. (2012) 55:167–75. doi: 10.1002/ajim.21017
45. Bosma H, Peter R, Siegrist J, Marmot M. Two alternative job stress models and the risk of coronary heart disease. *Am J Public Health*. (2008) 88:68–73. doi: 10.2105/AJPH.88.1.68
46. Krause N, Rugulies R, Maslach C. Effort-reward-imbalance at work and self-rated health of las vegas hotel room cleaners. *Am J Ind Med*. (2010) 53:372–86. doi: 10.1002/ajim.20732
47. Peter R, Hammarström A, Hallqvist J, Siegrist J, Theorell T. Does occupational gender segregation influence the association of effort-reward-imbalance with

myocardial infarction in the sheep-study? *Int J Behav Med.* (2006) 13:34–43. doi: 10.1207/s15327558ijbm1301_5
48. Joksimovic L, Siegrist J, Meyer-Hammer M, Peter R, Franke B, Klimek WJ. Overcommitment predicts restenosis after coronary angioplasty in cardiac patients. *Int J Behav Med.* (1999) 6:3565–9. doi: 10.1207/s15327558ijbm0604_4
49. Rugulies R, Norborg M, Sorensen TS, Knudsen LE, Burr H. Effort-reward-imbalance at work and risk of sleep disturbances. cross-sectional and prospective results from danish work environment cohort study. *J Psychosom Res*. (2009) 66:75–83. doi: 10.1016/j.jpsychores.2008.05.005
50. Head J, Stansfeld SA, Siegrist J. The psychosocial work environment and alcohol dependence: a prospective study. *Occup Environ Med.* (2004) 61:219–24. doi: 10.1136/oem.2002.005256
51. Bourbonnais R, Jauvin N, Dussault J, Vézina M. Psychosocial work environment, interpersonal violence at work and psychotropc drug unse among correctional officers. *Int J Law Psychiatry.* (2010) 30:355–68. doi: 10.1016/j.ijlp.2007.06.008
52. Chen SW, Wang PC, Hsin PL, Oates A, Sun I, Liu SI. Job stress models, depressive disorders and work performance of engineers in microelectronics industry. *Int Ach Occup Environ Health.* (2011) 84:91–103. doi: 10.1007/s00420-010-0538-y
53. Park SG, Min KB, Chang SJ, Kim HC, Min JY. Job stress and depressive symptoms among korean employees: the effects of culture on work. *Int Ach Occup Environ Health.* (2009) 82:397–405. doi: 10.1007/s00420-008-0347-8
54. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Wöhrmann AM, Gerstenberg S, Hünefeld L, Pundt F, Reeske-Behrens A, et al. *Arbeitszeitreport Deutschland 2016.* Available online at: http://www.baua.de/de/Publikationen/Fachbeitraege/F2398.pdf?__blob=publicationFile&v=15 (accessed May 04, 2019).
55. Laux G. Affektive störungen. In: Möller HJ, Laux G, Deister A, (Hrsg.). *Psychiatrie und Psychotherapie*. New York, NY: Thieme Stuttgart (2009). p. 76–110. doi: 10.1055/b-0034-39953
56. Maslach, C, Jackson SE. Burnout in organizational settings. In: Oskamp S, (Hrsg.). *Applied Social Psychology Annual*. Berverly Hills: Sage (1984). p. 133–53.
57. Ommen O, Driller E, Janßen C, Richter P, Pfaff H. Burnout bei ärzten - sozialkapital als mögliche ressource? In: Brähler E, Alfermann D, Stiller J, (Hrsg.). *Karriereentwicklung und Berufliche Belastung im Arztberuf*. Göttingen: Vandenhoek und Ruprecht (2008). p. 190–208.
58. Firth H, Britton P. Burnout, absence and turnover amongst British nursing staff. *J Occup Psychol.* (1989) 62:55–9. doi: 10.1111/j.2044-8325.1989.tb00477.x
59. Sozialagenda. Statistischer Bericht der von EU (Sicherheit und Gesundheit am Arbeitsplatz). In: Sozialagenda, Nr. 25, ISSN (2010) 1682–7805:23–24. Available online at: http://ec.europa.eu/social/main.jsp?catId=737&langId=en&pubId=604&type=1&furtherPubs=no (accessed May 04, 2019).
60. Maatouk I, Müeller A, Gündel H. Prävention psychischer und psychosomatischer erkrankungen in der arbeitswelt - uberblick mit schwerpunktsetzung auf demografiesensible interventionen. *Gesundheitswesen*. (2016) 78:781–94. doi: 10.1055/s-0042-105438
61. Jerg-Bretzke L, Limbrecht K. Where have they gone? – a discussion on the balancing act of female doctors between work and family. *GMS Zeitschrift für Medizinische Ausbildung*. (2012) 29:7–11. doi: 10.3205/zma000789
62. Jerg-Bretzke L, Limbrecht K. Wo sind sie geblieben?- eine diskussion über die posititionierung von medizinerinnen zwischen karriere, beruf und familie. *GMS Zeitschrift für Medizinische Ausbildung*. (2012) 29:83–8.
63. Deutsches Institut für Wirtschaftsforschung. *Führungskräftemonitor*. (2015). Available online at: http://nbn-resolving.de/urn:nbn:de:0084-diwkompakt_2015--1005 (accessed May 03, 2016).
64. Schmidt C, Möller J, Schmidt K, Gerbershagen MU, Wappler F, Limmroth V, et al. Generation Y. rekrutierung, entwicklung und bindung. *Anaesthesist*. (2011) 60:517–24. doi: 10.1007/s00101-011-1886-z
65. Niessen C, Sonnentag S, Neff A, Unger D. ressourcen und belastungen von doppelekarrierpaaren in der wissenschaft - eine arbeitspsychologische perspektive. In: Gramespacher E, Fink J, Rothäusler I, (Hrsg.). *Dual Career Couples an Hochschulen. Zwischen Wissenschaft, Praxis und Politik*. Opladen: Verlag Barbara Buderich (2010). p. 75–85. doi: 10.2307/j.ctvddzrxd.8
66. Ford MT, Heinen BA, Langkammer KL Work and family satisfaction and conflict: a meta-analysis of cross-domain relations. *J Appl Psychol*. (2007) 92:57–80. doi: 10.1037/0021-9010.92.1.57
67. Demerouti E, Taris TW, Bakker AB. Need for recovery, home-work interference and performance: is lack of concentration the link? *J Vocational Behav*. (2007) 71:204–20. doi: 10.1016/j.jvb.2007.06.002
68. Grandey AA, Cropanzano R. The conservation of resources model applied to work-family conflict and strain. *J Vocational Behav*. (1999) 54:350–70. doi: 10.1006/jvbe.1998.1666
69. Schieman S, McBrier DB, Van Gundy K. Home-to-work conflict, work qualities and emotional distress. *Soc Forum.* (2003) 18:137–64. doi: 10.1023/A:1022658929709
70. Otterbach S, Tavener M, Forder P, Powers J, Loxton D, Byles J. The effect of motherhood and work on women's time pressure: a cohort analysis using the Australian longitudinal study on women's health. *Scand J Work Environ Health.* (2016) 42:500–09. doi: 10.5271/sjweh.3590
71. Ernst & Young. EY Studentenstudie 2016. *In welche Branchen zieht es Studenten in Deutschland?* (2016). Available online at: http://www.ey.com/Publication/vwLUAssets/EY-Studentenstudie-2016-Branchen/FILE/EY-Studentenstudie-2016-Branchen.pdf (accessed October 10, 2016).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

MINI REVIEW
published: 20 March 2020
doi: 10.3389/fpsyt.2020.00163

Epigenetics Underlying Susceptibility and Resilience Relating to Daily Life Stress, Work Stress, and Socioeconomic Status

Michael G. Gottschalk[1], *Katharina Domschke*[1,2] *and Miriam A. Schiele*[1]*

[1] Department of Psychiatry and Psychotherapy, Medical Center – University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany, [2] Center for Basics in NeuroModulation, Faculty of Medicine, University of Freiburg, Freiburg, Germany

OPEN ACCESS

Edited by:
Christine Allwang, Technical University of Munich, Germany

Reviewed by:
Livio Provenzi, Neurological Institute Foundation Casimiro Mondino (IRCCS), Italy
Michael Deuschle, Central Institute for Mental Health, Germany

***Correspondence:**
Miriam A. Schiele
miriam.schiele@uniklinik-freiburg.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: 06 November 2019
Accepted: 20 February 2020
Published: 20 March 2020

Citation:
Gottschalk MG, Domschke K and Schiele MA (2020) Epigenetics Underlying Susceptibility and Resilience Relating to Daily Life Stress, Work Stress, and Socioeconomic Status. Front. Psychiatry 11:163. doi: 10.3389/fpsyt.2020.00163

Susceptibility and resilience to mental disorders result from a complex choreography of gene–environment interactions with epigenetics at the intersection of external psychological stressors and internal biological systems. Increasing awareness of the growing disease burden influenced by daily life stress ("daily hassles"), work-related stress, and low socioeconomic status (SES) has resulted in a novel interest into their underlying molecular signatures. This review offers a brief outline of psychiatric epigenetics and a comprehensive overview of recent findings exploring the relationship of various occupational stressors and DNA methylation in epigenome-wide association studies (EWAS) and in candidate gene studies including the serotonin transporter (*SLC6A4*; *5-HTT*LPR), melatonin receptor 1A (*MTNR1A*), brain-derived neurotrophic factor (*BDNF*), tyrosine hydroxylase (*TH*), and the protein family of DNA methyltransferases (*DNMTs*). Conceptual and methodological challenges of epigenetic investigations with a special focus on gene–environment interactions are highlighted and discussed. The findings are integrated into a pathophysiological framework featuring epigenetic plasticity factors and work-related stress as a possible central detrimental component targetable by workplace interventions. Finally, the potential of dynamic epigenetic biomarkers of treatment response to pharmacotherapy or psychotherapy is expanded upon.

Keywords: epigenetics (MeSH), work stress, daily life stress, socioeconomic status (MeSH), susceptibility, resilience (psychological), candidate risk variants, epigenome wide association

INTRODUCTION

Chronic exposure to environmental stressors, including but not limited to work-related stress, has been implicated in the patho-etiology of various mental disorders and represents a substantial cause of morbidity, imposing a considerable societal disease burden (1). An individual's response to detrimental environmental influences is affected by an interplay of its intrinsic genetic configuration

and its susceptibility or resilience toward external stimuli, which has led to a growing understanding of gene–environment interactions in the onset, course, and treatment of mental disorders (2). Epigenetics has emerged as a molecular correlate of this intersection, and a converging body of evidence has been collected outlining the effects of early-life stress and traumatic experiences, but less so of chronic psychosocial stressors on the expression of candidate genes involved in psychopathology (3).

Given the known connections between increased work-related stress and poor long-term mental health outcome, this mini review explicitly focuses on summarizing the current state of the literature on the epigenetics of daily life stress, work-related stress, and socioeconomic status (SES) and highlights future challenges and opportunities relevant to the field of psychiatry and psychology. In order to offer a concise overview, PubMed searches combining the terms "work/daily/occupational stress" and "socioeconomic status" with "epigenetics" and "DNA/genome wide methylation" were performed in October 2019, and the resulting titles and abstracts were screened for relevance. Please refer to **Table 1** for an overview of primary findings.

A BRIEF BACKGROUND IN EPIGENETICS

Epigenetics constitutes the effects of DNA and histone modifications and of micro RNAs, subsumed as changes to the structure of the DNA strand (but importantly not as changes to the DNA sequence itself), or the interaction of mRNA with noncoding RNAs, affecting transcription and translation. Epigenetic modifications describe dynamic processes with an inherent capacity of intraindividual reversibility. The functionally most well described and major epigenetic modification with relevance to available studies investigating work stress-related phenomena is DNA methylation. Therefore, other epigenetic processes will not be further expanded upon. DNA methylation occurs at cytosine carbon atoms in CpG nucleotide pairs, often accumulating in CpG-rich genomic sites referred to as CpG islands (19). DNA methylations are catalyzed by the enzyme class of DNA-methyltransferases (DNMTs) and become functionally relevant due to other proteins recognizing and binding to methylated DNA sequences and thereby, for example, prohibiting other interaction partners of the transcription start complex to bind or pass, resulting in a *de facto* silencing of the downstream genomic region. Generally speaking, increased CpG methylation of promoters, enhancer elements, or transcription start sites leads to lower transcription levels of the associated mRNA, whereas decreased methylation of the respective sites would be linked to higher transcript concentrations (20). It should be noted that structural [e.g., single nucleotide polymorphisms (SNPs)] and functional (e.g., CpG methylation) changes of the DNA share an interdependence, insofar as for example, SNPs can interfere with target recognition sites of enzymes and hence affect the local occurrence of epigenetic base pair modifications, while methylation changes can alter the topological susceptibility to regional mutations, both of which may impact higher levels of biological complexity including cognitive processes and behavior (21, 22).

DAILY LIFE STRESS AND EPIGENETICS

The serotonin transporter-linked polymorphic region (*5-HTT*LPR), a promoter region polymorphism of the serotonin transporter gene (*SLC6A4*)—differentiated into a high transcription (more active) long (l) allele and a less active short (s) allele—as well as *SLC6A4* methylation have been commonly investigated in interaction with early life stressors on stress responsivity. Far fewer studies, however, have integrated the role of current stressful events. One such study not only evaluated the interaction between early life stress and *5-HTT*LPR genotype on blood-based *SLC6A4* methylation, *SLC6A4* expression, and cortisol response to the Trier Social Stress Test (TSST) but also analyzed the association of chronic stress experiences, gene expression, and cortisol response as a function of *5-HTT*LPR genotypes (4). Current stress experience over the past 3 months as measured by the Trier Inventory of Chronic Stress (TICS) and baseline *SLC6A4* expression in 105 psychiatrically healthy Caucasian males did not differ as a function of *5-HTT*LPR genotype, whereas l/l genotype carriers displayed significantly higher *SLC6A4* expression in response to the TSST, as compared to s allele carriers. Interestingly, l/l genotype carriers further showed increased global promoter methylation levels, both as a function of early-life stress [childhood trauma questionnaire (CTQ)] and in interaction with recent chronic daily stress. Upon closer investigation, s allele carriers, but not l/l genotype carriers, possessed significantly increased methylation of CpG islands flanked upstream by the 5-*HTT*LPR and downstream by the untranslated first *SLC6A4* exon, which showed increased methylation levels as a function of recent chronic daily stress and correlated positively with glucocorticoid receptor (*NR3C1*) expression [for more evidence of *NR3C1* as a key mediator of early adversity in stress-related disorders, please refer to Palma-Gudiel, Cordova-Palomera (23)]. Given that elevated *SLC6A4* methylation levels of the very same site have been linked to major depressive disorder (MDD) (24) and increased levels of burnout symptoms (6) (see below), this distinct genomic region might represent a particularly dynamic methylation site, responsive to chronic recent daily stressors.

By way of an indirect epigenetic approach, a multistep gene–environment interaction study tested for main and interaction effects of 31 SNPs in epigenetic regulatory genes and daily life stress or pleasant experiences, respectively, on emotional affectivity in a discovery sample of 112 psychiatrically healthy individuals, a population-based replication sample of 434 individuals and three further samples of unaffected siblings of patients with psychosis (n = 85), patients with psychosis (n = 110), and patients with a MDD lifetime history and residual symptoms (n = 126) (5). All samples showed associations between daily life stress, negative affectivity, pleasant

TABLE 1 | Overview of epigenetic studies relating to daily life stress, work stress, and socioeconomic status.

Study	Sample	Tissue	Assessment	Gene(s)/ scope	Findings
Daily life stress					
Duman and Canli (4)	105 Caucasian males	Blood	TICS for past 3 months	*SLC6A4*	↑ total methylation as a function of chronic daily stress in *5-HTTLPR* l/l genotype carriers ↑ promoter methylation as a function of chronic daily stress in *5-HTTLPR* s allele carriers
Pishva et al. (5)	112 Dutch/Belgian psychiatrically healthy individuals, a population-based replication sample of 434 individuals, 85 unaffected siblings of patients with psychosis, 110 patients with psychosis, 126 patients with a MDD lifetime history and residual symptoms	Blood, saliva, or buccal epithelium	Experience sampling method for daily stressful and pleasant events	*DNMT1*, *DNMT3A*, *DNMT3B*, *MTHFR*	Association of the minor *DNMT3A* rs11683424 T allele with a reduced impact of daily life stress on negative affectivity in the discovery sample, replication sample, and in the sample of patients with a MDD lifetime history
Work stress					
Alasaari et al. (6)	24 Finnish female nurses reporting high and 25 female nurses reporting low work stress environments	Blood	JCQ	*SLC6A4*	↓ promoter methylation associated with increased perceived work stress
Miyaki et al. (7)	360 Japanese manufacturing company workers	Saliva	JCQ	*TH*	↑ overall average / promoter / 5'-regulatory region methylation associated with increased work strain
Song et al. (8)	360 Japanese manufacturing company workers	Saliva	JCQ	*BDNF*	↑ overall average methylation associated with increased work strain
Sulkava et al. (9)	59 Finnish pilots, flight attendants, and nurses (from Alasaari et al., 2014)	Blood	–	*MTNR1A*	↑ methylation levels in the *MTNR1A* promoter region associated with the minor *MTNR1A* rs12506228 A allele (discovered in a GWAS of work-related exhaustion in the same study)
SES					
Bush et al. (10)	178 kindergarten children from mixed ethnic backgrounds	Buccal epithelium	Composite measure of parental income and education used as a proxy of SES	EWAS	Overrepresentation of altered methylation at CpG sites in genes related to immune and developmental regulation functions associated with low SES
Coker et al. (11)	241 Mexican-American maternal–infant pairs	Cord blood	Neighborhood-level characteristics used as a proxy of SES	EWAS	↑ methylation of LINE1 elements associated with low SES
Fiorito et al. (12)	Meta-analysis of 5,087 samples of independent cohorts from Australia, Ireland, and Italy	Blood	Highest level of educational attainment used as a proxy of SES	Accelerated intrinsic epigenetic aging	Increased accelerated epigenetic aging associated with low SES
Jones-Mason et al. (13)	100 late adolescents from mixed ethnic backgrounds	Blood	Hollingshead Measure of SES	*SLC6A4*	↑ methylation and low SES linked to increased reports of trauma
Laubach et al. (14)	609 maternal–infant pairs from mixed ethnic backgrounds	Cord blood and peripheral blood (3-year follow-up)	Composite measure of individual- and neighborhood-level metrics used as a proxy of SES	EWAS	Altered methylation in CpG sites mapped to *ACSF3*, *TNRC6C-AS1*, *MTMR4* and *LRRN4* associated with low SES, *LRRN4* methylation changes persisted into early childhood
McDade et al. (15)	489 Filipino youth	Blood	Composite measure of income, assets, and education used as a proxy of SES	EWAS	Overrepresentation of altered methylation at CpG sites in genes related to immune functions, skeletal development, and CNS development associated with low SES
Santos et al. (16)	426 infants born <28 weeks of gestation from mixed ethnic backgrounds	Placenta	Composite measure of parental education, marital status, food and nutritional service assistance, and public health insurance used as a proxy of SES	EWAS	Overrepresentation of altered methylation at CpG sites in genes related to cellular immune and stress response associated with low SES

(Continued)

TABLE 1 | Continued

Study	Sample	Tissue	Assessment	Gene(s)/ scope	Findings
Swartz et al. (17)	132 Caucasian adolescents	Saliva	Highest level of parental educational attainment used as a proxy of SES	*SLC6A4*	↑ methylation change over 2 years associated with low SES and increased threat-related amygdala reactivity
Uddin et al. (18)	77 trauma-exposed controls and 23 PTSD patients, primarily with African-American background	Blood	Highest level of educational attainment used as a proxy of SES	EWAS	Methylation×SES interaction occurred primarily in genes related to nervous system function

5-HTTLPR, serotonin transporter-linked polymorphic region; ACSF3, acyl-CoA synthetase family member 3 gene; BDNF, brain-derived neurotrophic factor gene; DNMT1, DNA methyltransferase 1 gene; DNMT3A, DNA methyltransferase 3 alpha gene; DNMT3B, DNA methyltransferase 3 beta gene; EWAS, epigenome-wide association study; GWAS, genome-wide association study; JCQ, Karasek's Job Content Questionnaire; LINE1, L1 long interspersed nuclear elements; LRRN4, leucine-rich repeat neuronal 4 gene; MDD, major depressive disorder; MTHFR, methylenetetrahydrofolate reductase gene; MTMR4, myotubularin-related protein 4 gene; MTNR1A, melatonin receptor 1A gene; SES, socioeconomic status; SLC6A4, serotonin transporter gene; TH, tyrosine hydroxylase gene; TICS, Trier Inventory of Chronic Stress; TNRC6C-AS1, TNRC6C antisense RNA 1 gene. Arrows indicate increased (↑) and decreased (↓) methylation, respectively.

experiences, and positive affectivity, respectively, yet no SNP main effect emerged for either negative or positive affectivity. Following *post hoc* multiple comparisons correction in the interaction analyses of SNPs and daily life stress or pleasant experiences, respectively, in the discovery sample, only one SNP was validated as significant and directionally similar in the replication sample and furthermore in the sample of patients with a MDD lifetime history: The minor rs11683424 T allele in the gene coding for the DNA methyltransferase 3 alpha (*DNMT3A*) was associated with a reduced impact of daily life stress on negative affectivity. This result is particularly relevant since DNMT3A is classified as a *de novo* methyltransferase, dynamically reshaping methylation patterns, rather than statically preserving preexisting methylation patterns during DNA replication, as for example maintained by DNMT1 (25), signifying that genetic variation in regulatory enzymes of DNA methylation might moderate the *ad hoc* effects of daily life stressors on emotional regulation and thereby psychopathological susceptibility and resilience *via* downstream epigenetic processes.

WORK-RELATED STRESS AND EPIGENETICS

Considering the adverse emotional and physical responses to chronic work-related stress, which are reached when the work demands exceed an individual's coping ability and capacity (26), it appears surprising how seldom the molecular interplay of perceived occupational stressors and maladaptive outcomes has been examined.

In a female nurses cohort who reported either high (n = 24) or low (n = 25) work stress environments, significantly lower *SLC6A4* methylation of the same region described by Duman and Canli (4) above was discerned in the high-stress group (6). Notably, in a multifactorial analysis of covariance including work stress environment, burnout, work control, work demand, age, and *5-HTT*LPR genotypes as explanatory variables, only perceived work stress significantly and independently affected overall methylation levels. Higher methylation levels were associated with an increasing intensity of burnout symptom reports when corrected for perceived work stress and vice versa. It could be hypothesized that *SLC6A4* promoter hypomethylation reflects an adaptational mechanism independent of the *5-HTT*LPR genotype in response to work-related stress, which may initially follow a physiological role to minimize stress exposure and preserve cognitive functioning, but results in dysfunctional long-term consequences manifesting as failed coping mechanisms and increasingly depressed mood.

Another impactful factor of work-related stress is shift work, which has been linked to adverse long-term health effects, including, but not limited to, an increased risk of mental disorders (27), but whose molecular underpinnings have rarely been explored. In a fixed-effects meta-analysis of genome-wide association studies (GWAS) (total n = 753 samples, including subsets of the general population, nurses, and airline employees) of work-related exhaustion, rs12506228 was the only SNP reaching genome-wide significance ($p = 4.90 \times 10^{-8}$) (9). Since rs12506228 is located in a CpG island in the 5'-regulatory region of the gene coding for the melatonin receptor 1A (*MTNR1A*), a subsequent *in silico* search of available postmortem brain data suggested reduced *MTNR1A* central nervous system (CNS) expression levels to be linked to the minor »risk« A allele. Complementing this transcriptomic approach, an analysis of bead chip methylation data of pooled blood samples from the nurse (6) and airline employee sample subsets (total n = 59) further hinted at significantly higher methylation levels in the *MTNR1A* promoter region to be associated with the rs12506228 *MTNR1A* A allele. Reduced central melatonin signaling in rs12506228 A allele carriers, especially considering its inhibitory effect *via* MTNR1A in the suprachiasmatic nucleus, where melatonin acts as a stabilizer of the circadian rhythm against light-induced phase shifts (28), might result in an increased sensitivity to nocturnal lights, for example, because of epigenetically reduced expression of *MTNR1A*, leading to circadian disruptions and ultimately increased work-related stress due to night shifts.

Additional candidate gene approaches targeting the epigenetics of work-related stress have been conducted in a cohort of 360 Japanese manufacturing company workers, who were subdivided into four quartile-based groups according to their reported job strain. The overall average methylation across CpG sites covering the tyrosine hydroxylase gene (*TH*) was significantly elevated in workers reporting a higher work

strain, as was the methylation of the promoter and the 5'-regulatory region by itself, with methylation and the degree of work-related stress levels displaying a significant positive correlation (7). Furthermore, the overall average methylation of the gene coding for the brain-derived neurotrophic factor (*BDNF*) was increased in individuals with higher reported work strain (8). These results highlight the need to account for the temporal dynamic of epigenetic modifications associated with work-related stress, for example, *BDNF* methylation has been demonstrated to be unaltered following acute psychosocial stress (29), while preclinical evidence proposes that chronic stress exposure leads to a glucocorticoid-dependent hypermethylation of *TH*, but only when combined with additional neuropsychiatric risk mutations (30).

SOCIOECONOMIC STATUS AND EPIGENETICS

Recently, interest has sparked into investigations of epigenetics related to SES, as a combination of low SES and high job demands has been linked to increased morning cortisol and diurnal cortisol secretion (31), supporting the notion that lower SES is associated with various work-related stressors precipitating a higher prevalence of mental disorders and health-impairing behaviors (32).

A meta-analysis of three samples (total n = 5,087) reported a linear increase of accelerated intrinsic epigenetic aging when comparing high to medium and low SES (12). Moreover, individuals who experienced a change in SES over their life span (based on the trajectory of father's occupational position as a proxy of early-life SES and individual highest occupational position as a proxy for adulthood SES) showed intermediate levels of accelerated epigenetic aging, indicating a potential reversibility of maladaptive epigenetic effects due to low SES. Notably, sex-dependent DNA methylation changes associated with SES have been demonstrated to already exist at the time of birth and to partially persist into early childhood (14, 16), mainly affecting biological processes regulating immunological and developmental functions (10).

Integrating attachment variables into an analysis of SES and *SLC6A4* promoter methylation in 100 adolescents, higher methylation and low SES were linked to higher reports of trauma (13). Within the group with unresolved attachment style, yet not in the groups with secure or organized attachment style, low SES was associated with increased methylation, implying that attachment security might act as a protective factor against the effects of low SES on *SLC6A4* promoter methylation. This notion appears to be particularly relevant since an explorative epigenome-wide association study (EWAS) including trauma-exposed controls (n = 77) and post-traumatic stress disorder (PTSD) patients (n = 23) has proposed that methylation × SES interaction effects occur primarily in genes related to nervous system function (18), offering a biological pathway by which external stressors might elicit maladaptive central changes. Additionally, biological pathways highlighted by EWAS of early-life SES-related stress have pointed toward altered methylation in genes governing CNS and immune functions (10, 15), some of which appear stable over different developmental stages (14), and with a particular molecular focus on L1 long interspersed nuclear elements (LINE1 elements) hypermethylation (11).

Reasonably, continuous research efforts have been invested into an elucidation of how low SES results in a heightened risk of mental disorders. A longitudinal multilevel approach integrating epigenetic, neuroimaging, and psychometric readouts from 132 adolescents reported that low SES was the only factor among environmental stress variables predicting a greater 2-year increase in *SLC6A4* promoter methylation, independent of a MDD family history (17). Besides, increases in proximal *SLC6A4* promoter methylation predicted increases in threat-related amygdala reactivity over the same time window, which in turn predicted elevated levels of depressive symptoms another year later, but this time solely in individuals with a MDD family history. A moderated mediation model confirmed that lower SES indirectly affected future increases in depressive symptom intensity in individuals with, but not without, a MDD family history, *via SLC6A4* promoter hypermethylation, which in turn predicted heightened amygdala responsivity. These findings add to the notion of elevated peripheral *SLC6A4* promoter methylation as an early surrogate stress marker reflecting increased central amygdala reactivity and lower brain expression levels of *SLC6A4* (33).

DISCUSSION

Conceptual and Methodological Challenges

As exemplified by the above studies, investigations into stress-related epigenetics not only have to reach adequate sample numbers to allow for the detection of potentially small effect sizes, they also have to specifically monitor the homogeneity of their cohorts, for example, sex (34), ethnicity (35), and smoking status (36) have all been shown to significantly influence the epigenome. Also, it should be kept in mind that, as with most human psychiatric research, the above listed findings constitute correlational evidence in need of further independent replication. Moreover, a notorious challenge is the division into epigenetic responses to recent environmental stressors and methylation changes that date back to conception. The epigenetic modifications resulting from *in utero* exposure or during critical "windows of vulnerability" in early-life development have been demonstrated to permanently affect methylation patterns for several decades (37, 38). Therefore, longitudinal within-subject designs should be preferred in order to distinguish into hypothetically life-long methylation patterns as a source of susceptibility to work-related stressor and dynamic molecular adaptions to recently experienced occupational adversities.

Another often raised controversy relates to the evaluation of epigenetic patterns in peripheral tissues, mainly leukocytes derived from blood or buccal cells from saliva samples, when

the psychiatric main interest lies within the CNS pathophysiology of mental disorders. However, interindividual differences in brain methylome patterns have been proven to be reflected in peripheral samples (39), a positive cross-correlation between blood and saliva methylation has been confirmed (40), and both sampling types have been verified to deliver temporally stable results (41). Nonetheless, direct conclusions from peripheral to central molecular changes should be drawn with caution, and only independent replication and cross-tissue evidence will further support the rise of surrogate epigenetic biomarkers viable to contribute clinical benefits in therapeutic decision making.

Furthermore, accessible measures of daily life stress and work-related stress ultimately represent subjective values and are difficult to accurately quantify. The application of multiple validated retrospective self-report questionnaires assessing comparable stressor constructs, or of repeated recall bias-free real-time evaluations of behaviors and experiences in natural daily environments [ecological momentary assessment; (42)], appears to be the gold standard for future investigations. Also, epigenetic findings should be followed up by *in vivo* and *in vitro* evaluation of potential causal mechanisms relating transcriptomic expression changes to higher levels of biological functioning. Eventually, candidate risk gene will be combined into candidate risk haplotypes before hypothesis-driven work will start to complement increasingly accessible hypothesis-generating EWAS approaches (43). As this mini review has demonstrated, currently, there is a reliance on single-locus investigations and comparably small sample sizes (and therefore reduced statistical power), which has resulted in a research focus on mostly established candidate risk genes. Prospective multi-locus study designs will help to disentangle the epigenetic effects of occupational adversities and targeted protective measures in relation to work stress-related susceptibility (44).

From Novel Pathophysiological Frameworks Toward Individualized Treatments

The present state of literature harmonizes with the notion of the "differential susceptibility hypothesis," stressing that rather to hunt for »risk« genes, one should consider »plasticity« genes, which can render an individual more receptive to environmental stimuli in general, while their interaction can result in added allostatic load or buffer organismal defences (45). As exemplified above, the *5-HTT*LPR genotype-dependent *SLC6A4* promoter methylation in response to an acute (4) or chronic work-related stressor (6) might boost or diminish an individual's subsequent reactions to similar or derivative forms of stress. Daily life stress, work-related stress, and SES therefore represent welcome additions to future epigenetic approaches to unravel the ever-elusive point where heredity and nature meet environment and nurture but should always be considered as plasticity variables and be evaluated alongside potential coping factors (46).

The accumulation and integration of multilevel evidence relating to individual epigenetic plasticity markers, for example, from SES-dependent modifications in *SLC6A4* promoter methylation to neuronal reactivity and finally to psychometric alterations (17), enhance the accessibility of predictive molecular signatures and finally deepen our insight into interlaced levels of systems biology (47). Biomarkers of disease course development or treatment response hold a particular value due to their inherent epigenetic dynamic. In light of potentially reversible SES-dependent maladaptive DNA methylation patterns, it should be noted that epigenetic markers have already been suggested as predictors and potential mechanistic correlates of pharmacological and psychological therapy responsiveness, with DNA methylation measurements reverting to values comparable to healthy controls over the time course of treatment (48–51). Multiple forms of preventive interventions against stressors like work exhaustion/strain and shift work and associated common mental disorders are currently recognized, including the enhancement of employee control and the promotion of physical activity (52). Future working generations might consequently possibly benefit from indicated preventive interventions or targeted treatment approaches depending on the quantifiable state of epigenetic biomarkers. Particularly, when considering potential long-term effects of transgenerational epigenetic inheritance and *in utero* exposure influenced by work-related stressors on mental health traits, which creates novel perspectives of social equality and responsibility alike (53).

CONCLUSION

Notwithstanding the epidemiological and economic impact of workplace stressors, investigations into the relevant epigenetic mechanisms mediating susceptibility or resilience toward mental disorders have been limited. Gathered multilevel evidence specifically favors a role of *SLC6A4* promoter methylation patterns as correlates of acute daily stress, chronic work-related stress, and low SES upbringing, although hypothesis-generating studies supporting an involvement of the serotonergic system are still needed. Upcoming epigenetic research should aim to expand beyond an integration of occupational psychometric readouts as additional risk variables and progress to a dimensional understanding of psychopathology accompanied by prognostic molecular plasticity markers regulating individual work stress internalization and allowing for personalized treatment.

AUTHOR CONTRIBUTIONS

MG conducted the literature search and wrote the first manuscript draft. MS and KD contributed to the literature search and to the revision of the manuscript. All authors contributed to and have approved the final manuscript version.

FUNDING

This work was partly supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – project number 44541416 – TRR 58 "Fear, Anxiety, Anxiety Disorders" (projects C02 and Z02 to KD), the German Ministry of Research and Education (BMBF, 01EE1402F, PROTECT-AD, project P5 to KD), and the EQUIP Medical Scientist Program of the Medical Faculty, University of Freiburg, Germany (to MAS). The funding sources had no further role in the study design, in the collection, analysis, and interpretation of data, in the writing of the report, and in the decision to submit the paper for publication.

ACKNOWLEDGMENTS

KD and MS are members of the Anxiety Disorders Research Network (ADRN), European College of Neuropsychopharmacology (ECNP).

REFERENCES

1. Virtanen M, Honkonen T, Kivimaki M, Ahola K, Vahtera J, Aromaa A, et al. Work stress, mental health and antidepressant medication findings from the Health 2000 Study. *J Affect Disord* (2007) 98(3):189–97. doi: 10.1016/j.jad.2006.05.034
2. Schiele MA, Domschke K. Epigenetics at the crossroads between genes, environment and resilience in anxiety disorders. *Genes Brain Behav* (2018) 17(3):e12423. doi: 10.1111/gbb.12423
3. Schuebel K, Gitik M, Domschke K, Goldman D. Making Sense of Epigenetics. *Int J Neuropsychopharmacol* (2016) 19(11):pyw058. doi: 10.1093/ijnp/pyw058
4. Duman EA, Canli T. Influence of life stress, 5-HTTLPR genotype, and SLC6A4 methylation on gene expression and stress response in healthy Caucasian males. *Biol Mood Anxiety Disord* (2015) 5:2. doi: 10.1186/s13587-015-0017-x
5. Pishva E, Drukker M, Viechtbauer W, Decoster J, Collip D, van Winkel R, et al. Epigenetic genes and emotional reactivity to daily life events: a multi-step gene-environment interaction study. *PloS One* (2014) 9(6):e100935. doi: 10.1371/journal.pone.0100935
6. Alasaari JS, Lagus M, Ollila HM, Toivola A, Kivimaki M, Vahtera J, et al. Environmental stress affects DNA methylation of a CpG rich promoter region of serotonin transporter gene in a nurse cohort. *PloS One* (2012) 7(9):e45813. doi: 10.1371/journal.pone.0045813
7. Miyaki K, Suzuki T, Song Y, Tsutsumi A, Kawakami N, Takahashi M, et al. Epigenetic changes caused by occupational stress in humans revealed through noninvasive assessment of DNA methylation of the tyrosine hydroxylase gene. *J Neurol Neurol Disord* (2015) 2(2):1–8. doi: 10.15744/2454-4981.2.201
8. Song Y, Miyaki K, Suzuki T, Sasaki Y, Tsutsumi A, Kawakami N, et al. Altered DNA methylation status of human brain derived neurotrophis factor gene could be useful as biomarker of depression. *Am J Med Genet B Neuropsychiatr Genet* (2014) 165B(4):357–64. doi: 10.1002/ajmg.b.32238
9. Sulkava S, Ollila HM, Alasaari J, Puttonen S, Harma M, Viitasalo K, et al. Common Genetic Variation Near Melatonin Receptor 1A Gene Linked to Job-Related Exhaustion in Shift Workers. *Sleep* (2017) 40(1):1–10. doi: 10.1093/sleep/zsw011
10. Bush NR, Edgar RD, Park M, MacIsaac JL, McEwen LM, Adler NE, et al. The biological embedding of early-life socioeconomic status and family adversity in children's genome-wide DNA methylation. *Epigenomics* (2018) 10(11):1445–61. doi: 10.2217/epi-2018-0042
11. Coker ES, Gunier R, Huen K, Holland N, Eskenazi, B. DNA methylation and socioeconomic status in a Mexican-American birth cohort. *Clin Epigenet* (2018) 10:61. doi: 10.1186/s13148-018-0494-z
12. Fiorito G, Polidoro S, Dugue PA, Kivimaki M, Ponzi E, Matullo G, et al. Social adversity and epigenetic aging: a multi-cohort study on socioeconomic differences in peripheral blood DNA methylation. *Sci Rep* (2017) 7(1):16266. doi: 10.1038/s41598-017-16391-5
13. Jones-Mason K, Allen IE, Bush N, Hamilton, S. Epigenetic marks as the link between environment and development: examination of the associations between attachment, socioeconomic status, and methylation of the SLC6A4 gene. *Brain Behav* (2016) 6(7):e00480. doi: 10.1002/brb3.480
14. Laubach ZM, Perng W, Cardenas A, Rifas-Shiman SL, Oken E, DeMeo D, et al. Socioeconomic status and DNA methylation from birth through mid-childhood: a prospective study in Project Viva. *Epigenomics* (2019) 11(12):1413–27. doi: 10.2217/epi-2019-0040
15. McDade TW, Ryan CP, Jones MJ, Hoke MK, Borja J, Miller GE, et al. Genome-wide analysis of DNA methylation in relation to socioeconomic status during development and early adulthood. *Am J Phys Anthropol* (2019) 169(1):3–11. doi: 10.1002/ajpa.23800
16. Santos HP Jr., Bhattacharya A, Martin EM, Addo K, Psioda M, Smeester L, et al. Epigenome-wide DNA methylation in placentas from preterm infants: association with maternal socioeconomic status. *Epigenetics* (2019) 14(8):751–65. doi: 10.1080/15592294.2019.1614743
17. Swartz JR, Hariri AR, Williamson, DE. An epigenetic mechanism links socioeconomic status to changes in depression-related brain function in high-risk adolescents. *Mol Psychiatry* (2017) 22(2):209–14. doi: 10.1038/mp.2016.82
18. Uddin M, Galea S, Chang SC, Koenen KC, Goldmann E, Wildman DE, et al. Epigenetic signatures may explain the relationship between socioeconomic position and risk of mental illness: preliminary findings from an urban community-based sample. *Biodemography Soc Biol* (2013) 59(1):68–84. doi: 10.1080/19485565.2013.774627
19. Fu Y, He, C. Nucleic acid modifications with epigenetic significance. *Curr Opin Chem Biol* (2012) 16(5-6):516–24. doi: 10.1016/j.cbpa.2012.10.002
20. Suzuki MM, Bird A. DNA methylation landscapes: provocative insights from epigenomics. *Nat Rev Genet* (2008) 9(6):465–76. doi: 10.1038/nrg2341
21. Lester BM, Tronick E, Nestler E, Abel T, Kosofsky B, Kuzawa CW, et al. Behavioral epigenetics. *Ann N Y Acad Sci* (2011) 1226:14–33. doi: 10.1111/j.1749-6632.2011.06037.x
22. Meaburn EL, Schalkwyk LC, Mill, J. Allele-specific methylation in the human genome: implications for genetic studies of complex disease. *Epigenetics* (2010) 5(7):578–82. doi: 10.4161/epi.5.7.12960
23. Palma-Gudiel H, Cordova-Palomera A, Leza JC, Fananas L. Glucocorticoid receptor gene (NR3C1) methylation processes as mediators of early adversity in stress-related disorders causality: A critical review. *Neurosci Biobehav Rev* (2015) 55:520–35. doi: 10.1016/j.neubiorev.2015.05.016
24. Zhao J, Goldberg J, Bremner JD, Vaccarino, V. Association between promoter methylation of serotonin transporter gene and depressive symptoms: a monozygotic twin study. *Psychosom Med* (2013) 75(6):523–9. doi: 10.1097/PSY.0b013e3182924cf4
25. Okano M, Bell DW, Haber DA, Li, E. DNA methyltransferases Dnmt3a and Dnmt3b are essential for de novo methylation and mammalian development. *Cell* (1999) 99(3):247–57. doi: 10.1016/s0092-8674(00)81656-6
26. Folkman S, Lazarus RS, Dunkel-Schetter C, DeLongis A, Gruen, RJ. Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *J Pers Soc Psychol* (1986) 50(5):992–1003. doi: 10.1037//0022-3514.50.5.992
27. Wisetborisut A, Angkurawaranon C, Jiraporncharoen W, Uaphanthasath R, Wiwatanadate, P. Shift work and burnout among health care workers. *Occup Med (Lond)* (2014) 64(4):279–86. doi: 10.1093/occmed/kqu009
28. Arendt, J. Melatonin and human rhythms. *Chronobiol Int* (2006) 23(1-2):21–37. doi: 10.1080/07420520500464361
29. Unternaehrer E, Luers P, Mill J, Dempster E, Meyer AH, Staehli S, et al. Dynamic changes in DNA methylation of stress-associated genes (OXTR, BDNF) after acute psychosocial stress. *Transl Psychiatry* (2012) 2:e150. doi: 10.1038/tp.2012.77
30. Niwa M, Jaaro-Peled H, Tankou S, Seshadri S, Hikida T, Matsumoto Y, et al. Adolescent stress-induced epigenetic control of dopaminergic neurons via glucocorticoids. *Science* (2013) 339(6117):335–9. doi: 10.1126/science.1226931

31. Kunz-Ebrecht SR, Kirschbaum C, Steptoe, A. Work stress, socioeconomic status and neuroendocrine activation over the working day. *Soc Sci Med* (2004) 58(8):1523–30. doi: 10.1016/S0277-9536(03)00347-2
32. Baum A, Garofalo JP, Yali, AM. Socioeconomic status and chronic stress. Does stress account for SES effects on health? *Ann N Y Acad Sci* (1999) 896:131–44. doi: 10.1111/j.1749-6632.1999.tb08111.x
33. Nikolova YS, Koenen KC, Galea S, Wang CM, Seney ML, Sibille E, et al. Beyond genotype: serotonin transporter epigenetic modification predicts human brain function. *Nat Neurosci* (2014) 17(9):1153–5. doi: 10.1038/nn.3778
34. Bale, TL. Sex differences in prenatal epigenetic programming of stress pathways. *Stress* (2011) 14(4):348–56. doi: 10.3109/10253890.2011.586447
35. Capron LE, Ramchandani PG, Glover, V. Maternal prenatal stress and placental gene expression of NR3C1 and HSD11B2: The effects of maternal ethnicity. *Psychoneuroendocrinology* (2018) 87:166–72. doi: 10.1016/j.psyneuen.2017.10.019
36. Stroud LR, Papandonatos GD, Rodriguez D, McCallum M, Salisbury AL, Phipps MG, et al. Maternal smoking during pregnancy and infant stress response: test of a prenatal programming hypothesis. *Psychoneuroendocrinology* (2014) 48:29–40. doi: 10.1016/j.psyneuen.2014.05.017
37. Joubert BR, Felix JF, Yousefi P, Bakulski KM, Just AC, Breton C, et al. DNA Methylation in Newborns and Maternal Smoking in Pregnancy: Genome-wide Consortium Meta-analysis. *Am J Hum Genet* (2016) 98(4):680–96. doi: 10.1016/j.ajhg.2016.02.019
38. Guida F, Sandanger TM, Castagne R, Campanella G, Polidoro S, Palli D, et al. Dynamics of smoking-induced genome-wide methylation changes with time since smoking cessation. *Hum Mol Genet* (2015) 24(8):2349–59. doi: 10.1093/hmg/ddu751
39. Davies MN, Volta M, Pidsley R, Lunnon K, Dixit A, Lovestone S, et al. Functional annotation of the human brain methylome identifies tissue-specific epigenetic variation across brain and blood. *Genome Biol* (2012) 13 (6):R43. doi: 10.1186/gb-2012-13-6-r43
40. Thompson TM, Sharfi D, Lee M, Yrigollen CM, Naumova OY, Grigorenko, EL. Comparison of whole-genome DNA methylation patterns in whole blood, saliva, and lymphoblastoid cell lines. *Behav Genet* (2013) 43(2):168–76. doi: 10.1007/s10519-012-9579-1
41. Talens RP, Boomsma DI, Tobi EW, Kremer D, Jukema JW, Willemsen G, et al. Variation, patterns, and temporal stability of DNA methylation: considerations for epigenetic epidemiology. *FASEB J* (2010) 24(9):3135–44. doi: 10.1096/fj.09-150490
42. Shiffman S, Stone AA, Hufford, MR. Ecological momentary assessment. *Annu Rev Clin Psychol* (2008) 4:1–32. doi: 10.1146/annurev.clinpsy.3.022806.091415
43. Goldman D, Domschke, K. Making sense of deep sequencing. *Int J Neuropsychopharmacol* (2014) 17(10):1717–25. doi: 10.1017/S1461145714000789
44. Provenzi L, Brambilla M, Borgatti R, Montirosso, R. Methodological Challenges in Developmental Human Behavioral Epigenetics: Insights Into Study Design. *Front Behav Neurosci* (2018) 12:286. doi: 10.3389/fnbeh.2018.00286
45. Belsky J, Jonassaint C, Pluess M, Stanton M, Brummett B, Williams R. Vulnerability genes or plasticity genes? *Mol Psychiatry* (2009) 14(8):746–54. doi: 10.1038/mp.2009.44
46. Schiele MA, Ziegler C, Holitschke K, Schartner C, Schmidt B, Weber H, et al. Influence of 5-HTT variation, childhood trauma and self-efficacy on anxiety traits: a gene-environment-coping interaction study. *J Neural Transm (Vienna)* (2016) 123(8):895–904. doi: 10.1007/s00702-016-1564-z
47. Gottschalk MG, Domschke, K. Novel developments in genetic and epigenetic mechanisms of anxiety. *Curr Opin Psychiatry* (2016) 29(1):32–8. doi: 10.1097/YCO.0000000000000219
48. Ziegler C, Richter J, Mahr M, Gajewska A, Schiele MA, Gehrmann A, et al. MAOA gene hypomethylation in panic disorder-reversibility of an epigenetic risk pattern by psychotherapy. *Transl Psychiatry* (2016) 6:e773. doi: 10.1038/tp.2016.41
49. Schiele MA, Ziegler C, Kollert L, Katzorke A, Schartner C, Busch Y, et al. Plasticity of Functional MAOA Gene Methylation in Acrophobia. *Int J Neuropsychopharmacol* (2018) 21(9):822–7. doi: 10.1093/ijnp/pyy050
50. Domschke K, Tidow N, Schwarte K, Deckert J, Lesch KP, Arolt V, et al. Serotonin transporter gene hypomethylation predicts impaired antidepressant treatment response. *Int J Neuropsychopharmacol* (2014) 17(8):1167–76. doi: 10.1017/S146114571400039X
51. Schiele MA, Gottschalk MG, Domschke, K. The applied implications of epigenetics in anxiety, affective and stress-related disorders - A review and synthesis on psychosocial stress, psychotherapy and prevention. *Clin Psychol Rev* (2020) 77:101830. doi: 10.1016/j.cpr.2020.101830
52. Joyce S, Modini M, Christensen H, Mykletun A, Bryant R, Mitchell PB, et al. Workplace interventions for common mental disorders: a systematic meta-review. *Psychol Med* (2016) 46(4):683–97. doi: 10.1017/S0033291715002408
53. Meloni M, Muller, R. Transgenerational epigenetic inheritance and social responsibility: perspectives from the social sciences. *Environ Epigenet* (2018) 4 (2):dvy019. doi: 10.1093/eep/dvy019

Conflict of Interest: KD is a member of the Janssen Pharmaceuticals, Inc. Steering Committee Neurosciences.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 31 March 2020
doi: 10.3389/fpsyt.2020.00145

Changes in Working Conditions and Mental Health Among Intensive Care Physicians Across a Decade

Petra Beschoner[1], Jörn von Wietersheim[1], Marc N. Jarczok[1], Maxi Braun[2], Carlos Schönfeldt-Lecuona[3], Lucia Jerg-Bretzke[1] and Laurenz Steiner[4]*

[1] Department of Psychosomatic Medicine and Psychotherapy, Ulm University Medical Center, Ulm, Germany, [2] Clinic of Psychosomatics Kloster Dießen, Dießen am Ammersee, Germany, [3] Department of Psychiatry and Psychotherapy III, Ulm University Medical Center, Ulm, Germany, [4] III. Medical Clinic, University Medical Center Mannheim, Mannheim, Germany

OPEN ACCESS

Edited by:
Claas Lahmann, Freiburg University Medical Center, Germany

Reviewed by:
Steffi Riedel-Heller, University Hospital Leipzig, Germany
Matthias Weigl, Ludwig Maximilian University of Munich, Germany
Stefan Schmidt, Freiburg University Medical Center, Germany

****Correspondence:***
Petra Beschoner
petra.beschoner@uni-ulm.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *01 November 2019*
Accepted: *17 February 2020*
Published: *31 March 2020*

Citation:
Beschoner P, von Wietersheim J, Jarczok MN, Braun M, Schönfeldt-Lecuona C, Jerg-Bretzke L and Steiner L (2020) Changes in Working Conditions and Mental Health Among Intensive Care Physicians Across a Decade. Front. Psychiatry 11:145. doi: 10.3389/fpsyt.2020.00145

Background: International studies have shown that among physicians working in intensive care, a relatively high level of work load, an elevated risk of developing burnout and reduced mental health are frequent. The implementation of a legislative intervention in Germany with the goal to reduce the working hours of physicians, offered an opportunity to investigate the potential influence of occupational conditions on stress and mental health. The present study investigates working conditions, occupational stress and burnout risk in two samples of German Intensive Care Physicians in 2006 and 2016. The aim was to assess how occupational and private stress factors influenced burnout and Effort-Reward-Imbalance indices over this time-period.

Methods: Intensive care physicians were surveyed during the annual conference of their profession in two cross-sectional studies (10-year gap). Data on demographic (occupational, family), medical history, and mental health (burnout and Effort-Reward-Imbalance) were assessed by paper pencil questionnaires.

Results: In total, $N = 2{,}085$ physicians participated (2006: $N = 1{,}403$, 2016: $N = 695$), with $N = 1{,}840$ (2006 = 1,248; 2016 = 592) eligible for propensity score matching comparison. In general, more working hours per week and working days on weekends were associated with an increased effort/reward imbalance and higher burnout scores. From 2006 to 2016, reductions in working hours per week and days worked on weekends were accompanied by improvements in occupational stress (Effort-Reward-Imbalance) and by trend in mental health indices (burnout) after matching for differences in working conditions.

Conclusions: The study presents the changes concerning occupational stress factors and mental wellbeing in physicians working in intensive care in 2016 as compared to 2006. These findings may promote the implementation of preventive strategies in the vocational context to protect health and productivity of physicians, especially intensive care physicians.

Keywords: mental health, burnout, effort-reward-imbalance, intensive care physicians, working conditions, occupational stress

INTRODUCTION

The association of occupational stress and burnout with various types of health care professionals and the consequences for patients, employees, and institutions has gained increasing attention over the last two decades. Both stress and burnout are highly relevant topics across all medical fields and throughout all levels of hierarchy in medical institutions (1–3). This also applies to physicians, for whom high levels of stress and burnout are reported in the international literature (1, 4–7). Working in health care imposes various demands on physicians for various reasons: the challenging work environment, such as time constraints, scheduling of tasks and interruptions, lack of control over the workload, hierarchies, conflicts among colleagues and clashes with patients and their relatives are frequently mentioned challenges (8–10). Long working hours are another burden related to stress and burnout among physicians (11–13).

Particularly intensive care medicine, has been described as a health care section associated with high loads of stress (1, 14), and intensive care physicians appear to be severely affected by stress and burnout (5, 15). Specific stressors affecting physicians working in the field of intensive care are: time pressure, inadequate communication, lack of time management, traumatizing emergency situations with danger for body, and life of other persons and emotionally stressful "end-of-life-issues" (5, 16).

This professional stress plays an important role in the development of burnout in physicians (17). In a study on occupational stress, working conditions and private life among 1,202 physicians, Wu et al. (13) found that high extrinsic effort and more than 40 hours of work per week predicted high "Emotional Exhaustion," one dimension of burnout. Tomioka et al. (18) found that in 702 of the physicians interviewed, long working hours were associated with an increased professional stress experience (Effort-Reward-Imbalance Questionnaire, ERI). However, they did not find a connection with depressiveness, which was also recorded. Martini et al. (19) substantiates these findings and assessed higher burnout rates among doctors with long working hours (>70 hours per week). They also examined the effects of the introduction of a working time limit on young physicians in 2006. Here, they found lower burnout levels, at least among young professionals, after the introduction of a working time limit. Shanafeldt et al. (20) were also able to demonstrate this positive effect of a reduction in working hours on the dimension "Emotional Exhaustion" of burnout (Maslach Burnout Inventory/ MBI-EE) in a large cohort of physicians in a longitudinal study.

In another longitudinal study with 143 physicians of internal medicine, Gopal et al. (21) found a positive effect of an arranged working time limitation on burnout, especially the dimension "Emotional Exhaustion." Yet, in their systematic review, Ahmed et al. (22) conclude that reducing the working time of young doctors is not consistently accompanied by improvements in well-being and other factors need to be addressed.

However, the above presented findings on working hours, occupational stress and mental health in physicians come mainly from the USA and Asia. The extent to which they can be transferred to Europe and Germany in particular remains tentative.

Some data are now also available for Germany: Loerbrocks et al. (23) examined occupational stress in 416 German doctors according to the Effort-Reward-Imbalance model. They found a link between high values in the Effort-Reward-Ratio and reduced quality in patient care. Against the assumption, they could not present a significant correlation with depressiveness, which was found in a prospective study of 417 physicians in German hospitals, by Li et al. (24). They found that over time, increasing Effort-Reward-Imbalance values are predictive for the development of depression.

Voltmer et al. (25) were able to demonstrate an influence of occupational stress (Effort-Reward-Imbalance) and working hours on occupational satisfaction. They examined 414 privately employed physicians in Germany and found a significantly higher occupational stress burden compared to a sample of physicians in Norway. In a cross-sectional study, Ohlander et al. (26) compared a cohort of 85 physicians working in Sweden with a cohort of 561 physicians working in Germany in terms of working time and Effort-Reward-Imbalance. They were able to show that doctors in Germany have significantly longer working hours and higher Effort–Reward-Ratio Values. In addition, they were able to show a correlation between long working hours and the stressful occupational life.

These data show the importance of research on working conditions, occupational stress and possible health consequences in Europe. To our knowledge, in Europe no studies have so far been conducted in cohorts with more than 600 participants, examining working hours, stress and burnout in physicians. Furthermore, there is no study to date that has studied the effects of legal changes in working hours on stress and mental impairments in physicians after a period of 10 years.

In 2003, the Working Hours Act, which limits the working time of physicians by classifying on-call duty as working time, came into force in Europe. This Working Hours Act had to be implemented on January 1, 2007 (27). Thus, the aim of our study was on the one hand to record changes in working hours, occupational stress and burnout among physicians at a date before the implementation of the Working Hours Act (2006) and at a date 10 years later (2016). On the other hand, another aim of the study at hand was to record the relationships described in the literature (20–22) between the expected reduction in working hours and stress and burnout after a period of 10 years.

We assume that a reduction in working hours established by law has other effects on the experience of reward than a self-chosen reduction in working hours through part-time work (which is dearly paid). The associated positive effects have already been investigated (20). We expected a significant effect on the physicians' reward experience through the legally anchored work relief implemented by the employers.

In addition, we chose the period of a decade, to record effects resulting out of the long-term establishment and routine of the implementation of the Working Hours Act. Furthermore, we tried to avoid recording short-term effects, which might have occurred, for example, as a result of the knowledge of

pending relief, or due to possible anger and uncertainty related to unstructured implementation of the changes, etc. We also wanted to avoid recording potential short-term effects due to the fact that the changes had not yet been implemented.

To assess possible changes across this decade we surveyed attendees of the annual meeting of the German Interdisciplinary Association for Intensive and Emergency medicine (DIVI) in 2006 and 2016 with the same methodology.

We chose the field of intensive care medicine since physicians in this field are particularly confronted with existential stress factors such as end-of-life-issues (5, 16), but not a specific large burden due to long working hours. Nevertheless, we expected a positive effect of the reduction of working hours on the experienced stress and burnout of intensive care physicians. This assumption is made on the basis of previous work (20, 21), suggesting that emotional distancing from emotionally stressful situation is enhanced by shorter working hours and, more free-time on the weekends.

In accordance with the literature above, we focused in especially on the interaction between working time, professional stress experience and the dimension "Emotional Exhaustion" in burnout. In the literature, working time is described as an influencing factor on stress experience (11) and the dimension "Emotional Exhaustion" of burnout syndrome (13) in physicians. We recorded working hours in the form of weekly working hours and the number of free weekends per month. To our knowledge, the latter has not yet been investigated and possibly influences the stress-related experience differently than the mere weekly working time. Simply put, a free weekend might offer different possibilities of regeneration than, for example, half hour less working time per day.

To measure stress, we used the Effort-Reward-Imbalance Questionnaire (28) because it is particularly suited to measure stress in workers who have many occupational interpersonal interactions (29). The ERI concept encompasses the development of occupational stress and the resulting health consequences. Numerous studies show its link to burnout and other adverse effects on health among health care professionals (30–32). In this context, serious effects such as suicidal tendencies, which are known to be an important issue among physicians (33) need to be addressed (33). Physicians in intensive care medicine have a particularly high suicide risk, compared to other specializations (34).

Burnout was recorded with the Maslach Burnout Inventory (35) and again, we put the focus on the dimension "Emotional Exhaustion." This affective component of the Maslach burnout construct is specifically influenced by Effort-Reward-Imbalance and impacts the quality of patient care (36). Improvements in the mentioned indicators would provide evidence consistent with a current model of the effects of working conditions on burnout and Effort-Reward Imbalance (28, 37).

Aim of this study was to assess changes between 2006 and 2016 in the private and professional situation of physicians working in intensive care units. Firstly, we expected changes in the working hours, as a result of the Working Hours Act. Secondly, potential differences in stress experience and mental health indices were measured. Thirdly, links between private and professional factors as well as occupational stress (ERI) and burnout (MBI-EE) were assessed, with an expected positive effect of weekly working hours and free weekends on ERI and MBI-EE. Additionally, the question if effects of working time on MBI-EE were mediated by ERI, was addressed. Finally, we were interested to see if a possible mediation between work hours and free weekends with Effort-Reward-Imbalance and "Emotional Exhaustion" could be found. These analyses were conducted on the data of 2006 and 2016 to assess the stability of these correlations.

METHODS

We surveyed intensive care physicians at the annual meeting of the German Interdisciplinary Association for Intensive and Emergency Medicine (Deutsche Interdisziplinäre Vereinigung für Intensiv- und Notfallmedizin, DIVI) in 2006 and 2016. About 6,000 attendees from German speaking countries registered for this conference in 2016 (38).

The data collection procedure in 2006 and 2016 was identical. A stand with questionnaires and a lockable return box was set up in the foyer area of the DIVI conference. Two posters were placed on a partition wall, referring to the survey carried out during the conference and our stand. A contact person was present at all times to acquire participants and answer any related questions. In addition, questionnaires were handed out personally to the participants in the entire conference area. The participants received the questionnaire with a short explanation of its contents as well as the anonymity and the possibility of sending the questionnaire by post. The participants were informed on the cover page of the questionnaire that they agreed to participate by filling in the form and submitting it anonymously to the collection box.

The data collected included personal information, information about the family, the professional situation and the medical history using an identical questionnaire in 2006 and 2016. In order to assure that the questionnaire was filled out by an intensive care physician despite the survey taking place at an intensive care medical congress, we recorded the medical field of activity in our questionnaire. The section on medical history covered the entire life span. To assess burnout, ERI and Overcommitment, standardized instruments were used (32, 35). The duration to complete the questionnaires was about 15-20 min and they were returned anonymously. A total of $N = 2{,}551$ Questionnaires (in 2006) and $N = 1{,}627$ Questionnaires (in 2016) were handed out and $N = 1{,}403$ (in 2006) and $N = 695$ (in 2016) questionnaires were returned. The return rate was 55% in 2006 and 42% in 2016. Questionnaires with too much missing data were excluded. Thus, in 2006 $N = 1.248$ and in 2016 $N = 592$ data sets were analyzed. Data sets of participants with missing information on sex and age were completely discarded. When data of items in the standardized instruments (ERI, OC, BDI-II, MBI) were missing, these questionnaires were excluded from the evaluations (listwise deletion). Missing data on other items was coded as "not reported."

The Ethics Commission of the University of Ulm approved the study design (192/16).

Some of the data will simultaneously be published in a dissertation.

Psychometric Tests

The following psychometric research instruments were used.

Maslach Burnout Inventory D (MBI-D) (35, 39, 40)

The original MBI by Maslach and Jackson, was chosen in the German, reviewed and revised version by Büssing and Perrar (MBI-D).

Even though at least four German translations exist, the version by Büssing and Perrar is the only one authorized by Maslach (41). Since the 1992 version of the translated instrument has been revised and reviewed but not yet published, the approval was given by Prof. J. Glaser of the University of Innsbruck.

The MBI-D consists of 21 items. Subjects are asked to rate each item, ranging from 1 (never) to 6 (very often). The scale itself has three domains: "Emotional Exhaustion" (MBI-EE) (9 items), "Depersonalization" (MBI-DP) (5 items) and "Reduced Personal Accomplishment" (MBI-PA) (7 items). "Emotional Exhaustion" means feeling emotionally overstrained by work. Depersonalization reflects an indifferent or cynical attitude toward patients. Personal Accomplishment addresses feelings of competence and achievement at work.

The MBI provides semi-continuous outcome variables (item mean, sum score) that allow the scientific consideration of the burnout construct in comparison to other constructs such as ERI and the development of burnout severity over time. We used the item means, since this approach methodically meets the problem of missing items. We also calculated sum scores to make for enhanced comparability with data from other publications.

A categorical consideration of the burnout construct measured with the MBI-D is possible, but difficult due to the lack of reliable and stable cut-off values. Nevertheless, a categorical analysis of the burnout values allows a rough assessment of the prevalence, which is sometimes of assistance and necessary, especially in the medical context. For this interpretation we defined a cut-off of >4.5 points (item mean) for the domain "Emotional Exhaustion" (oral communication in 2006 and 2016 with Prof. J. Glaser, University of Innsbruck). We focused solely on "Emotional Exhaustion" based on the early theory of Maslach et al. (42) where "Emotional Exhaustion" is the core element of burnout, and is the most obvious manifestation of this complex construct. In addition, Wang et al. (43) show that the dimension "Emotional Exhaustion" in particular is significantly related to long working hours, high job effort and low reward. It has also been shown that "Emotional Exhaustion" is particularly influenced by ERI with effects on the quality of care [e.g., Weigl et al. (36)].

Effort-Reward-Imbalance (ERI) (32, 37, 44)

Effort is measured by 5 items. All questions refer to one's present occupation and subjects are asked to indicate in how far the items reflect their typical work situation (Sample question Effort: "Due to the high workload, there is often a great deal of time pressure." Sample question Reward: "I get the recognition I deserve from my superiors"). Higher ratings point to higher efforts, ranging from 1 (does not apply) to 5 (does apply). The sum of these ratings is computed as a measure of extrinsic effort (range from 5 to 25). Reward is measured by 11 items. After variable recoding procedures, lower ratings point to lower rewards, with the sum ranging from 11 to 55. The ERI ratio is computed as ratio of the effort score divided by the reward score and then multiplied by a correction factor to correct the difference in the numbers of items of the two scales. Values > 1 indicate a negative imbalance (ERI) between effort and reward (32, 44). Finally, overcommitment (OC) is measured by 6 items ranging from 1 (low) to 4 (high). (Sample item Overcommitment: People close to me say I sacrifice too much for my job). Sum scores for overcommitment range from 6 to 24. A score > 16 indicates that a subject is at risk to develop stress symptoms (32).

Statistical Analysis

All statistical computations were performed with the Statistical Package for the Social Sciences (SPSS), Version 24.0 and Stata 15.1 SE (Stata Corp, USA).

Bivariate Analysis

In a first step, significance tests were performed on all categorical variables using Chi square tests to estimate average, unadjusted between year differences. Continuous variables were tested on skewness and kurtosis for normal (Gaussian) distribution (using Stata's *ladder* command) and linearly transformed according to the ladder of power (45). Yet, none of the tested variables were eligible for linear transformation. Subsequently Mann-Whitney *U*-Test for nonparametric data was applied. Statistical significance was assumed for $p \leq 0.05$.

Average Treatment Effect Estimation Using Propensity Score Matching

To improve comparability of the samples in 2006 and 2016 and to reduce the risk of bias due to confounding covariates, a statistical matching technique (i.e., propensity score matching) was applied (Cf. **Table 4**). This method is superior when comparing treated (or exposed) vs. untreated (or unexposed) populations from observational, non-experimental data (45). Here, similar observations are compared on the outcome variable of interest using propensity scores from a set of matching variables, which can be assumed to have an influence on working time and occupational stress. These variables were: sex, age, working full-time/part-time, working in hospital/private practice, leadership/assistance position. On all categorical matching variables, missing information was recoded into a new missing category prior to effect estimations (i.e., sex: male, female, missing) to include as much information as possible into the model (46). The Stata command *"teffects psmatch"* was used to estimate the average treatment effect from the present observational.

Mediation Analysis

Four distinct mediation models were estimated (Cf. **Figure 2**) [per year for the X variables "total working time (hours per

week) and number of free weekends (per month)] using a structural equation approach as suggested by Ditlevsen et al. (47). The purpose of the mediation analysis is to see if the underlying association between worktime and free weekends and MBI is mediated by ERI in the same manner in both years. One of the main advantages of the structural equation approach is a simultaneous estimation of all specified pathways. Following the procedure for mediation analysis suggested by Hayes et al. (48) our equations were identified to estimate the direct, indirect, and total effect (see **Figure 2** for a graphical representation of the model). All mediation models were adjusted for the potential differences across the two sampling timepoints using age (years), sex (male vs. female), and position (Managing position yes vs. no). The indirect and total effects are reported in **Figure 2**. The model parameters were estimated using a maximum likelihood procedure allowing missing values (Expectation-Maximization) to maintain as much information as possible. To better adjust for between subject variations, an alternative robust variance estimation method (bootstrapping with 1,000 replications) was performed.

The reported regression coefficients were not standardized to keep the original metric of X and Y for two reasons. First, to allow meaningful interpretation of the indirect effect and second, to allow for between year comparisons of the regression coefficients. For example, an indirect effect of "Work hours (per week)" (X) on MBI-EE (Y) can be interpreted as the difference in MBI-EE unit (Score change) attributional to the indirect pathway through the mediator ERI [see Ditlivsen et al. (47) for an in-depth discussion].

RESULTS

Descriptive Data Analysis of the Samples in 2006 and 2016

A total of $N = 1{,}385$ participants were available in 2006 and $N = 687$ in 2016. In 2006 we excluded $N = 455$ data sets, in 2016 $N = 95$ because the questionnaires were too incomplete. The total analysis sample comprise $N = 1{,}840$ participants. In 2006 38.8% of the participants were female. This proportion slightly increased in 2016 (43.2%). The mean age increased significantly by 3.5 years to 44.8 years (Cf. **Table 1**).

Family Situation

In 2006, fewer physicians lived without a partner and less had children than in 2016. The number of children living in the household of the participants at the time of the survey decreased slightly from 2006 to 2016. (Cf. **Table 1**).

Professional Situation

The percentage of surveyed intensive care physicians working full-time at the time of the survey, decreased significantly by around 9 percentage points from 2006 to 2016. The percentage of those working in a hospital increased significantly by around 7 percentage points in this decade, while the percentage points of those working in private practices decreased. And in 2016 nearly 17 percentage points more of physicians surveyed held a senior position than in 2006 (Cf. **Table 1**).

Changes in Worktime, Burnout, and Mental Health Between the Samples in 2006 and 2016

Worktime

The number of free weekends (without being on call) increased significantly from a mean of 1.9 in 2006 to a mean of 2.1 in 2016. Regarding the number of hours worked per week, those surveyed listed approximately 3 hours more in 2006 than in 2016. (Cf. **Table 1**). Similar to these results, the working time of full-time employees decreased by 2.5 hours from 2006 to 2016 (95% CI -3.78 to -1.24, $p \leq 0.001$, Mann-Whitney U-Test). This shows that the reduction in working hours from 2006 to 2016 is not the sole effect of more part-time work or a higher proportion of women.

Despite this improvement, there was no significant difference between 2006 and 2016 in the frequency with which the question "*whether the participant had ever been on sick leave due to overload*" was answered with yes. (Cf. **Table 1**).

Health and Medical History

There was no significant difference in participants suffering from an acute or chronic disease between 2006 and 2016. The frequency of medication intake, especially antidepressant intake, sedative intake, and analgesic intake also did not differ significantly between 2006 and 2016. A depression in the medical history was found by more than 5% participants less in 2016 than in 2006. The percentage of those who had the diagnosis confirmed by a medical specialist, however, had increased significantly by nearly 11 percentage points. This effect did not turn out to be significant. The number of respondents currently undergoing psychotherapeutic treatment did not change significantly between 2006 and 2016. Similarly, the number of those who had previously undergone psychotherapeutic therapy remained unchanged. Suicide attempts were less frequent in 2016 compared to 2006, but due to the small number of reported cases no statements can be made about the significance level.

Current Burnout Symptoms

The continuous variables (item means) in the domains "Emotional Exhaustion" "Personal Accomplishment" of the Maslach Burnout Inventory show a significant improvement from 2006 to 2016. In the domain "Depersonalization," the item means did not differ significantly from 2006 to 2016 (Cf. **Table 2**). The sum scores show the same trend.

The dichotomous analysis of the MBI data indicate a similar proportion of 8.2% ($N = 102$ in 2006; $N = 48$ in 2016) reaching the 4.5 cutoff for "Emotional Exhaustion" ($p = 0.37$; Cf. **Figure 1**).

Effort-Reward-Imbalance

An Effort-Reward-Imbalance (values > 1) existed in 2006 for 23.9% ($N = 298$) of the participants; in 2016, the percentage was about 10 percentage points lower (14.7%; $N = 87$) ($p \leq 0.001$). The percentage for Overcommitment did not differ significantly from 2006 to 2016 (2006: 27.2%, $N = 340$) vs. 2016: 23.8%, $N = 48$; $p < 0.15$) (Cf. **Figure 1**).

TABLE 1 | Comparison of family, occupational and health characteristics after matching.

		2006	2016	*P*	*V*
		N (%)	*N* (%)		
Gender					
Female		485 (38.86)	256 (43.24)	0.073	−0.0417
Male		763 (61.14)	336 (56.76)		
Partnership					
No		183 (14.66)	95 (16.05)	<0.001	0.1812
Yes		1.052 (84.29)	451 (76.18)		
Not reported		13 (1.04)	46 (7.77)		
Children					
No		513 (41.11)	235 (39.70)	0.643	0.0219
Yes		720 (57.69)	352 (59.46)		
Not reported		15 (1.20)	5 (0.84)		
Full-time contract					
No		168 (13.46)	136 (22.97)	<0.001	0.0219
Yes		1.067 (85.50)	455 (76.86)		
Not reported		13 (1.04)	1 (0.17)		
Main occupation					
Private Practice		167 (13.38)	44 (7.43)	<0.001	0.982
Hospital		1.051 (84.21)	541 (91.39)		
Not reported		30 (2.40)	7 (1.18)		
Working position					
Senior position		485 (38.86)	330 (55.74)	<0.001	0.1601
Assistance position		733 (58.73)	255 (43.07)		
Not reported		30 (2.40)	7 (1.18)		
Acute/chronic illness					
No		918 (73.56)	400 (67.57)	0.008	0.0621
Yes		330 (26.44)	192 (32.43)		
Medication intake					
No		1.016 (81.41)	426 (71.96)	<0.001	0.1072
Yes		232 (18.59)	166 (28.04)		
Antidepressant intake					
No		1.235 (98.96)	585 (98.82)	0.786	0.0063
Yes		13 (1.04)	7 (1.18)		
Sedative intake					
No		1.229 (98.48)	582 (98.31)	0.788	0.0063
Yes		19 (1.52)	10 (1.69)		
Analgesic intake					
No		1.117 (89.50)	524 (88.51)	0.523	0.0149
Yes		131 (10.50)	68n (11.49)		
Work missed due to overload					
No		1.177 (94.31)	551 (93.07)	0.300	0.0242
Yes		71 (5.69)	41 (6.93)		
Currently in psychotherapy					
No		1.213 (97.20)	578 (97.64)	0.584	−0.0128
Yes		35 (2.80)	14 (2.36)		
Previously in psychotherapy					
No		1.067 (85.50)	512 (86.49)	0.570	−0.0133
Yes		181 (14.50)	80 (13.51)		
Depression in medical history					
No		990 (79.33)	501 (84.63)	0.007	−0.0632
Yes		258 (20.67)	91 (15.37)		
Of which diagnosed by a specialist	No	189 (74.41)	56 (63.64)	0.053	0.1045
	Yes	65 (25.59)	32 (36.36)		
Suicide attempt					
No		1.237 (99.12)	589 (99.49)	0.063	−0.0409
Yes		11 (0.88)	3 (0.51)		

	2006			2016			*P*	*R* 95% conf. interval
	N	*M*	*SD*	*N*	*M*	*SD*		
Age	1.248	41.3	7.83	592	44.8	9.38	<0.001	−0.19 (−0.23 to −0.15)
Number of children (when yes)	605	1.92	0.844	334	1.63	1.03	<0.001	0.15 (0.09 to 0.21)
Work hours (per week)	1.248	55.7	13.5	592	53.2	12.2	<0.001	0.09 (0.04 to 0.13)
Free weekends (per month)	1.248	1.87	0.732	592	2.11	0.759	<0.001	−0.15 (−0.20 to −0.11)

P-values from chi square test and for continuous data from Mann-Whitney-U-Test. Effect size (66): Cramers V = 0.1 small effect, V = 0.3 medium effect, V = 0.5 large effect.

TABLE 2 | Comparison of questionnaire scores of the study samples in 2006 and 2016.

Questionnaire scores	2006 ($N = 1.248$)		2016 ($N = 592$)			Cohens D 95% conf. interval
MBI (item means)	***M***	***SD***	***M***	***SD***	***p***	
Emotional Exhaustion	3.17	0.95	3.0	0.99	<0.001	0.18 (0.08 to 0.28)
Depersonalization	2.55	0.90	2.48	0.90	0.083	0.08 (−0.01 to 0.18)
Personal Accomplishment	4.6	0.65	4.74	0.60	<0.001	−0.22 (−0.32 to −0.12)
MBI (sum scores)						
Emotional Exhaustion	28.5	8.54	27.0	8.91	<0.001	0.18 (0.08 to 0.28)
Depersonalization	12.8	4.44	12.4	4.48	0.083	0.19 (0.09 to 0.29)
Personal Accomplishment	32.2	4.54	33.2	4.19	<0.001	0.08 (−0.01 to 0.18)
ERI						
Effort	15.2	3.34	14.4	3.52	<0.001	0.24 (0.14 to 0.34)
Reward	41.9	7.91	46	7.43	<0.001	−0.53 (−0.63 to −0.43)
Esteem	19.6	4.17	20.9	4.09	<0.001	−0.30 (−0.4 to −0.2)
Job security	7.97	1.88	8.61	1.64	<0.001	−0.35 (−0.45 to −0.25)
Job promotion	14.3	3.8	16.6	3.5	<0.001	−0.60 (−0.70 to −0.50)
Effort-Reward-Ratio	0.85	0.35	0.73	0.29	<0.001	0.38 (0.28 to 0.48)
Overcommitment	14.2	3.82	13.9	3.7	0.122	0.08 (−0.02 to 0.18)

Sample Size N = 1,840. P-Values from Mann-Whitney-U-Test. Effect size (66): Cohens D, D = 0.1 small effect, D = 0.3 medium effect, D = 0.5 large effect.

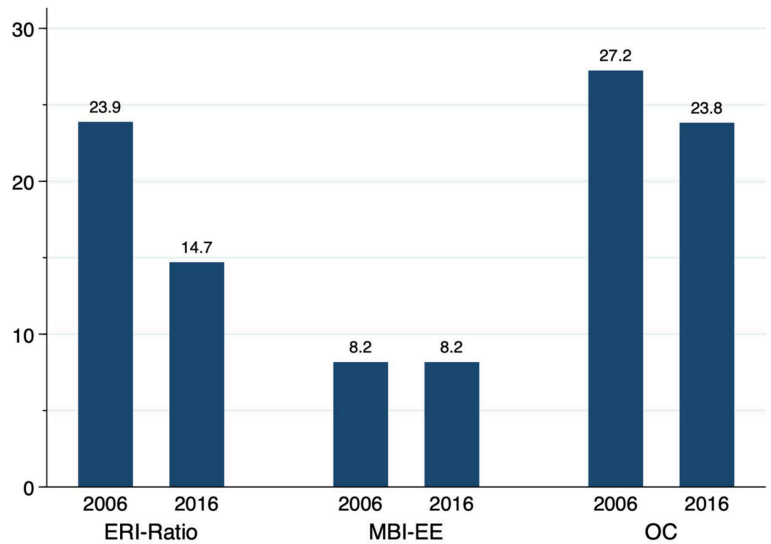

FIGURE 1 | Descriptives of burnout risk, effort-reward-imbalance and overcommitment (percentage). *P*-values derived from propensity score matched data (ATE). Effort-Reward-Ratio >1 ($p \leq 0.001$), MBI-EE score > 4.5 ($p = 0.37$), OC score > 16 ($p = 0.15$). Effect size: Cramers $V = 0.1$ small effect, $V = 0.3$ medium effect, $V = 0.5$ large effect (66): ERI-Ratio: −0.11; MBI-EE: −0.00; OC: −0.04.

Correlations

Table 3 reports Pearson's correlations between socioeconomic/professional factors and assessment of Effort-Reward-Imbalance and burnout, excluding the "not reported" categories. The more hours worked per week and less free weekends per month showed a statistically significant correlation with higher scores for Overcommitment, Effort-Reward-Imbalance and "Emotional Exhaustion" (MBI-EE). Having children (No/Yes) correlates significantly with slightly higher scores on ERI, while having a partner (No/Yes) correlates statistically significant and positively with MBI-EE and statistically significant and negatively with Overcommitment. Men seem to report lower MBI-EE scores compared to women. Working in an assistance position correlates statistically significant with lower Overcommitment and higher MBI-EE.

Mediation

Figure 2 shows the unstandardized coefficients from the four different mediation models. The comparison of coefficients of

2006 and 2016 reveals a similar picture. Largest difference is seen in the association of ERI with MBI-EE [Path B].

The variable "Work hours (per week)" was significantly positively associated with ERI [Path A1] in both years. The variable "Free weekends (per month)" was significantly negatively associated with ERI [Path A1] in both years.

TABLE 3 | Results of the correlation analyses (combined 2006 and 2016).

	ERI	OC	MBI-EE
Gender (W vs. M)	0.018	−0.032	−0.083**
Working position (Senior vs. Assistance; $N = 1,803$)	−0.019	−0.064**	0.091**
Work hours (per week)	0.200**	0.170**	0.066**
Free weekends (per month)	−0.179**	−0.125**	−0.113**
Children ($N = 939$)	0.074*	0.028	0.034
Partnership ($N = 1,781$)	−0.015	−0.058*	0.098*

*M, men; W, women; OC, Overcommitment; ERI, Effort-Reward Ratio; MBI-EE, Emotional Exhaustion item scores. Correlation coefficient [Pearsons R; effect size: R = 0.1 small effect, R = 0.3 medium effect, R = 0.5 large effect; Cohen (66)], *p ≤ 0.05, **p < 0.01. N = 1,840 unless indicated otherwise.*

Furthermore, ERI was significantly associated with both MBI-EE in both years [Path B]. "Work hours (per week)" was significantly positively associated with MBI-EE, [Path C1] but not when the mediator was added to the model [Path C′]. Thus, we assume a complete mediation. In addition, "Work hours (per week)" had a significant indirect and total effect in both years. "Free weekends (per month) had a significant and total effect in both years. The effect was weaker in 2016 than in 2006.

The proportion mediated is estimated as follows: "Work hours (per week)" 2006= indirect/total effect = 0.0056/0.0061 = 92%. ERI mediated to 92% the effect of the "Work hours (per week)" on MBI-EE in 2006. ERI mediated 72% of the effect of the "Work hours (per week)" on MBI-EE.

The proportion mediated "Free weekends (per month)" 2006: ERI mediates 98 % of the effect of the "Free weekends (per month)" on MBI-EE. In 2016, ERI mediated 81% of the effect of the "Free weekends (per month)" on MBI-EE.

Post estimation results indicate significant indirect effects of "Work hours (per week)" or "Free weekends (per month)" mediated through ERI in all four mediation models (Cf. **Figure 2**).

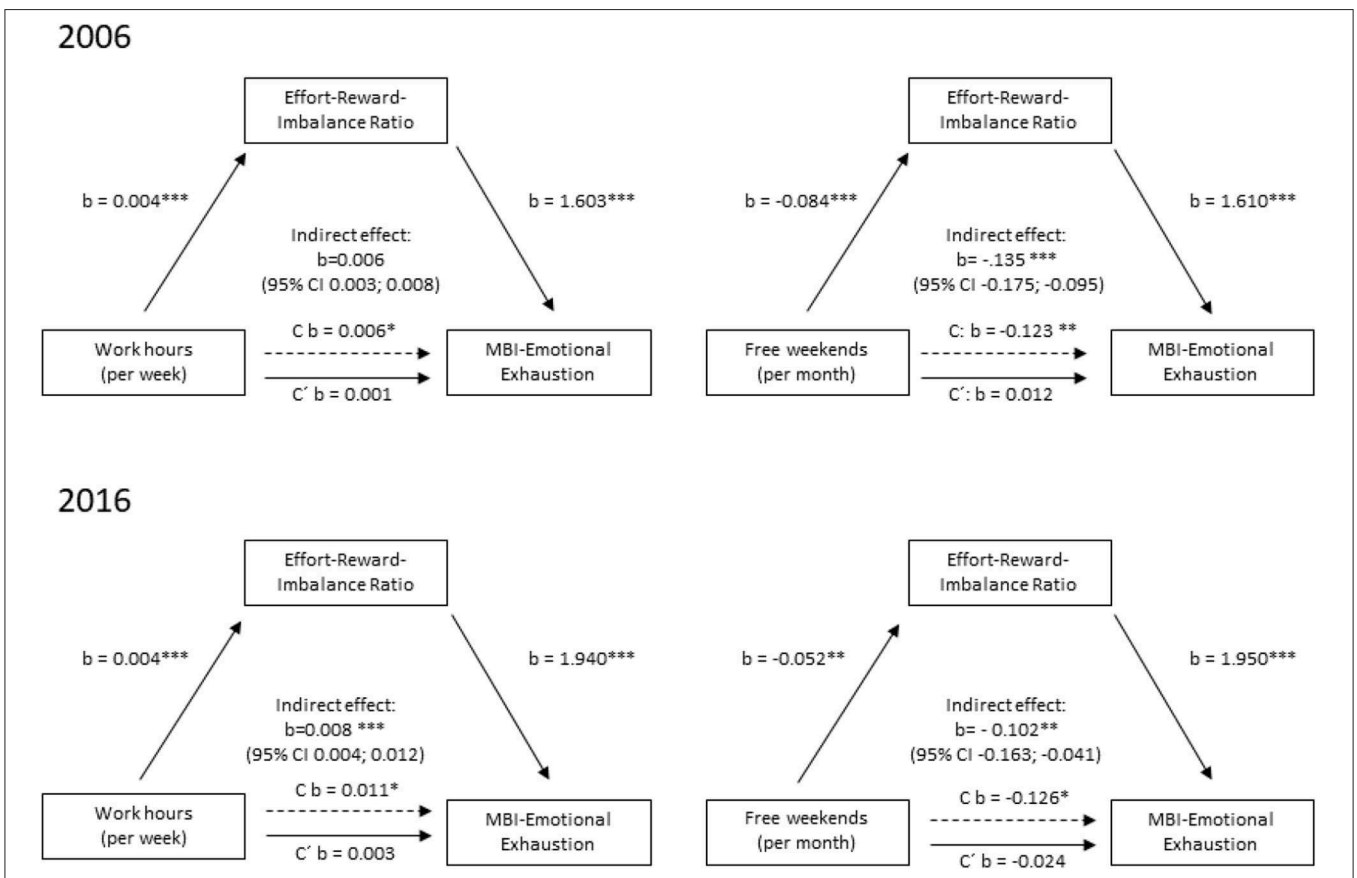

FIGURE 2 | Mediation analyses of workload factors effort reward imbalance (Mediator M) and burnout (Dependent variable Y) as continuous variable per assessment year (2006 vs. 2016); all structural equation models (bootstrapped) were adjusted for age, sex, working fulltime/part-time, working in hospital/private practice and leadership/assistance position; *p <0.05, **p < 0.01, ***p < 0.001. Unstandardized coefficients are reported. C refers to the direct effect of X on Y without inclusion of the according mediator M. C′ refers to the direct effect of X on Y with inclusion of the according mediator M. For example, in 2006 per unit change in work hours per week the ERI rises by 0.004 points. Similar, per unit change in ERI, the MBI-EE scale increases on average by 1.6 scalepoints.

TABLE 4 | Average treatment (year) effect from observational data using logistic models after propensity-score matching (2016 vs. 2006), caliper 0.15.

N = 1,840	ATE Coef.	AI Robust std. err.	z	P>|z|	95% conf. interval	
Work hours (per week)	−1.94	0.63	−3.07	< 0.01	−3.18	−0.70
Free weekends (per month)	0.18	0.04	4.41	< 0.01	0.10	0.26
ERI Effort	−0.82	0.19	−4.22	< 0.01	−1.20	−0.44
ERI Reward	3.46	0.41	8.36	< 0.01	2.65	4.28
ERI Esteem	1.10	0.23	4.83	< 0.01	0.65	1.54
ERI Job security	0.68	0.10	6.93	< 0.01	0.49	0.88
ERI Job promotion	1.69	0.19	8.74	< 0.01	1.31	2.07
Effort-Reward-Ratio	−0.11	0.02	−7.05	< 0.01	−0.15	−0.08
Overcommitment	−0.23	0.21	−1.09	0.27	−0.64	0.18
ERI categorical	−0.08	0.02	−3.81	< 0.01	−0.12	−0.04
OC categorical	−0.04	0.02	−1.45	0.15	−0.08	0.01
MBI-EE item scores	−0.13	0.05	−2.31	0.02	−0.23	−0.02
MBI-DP item scores	0.02	0.05	0.46	0.64	−0.07	0.12
MBI-PA item scores	0.09	0.03	2.46	0.01	0.02	0.15
MBI-EE sum scores	−1.14	0.49	−2.31	0.02	−2.11	−0.17
MBI-DP sum scores	0.12	0.25	0.46	0.64	−0.37	0.60
MBI-PA sum scores	0.60	0.24	2.46	0.01	0.12	1.08
MBI-EE categorical	0.01	0.02	0.89	0.37	−0.02	0.05
MBI-DP categorical	0.00	0.01	0.11	0.91	−0.02	0.02
MBI-PA categorical	0.01	0.00	2.36	0.02	0.00	0.01
Work missed due overload	0.01	0.01	0.64	0.52	−0.02	0.03
Currently in psychotherapy	−0.01	0.01	−1.37	0.17	−0.02	0.00
Previously in psychotherapy	−0.01	0.02	−0.64	0.52	−0.05	0.03
Depression in medical history	−0.06	0.02	−3.23	< 0.01	−0.10	−0.03
Suicide attempt	0.00	0.00	−0.96	0.34	−0.01	0.00
Medication intake	0.03	0.02	1.40	0.16	−0.01	0.07
Antidepressant intake	0.00	0.01	0.10	0.92	−0.01	0.01
Sedative intake	0.00	0.01	−0.03	0.97	−0.01	0.01
Analgesic intake	0.00	0.02	0.24	0.81	−0.03	0.04
Acute/chronic illness	0.01	0.02	0.25	0.80	−0.04	0.05

Matching variables were sex (Men, Women), age (years), full-time contract (No, Yes, not reported); main occupation (private practice, hospital, not reported), working position (senior position, assistance position, not reported). AI, robust Abadie-Imbens standard errors with caliper of 0.15. Reading example: The average weekly worktime is significantly different between years indicating an average reduction in work-time of 1.94 h.

DISCUSSION

In the two cross-sectional surveys in 2006 and 2016 presented here we assessed mental health professionals, working in intensive care, with semi-structured questionnaires to obtain data on their personal life and working conditions and with standard instruments (Effort-Reward-Imbalance Questionnaire and Maslach Burnout Inventory) (35, 44) based on the literature suggesting high risk for emotional stress and affective psychopathology in this group (1, 5, 14–16). The surveys were conducted at two annual conferences. Our aim was to investigate the connections between private and professional conditions and health-related factors (professional life, stress, family, and burnout), and their changes during the intervening decade. The data show changes in working life, stress levels, and mental impairment of intensive care physicians in the decade from 2006 to 2016, and they make it possible to identify correlations with a Working Hours Act transposed into European law at the beginning of this decade.

Private, Occupational, and Health Situation

Between 2006 and 2016 an important legislative intervention for physicians was enacted: the German Working Hours Act (27). This law classified the assessment of on-call duty by doctors as working time, so that the legally permissible working hours of physicians were reduced. Our data show that, even after adjusting for the different composition of conference attendees, weekly working hours had decreased and free weekends had increased as one would expect from the effects of the new legislation. Beside those concerning working hours and free weekends, we observed several changes in sociodemographic composition and family structure.

The approach of the gender data from 2006 to 2016 probably reflects the increase in the number of women working in the medical field (49, 50). What is noteworthy is the higher mean age and the higher percentage of the number of surveyed intensive care physicians in leadership positions in 2016 compared to 2006. This suggests a development whereby younger physicians, who tend to be residents, attend conferences less frequently than their older colleagues and colleagues in leadership positions than in the past. It is also possible that the higher percentage of women might have contributed to this finding if women attend conferences less frequently because of family commitments (51). To avoid possible confounds arising from the different composition of participants in the two cohorts, we conducted analyses where the samples were matched for these variables.

A possible reason for the significantly lower number of weekly working hours in 2016 compared to 2006 might in part be the higher number of part-time positions. However, also the number of hours worked by full-time participants decreased significantly in these 10 years. The amendment and implementation of the German Working Hours Act (27) may have played a role in this respect. The increase of free weekends without being on call between 2006 and 2016 points in the same direction. It is also possible that a changed attitude about the profession and the preparedness to take time off, especially in younger physicians, may have contributed to this development (52, 53).

What is noteworthy regarding the health-related data is that there were no significant changes in the incidence of reported acute and chronic illnesses and in the use of medication between 2006 and 2016. At the same time, the incidence of reported depressive episodes in the medical history of the physicians surveyed decreased significantly by almost 6 percentage points. However, the incidence is still relatively high at 16.5% in 2016 in comparison with the general population. The lifetime prevalence of a depressive episode in Germany is currently 11.6% (54). With regard to suicidal tendencies, the physicians we interviewed seem to be relatively unaffected. The rates of attempted suicides of the physicians surveyed (0.9 % in 2006; 0.5% in 2016) were lower than the lifetime prevalence of attempted suicides in Germany (1.7%) (55). The empirical literature indicates that the suicide rate for physicians is by 1.4-2.7 times higher than that in the general population or for members of other academic professions (33, 34). Naturally, we could only ask about suicide attempts. Interestingly, the rates of attempted suicides decreased from 2006 to 2016, even though we cannot make any statements on significance due to the small number of cases. According to the ERI model, the decline could be attributed to the decline in stress and burnout risk from 2006 to 2016 (28, 30).

There were no significant changes in reported depressive episodes in the medical history, but the percentage of those who had the diagnosis confirmed by a medical specialist increased from 2006 to 2016 by nearly 12% percentage points. This tendency gives us reason to hope that the stigmatization associated with a psychiatric diagnosis has decreased within the medical community (56), even if the difference is not statistically significant. Also, the percentage of practitioners accepting psychotherapeutic help in the past is nearly as high as the rate of those who suffered from a depressive episode in the past and did not decrease parallel to the frequency of reporting depression in the medical history. This may be indicative of a beginning change in the acceptance of psychiatric help among intensive care physicians. This is remarkable, as doctors often find it difficult to switch to the role of the patient, and mental illness is stigmatized even among physicians (57, 58). Notwithstanding these improvements, the propensity to avail oneself of psychiatric or psychotherapeutic treatment in the face of the high self-reported morbidity remains remarkably low.

This is also reflected in the sick leave figures, which did not differ significantly from 2006 to 2016, but appear low compared to those for depressive episodes in the past and acute/chronic disease at the time the survey was conducted. Possibly this points to a culture in medicine of not taking time off when sick (59).

As a note of caution, it should be mentioned here that the data on depression in the medical history and attempted suicides are based on a retrospective self-assessment. It is possible that intensive care physicians may not be proficient in the assessment, perception, and interpretation of psychiatric symptoms. Nevertheless, our data are consistent with previous reports of severe stress in intensive care physicians caused by the specific challenges in this area of work (5, 60).

Effort-Reward-Imbalance, Overcommitment, and Burnout

The main findings of our study concern burnout risk and occupational stress. The ERI model proposed by Siegrist measures effort/reward crises at the workplace. If an Effort-Reward-Imbalance persists, the individuals in question may develop psychological and physiological stress symptoms that may be harmful in the long run (28, 37). The ERI model also takes the individual overcommitment into consideration, which, if excessive, may also lead to a higher risk for illness (37).

Interestingly, the surveyed intensive care physicians report high levels of overcommitment in both years, while the Effort-Reward-Imbalances score for this group was significantly lower in 2016. This can be seen at a glance in the comparison of dichotomous variables (**Figure 1**). A possible explanation is that not the intrinsic factor "overcommitment," that obviously remained unchanged high over the decade, but both, the number of hours worked per week and the frequency of on-call weekends, which decreased significantly between 2006 and 2016, have reduced the experience of work-related stress (Effort-Reward-Imbalance). The correlation analysis and the computed mediation model confirm this assumption.

In the domains "Emotional Exhaustion" and "Personal Accomplishment" of the Maslach Burnout Inventory the continuous variables show a significant difference between 2006 and 2016, with lower scores in 2016. An explanation for this improvement in burnout risk could be the reduced occupational stress respectively the reduced Effort-Reward-Imbalances. This in turn would be consistent with Siegrist's model, which suggests that Effort-Reward-Imbalances lead to psychological stress symptoms and health impairments (28). It is also consistent with Maslach and Jacksons Burnout model. They see working conditions and organizational structures as the main cause

of burnout symptoms, and interpret burnout as a mismatch between a human being and working conditions (42).

In spite of the improvement in terms of Effort-Reward-Imbalances and burnout risk since 2006, the figures remain relatively high in comparison to the general population.

In this study 8.2% of the physicians reached the cutoff for an acute burnout risk, the item means for 2016 were 3.0 (EE), 2.48 (DP), and 4.74 (PA) and thus significantly lower than the values found by Wang et al. (43) in a cohort of 475 physicians in China. The authors report item means of 3.49 for EE, of 2.27 for DP and of 5.12 for PA. The data are only comparable to a limited extent, since the authors used a 19-item revised Chinese version of the MBI with a rating of items from 1 to 7 and a cut-off of 4.5 (43). The "Study on the Health of Adults in Germany" (61) reports a burnout prevalence of 4.2% for German employees. A comparison of burnout in US physicians and in the general population in 2012, using a 22-item version of the MBI, revealed a burnout sum score of 21.0 for "Emotional Exhaustion," 5.0 for depersonalization and 42.0 for personal accomplishment in the physician's sample and significantly higher risk for "Emotional Exhaustion," "Depersonalization" and overall burnout compared to the matched population sample (3). In a survey among members of the State Chamber of Physicians of Saxony, Germany, similar sum scores for "Emotional Exhaustion" (21.3), higher sum scores for Depersonalization (9.9) and lower scores for Personal Accomplishment (36.3) were found (7). Our findings indicate an even less favorable situation in the 2016 sample (EE: 27.0; DP: 12.4, PA: 33.2), although Burnout scores showed a positive trend since 2006 to the effect that MBI-EE item means and sum scores decreased significantly. The scores for MBI-DP and MBI-PE also decreased, but this change was not statistically significant. However, the comparison of our data with the data of Wang et al. (43), Shanafeldt et al. (3), and Pantenburg et al. (7) is only possible to a limited extent, since we used a 21-item version of the MBI (38) and coded the items with 1-6, while our colleagues used other versions of the MBI and coded the items differently. This could explain the higher values in our study.

The evaluation of data from the Second German Sociomedical Panel of Employees identified an Effort-Reward-Imbalance ratio > 1 among 25.9% employees in the general population (62). Larisch et al. (63) found an Effort-Reward-Imbalance ratio > 1 in 16.1% among 315 employees of a metropolitan transport company. Pantenburg et al. (7) reported an averaged Effort-Reward-Imbalance-Ratio of 1.3 and mean values for effort, reward, and overcommitment of 17.9, 31.2, and 14.2, which are all well above the values in our sample in 2016.

Correlations Between Occupational and Private Factors and Effort-Reward-Imbalance and Burnout

In our correlation analyses we looked at relations between gender, professional position, weekly working hours, free weekends, partnership, and children with Effort-Reward-Imbalance (ER-Ratio > 1), overcommitment and the dimension "Emotional Exhaustion" of burnout syndrome. Depression and suicide attempts in medical history were excluded on the one hand because we were interested in the current situation at the time of the survey. On the other hand, the data collected by standardized instruments are more objectifiable, as non-standardized requested data on the prehistory. Particularly in questions of depression and suicide tendencies, it must be considered that in the context of a congress these topics may be avoided and there is a tendency to trivialize earlier difficult phases of life.

We decided to consider only the dimension "Emotional Exhaustion," since Maslach et al. (42) described this dimension to be the central element of burnout, and the most obvious manifestation of this complex construct (42). In addition, the data from Wang et al. (43) show that the dimension "Emotional Exhaustion" in particular is significantly related to long working hours, high job effort, and low reward. It has also been shown that "Emotional Exhaustion" is particularly influenced by Effort-Reward-Imbalance with effects to quality of care [e.g., Weigl et al. (36)].

The correlation analysis revealed correlations between weekly working hours and free weekends and OC, ERI, and MBI-EE. We tried to clarify by means of a mediation analysis whether these effects are direct or whether the influence of working time on burnout is mediated by ERI. Overcommitment was left out, since OC is the intrinsic (and relatively stable) component of the ERI model and, at high levels, leads to the stress experience being intensified by gratification crises (28, 37). Since this effect is already established in the model and the OC values had changed little between 2006 and 2016, we did not consider OC in a mediation analysis.

The mediation analyses showed a complete mediation of the relationship between working time and "Emotional Exhaustion" as a core dimension of burnout through Effort-Reward-Imbalance. We could determine this for the data from 2006 and also for the data from 2016, although in these 10 years Effort-Reward-Imbalance has clearly decreased, as well as "Emotional Exhaustion." And we were able to determine this mediation effect both for the weekly working time and for the number of free weekends per month. In particular, the indirect effect of free weekends was highly significant. This seems essential to us because we suspect that there is a difference in the recovery effect between e.g. half an hour less work per day and one free weekend day more per month.

According to the correlation and mediation analysis and the decreasing rates in both, weekly working hours/free weekends and Effort-Reward-Imbalance, from 2006 to 2016, there seems to be a solution to the problem of high occupational stress and burnout risk: fewer working hours per week and more free weekends. This solution poses considerable difficulties. Reduced working hours may mean that more physicians need to be hired. This means additional financial expenditure for the employers, additional financial expenditure for the federal state which has to train more physicians and restructuring and additional expenditure at the medical faculties. But it can also mean changing processes. Away from

excessive bureaucratic tasks, toward more patient centricity with more flexibility and room for maneuver, as Smaggus' work suggests (64).

STRENGTHS AND LIMITATIONS

One of the strengths of our study is that it addresses a very topical issue. The methodological strengths of our study lie in the recording of occupational stress and mental impairment using established models of work stress and burnout (32, 42). This enables a theory-based interpretation and points the way to appropriate interventions. Also, we were able to collect data from a large sample of physicians working in different settings and areas of intensive care medicine, and we achieved relatively high response rates, which increases the informative value of our data. A further strength lies in the prospective investigation of the effects of working conditions of physicians over a long follow up period.

In addition, some limitations of our study are noteworthy.

First of all, the samples comprise of two independent cross-sectional surveys, which limits statements about individual change over time.

Our study aims to investigate the effect of statutory working time regulation on indicators of stress (ERI and Overcommitment) and burnout. The temporal relationship between working time and stressful life or burnout has already been established by longitudinal studies in physicians (18, 20). Therefore, between the present two cross-sectional samples we assume a similar temporal relationship.

The conference where the data were obtained are the largest conferences for intensive care medicine in Germany. In 2016 about 6000 intensive care physicians participated (38). The conference offers a scientific program and training opportunities. It is aimed at both university and non-university intensive care physicians, physicians in clinics and practices. The survey conducted at these conferences enabled us to cover the range of intensive care physicians as well as possible, thus increasing the representativeness.

Yet, we collected the data with the same methods (paper pencil questionnaires) from the same target group (physicians) and at the same conference.

The studies were carried out at conferences, which means certain selection of the participants. The advantage of achieving data on a conference is a good response rate, which we probably got by the direct and personal information of the participants.

At the same time, we cannot rule out an overlap of participants, who took part on both conferences.

We discovered a small reduction of working hours in the period of 10 years. This could be a result of a change in the law, but also many other aspects have changed in 10 years that we have not recorded or could not record (i.e., increase in the proportion working part time).

The studies were carried out at intensive care conferences in Hamburg, which did not prevent a certain selection. The intuitive assumption that acutely or severely stressed and exhausted colleagues are less likely to attend a conference would mean that the study underestimates the prevalence of Effort-Reward-Imbalance and burnout. Another point is the congress venue. Hamburg is an attractive cosmopolitan city that perhaps attracts a different sample than a smaller or provincial congress venue.

For the survey at congresses, we decided with the aim of achieving a good response rate, which we wanted to achieve through the large number of participants at the congress and the direct and personal information of the participants. The return rate was then actually higher than typically expected when surveys are mailed or emailed (65).

The data collected were determined by self-disclosure, which must also be viewed critically, despite anonymous submission of the questionnaires. It is conceivable that statements on depression and suicide could be avoided in the context of a conference. In this case, we would have expected no statements to be made on these issues. As we had little missing information in questions on these topics, we assume that this was not too much of an obstacle. A fundamental tendency toward dissimulation or aggravation of symptoms and medical history, for whatever reason, cannot be recorded with questionnaires, but must be considered when collecting data using this method.

The study was conducted with intensive care physicians, which allows statements on this group, but the transferability of the results to other specialist groups must be viewed critically. Another limitation of our study is that we collected data from random samples of physicians working in Germany. The extent to which our data can be transferred to other countries is unclear.

Methodologically, it must also be considered with caution that we relate the working time surveyed to occupational stress, measured with the Effort-Reward-Questionnaire, whereby the ERI questionnaire also asks about the burden of working time in one item. Yet, we gave priority to maintain the validated instrument.

For physicians from other European countries, the data could be of interest and informative value as they show changes in working hours, stress and burnout after the implementation of European labor law. This could have implications for interventions in clinics in other European countries.

Despite the limitations our conclusions provide valuable insights into the mechanisms of how the balance between effort and reward for intensive care physicians can be maintained and positively influenced. The data on the correlations between weekly working hours, free weekends and ERI and psychological stress in the form of burnout indicate that this is a worthwhile endeavor.

In summary, our study constitutes the first large questionnaire survey on occupational and private life stress factors, burnout and health in physicians working in intensive care after a legislative intervention. Our data show positive changes in the professional and private situation as well as the emotional well-being of intensive care physicians, but there is stillroom for further improvements. The influence of the number of hours worked per week and the number of on-call weekends on the ERI illustrates the need for preventive interventions, specifically designed for physicians working in intensive care. These results should be further substantiated by prospective studies. Still, it should be possible to reduce professional stress by taking some action regarding the number of hours worked, which seems reasonable in a specialty

that is characterized by high emotional stress, and the intensive and constant confrontation with "end of life" issues. Taking into consideration the tendency to overcommit, this should be supplemented by individual preventives measures as well as easily accessible therapeutic support, customized for the needs and fears of the physicians working in intensive care.

DATA AVAILABILITY STATEMENT

The datasets analyzed in this article are not publicly available because the participants were not informed that the data would be publicly available and therefore could not agree to this. Requests to access the datasets should be directed to Petra Beschoner, petra.beschoner@uni-ulm.de.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethikkommission Universität Ulm, Ulm, Germany. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

PB, LS, MB, CS-L and JW: conceptualization. CS-L, LJ-B, JW, and MJ: statistical analysis. MB and CS-L: funding acquisition. PB, LS, and MJ: methodology. PB and LS: writing-original draft preparation.

FUNDING

The Deutsche Suchtstiftung Matthias Gottschaldt supported the present study to finance the licences for the screening instruments and material.

ACKNOWLEDGMENTS

We would like to thank the attendees of the conferences for their participation in the studies. We would also like to thank the German Interdisciplinary Association for Intensive and Emergency Medicine [Deutsche Interdisziplinäre Vereinigung für Intensiv und Notfallmedizin (DIVI)] and its former presidents, for the keen interest and the assistance with the survey. And finally, we would like to thank Mr. R.W. Freudenmann, Mr. F.-G. Pajonk, Mrs. E. Rottler, and Mrs. T. Mehta for their interest, active cooperation and helpful advice.

REFERENCES

1. Myhren H, Ekeberg Ø, Stokland O. Job satisfaction and burnout among intensive care unit nurses and physicians. *Crit Care Res Pract.* (2013) 2013:786176. doi: 10.1155/2013/786176
2. Dyrbye LN, Varkey P, Boone SL, Satele DV, Sloan JA, Shanafelt TD. Physician satisfaction and burnout at different career stages. *Mayo Clin Proc.* (2013) 88:1358-67. doi: 10.1016/j.mayocp.2013.07.016
3. Shanafelt TD, Boone S, Tan L, Dyrbye LN, Sotile W, Satele D, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med.* (2012) 172:1377-85. doi: 10.1001/archinternmed.2012.3199
4. Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of burnout among physicians: a systematic review. *JAMA*. (2018) 320:1131–50. doi: 10.1001/jama.2018.12777
5. Chuang CH, Tseng PC, Lin CY, Lin KH, Chen YY. Burnout in the intensive care unit professionals: a systematic review. *Medicine*. (2016) 95:e5629. doi: 10.1097/MD.0000000000005629
6. Braun M, Schönfeldt-Lecuona C, Freudenmann RW, Mehta T, Hay B, Kächele H, et al. Depression, burnout, effort and reward imbalance among psychiatrists. *Psychother Psychosom.* (2010) 79:326–7. doi: 10.1159/000319531
7. Pantenburg B, Luppa M, König H-H, Riedel-Heller SG. Burnout among young physicians and its association with physicians wishes to leave: results of a survey in Saxony, Germany. *J Occup Med Toxicol.* (2016) 11:2. doi: 10.1186/s12995-016-0091-z
8. Domagała A, Bała MM, Storman D, Peña-Sánchez JN, Swierz MJ, Kaczmarczyk M, et al. Factors associated with satisfaction of hospital physicians: a systematic review on European data. *Int J Environ Res Public Health.* (2018) 15:2546. doi: 10.3390/ijerph15112546
9. Friedberg MW, Chen PG, Van Busum KR, Aunon F, Pham C, Caloyeras J, et al. Factors affecting physician professional satisfaction and their implications for patient care, health systems, and health policy. *Rand Health Q.* (2014) 3:1.
10. Linzer M, Manwell LB, Williams ES, Bobula JA, Brown RL, Varkey AB, et al. Working conditions in primary care: physician reactions and care quality. *Ann Intern Med.* (2009) 151:9. doi: 10.7326/0003-4819-151-1-200907070-00006
11. Maccacaro G, Di Tommaso F, Ferrai P, Bonatti D, Bombana S, Merseburger A. The effort of being male: a survey on gender and burnout. *Med Lav.* (2011) 102:286-96.
12. Virtanen M, Kurvinen T, Terho K, Oksanen T, Peltonen R, Vahtera J, et al. Work hours, work stress, and collaboration among ward staff in relation to risk of hospital-associated infection among patients. *Med Care.* (2009) 47:310–8. doi: 10.1097/MLR.0b013e3181893c64
13. Wu H, Liu L, Wang Y, Gao F, Zhao X, Wang L. Factors associated with burnout among Chinese hospital doctors: a cross-sectional study. *BMC Public Health.* (2013) 13:786. doi: 10.1186/1471-2458-13-786
14. Kinzl JF, Traweger C, Biebl W, Lederer W. Burnout and stress disorders in intensive care physicians. *DMW*. (2006) 131:2461–4. doi: 10.1055/s-2006-955030
15. Van Mol MM, Kompanje EJ, Benoit DD, Bakker J, Nijkamp MD. The prevalence of compassion fatigue and burnout among healthcare professionals in intensive care units: a systematic review. *PLoS ONE.* (2015) 10:e0136955. doi: 10.1371/journal.pone.0136955
16. de Oliveira GS, Chang R, Fitzgerald PC, Almeida MD, Castro-Alves LS, Ahmad S, et al. The prevalence of burnout and depression and their association with adherence to safety and practice standards: a survey of United States anesthesiology trainees. *Anesth Analg.* (2013) 117:182–93. doi: 10.1213/ANE.0b013e3182917da9
17. Selmanovic S, Ramic E, Brekalo-Lazarevic S, Alic A. Stress at work and burnout syndrome in hospital doctors. *Med Arh.* (2011) 65:221–4. doi: 10.5455/medarh.2011.65.221-224
18. Tomioka K, Morita N, Saeki K, Okamoto N, Kurumatani N. Working hours, occupational stress and depression among physicians. *Occup Med.* (2011) 61:163–70. doi: 10.1093/occmed/kqr004
19. Martini S, Arfken CL, Balon R. Comparison of burnout among medical residents before and after the implementation of work hours limits. *Acad Psychiatry*. (2006) 30:352–5. doi: 10.1176/appi.ap.30.4.352
20. Shanafelt TD, Mungo M, Schmitgen J, Storz KA, Reeves D, Hayes SN, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work effort. *Mayo Clin Proc.* (2016) 91:422–31. doi: 10.1016/j.mayocp.2016.02.001

21. Gopal R, Glasheen JJ, Miyoshi TJ, Prochazka AV. Burnout and internal medicine resident work-hour restrictions. *Arch Intern Med.* (2005) 165:2595–600. doi: 10.1001/archinte.165.22.2595
22. Ahmed N, Devitt KS, Keshet I, Spicer J, Imrie K, Feldman L, et al. A systematic review of the effects of resident duty hour restrictions in surgery: impact on resident wellness, training, and patient outcomes. *Ann Surg.* (2014) 259: 1041-53. doi: 10.1097/SLA.0000000000000595
23. Loerbroks A, Weigl M, Li J, Angerer P. Effort-reward imbalance and perceived quality of patient care: a cross-sectional study among physicians in Germany. *BMC Public Health.* (2016) 16:342. doi: 10.1186/s12889-016-3016-y
24. Li J, Weigl M, Glaser J, Petru R, Siegrist J, Angerer P. Changes in psychosocial work environment and depressive symptoms: a prospective study in junior physicians. *Am J Ind Med.* (2013) 56: 1414-22. doi: 10.1002/ajim.22246
25. Voltmer E, Rosta J, Siegrist J, Aasland OG. Job stress and job satisfaction of physicians in private practice: comparison of German and Norwegian physicians. *Int Arch Occup Environ Health.* (2012) 85: 819-28. doi: 10.1007/s00420-011-0725-5
26. Ohlander J, Weigl M, Petru R, Angerer P, Radon K. Working conditions and effort-reward imbalance of German physicians in Sweden respective Germany: a comparative study. *Int Arch Occup Environ Health.* (2015) 88:511-9. doi: 10.1007/s00420-014-0978-x
27. Bernd G. Labour law: on-call time is working time. *Dtsch Arztebl.* (2013) 110:2.
28. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol.* (1996) 1:27–41. doi: 10.1037/1076-8998.1.1.27
29. Marmot M, Siegrist M, Theorell T, Feeney A. Health and the psychosocial environment at work. In: Marmot M, Wilkinson RG, editors. *Social Determinants of Health*. London: Oxford University Press (1999). p. 105-31.
30. Loerbroks A, Cho SI, Dollard MF, Zou J, Fischer JE, Jiang Y et al. Associations between work stress and suicidal ideation: individual-participant data from six cross-sectional studies. *J Psychosom Res.* (2016) 90:62–9. doi: 10.1016/j.jpsychores.2016.09.008
31. Dai JM, Collins S, Yu HZ, Fu H. Combining job stress models in predicting burnout by hierarchical multiple regressions: a cross-sectional investigation in Shanghai. *J Occup Environ Med.* (2008) 50:785–90. doi: 10.1097/JOM.0b013e318167750a
32. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, et al. The measurement of effort-reward imbalance at work: European comparisons. *Soc Sci Med.* (2004) 58:1483–99. doi: 10.1016/S0277-9536(03)00351-4
33. Schernhammer ES, Colditz GA. Suicide rates among physicians: a quantitative and gender assessment (meta-analysis). *Am J Psychiatry.* (2004) 161:2295–302. doi: 10.1176/appi.ajp.161.12.2295
34. Hawton K, Clements A, Sakarovitch C, Simkin S, Deeks JJ. Suicide in doctors: a study of risk according to gender, seniority and specialty in medical practitioners in England and Wales, 1979-1995. *J Epidemiol Community Health.* (2001) 55:296–300. doi: 10.1136/jech.55.5.296
35. Maslach C, Jackson SE, Leiter MP. *Maslach Burnout Inventory, Manual*. Palo Alto, CA: Consulting Psychologists Press (1996).
36. Weigl M, Schneider A, Hoffmann F, Angerer P. Work stress, burnout, and perceived quality of care: a cross-sectional study among hospital pediatricians. *Eur J Pediatr.* (2015) 174:1237–46. doi: 10.1007/s00431-015-2529-1
37. Siegrist J. Effort-reward imbalance model. In: Fink G, editor. *Stress: Concepts, Cognition, Emotion, and Behavior*. London: Academic Press (2016). p. 81-6. doi: 10.1016/B978-0-12-800951-2.00009-1
38. Vogt L. *Artificial Respiration Is Becoming More and More Important. DIVI-Congress.* (2016). Available online at: https://idw-online.de/de/news664025 (accessed September 02, 2019).
39. Büssing A, Perrar KM. The measurement of burnout. Investigation of a German version of the Maslach Burnout Inventory (MBI-D). *Diagnostica.* (1992) 38:328–53.
40. Schaufeli WB, Bakker AB, Hoogduin K, Schaap C, Kladler A. On the clinical validity of the Maslach Burnout Inventory and the burnout measure. *Psychol Health.* (2001) 16:565–82. doi: 10.1080/08870440108405527
41. Burisch M. *Burnout Syndrome. Theory of Inner Exhaustion.* Heidelberg: Springer Medizin Verlag (2010).
42. Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol.* (2001) 52:397–422. doi: 10.1146/annurev.psych.52.1.397
43. Wang Z, Xie Z, Dai J, Zhang L, Huang Y, Chen B. Physician burnout and its associated factors: a cross-sectional study in Shanghai. *J Occup Health.* (2014) 56:73–83. doi: 10.1539/joh.13-0108-OA
44. Rödel A, Siegrist J, Hessel A, Brähler E. Questionnaire for measuring professional gratification crises. *Z Differ Diagnost Psychol.* (2004) 25:227–38. doi: 10.1024/0170-1789.25.4.227
45. Elze MC, Gregson J, Baber U, Williamson E, Sartori S, Mehran R, et al. Comparison of propensity score methods and covariate adjustment: evaluation in 4 cardiovascular studies. *J Am Coll Cardiol.* (2017) 69: 345-57. doi: 10.1016/j.jacc.2016.10.060
46. Gould W, Hilbe J. Ladder-of-Powers variable transformation. *Stata Tech Bull.* (1991) 2:14–5.
47. Ditlevsen S, Christensen U, Lynch J, Damsgaard MT, Keiding N. The mediation proportion : a structural equation approach for estimating the proportion of exposure effect on outcome explained by an intermediate variable. *Epidemiology.* (2005) 16:114–20. doi: 10.1097/01.ede.0000147107.76079.07
48. Hayes AF. Beyond Baron and Kenny: statistical mediation analysis in the new millennium. *Commun Monogr.* (2009) 76:408–420. doi: 10.1080/03637750903310360
49. Young A, Chaudhry HJ, Pei X, Arnhart K, Dugan M, Snyder GB. A census of actively licensed physicians in the United States, 2016. *J Med Regul.* (2017) 103:7–21. doi: 10.30770/2572-1852-103.2.7
50. Jefferson L, Bloor K, Maynard A. Women in medicine: historical perspectives and recent trends. *Br Med Bull.* (2015): 114:5-15. doi: 10.1093/bmb/ldv007
51. Haines VY III, Bilodeau J, Demers A, Marchand A, Beauregard N, Durand P, et al. Sex, gender dynamics, differential exposure, and work-family conflict. *J Fam Issues.* (2019) 40:215–39. doi: 10.1177/0192513X18806945
52. Williams VN, Medina J, Medina A, Clifton S. Bridging the millennial generation expectation gap: perspectives and strategies for physician and interprofessional faculty. *Am J Med Sci.* (2017) 353:109–15. doi: 10.1016/j.amjms.2016.12.004
53. Kasch R, Engelhardt M, Förch M, Merk H, Walcher F, Fröhlich S. Physician shortage: how to prevent generation Y from staying away-results of a nationwide survey. *Zbl Chir.* (2016) 141:190–6. doi: 10.1055/s-0035-1557857
54. Busch M, Maske U, Ryl L, Schlack R, Hapke U. Prevalence of depressive symptoms and diagnosed depression among adults in Germany. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz.* (2013) 56:733–9. doi: 10.1007/s00103-013-1688-3
55. Teismann T, Dorrmann W. Suicidal tendency. *Psychotherapeut.* (2013) 58:297–311. doi: 10.1007/s00278-013-0984-6
56. Knaak S, Mantler E, Szeto A. Mental illness-related stigma in healthcare: barriers to access and care and evidence-based solutions. *Health Manage Forum.* (2017) 30:111–6. doi: 10.1177/0840470416679413
57. Tillett R. The patient within-psychopathology in the helping professions. *Adv Psychiatr Treat.* (2003) 9:272–9. doi: 10.1192/apt.9.4.272
58. Peris TS, Teachman BA, Nosek BA. Implicit and explicit stigma of mental illness: links to clinical care. *J Nerv Ment Dis.* (2008) 196:752–60. doi: 10.1097/NMD.0b013e3181879dfd
59. Oxtoby K. Why doctors don't take sick leave. *BMJ.* (2015) 351:h6719. doi: 10.1136/bmj.h6719
60. Roden-Foreman JW, Bennett MM, Rainey EE, Garrett JS, Powers MB, Warren AM. Secondary traumatic stress in emergency medicine clinicians. *Cogn Behav Ther.* (2017) 46:522–32. doi: 10.1080/16506073.2017.1315612
61. Kurth BM. First results from the "Study on Adult Health in Germany" (DEGS). *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz.* (2013) 55:980–90. doi: 10.1007/s00103-012-1504-5
62. Bethge M, Radoschewski FM, Gutenbrunner C. Effort-reward imbalance and work ability: cross-sectional and longitudinal findings from the Second German Sociomedical Panel of Employees. *BMC Public Health.* (2012) 12:875. doi: 10.1186/1471-2458-12-875

63. Larisch M, Joksimovic L, von dem Knesebeck O, Starke D, Siegrist J. Professional gratification crises and depressive symptoms. *Psychother Psychosom Med Psychol.* (2003) 53:223–8. doi: 10.1055/s-2003-38867
64. Smaggus A. Safety-I, Safety-II and burnout: how complexity science can help clinician wellness. *BMJ Qual Saf.* (2019) 28:667–671. doi: 10.1136/bmjqs-2018-009147
65. Sax LJ, Gilmartin SK, Bryant AN. Assessing response rates and nonresponse bias in web and paper surveys. *Res High Educ.* (2003) 44: 409-32. doi: 10.1023/A:1024232915870
66. Cohen J. *Statistical Power Analysis for the Behavioral Sciences.* 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates (1988).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 27 April 2020
doi: 10.3389/fpsyt.2020.00298

Secondary Traumatic Stress, Mental State, and Work Ability in Nurses—Results of a Psychological Risk Assessment at a University Hospital

Christian Bock[1†], Ivo Heitland[2†], Tanja Zimmermann[3], Lotta Winter[2] and Kai G. Kahl[2]*

[1] Department of Occupational Safety, Hannover Medical School, Hannover, Germany, [2] Department of Psychiatry, Social Psychiatry and Psychotherapy, Hannover Medical School, Hannover, Germany, [3] Department of Psychosomatic Medicine and Psychotherapy, Hannover Medical School, Hannover, Germany

OPEN ACCESS

Edited by:
Christian Huber, University Psychiatric Clinic Basel, Switzerland

Reviewed by:
Rainer Leonhart, University of Freiburg, Germany
Serge Brand, University Psychiatric Clinic Basel, Switzerland

***Correspondence:**
Kai G. Kahl
kahl.kai@mh-hannover.de

†These authors have contributed equally to this work and share first authorship

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *06 November 2019*
Accepted: *25 March 2020*
Published: *27 April 2020*

Citation:
Bock C, Heitland I, Zimmermann T, Winter L and Kahl KG (2020) Secondary Traumatic Stress, Mental State, and Work Ability in Nurses—Results of a Psychological Risk Assessment at a University Hospital. Front. Psychiatry 11:298. doi: 10.3389/fpsyt.2020.00298

Psychological risk assessment is a legal obligation for companies and part of occupational safety and employment protection in Germany. However, data from psychological risk assessments in nursing staff are scarce, although this population is at increased risk for secondary traumatic stress by patient experienced trauma. Therefore, our study aimed at examining the frequency of reported secondary trauma events, secondary traumatic stress, and its possible consequences for psychological well-being and work ability in nurses. N = 320 nurses (n = 280 female) were assessed at a University Hospital in Germany as part of the psychological risk assessment. Secondary traumatic events, secondary traumatic stress, and symptoms of depression and anxiety were measured using self-report questionnaires (PHQ-2, GAD-2), and work ability was assessed using a modified version of the questionnaire for workplace analysis (KFZA). Of 320 nurses, 292 (91.2%) experienced secondary trauma, and 74 nurses (25.3%) reported secondary traumatic symptoms. Nurses with secondary traumatic symptoms reported higher depression ($p < 0.001$) and anxiety scores ($p < 0.001$) compared to nurses without secondary trauma experience, and to nurses with secondary trauma experience but without secondary traumatic stress (both $p < 0.001$). Further, nurses with secondary traumatic stress reported significantly reduced work ability, social support and control over work, and increased emotional strain and labor time. Nurses with secondary traumatic stress may be at increased risk of developing major depression and anxiety disorders, and particularly need support in overcoming secondary traumatic experiences. Psychological risk assessment is a useful tool to identify groups at risk, and pave the way to implement strategies to improve mental well-being and prevent work ability in high risk groups.

Keywords: secondary traumatic stress, nurse, work strain, depression, anxiety, workload

INTRODUCTION

Work-related stress belongs to the most concerning issues in occupational health in industrialized countries (1). Stress is experienced by approximately 45% of European employees, and is seen as the second most important threat after musculoskeletal problems posed by the working environment (2). Studies supports the association between perceived stress, physical and mental health, being probably linked *via* stress axis activation (3).

The implementation of psychological risk assessments has been a legal obligation for German companies since 2013 (4). Although there are no regulations regarding the instruments used to assess psychological risk at work, it was proposed to use questionnaires and/or structured interviews to capture data from employees. This offers the opportunity to assess work-related psychological risk factors such as secondary traumatic stress and relate them to measures of psychological health and work ability.

Among hospital workers, patient care professionals are more vulnerable to develop work-related health problems compared to other professions (5). Among others, secondary traumatic stress (STS) is an occupational hazard for persons who provide direct patient care. STS is defined according to Figley (1995) as "the natural consequent behaviors and emotions resulting from knowledge about a traumatizing event experienced by a significant other. It is stress resulting from helping, or wanting to help a traumatized or suffering person" (6).

The experience of STS has been reported frequently in many caring professions including nursing. There are several published studies examining STS and closely related conditions in different nursing specialties such as emergency care (7–9), critical care (10), cancer/oncology (11, 12), internal medicine/heart and vascular nurses (13), primary care (14), labor and delivery (15), psychiatric care (16), and pediatric care (17, 18). These studies demonstrated that STS is a frequent condition across nursing specialties, with prevalence rates ranging between 35% and 60% (19).

Nurses who experienced STS were described to suffer emotionally as a result of shared traumas with their patients. They may have recurrent thoughts or distressing dreams, sleep disturbances, and even flashbacks of difficult patient experiences have been described. Furthermore, they may have difficulties performing their jobs because of psychological distress (8).

We here report data from a cohort of nurses working in a university hospital in Germany who underwent psychological risk assessment between 2016 and 2018. We aimed at examining the frequency of secondary traumatic experiences, STS, and their potential association with measures of psychological and work-related problems. Our primary hypothesis was that individuals who reported secondary traumatic stress have increased anxiety and depression scores.

METHODS

Participants

This study was approved by the local ethic committee (Hannover Medical School). Psychological risk assessment was performed in 1,057 participants working in different professions and in different Departments at the Hannover Medical School. Participants were asked to fill in a questionnaire anonymously as a part of the psychological risk assessment process. Of the 1,057 participants 338 were nurses, of whom 320 questionnaires were complete.

Measures

Secondary traumatic stress was assessed using a questionnaire with two questions which are part of the Freiburg PTSD Screening (20). Participants were asked whether they experienced traumatic events at work (yes/no), and whether they currently suffer from flashbacks regarding traumatic events at work (yes/no). These data were used to classify subjects based on STE/STS into three distinct groups. If no traumatic work event was reported, subjects were classified as the "no STE" group. If a traumatic event at work was reported without flashbacks, subjects were classified as experience of secondary traumatic event without secondary traumatic stress, the "STE without STS" group. If flashbacks were affirmed in the context of this traumatic experience, subjects were classified into the "STE with STS" group.

Symptoms of depression and anxiety were assessed using the two item Patient Health Questionnaire-2 (PHQ-2) (21) and the two item Generalized Anxiety Disorder scale (GAD-2) (22). Both scales pertain to symptom frequency during the last two weeks using a 4-point Likert scale (0-3) ranging from "Not at all" (0) to "Almost every day" (3). Scores for both questionnaire range from 0 to 6, with ≥3 being used as the optimal cutoff point for screening purposes. The PHQ-2 assessed the frequency of depressed mood and anhedonia ("Loss of interest" and "Dejection or hopelessness"). Sum scores ≥3 suggest a major depressive disorder (23). The GAD-2 assessed core anxiety symptoms, i.e. tension and uncontrollable worry ("Nervousness or tension" and were "Not being able to stop or control worries"). Scores ≥3 points suggest presence of an anxiety disorder (24).

Age was measured on a 5-point ordinal scale consisting of the items "up to 25 years", "26–35 years", "36–45 years", "46–55 years", "56 years or more".

Work strain and work ability were assessed using a modified version of the questionnaire for workplace analysis (KFZA; Prumper, Hartmannsgruber and Frese (25). The final questionnaire consisted of 7 scales with two items each: Questions about workload (two items, $\alpha = 0.70$), control over work (two items, $\alpha = 0.70$), social support (two items, $\alpha = 0.72$), workflow (two items, $\alpha = 0.70$), feedback (two items, $\alpha = 0.64$), work environment (two items, $\alpha = 0.60$), and information/participation (two items, $\alpha = 0.70$). Denominators ranged from "I strongly agree", "I agree", "Neither agree nor disagree", to "I disagree" and "I strongly disagree".

Data Analysis

All statistical analyses were conducted using SPSS version 25. Descriptive analyses were performed for the whole group concerning age, gender, marital status, nursing specialty, secondary traumatic events and secondary traumatic stress, and occupational conditions.

Group differences concerning nominal variables were compared using Chi square tests. To examine the effects of STE/STS, MANOVA's were performed using STE/STS as independent variable with the 3 levels "no STE", "STE without STS" and "STE with STS", and measures of psychological health (PHQ-2, GAD-2; MANOVA #1) as well as measures of work strain and work ability (MANOVA #2) as dependent variables. Finally, Bonferroni-corrected post-hoc tests were used for pairwise comparisons.

TABLE 1 | Psychosocial and occupational data.

Factor	All nurses (N/%)
Female Gender (N/%)	280 (87.5%)
Age range (y)	
≤25	51 (15.9%)
26-35	111 (34.7%)
36-45	66 (20.6%)
46-55	67 (20.8%)
≥56	25 (7.8%)
Nursing specialty	
Surgical care	78 (24.4%)
Pediatric care	63 (19.7%)
Psychiatric care	49 (15.3%)
Internal medicine	130 (40.6%)
Secondary traumatic event	292/320 (91.2%)
Secondary traumatic stress	74/292 (25.3%)
Marital status	
Singled	87 (27.2%)
Married/partnership	207 (64.7%)
Divorced	22 (6.9%)
Widowed	4 (1.3%)
Occupational condition	
Support by peers	251 (78.5%)
Support by supervisor	172 (53.8%)
Shift work	268 (83.8%)
Overtime hours	160 (50%)
Security of employment	298 (93.1%)
Opportunity of advancement	71 (22.2%)

RESULTS

Eighty-eight percent of the sample were female, and most were in the age range between 26-35 years. One-hundred thirty (40.6%) were working in internal medicine, 78 (24.4%) in surgery, 63 (19.7%) in pediatric care, and 49 (15%) in psychiatric care (**Table 1**). Most nurses were partnered (207, 64.7%).

Secondary traumatic events were reported by 292 nurses (91.2%), of whom 74 (25.3%) reported that these events lead to continuous rumination and/or flashbacks (**Table 1**).

A MANOVA with group (no STE; STE without STS; STE with STS) as independent variable, and psychological health as dependent variables (PHQ-2, GAD) showed a significant multivariate effect [Wilks Lambda = 0.88, F(4, 632) = 10.5, $p < 0.001$, partial $\eta^2 = 0.06$]. Corresponding univariate tests showed significant group effects for both symptoms of anxiety (GAD-2 sum score) [F(2,317) = 16.0, $p < 0.001$, partial $\eta^2 = 0.09$] and symptoms of depression (PHQ-2 sum score) [F(2,317) = 20.3, $p < 0.001$, partial $\eta^2 = 0.11$].

Post-hoc analyses for symptoms of anxiety revealed higher GAD-2 sum score in nurses who experienced secondary traumatic stress compared to nurses without experience of a secondary traumatic event ($p < 0.001$), and compared to nurses who had experienced secondary traumatic event with developing secondary traumatic stress ($p < 0.001$) (**Figure 1A**).

Post-hoc analyses for symptoms of depression revealed higher PHQ-2 sum score in nurses who experienced secondary traumatic stress compared to nurses without experience of a secondary traumatic event ($p < 0.001$), and compared to nurses who had experienced secondary traumatic event with developing secondary traumatic stress ($p < 0.001$) (**Figure 1B**).

Further analyses were made to identify possible group associations with regard to measures of work strain and work ability. There was a significant multivariate effect of group on work strain and work ability [Wilks Lambda = 0.87, F(14, 596) =

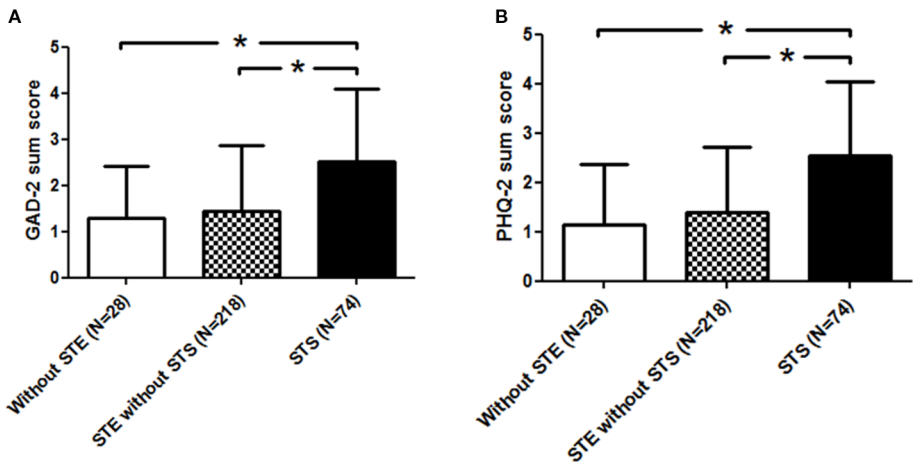

FIGURE 1 | (A) Increased symptoms of anxiety symptoms in nurses who reported secondary traumatic stress (STS) compared to both other groups. *Indicates a significance level <0.001. **(B)** Increased symptoms of depression in nurses who reported secondary traumatic stress (STS) compared to both other groups. *Indicates a signifcance level <0.001.

2.7, p = 0.001, partial η^2 =.06]. Corresponding univariate tests showed significant group effects for workload [F(2,304) = 8.3, p < 0.001, partial η^2 =.05], social support [F(2,304) = 4.6, p = 0.011, partial η^2 =.03], workflow [F(2,304) = 10.2, p < 0.001, partial η^2 =.06] and participation [F(2,304) = 7.1, p = 0.001, partial η^2 =.04], but no significant effects for control over work and planning [F(2,304) = 2.9, p = 0.057], work environment [F (2,304) = 1.7, p = 0.18] and feedback [F(2,304) = 1.3, p = 0.27]. The corresponding descriptive statistics for all work-related data are shown in **Table 2**.

Post-hoc analyses revealed that nurses from the "STE with STS" group reported significantly more frequent feelings of "being under pressure" and "having too much work" (workload scale) compared to nurses from the "no STE" (p = 0.005) and nurses from the "STE without STS" groups (p < 0.001, see **Table 2** for descriptive statistics). Furthermore, nurses from the "STE with STS" group reported less support by colleagues and supervisors (support scale) than nurses from the "STE without STS" group (p = 0.010). In addition, nurses from the "STE with STS" group reported being less being informed/well equipped and more often interrupted (workflow scale) than nurses from the "STE without STS" group and the "no STE" group (both p-values < 0.001). Finally, "STE with STS" nurses reported being less kept up-to-date with information and ideas/ less being considered by superiors (participation scale) than "STE without STS" (p = 0.002) and "no STE" (p = 0.015) nurses. There were no group effects with regard to age, gender and nursing specialty (all p-values n.s). See **Table 2** for an overview of descriptive statistics regarding all post-hoc tests and distributions.

TABLE 2 | Descriptive statistics for age, gender, and nursing specialty, work strain and work ability dependent on secondary traumatic experiences (no STE, STE without STS, STE with STS).

	No STE (N=28)	STE without STS (N=218)	STE with STS (N=74)
Gender			
Female	26 (9.3%)	186 (66.4%)	68 (24.3%)
Male	2 (5.0%)	32 (80%)	6 (15%)
Age range			
≤25y	8 (15.7%)	32 (62.7%)	11 (21.6%)
26-35y	9 (8.1%)	71 (64.0%)	31 (27.9%)
36-45y	5 (7.6%)	48 (72.7%)	13 (19.7%)
46-55y	4 (6.0%)	48 (71.6%)	15 (22.4%)
≥55y	2 (8.0%)	19 (76.0%)	4 (16%)
Nursing specialty			
Surgical care	7 (9.0%)	54 (69.2%)	17 (21.8%)
Internal medicine	14 (10.8%)	84 (64.6%)	32 (24.6%)
Pediatric care	3 (4.8%)	44 (69.8%)	16 (25.4%)
Psychiatric care	4 (8.2%)	36 (73.5%)	9 (18.4%)
Workload			
Being under pressure	3.6 ± 0.8	3.8 ± 0.8	4.1 ± 0.7 [a,b]
Having too much work	3.2 ± 0.9	3.3 ± 0.8	3.7 ± 0.8 [a,b]
Control over work			
Influence on amount of work	3.5 ± 0.7	3.6 ± 0.7	3.7 ± 0.8
Plan work independently	3.7 ± 0.9	3.3 ± 0.9 [a]	3.0 ± 0.8 [a,b]
Social support			
Support by colleagues	4.1 ± 0.6	4.0 ± 0.8	3.7 ± 0.7 [a,b]
Support by supervisor	3.5 ± 1.1	3.5 ± 1.1	3.1 ± 1.1 [a,b]
Workflow			
Information or equipment not available	2.4 ± 0.8	2.5 ± 0.8	3.0 ± 1.1 [a,b]
Work often interrupted	3.6 ± 1.0	4.0 ± 0.8 [a]	4.3 ± 0.7 [a,b]
Feedback			
Appropriate feedback by colleagues	2.7 ± 0.9	2.8 ± 1.0	3.1 ± 1.1
Appropriate feedback by supervisors	2.7 ± 0.9	3.0 ± 1.2	3.2 ± 1.1
Work environment			
Stressful work environment	3.5 ± 1.3	3.6 ± 1.2	3.9 ± 1.2
Equipment inadequate	3.2 ± 1.2	3.6 ± 1.1	3.6 ± 1.2
Information and participation			
Always kept up-to-date	3.5 ± 0.8	3.4 ± 0.8	2.9 ± 1.1 [a,b]
Superiors consider employees ideas	2.3 ± 1.0	1.6 ± 0.7 [a]	1.6 ± 0.7 [a,b]

[a]Means a group difference (P < 0.05) between "STE with STS" and "no STE". [b]Means a group difference (P < 0.05) between "STE with STS" and "STE without STS". STS, secondary traumatic stress.

DISCUSSION

This study assessed the frequency of secondary traumatic experiences, secondary traumatic stress, mental health problems and work ability in 320 nurses from a university hospital. We demonstrate high rates (> 90%) of self-reported secondary traumatic experiences in nurses of different professions. Those who developed STS (25.3%) displayed more symptoms of depression and anxiety, experienced higher job strain, and lower work ability.

The psychological and work-related consequences of secondary traumatic stress in nurses have seldom been studied. Reports so far demonstrated relatively high levels of STS in nurses (19), described risk factors (26) and emotional consequences such as compassion fatigue and burnout (27, 28). Our study expands these studies by showing high amounts of secondary traumatic experiences in nurses from different nursing specialties, demonstrating that those who are burdened by secondary traumatic stress report higher levels of anxiety and depression symptoms, and demonstrating consequences in the workplace. In particular, we found that those afflicted by STS reported higher job strain, less social support by colleagues and supervisors, and less participation.

The combination of STS with psychological burden and less social support by peers may pave the way to further problems such as the development of anxiety disorders, major depression (29, 30), and absenteeism from work (31). Predictors of absenteeism in nurses have been reviewed by Davey and colleagues, and high job strain, low peer or supervisor support, low work control, and high role overload were identified as important factors (31). Several of the aforementioned factors were also found in our sample of nurses with STS.

Other factors leading to the experience of job strain have been studied intensively. Job characteristics, such as high work demands in combination with limited autonomy and support were shown to contribute to an overall experience of job strain. (32, 33). Further, personality traits may play an important role in

perceiving job demands as stressful. E.g., type D personality has been proposed to consist of distress-prone characteristics, i.e. inhibited interpersonal interactions and a predisposition towards negative affectivity (34). Type D personality traits have been associated with higher levels of depressive symptoms, overall mental stress and health, higher rates of disability and higher rates of sick leave (35–37). In a recent study by Duan-Porter and colleagues, personality traits of negative affectivity accounted for 36% of between-individual variation in depressive symptoms over 12 months, and job characteristics and coping explained an additional 5% and 8% (38).

Individual coping strategies may also influence perceived job strain and the development of depressive symptoms. Individuals who are at greater risk for depression have more avoidant coping strategies, while individuals who deal proactively with stressors and use social support seem to be less prone to depression (39–41).

Since personality traits and coping strategies were not assessed in our study, we cannot rule out whether personality traits of nurses with difficulties to cope with patients' situations may influence the perception of secondary traumatic event and secondary traumatic stress. Further, we cannot comment on the question whether workplace-related stress may add or multiply the risk of secondary traumatic events.

Implications for Practice

Based on our findings we recommend including measures of secondary traumatic events and secondary traumatic stress symptoms in the psychological risk assessment process for nurses and for employees of other professions who directly care for patients in hospitals. Measures of individual coping strategies and personality factors may also be integrated.

An open question applies to whether a 2-question solution like in our study might be sufficient, or whether more detailed questionnaires are advantageous. E.g., a more detailed analyses of secondary traumatic stress symptoms can be achieved using the Secondary Traumatic Stress Scale (42), that corresponds to the symptoms of post-traumatic stress disorder listed in the Diagnostic and Statistical Manual of Mental Disorders (43). The STSS is composed of three subscales, namely intrusion, avoidance, and arousal. The instrument is designed to assess only secondary traumatic stress, and has achieved high levels of internal consistency reliability in published studies (19). However, one has to take in mind that data driven from a psychological risk assessment are part of occupational health and safety procedures. These assessments typically do not integrate sophisticated measurements as this is the case in clinical studies.

Second, based on our results and on other existing studies, comprehensive offers for nurses are recommended to provide continuous psychological support. Nurses need to be educated about their vulnerability when working with patients, about signs and symptoms of secondary traumatic stress, risk factors, and STS-related coping behaviors such as avoidant and numbing responses (44). Further, continuing education may be offered whereby nurses learn about ways how to prevent STS symptoms, and increase resilience to STS.

Several factors have been described that may enhance or prevent the occurrence of STS symptoms. According to Ratrout and Hamdan-Mansour, personal and organizational factors have to be considered to understand the process of developing STS symptoms (8). Personal factors include age (26), gender and years of working experience (7), educational level (45), trauma training, social support and personal trauma history (26) coping strategies (40) and personality factors (46). Organizational factors include trauma case load (26), peer and organizational support (47), and clinical supervision (48).

Rourke (2007) identified three areas of strategies (personal, professional, organizational) for preventing or ameliorating STS (49). On the personal level, strategies such as a healthy lifestyle (such as getting enough sleep, regular exercise, healthy diet), enjoying leisure time activities, managing a good work-family balance, permitting adequate time for grieving lose patients, and eventually using psychotherapy for those care providers who have strong emotional responses in the context of STS were recommended (49).

On the professional level, suggested strategies comprised peer consultation, setting boundaries, and/or meeting regularly with respectful professionals; and on the organizational level, strategies such as establishing a respectful and encouraging atmosphere and creating a support team were recommended (49).

These offers may include external and/or internal supervision, group intervision, and continuous quality management. Hospitals are recommended to offer opportunities for crisis intervention to nurses (and other employees) after a secondary work-related traumatic event. Our results demonstrate the effect of (perceived or real) lack of social support by colleagues and superiors. Therefore, a positive working atmosphere, offers to promote collegiality, an appreciative and constructive feedback culture should be mandatory.

Limitations

The nature of the traumatic stressors, and psychological factors such as subjective interpretation of the traumatic stressor were not assessed in our study. Further, due to the cross-sectional design of the study we can only report associations, and cannot infer causality. The data presented here belong to the psychological risk assessment, which is a legal obligation for companies in Germany. The questionnaire used here had to be approved by the Employee Committee. Some interesting facets of our results, such as personality traits, coping mechanisms, and ability for the job, were not approved.

CONCLUSION

We found high rates of secondary traumatic experiences in nurses of different professions. Those who developed secondary traumatic stress displayed more symptoms of depression and anxiety, higher job strain and lower work ability. We conclude that secondary traumatization and secondary traumatic stress symptoms should not be regarded

as a lack of resilience, but as an occupational hazard of the nurses' working environment. The issuing of measures to reduce secondary traumatic stress symptoms is an opportunity for hospitals to promote mental health, work ability and commitment to the company by their employed nurses.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Local Ethics Committee of the Hannover Medical School, Hannover, Germany. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

CB, KK, and TZ designed the study. CB collected the data. CB and KK conducted the analyses. TZ supervised the method and statistical analyses. KK and LW wrote the manuscript. IH revised the statistical section. All authors made substantial contributions to the conception or design of the work, or the acquisition, or interpretation of data for the work; for drafting the work or revising it; approved the final version to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

The authors thank Christine Wilhelm for proofreading this paper.

REFERENCES

1. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen DM. Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med (Lond)* (2010) 60:277–86. doi: 10.1093/occmed/kqq081
2. European Agency for Safety and Health at Work. *Calculating the Cost of Work-related Stress and Psychological Risks*. Luxembourg: Publications Office of the European Union (2014).
3. Penz M, Siegrist J, Wekenborg MK, Rothe N, Walther A, Kirschbaum C. Effort-reward imbalance at work is associated with hair cortisol concentrations: Prospective evidence from the Dresden Burnout Study. *Psychoneuroendocrinology* (2019) 109:104399. doi: 10.1016/j.psyneuen.2019.104399
4. Beck DB, Breutmann N, Fergen A, Gregersen S, Morschhäuser M, Reddehase B, et al. Empfehlungen zur Umsetzung der Gefährdungsbeurteilung psychischer Belastung. In: *Leitung des GDA-Arbeitsprogramms Psyche, c/o Bundesministerium für Arbeit und Soziales. Bundesministerium für Arbeit und Soziales* (2017).
5. Aust B, Rugulies R, Skakon J, Scherzer T, Jensen C. Psychosocial work environment of hospital workers: validation of a comprehensive assessment scale. *Int J Nurs Stud* (2007) 44:814–25. doi: 10.1016/j.ijnurstu.2006.01.008
6. Salston M, Figley CR. Secondary traumatic stress effects of working with survivors of criminal victimization. *J Traumat Stress* (2003) 16:167–74. doi: 10.1023/A:1022899207206
7. Dominguez-Gomez E, Rutledge DN. Prevalence of secondary traumatic stress among emergency nurses. *J Emerg Nurs* (2009) 35:199–204. doi: 10.1016/j.jen.2008.05.003
8. Ratrout HF, Hamdan-Mansour AM. Secondary traumatic stress among emergency nurses: Prevalence, predictors, and consequences. *Int J Nurs Pract* (2020) 26:e12767. doi: 10.1111/ijn.12767: e12767
9. Duffy E, Avalos G, Dowling M. Secondary traumatic stress among emergency nurses: a cross-sectional study. *Int Emerg Nurs* (2015) 23:53–8. doi: 10.1016/j.ienj.2014.05.001
10. Salimi S, Pakpour V, Rahmani A, Wilson M, Feizollahzadeh H. Compassion Satisfaction, Burnout, and Secondary Traumatic Stress Among Critical Care Nurses in Iran. *J Transcult Nurs* (2020) 31:59–66. doi: 10.1177/1043659619838876
11. Quinal L, Harford S, Rutledge DN. Secondary traumatic stress in oncology staff. *Cancer Nurs* (2009) 32:E1–7. doi: 10.1097/NCC.0b013e31819ca65a
12. Partlak Gunusen N, Ustun B, Sercekus Ak P, Buyukkaya Besen D. Secondary traumatic stress experiences of nurses caring for cancer patients. *Int J Nurs Pract* (2019) 25:e12717. doi: 10.1111/ijn.12717
13. Young JL, Derr DM, Cicchillo VJ, Bressler S. Compassion satisfaction, burnout, and secondary traumatic stress in heart and vascular nurses. *Crit Care Nurs Q* (2011) 34:227–34. doi: 10.1097/CNQ.0b013e31821c67d5
14. Kintzle S, Yarvis JS, Bride BE. Secondary traumatic stress in military primary and mental health care providers. *Mil Med* (2013) 178:1310–5. doi: 10.7205/MILMED-D-13-00087
15. Beck CT, Gable RK. A mixed methods study of secondary traumatic stress in labor and delivery nurses. *J Obstet Gynecol Neonatal Nurs* (2012) 41:747–60. doi: 10.1111/j.1552-6909.2012.01386.x
16. Mangoulia P, Koukia E, Alevizopoulos G, Fildissis G, Katostaras T. Prevalence of Secondary Traumatic Stress Among Psychiatric Nurses in Greece. *Arch Psych Nurs* (2015) 29:333–8. doi: 10.1016/j.apnu.2015.06.001
17. Kellogg MB, Knight M, Dowling JS, Crawford SL. Secondary Traumatic Stress in Pediatric Nurses. *J Pediatr Nurs* (2018) 43:97–103. doi: 10.1016/j.pedn.2018.08.016
18. Beck CT, Cusson RM, Gable RK. Secondary Traumatic Stress in NICU Nurses: A Mixed-Methods Study. *Adv Neonatal Care* (2017) 17:478–88. doi: 10.1097/ANC.0000000000000428
19. Beck CT. Secondary traumatic stress in nurses: a systematic review. *Arch Psych Nurs* (2011) 25:1–10. doi: 10.1016/j.apnu.2010.05.005
20. Schneider A, Lefering R, Neugebauer E. Examination of quality criteria of the Freiburger Screening Fragebogen to identify patients at risk for the development of a post-traumatic stress disorder in the group of severely injured accident patients. *Z Psychiatr Psych Ps* (2011) 59:241–50.
21. Lowe B, Kroenke K, Grafe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *J Psychosom Res* (2005) 58:163–71. doi: 10.1016/j.jpsychores.2004.09.006
22. Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder - The GAD-7. *Arch Intern Med* (2006) 166:1092–7. doi: 10.1001/archinte.166.10.1092
23. Manea L, Gilbody S, Hewitt C, North A, Plummer F, Richardson F, et al. Identifying depression with the PHQ-2: A diagnostic meta-analysis. *J Affect Disord* (2016) 203:382–95. doi: 10.1016/j.jad.2016.06.003
24. Plummer F, Manea L, Trepel D, McMillan D. Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic metaanalysis. *Gen Hosp Psychiatry* (2016) 39:24–31. doi: 10.1016/j.genhosppsych.2015.11.005
25. Prumper J, Hartmannsgruber K, Frese M. Kfza - a Short Questionnaire for Job Analysis. *Z Arb Organ* (1995) 39:125–32.
26. Hensel JM, Ruiz C, Finney C, Dewa CS. Meta-analysis of risk factors for secondary traumatic stress in therapeutic work with trauma victims. *J Traum Stress* (2015) 28:83–91. doi: 10.1002/jts.21998

27. Sodeke-Gregson EA, Holttum S, Billings J. Compassion satisfaction, burnout, and secondary traumatic stress in UK therapists who work with adult trauma clients. *Eur J Psychotraumatol* (2013) 4:1–10. doi: 10.3402/ejpt.v4i0.21869
28. Simon CE, Pryce JG, Roff LL, Klemmack D. Secondary traumatic stress and oncology social work: protecting compassion from fatigue and compromising the worker's worldview. *J Psychosoc Oncol* (2005) 23:1–14. doi: 10.1300/J077v23n04_01
29. Gariepy G, Honkaniemi H, Quesnel-Vallee A. Social support and protection from depression: systematic review of current findings in Western countries. *Br J Psych* (2016) 209:284–93. doi: 10.1192/bjp.bp.115.169094
30. Wang J, Mann F, Lloyd-Evans B, Ma R, Johnson S. Associations between loneliness and perceived social support and outcomes of mental health problems: a systematic review. *BMC Psychiatry* (2018) 18:156. doi: 10.1186/s12888-018-1736-5
31. Davey MM, Cummings G, Newburn-Cook CV, Lo EA. Predictors of nurse absenteeism in hospitals: a systematic review. *J Nurs Manag* (2009) 17:312–30. doi: 10.1111/j.1365-2834.2008.00958.x
32. Demerouti E, Bakker AB, de Jonge J, Janssen PP, Schaufeli WB. Burnout and engagement at work as a function of demands and control. *Scand J Work Environ Health* (2001) 27:279–86. doi: 10.5271/sjweh.615
33. Mastenbroek NJ, Demerouti E, van Beukelen P, Muijtjens AM, Scherpbier AJ, Jaarsma AD. Measuring potential predictors of burnout and engagement among young veterinary professionals; construction of a customised questionnaire (the Vet-DRQ. *Vet Rec* (2014) 174:168. doi: 10.1136/vr.101761
34. Denollet J. DS14: standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosom Med* (2005) 67:89–97. doi: 10.1097/01.psy.0000149256.81953.49
35. Mommersteeg PM, Denollet J, Martens EJ. Type D personality, depressive symptoms and work-related health outcomes. *Scand J Public Health* (2012) 40:35–42. doi: 10.1177/1403494811421533
36. Schiffer AA, Pedersen SS, Widdershoven JW, Hendriks EH, Winter JB, Denollet J. The distressed (type D) personality is independently associated with impaired health status and increased depressive symptoms in chronic heart failure. *Eur J Cardiovasc Prev Rehabil* (2005) 12:341–6. doi: 10.1097/01.hjr.0000173107.76109.6c
37. Mols F, Denollet J. Type D personality in the general population: a systematic review of health status, mechanisms of disease, and work-related problems. *Health Qual Life Outcomes* (2010) 23(8):9. doi: 10.1186/1477-7525-8-9
38. Duan-Porter W, Hatch D, Pendergast JF, Freude G, Rose U, Burr H, et al. 12-month trajectories of depressive symptoms among nurses-Contribution of personality, job characteristics, coping, and burnout. *J Affect Disord* (2018) 234:67–73. doi: 10.1016/j.jad.2018.02.090
39. Marjanovic Z, Greenglass ER, Coffey S. The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. *Int J Nurs Stud* (2007) 44:991–8. doi: 10.1016/j.ijnurstu.2006.02.012
40. Wazqar DY, Kerr M, Regan S, Orchard C. An integrative review of the influence of job strain and coping on nurses' work performance: Understanding the gaps in oncology nursing research. *Int J Nurs Sci* (2017) 4:418–29. doi: 10.1016/j.ijnss.2017.09.003
41. Jun D, O'Leary S M, McPhail S. Johnston V: Job strain and psychological distress in office workers: The role of coping. *Work* (2019) 64:55–65. doi: 10.3233/PWOR-192968
42. Kellogg MB, Dowling JS, Knight M, Crawford SL. Validating the Secondary Traumatic Stress Scale for Pediatric Nurses. *J Nurs Meas* (2018) 26:E114–26. doi: 10.1891/1061-3749.26.3.E114
43. Malachowski M. Understanding Mental Disorders: Your Guide to DSM-5, by the American Psychiatric Association. *Med Ref Serv Q* (2016) 35:467–8. doi: 10.1080/02763869.2016.1220766
44. Gates DM, Gillespie GL. Secondary traumatic stress in nurses who care for traumatized women. *J Obstet Gynecol Neonatal Nurs* (2008) 37:243–9. doi: 10.1111/j.1552-6909.2008.00228.x
45. Gates DM, Gillespie GL. Secondary traumatic stress in nurses who care for traumatized women. *J Obstet Gynecol Neonatal Nurs* (2008) 37:243–9. doi: 10.1111/j.1552-6909.2008.00228.x
46. Parker SK, Sprigg CA. Minimizing strain and maximizing learning: the role of job demands, job control, and proactive personality. *J Appl Psychol* (1999) 84:925–39. doi: 10.1037/0021-9010.84.6.925
47. Townsend SM, Campbell R. Organizational correlates of secondary traumatic stress and burnout among sexual assault nurse examiners. *J Forensic Nurs* (2009) 5:97–106. doi: 10.1111/j.1939-3938.2009.01040.x
48. Townsend SM, Campbell R. Organizational correlates of secondary traumatic stress and burnout among sexual assault nurse examiners. *J Forensic Nurs* (2009) 5:97–106. doi: 10.1111/j.1939-3938.2009.01040.x
49. Rourke MT. Compassion fatigue in pediatric palliative care providers. *Pediatr Clin North Am* (2007) 54:631–44. doi: 10.1016/j.pcl.2007.07.004

Conflict of Interest: KK has received speaker honoraria by Servier, EliLilly, Berlin Chemie, and Janssen-Cilag.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 07 May 2020
doi: 10.3389/fpsyt.2020.00371

Factors Associated With a Higher Score of Burnout in a Population of 860 French Psychiatrists

Philippe Nuss[1,2*], *Cedric Tessier*[1], *Marc Masson*[3,4], *Philippe Fossati*[5,6,7], *Raphaël Gaillard*[8], *Nathanaël Lapidus*[9] *and David Gourion*[4,10]

[1] AP-HP, Service de Psychiatrie et de Psychologie Médicale, Hôpital Saint-Antoine, Paris, France, [2] Sorbonne Université, INSERM, Centre de Recherche Saint-Antoine, CRSA, UMRS 938, Paris, France, [3] Nightingale Hospitals, Château de Garches Clinic, Garches, France, [4] Department of Psychiatry, Sainte-Anne Hospital, Paris, France, [5] Institut du cerveau et de la moelle epiniere, INSERM U 1127, Paris, France, [6] Sorbonne Université, CNRS UMR 7225, Paris, France, [7] AP-HP, Department of Adult Psychiatry, Pitie Salpetriere Hospital, Paris, France, [8] Centre Hospitalier Sainte Anne, Service Hospitalo-universitaire de Psychiatrie, Paris, France, [9] Sorbonne Université, INSERM, Institut Pierre Louis d'Epidémiologie et de Santé Publique IPLESP, AP-HP.Sorbonne Université, Public Health Department, Saint-Antoine Hospital, Paris, France, [10] Hautes etudes de commerce (HEC) Paris Business School, Jouy-en-Josas, France

OPEN ACCESS

Edited by:
Kai G. Kahl,
Hannover Medical School, Germany

Reviewed by:
Guillaume B. Fond,
Assistance Publique Hôpitaux de Marseille, France
Serge Brand,
University Psychiatric Clinic Basel, Switzerland
Julian Moeller,
University Psychiatric Clinic Basel, Switzerland

***Correspondence:**
Philippe Nuss
nuss.philippe@gmail.com

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *02 August 2019*
Accepted: *14 April 2020*
Published: *07 May 2020*

Citation:
Nuss P, Tessier C, Masson M, Fossati P, Gaillard R, Lapidus N and Gourion D (2020) Factors Associated With a Higher Score of Burnout in a Population of 860 French Psychiatrists. Front. Psychiatry 11:371. doi: 10.3389/fpsyt.2020.00371

Burnout rates are estimated to be twice as high among healthcare professionals as in the general working population, and studies indicate rising incidence. The present study aimed to identify the contextual factors associated with self-reported burnout rates among French psychiatrists. A total of 860 French or French-speaking psychiatrists completed an online questionnaire when they registered for a major psychiatric conference. The Copenhagen Burnout Inventory, a validated scale that independently appraises personal, work- and patient-related dimensions, was used to assess the degree of perceived burnout. Respondents were divided into lower risk and higher risk groups. The latter contained the 25% of individuals who scored the highest on each of the three dimensions of the CBI scale. Univariate analysis showed that private practice was associated with lower levels of risk on the personal and work-related dimensions. Working for the public sector and long hours were both associated with a higher score on the work-related dimension. Interestingly, none of the variables we investigated, except from poor atmosphere at work, correlated with the patient-related dimension. Among public-sector psychiatrists, female gender, longer hours, and more consultations per week were associated with a higher score on the work-related dimension. Working four or more night shifts per month was significantly associated with a higher score of burnout risk on all three dimensions. Private- and public-sector practitioners who mainly treated patients with schizophrenia had a higher score of burnout risk. Multivariate analysis showed that a poor atmosphere at work, longer hours, and working four or more night shifts were significantly associated with higher score of burnout risk. A nonreassuring working environment and more stressors while treating patients each had a possibly negative impact. Although this study only examined the factors that distinguish between clinicians with the lowest *versus* highest CBI

burnout risk scores, it opens up important avenues for research and development of programs to reduce burnout risk within the French healthcare system.

Keywords: burnout - professional, psychology, psychiatrist, public - private, risk factors, stressful life events

INTRODUCTION

Burnout is classically observed in the occupational context and is most often described among human service workers. Burnout is characterized either causally, as "a state of physical, emotional and mental exhaustion that results from long-term involvement in work situations that are emotionally demanding" (1), or conceptually, as "weariness or exasperation brought about by the individual's dedication to a cause or way of life that failed to meet their expectations" (2). Taxonomically speaking, burnout refers to stress (3), but this occupational phenomenon is not classified as a medical condition. The commonly used triad describing burnout as emotional exhaustion, depersonalization, and low sense of personal accomplishment related to one's work (4) was proposed in the wake of the original formulation of *occupational burnout* by Herbert J. Freudenberger (5). The conceptualization of burnout was recently refined in the ICD-11 classification (3). Here, burnout refers to a pathological condition related to significant and prolonged stress in the workplace attributed to work overload, inadequate resources to meet the demands of work, limited control over one's work schedule and lack of autonomy, and inadequate support from colleagues, supervisors, and coworkers. The core criteria of burnout include feelings of energy depletion or exhaustion, increased mental distance from one's job (or feelings of negativity or cynicism related to one's job), and reduced professional efficacy. The potential overlap between burnout and depression is still subject to debate (6–9), despite a large body of research pointing to a continuum between these two constructs (10). Because of the lack of categorical criteria for burnout, studies compare scores yielded by dimensional psychopathological scales of both burnout and depression but without the ability to use categorical cut-offs to decide whether these entities are discrete or continuous. In addition, depressogenic and burnout factors can coexist within a given working environment and variously affect individuals, blurring the psychopathological picture.

Psychiatrists are vulnerable to experiencing burnout, partly for reasons common to all healthcare professionals, partly for reasons specific to their activity. First, psychiatrists are both the instigators and the tools of their patients' treatment. An incompressible amount of personal emotional involvement and shared values is intimately bound up with a technical determination to achieve treatment effectiveness (11). Working while still in their residency with marginalized populations or in a context of suicide and violence—a frequent situation in public-sector practice—is liable to increase practitioners' risk of burnout (11). Another predisposing and precipitating factor in psychiatrists is the frequency of role conflict conditions in the work setting (12). While psychiatrists are trained to appraise symptoms, foresee changes along a lifelong trajectory, and use a verbal approach, they are often required to deliver short-term and mainly biological treatment responses (13). In addition, psychiatrists may have predisposing personality traits such as neuroticism, compared with physicians in other disciplines (14), and may be more prone to internalize their stressful experiences (15). Factors external to the doctor–patient therapeutic relationship, such as working conditions, may be yet more potent stressors for psychiatrists, just as they are detrimental for all physicians. These factors can contribute to the risk either directly, by inducing stress, or indirectly, by reducing psychiatrists' ability to build the therapeutic alliance required for treatment to be effective. The rapidly changing modes of service delivery, combined with limited resources, conflicting and paradoxical injunctions from government and healthcare/corporate management, and an ever heavier clerical burden are highly distressing to practitioners as they undermine the core conditions for care (16–18). Organizational factors, such as negative leadership behaviors and time-consuming bureaucratic issues, along with the general public's ambivalence toward psychiatry and psychiatrists, further contribute to occupational burnout (16, 17, 19, 20). Moreover, the increasing complexity and rapidity of change in the understanding of mental disorders, in terms of classification, neurobiology, psychopharmacology, and desirable outcome, contrast with the oversimplified and rapidly changing objectives and assessment tools adopted by institutions to measure clinical performance (13). Interestingly, despite these hurdles, medical doctors continue to express a strong desire to provide good-quality care, regardless of circumstances, and display engagement characterized by vigor, dedication, and absorption in work, which may well heighten the risk of burnout risk (21).

There is a striking absence of consensus on an operational definition of burnout, and this was highlighted in a recently published meta-analysis of 182 studies on burnout involving 109,628 individuals in 45 countries published between 1991 and 2018 (22). At least 142 unique definitions were found to describe overall burnout or burnout subscale criteria. Political, managerial, and ultimately financial hurdles, along with genuine scientific issues, may explain this flagrant lack of an agreed definition despite a growing burnout epidemic.

For the present study, we chose the Copenhagen Burnout Inventory (CBI) (23) over the Maslach Burnout Inventory (MBI) (4), which is mostly based on the notion of depersonalization, and is more quantitative than qualitative. Symptoms in psychiatry are mostly put into perspective and considered in a web of interactions and meanings, rather than being considered in isolation. This requires clinicians to combine a subjective style in their relations with patients and a rigorously analytic approach in order to gain an overall picture. This is why the MBI, which refers to work independently of how it is practiced, seems less suited to psychiatrists. By contrast, the CBI includes a patient-

related subcomponent and appraises the perceived distance between clinicians' expectations and their experienced reality and expectations, and this is therefore the tool we chose. Alongside the patient-related dimension, the CBI independently measures the personal and work-related dimensions that can shed light on the stressful effects of personality traits and working conditions. Our aim was to examine the factors that differentiate between clinicians with lower *versus* higher CBI burnout risk scores in each of the patient-, personal-, and work-related dimensions.

PARTICIPANTS AND METHODS

Participants

The sample comprised French or French-speaking psychiatrists from both the public and private sectors. An invitation to fill in an online questionnaire designed to appraise the risk of burnout was displayed on the registration page of Encéphale, a major psychiatric conference held in France each year. There were no specific incentives for filling in this questionnaire. This study was exempt from ethics approval as the French Ethics law on experimentation on humans (Loi Jardé, 12–17 June 2017, in accordance with the Declaration of Helsinki) clearly states that the evaluation of the professional practices is not under its supervision. This information has been confirmed after solicitation by the Saint-Antoine Ethical Committee on May 29 2019.

Burnout Scale

The CBI scale is composed of three independent subscales measuring personal- (6 items), work- (7 items), and patient- (6 items) related dimensions. The responses for twelve items are graduated in frequencies along a five-point Likert scale ranging from 'never/almost never' (0) to 'always' (4). The seven remaining items are categorized in intensity ranging from 'a very low degree' (0) to 'to a very high degree' (4). CBI scores were calculated for each dimension by summing the scores on all the relevant items for each participant. Personal questions in the CBI include "How often do you feel emotionally exhausted?" and "How often do you feel weak and susceptible to illness?" Work-related burnout is appraised *via* questions such as "Is your work emotionally exhausting?" and "Do you feel that every working hour is tiring for you?", while the patient-related dimension is evaluated with questions like "Do you find it hard to work with patients?" and "Do you sometimes wonder how long you will be able to continue working with patients?"

Additional Questions

Participants were asked four additional contextual questions. For the first one, they had to evaluate their workplace climate on a 3-point scale: 1 (*Reassuring*), 2 (*Stressful*), and 3 (*Extremely stressful*). Responses to the remaining three questions were provided on a 3-point scale: 1 (*Not at all*), 2 (*A little*), and 3 (*A lot*). They explored (i) the extent to which new societal demands for care/new challenges were affecting their perceived stress, (ii) the impact that rapid advances in scientific knowledge or imposed guidelines were having on their practice, and (iii) whether they were confronted with stressful situations in the course of their clinical practice.

Participants were also given a space where they could express themselves anonymously and add comments about their perceived stress.

Definitions of At-Risk Groups

In the first analysis, a total CBI score was obtained for each dimension by summing the scores on the relevant items for each participant. Three severity groups were initially identified: nonvulnerable (<50% of total CBI score), vulnerable (50-74% of total CBI score), and at-risk (≥75% of total CBI score). However, there were too few participants in the at-risk groups to conduct statistical comparisons, with just 12.1% for the personal-related score, 7.8% for the work-related score, and 2.3% for the patient-related score, and ultimately only 4% when the three CBI dimensions scores were summed.

In the second analysis, we sought to determine a cut-off score to identify a more suitable at-risk group in the context of the present survey. We found a compromise between identifying individuals with the highest total CBI score and forming a large enough sample to run comparisons in order to study the factors associated with a higher risk of burnout. Reasoning that a higher-risk population could be identified independently of the total CBI score, we defined it as the 25% of individuals who scored the highest on each of the three dimensions.

Statistical Analysis

For each CBI subscale, responses of higher-risk (HR) and lower-risk (LR) groups were described as mean ± standard deviation for quantitative variables and counts (percentages) for categorical variables. Results were stratified according to responders' practice (public *vs.* private). In a univariate analysis, responses were compared between HR and LR groups with the use of Mann–Whitney–Wilcoxon tests for quantitative variables and Fisher's exact tests for categorical variables. A multivariate logistic regression model selection was carried out to identify variables independently associated with HR on the global CBI scale, using the Akaike information criterion (AIC). Logistic regression results are reported with odds ratios (OR) with their 95% confidence intervals (CI). For all tests, differences were considered significant at the 0.05 threshold. All analyses were performed using R Statistical Software version 3.5 (Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Participants

A total of 1,010 online questionnaires were filled in, of which 860 were submitted prior to the conference and included in this analysis. Women represented 59.1% of respondents, with a higher proportion among public-sector practitioners than among private-sector ones (63.9 *vs.* 47.9%). The participants'

TABLE 1 | Variables studied for the personal dimension of the Copenhagen Burnout Inventory Values and statistical significance for the comparison between lower (LR) and higher (HR) risk of burnout are provided for the whole sample and the public- and private-sector subsamples.

Personal Dimension	Total Population (N = 840)			Public sector (n = 587)			Private sector (n = 253)		
Burnout Risk Variables	**LR**	**HR**	***p***	**LR**	**HR**	***p***	**LR**	**HR**	***p***
Female n (%)	353 (56.5)	142 (66.0)	0.016	254 (61.2)	120 (69.8)	0.059	99 (47.1)	22 (51.2)	0.737
Mean age in years (SD)	46.1 (12.3)	43.6 (11.5)	0.016	43.4 (12.2)	42.0 (11.3)	0.399	51.6 (10.6)	50.2 (9.9)	0.446
Sector n (%)			<0.001			0.925			N/A
Private	210 (33.6)	43 (20.0)		0	0		210 (83.0)	43 (17.0)	
Public	260 (41.6)	109 (50.7)		260 (62.7)	109 (63.4)		0	0	
Mixed	155 (24.8)	63 (29.3)		155 (37.3)	63 (36.6)		0	0	
Place of work n (%)			<0.001			0.738			0.006
Private sector	166 (26.6)	28 (13.0)		4 (1.0)	1 (0.6)		162 (78.3)	27 (67.5)	
University hospital	91 (14.6)	37 (17.2)		91 (21.9)	36 (20.9)		0	0	
General hospital	50 (8.0)	23 (10.7)		46 (11.1)	23 (13.4)		4 (1.9)	0	
Psychiatric hospital	146 (23.4)	79 (36.7)		144 (34.7)	75 (43.6		2 (1)	4 (10)	
Consultation clinic	57 (9.1)	14 (6.5)		57 (13.7)	14 (8.1)		0	0	
Other	115 (18.4)	34 (15.8)		73 (17.6)	23 (13.4)		39 (18.8)	9 (22.5)	
No. years after graduation n (%)			0.011			0.257			0.337
Residency	37 (5.9)	18 (8.4)		37 (8.9)	18 (10.5)		0 (0)	0 (0)	
1–5	141 (22.6)	58 (27.0)		121 (29.2)	53 30.8)		20 (9.5)	5 (11.6)	
6–10	88 (14.1)	32 (14.9)		64 (15.4)	27 (15.7)		24 (11.4)	5 11.6)	
11–20	117 (18.7)	44 (20.5)		63 (15.2)	30 (17.4)		54 (25.7)	14 (32.6)	
More than 20	242 (38.7)	63 (29.3)		130 (31.3)	44 (25.6)		112 (53.3)	19 (44.2)	
Atmosphere at work n (%)			<0.001			<0.001			0.067
Very difficult	8 (1.3)	19 (8.8)		8 (1.9)	17 (9.9)		0 (0)	2 (4.7)	
Difficult	84 (13.4)	58 (27).0		73 (17.6)	51 (29.7)		11 (5.2)	7 (16.3)	
Good	352 (56.3)	104 (48.4)		270 (65.1)	93 (54.1)		82 (39.0)	11 (25.6)	
Excellent	109 (17.4)	19 (8.8)		59 (14.2)	10 (5.8)		50 (23.8)	9 (20.9)	
No answer	72 (11.5)	15 (7.0)		5 (1.2)	1 (0.6)		67 (31.9)	14 (32.6)	
Mean no. hours worked per week (SD)	43.1 (11.0)	45.5 (10.3)	<0.001	42.4 (10.5)	45.1 (9.6)	<0.001	44.4 (11.9)	47.4 (12.7)	0.110
Mean no. consultations per week (SD)	45.6 (33.1)	42.2 (29.5)	0.266	33.7 ((23.6)	36.1 (25.8)	0.412	69.1 (36.4)	66.8 (30.7)	0.904
Mean no. night shifts per month (SD)	–	–	N/A	1.94 (2.2)	2.35 (2.6)	0.146	–	–	N/A
No. night shifts per month			N/A			0.056	–	–	N/A
0–3 (SD)	–			351 (84.6)	134 (77.9)		–	–	
4 or more (SD)	–			64 (15.4)	38 (22.1)		–	–	
Main disorder treated by category			<0.001			0.004			<0.001
Addiction	28 (4.5)	10 (4.7)		25 (6.0)	7 (4.1)		3 (1.4)	3 (7.0)	
Autism	16 (2.6)	18 (8.4)		16 (3.9)	17 (9.9)		0 (0)	1 (2.3)	
Schizophrenia/psychosis	187 (29.9)	88 (40.9)		182 (43.9)	82 (47.7		5 (2.4)	6 (14.0)	
Anxiety disorders	72 (11.5)	7 (3.3)		27 (6.5)	4 (2.3		45 (21.4)	3 (7.0)	
Mood disorders	262 (41.9)	68 (31.6)		130 (31.3)	41 (23.8)		132 (62.9)	27 (62.8)	
Personality disorders	60 (9.6)	24 (11.2)		35 (8.4)	21 (12.2)		25 (11.9)	3 (7.0)	
Head of department n (%)	133 (21.3)	56 (26.0)	0.155	115 (27.7)	51 (29.7)	0.614	18 (8.6)	5 (11.9)	0.559
Working alone n (%)	159 (25.4)	47 (21.9)	0.313	43 (10.4)	21 (12.2)	0.561	116 (55.2)	26 (60.5	0.614

mean age was 45.5 years (public: 42.9 ± 11.9 years; private: 51.4 ± 10.5 years, $p < 0.001$).

CBI Scores

Cronbach's alpha estimations [95% confidence interval] for personal, work-related, and patient-related subscales were 0.90 [0.89, 0.91], 0.90 [0.89, 0.91], and 0.89 [0.88, 0.90], respectively. We divided the sample into two groups: LR *versus* HR. The HR group contained the 25% of individuals who scored the highest on each of the three CBI dimensions. Results are set out for each dimension, first for the whole sample, then for public- *versus* private-sector practitioners (**Tables 1**–**3**). Interestingly, for the patient-related dimension, the HR and LR groups did not differ on associated variables (except for a poor atmosphere at work), indicating that the patient-doctor relationship barely contributed to severity in the HR group.

Univariate Analysis

Whole Sample

Personal Dimension

There were more female than male psychiatrists in the HR group for the personal dimension of the CBI (66.0 *vs*. 56.5%, $p = 0.016$). Mean age was lower for HR than for LR (43.6 *vs.* 46.1 years; $p = 0.016$). Private practice was associated with a lower risk of burnout on this dimension (17.0 *vs.* 29.3% for public practice, $p < 0.001$), prompting us to stratify the sample into public- *versus* private-sector practitioners. There was higher proportion of more experienced physicians in the LR group than in the HR group. Unsurprisingly, a good atmosphere at work was less frequent in the HR group (61.5 *vs.* 83.4%, $p < 0.001$). The number of hours worked per week was higher for the HR group (45.5 *vs*. 43.1 h, $p = 0.001$) (**Figure 1**). Among all treated disorders and compared to LR, the proportion of

TABLE 2 | Variables studied for the work-related dimension of the Copenhagen Burnout Inventory.

Work-Related Dimension	Total population (N = 840)			Public sector (n = 587)			Private sector (n = 252)		
Burnout Risk Variables	**LR**	**HR**	***p***	**LR**	**HR**	***p***	**LR**	**HR**	***p***
Female n (%)	333 (56.7)	157 (63.1)	0.091	239 (68.8)	130 (60.5)	0.054	94 (49.0)	27 (45.0)	0.658
Mean age in years (SD)	45.8 (12.4)	44.6 (11.4)	0.259	42.9 (12.1)	43.0 (11.5)	0.646	51.9 (10.7)	49.4 (9.6)	0.102
Sector n (%)			0.015			0.169			N/A
Private	192 (32.7)	60 (24.1)		0 (0.0)	0		192 (76.2)	60 (23.8)	
Public	241 (41.1)	127 (51.0)		241 (61.0)	127 (67.2)		0	0	
Mixed	154 (26.2)	62 (24.9)		154 (39.0)	62 (32.8)		0	0	
Place of work n (%)			0.013			0.134			0.429
Private sector	149 (25.4)	45 (18.1)		3 (0.8)	2 (1.1)		146 (76.0)	43 (71.7)	
University hospital	92 (15.7)	35 (14.1)		92 (23.3)	34 (18.0)		0 (0.0)	0 (0.0)	
General hospital	44 (7.5)	29 (11.6)		41 (10.4)	28 (14.8)		3 (1.6)	1 (1.7)	
Psychiatric hospital	141 (24.0)	81 (32.5)		137 (34.7)	79 (41.8)		4 (2.1)	2 (3.3)	
Consultation clinic	48 (8.2)	23 (9.2)		48 (12.2)	23 (12.2)		0 (0.0)	0 (0.0)	
Other	113 (19.2)	36 (14.5)		74 (18.8)	23 (12.2)		39 (20.4)	13 (21.7)	
No. years after graduation (%)			0.384			0.722			0.191
Residency	36 (6.1)	18 (7.2)		36 (9.1)	18 (9.5)		0 (0.0)	0 (0.0)	
1–5	139 (23.7)	60 (24.1)		119 (30.1)	35 (29.1)		20 (10.4)	5 (8.3)	
6–10	85 (14.5)	35 (14.1)		66 (16.7)	25 (13.2)		19 (9.9)	10 (16.7)	
11–20	106 18.1)	53 (21.3)		58 (14.7)	34 (18.2)		48 (25.0)	19 (31.7)	
More than 20	221 (37.6)	83 (33.3)		116 (29.4)	57 (30.2)		105 (54.7)	26 (43.3)	
Atmosphere at work n (%)			<0.001			<0.001			0.009
Very difficult	8 (1.4)	19 (7.6)		8 (2.0)	17 (9.0)		0 (0.0)	2 (3.3)	
Difficult	80 (13.6)	63 (25.3)		72 (18.2)	53 (28.0)		8 (4.2)	10 (16.7)	
Good	329 (56.0)	124 (49.8)		254 (64.3)	105 (55.6)		75 (39.1)	19 (31.7)	
Excellent	104 (17.7)	23 (9.2)		57 (14.4)	12 (6.3)		47 (24.5)	11 (18.3)	
No answer	66 (11.2)	20 (8.0)		4 (1.0)	2 (1.1)		62 (32.3)	18 (30.0)	
Mean no. hours worked per week (SD)	42.8 (11.0)	45.8 (10.3)	< 0.001	42.3 (10.5)	44.9 (9.7)	0.009	43.7 (12.1)	48.6 (11.9)	0.003
Mean no. consultations per week (SD)	44.1 (32.6)	45.8 (31.0)	0.270	32.8 (23.6)	37.5 (25.9)	0.035	67.3 (36.2)	71.9 (31.7)	0.163
Mean no. night shifts per month (SD)	–	–	N/A	1.96 (2.19)	2.32 (2.60)	0.317	–	–	NA
No. night shifts per month			N/A			0.080			NA
0–3 (SD)	–	–		334 (84.6)	148 (78.3)		–	–	
4 or more (SD)	–	–		61 (15.4)	41 (21.7)		–	–	
Main disorder treated by category			<0.001			<0.001			0.905
Addiction	27 (4.6)	10 (4.0)		23 (5.8)	8 (4.2)		4 (2.1)	2 (3.3)	
Autism	19 (3.2)	15 (6.0)		19 (44.8)	14 (7.4)		0 (0.0)	1 (1.7)	
Schizophrenia/psychosis	170 (29.0)	104 (41.8)		164 (41.5)	99 (52.4)		6 (3.1)	5 (8.3)	
Anxiety disorders	66 (11.2)	13 (5.2)		25 (6.3)	6 (3.2)		41 (21.4)	7 (11.7)	
Mood disorders	255 (43.4)	74 (29.7)		134 (33.9)	37 (19.6)		121 (63.0)	37 (61.7)	
Personality disorders	50 (8.5)	33 (13.3)		30 (7.6)	25 (13.2)		20 (10.4)	8 (13.3)	
Head of department n (%)	122 (20.8)	65 (26.1)	0.084	107 (27.1)	58 (30.7)	0.325	15 (7.8)	7 (11.7)	0.431
Working alone n (%)	147 (25.0)	59 (23.7)	0.726	39 (9.9)	25 (13.2)	0.257	108 (56.2)	34 (56.7)	1

participants who mainly treated patients with mood disorders was lower in the HR group (30.0 *vs.* 40.9%, p = 0.004), whereas the proportion of participants who mainly treated schizophrenia/psychosis was higher in this group (41.9 *vs.* 31.6%, p = 0.008).

Work-Related Dimension

Women did not significantly predominate in the HR group when the work-related dimension was considered. Again, psychiatrists working in the private sector were significantly less prone to meet the criteria for a higher risk of burnout (23.8 *vs.* 32.5%, p = 0.013).The number of hours worked per week followed the same pattern as that described above for the personal dimension. Proportions of mood disorders and schizophrenia/psychosis as mainly treated disorders were again lower (29.7 *vs.* 43.4%, p = 0.0002) and higher (41.8 *vs.* 29.0%, p = 0.0004) in the HR group, respectively.

Patient-Related Dimension

Interestingly, psychiatrists did not describe the doctor-patient relationship as being associated with an increased risk of burnout, whichever associated variable or subsample was examined.

Psychiatrists Working in the Public Sector

A total of 587 psychiatrists defined themselves as working either exclusively or mainly in the public sector.

Personal Dimension

The proportion of female psychiatrists was higher in the HR group, though this difference was not significant (69.8 *vs.* 61.2%, p = 0.059). Neither age nor years after graduation was associated with a risk of personal burnout. The number of hours worked per week was higher in the HR group (45.1 *vs.* 42.4 h, p < 0.001), while good atmosphere at work was less frequent (60.2 *vs.* 80.2%

TABLE 3 | Variables studied for the patient-related dimension of the Copenhagen Burnout Inventory.

Patient-Related Dimension	Total population (N = 819)			Public sector (n = 601)			Private sector (n = 245)		
Burnout Risk Variables	**LR**	**HR**	***p***	**LR**	**HR**	***p***	**LR**	**HR**	***p***
Female n (%)	360 (60.0)	121 (55.3)	0.229	271 (64.7)	93 (60.0)	0.329	89 (49.2)	28 (43.8)	0.471
Mean age in years (SD)	45.4 (12.1)	45.3 (12.1)	0.880	43.0 (11.9)	42.5 (11.9)	0.587	50.9 (10.7)	52.0 (10.0)	0.506
Sector n (%)			0.937			0.846			NA
Private	181 (30.2)	64 (29.2)		0 (0)	0 (0)		181 (73.9)	64 (26.1)	
Public	263 (43.8)	99 (45.2)		263 (62.8)	99 (63.9)		0 (0)	0 (0)	
Mixed	156 (26.0)	56 (25.6)		156 (37.2)	56 (36.1)		0 (0)	0 (0)	
Place of work n (%)			0.282			0.344			0.636
Private sector	139 (23.2)	51 (23.3)		4 (1.0)	1 (0.6)		135 74.6)	50 (78.1)	
University hospital	98 (16.3)	26 (11.9)		98 (23.4)	26 (16.8)		0 (0)	0 (0)	
General hospital	51 (8.5)	20 (9.1)		48 (11.5)	20 (12.9)		3 (1.7)	0 (0)	
Psychiatric hospital	152 (25.3)	67 (30.6)		148 (35.3)	65 (41.9)		4 (2.2)	2 (3.1)	
Consultation clinic	47 (7.8)	22 (10.0)		47 (11.2)	62 (14.2)		0 (0)	0 (0)	
Other	113 (18.8)	33 (15.1)		74 (17.6)	21 (13.5)		39 (21.6)	12 (18.8	
No. years after graduation n (%)			0.973			0.555			0.407
Residency	40 (6.7)	14 (6.4)		40 (9.5)	14 (9.0)		0 (0)	0 (0)	
1–5	138 (23.0)	55 (25.1)		116 (27.7)	53 (34.2)		22 (12.2)	2 (3.1)	
6–10	95 (15.8)	25 (11.4)		72 (17.2)	19 (12.3)		23 (12.7)	6 (9.4)	
11–20	109 (18.2)	47 (21.5)		67 (16.0)	24 (15.5)		42 (23.2)	23 (35.9)	
More than 20	218 (36.8)	78 (35.6)		124 (29.6)	45 (29.0)		94 (51.9)	33 (51.6)	
Atmosphere at work n (%)			<0.001			<0.001			0.009
Very difficult	12 (2.0)	15 (6.8)		11 (2.6)	14 (9.0)		1 (0.6)	1 (1.6)	
Difficult	89 (14.8)	50 (22.8)		80 (19.1)	42 (27.1)		9 (5.0)	8 (12.5)	
Good	328 (54.7)	118 (53.9)		261 (62.3)	83 (60.0)		67 37.0)	25 (39.1)	
Excellent	109 (18.2)	14 (6.4)		62 (14.8)	5 (3.2)		47 (26.0)	9 (14.1)	
No answer	62 (10.3)	22 (10.0)		5 (1.2)	1 (0.6)		57 (31.5)	21 (32.8)	
Mean no. hours worked per week (SD)	43.7 (10.6)	44.4 (11.0)	0.299	43.3 (9.9)	43.3 (10.5)	0.809	44.5 (11.9)	47.1 (11.7)	0.154
Mean no. consultations per week (SD)	44.9 (29.9)	46.6 (32.7)	0.213	33.8 (23.9)	36.8 (25.7)	0.233	68.0 (36.0)	70.4 (32.5)	0.517
Mean no. night shifts per month (SD)	–	–	N/A	1.96 (2.23)	2.35 (2.52)	0.080	–	–	NA
No. night shifts per month			N/A			0.106			NA
0–3 (SD)	–	–		353 (84.2)	121 (78.1)		–	–	
4 or more (SD)	–	–		66 (15.8)	34 (21.9)		–	–	
Main disorder treated by category			0.254			0.271			0.388
Addiction	27 (4.5)	10 (4.6)		24 (5.7)	7 (4.5)		3 (1.7)	3 (4.7)	
Autism	21 (3.5)	13 (5.9)		21 (5.0)	12 (7.1)		0 (0)	1 (1.6)	
Schizophrenia/psychosis	185 (30.8)	81 (37.0)		177 (42.2)	78 (50.3)		8 (4.4)	3 (4.7)	
Anxiety disorders	61 (10.2)	16 (7.3)		26 (6.2)	5 (3.2)		35 (19.3)	11 (17.2)	
Mood disorders	246 (41.0)	78 (35.6)		129 (30.8)	40 (25.8)		117 (64.6)	38 (59.4)	
Personality disorders	60 (10.0)	21 (9.6)		42 (10.0)	13 (8.4)		18 (9.9)	9 (12.5)	
Head of department n (%)	136 (22.7)	47 (21.5)	0.776	120 (28.6)	42 (27.1)	0.754	16 (8.8)	5 (7.8)	1
Working alone n (%)	144 (24.0)	59 (26.9)	0.411	43 (10.3)	21 (13.5)	0.296	101 (55.8)	38 (59.4)	0.661

$p < 0.001$). Though psychiatrists working four or more night shifts per month were more frequent in the HR group, this difference was not significant (15.4 *vs.* 22.1%, $p = 0.056$).

Work-Related Dimension

The proportion of female psychiatrists was higher in the HR group, though this difference was not significant (68.8 *vs.* 60.5%, $p = 0.054$). The number of hours worked per week and number of consultations per week were significantly higher in the HR group (44.9 *vs.* 42.3 h, $p = 0.009$ and 37.5 *vs.* 32.8 consultations, $p = 0.035$). Schizophrenia/psychosis as mainly treated disorders was again more frequent in the HR group (52.4 *vs.* 41.6%, $p = 0.016$).

Psychiatrists Working in the Private Sector

A total of 253 psychiatrists defined themselves as working either exclusively or mainly in the private sector. As mentioned earlier, most of them were in the LR group. The number of hours worked per week was higher in the HR group (44.9 *vs.* 42.3 h, $p < 0.009$) in this subsample.

Multivariate Analysis

A multivariate analysis including all variables revealed that a poor atmosphere at work (OR: 2.88, 95% CI [1.97, 4.20]), more hours worked per week (OR: 1.23 [1.04, 1.47]), and four or more night shifts per month (OR: 1.63 [1.06, 2.48]) were independently associated with HR on the global CBI scale.

Contextual Questions

We also asked questions enabling us to appraise more qualitatively the perceived conditions of the psychiatrists' working environment. In particular, they allowed us to pinpoint the nature of the stress associated with work, disentangling stress generated by the workplace climate from stress caused by actual clinical practice. We also distinguished

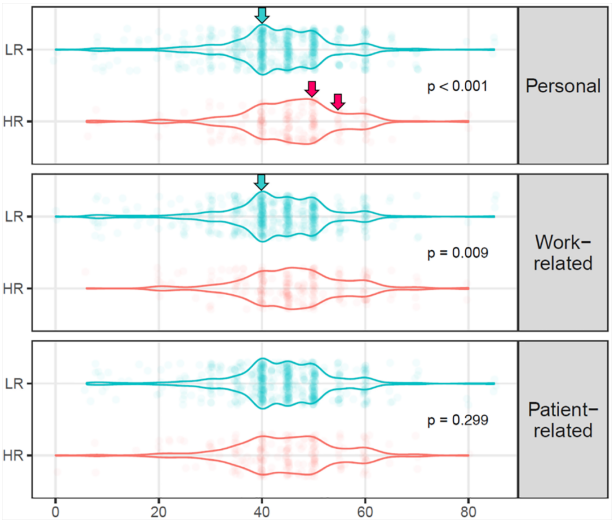

FIGURE 1 | Distribution of the number of hours worked per week by participants in the HR and LR groups for the personal and work- and patient-related dimensions of burnout. Arrows indicate the differences in distribution.

between potential external occupational stressors brought about by new challenges and by changes in society and expectations of care and possible internal ones arising from changes within the psychiatric culture, such as the growing predominance of a neuroscience-based approach to care or the imposition of guidelines.

Figure 2 shows that stress caused by the working environment and stress generated by clinical practice were both highly significantly associated with a high risk of burnout across all groups (total sample, public- and private-sector subsamples) and dimensions. Social pressure and expectations of care, together with new challenges in psychiatric practice, were also seen as significant stressors by participants in the HR group. By contrast, the neuroscience-based approach and imposition of guidelines distinguished less clearly between the LR and HR groups, with nonsignificant mean differences for the personal dimension in the private-sector subsample.

Additional Comments

Participants were also invited to freely express themselves about any topic they chose at the end of the questionnaire. In both the LR and HR groups, practitioners stated that, far from being wearisome, taking care of patients was often rewarding. They also acknowledged the deterioration in working conditions, with the burden of clerical work increasing at the cost of patient care. In contrast to the LR group, practitioners in the HR group indicated that they had taken (or were planning to do so in the near future) important decisions about their working status. Several psychiatrists, all in the HR group, stated that they had (or were about to) resigned from their position of public-sector practitioner/head of department or planned to take early retirement. They often described what had triggered this decision (*e.g.* "It was after a week of total insomnia related to the sudden accumulation of administrative demands: bed closures, merging of departments, and certification"). Most of the "recently resigned from the public sector" or "early-retirement prone" individuals stated that their decision had been taken "despite several years voluntarily shouldering major institutional responsibilities" and having "regretfully noted the lack of respect for, and usefulness of this additional work", along with "ceaseless reorganizations".

DISCUSSION

Results indicated that the 25% of psychiatrists with the highest total CBI scores differed significantly from those with lower CBI scores. In particular, female gender, younger age, practising in the public sector, and working longer hours each week were associated with higher personal burnout scores. Public sector and longer hours were also associated with higher work-related burnout scores. Interestingly, none of the variables we studied, with the exception of a poor atmosphere at work (invariably deleterious), was associated with a higher patient-related burnout score, indicating that the patient-doctor relationship barely contributed at all to burnout in this sample of psychiatrists.

Working longer hours was associated with the highest risk score group of work-related burnout in both public and private sector practitioners, as well as number of consultations per week within the public practice sample. When adjusted on the private practice status, working four or more night shifts per month was significantly associated with a higher risk score of burnout on the personal, work-, and patient-related dimensions. Not surprisingly, a poor atmosphere at work was associated with a higher risk score of burnout. The proportion of private practitioners treating people with schizophrenia was higher in

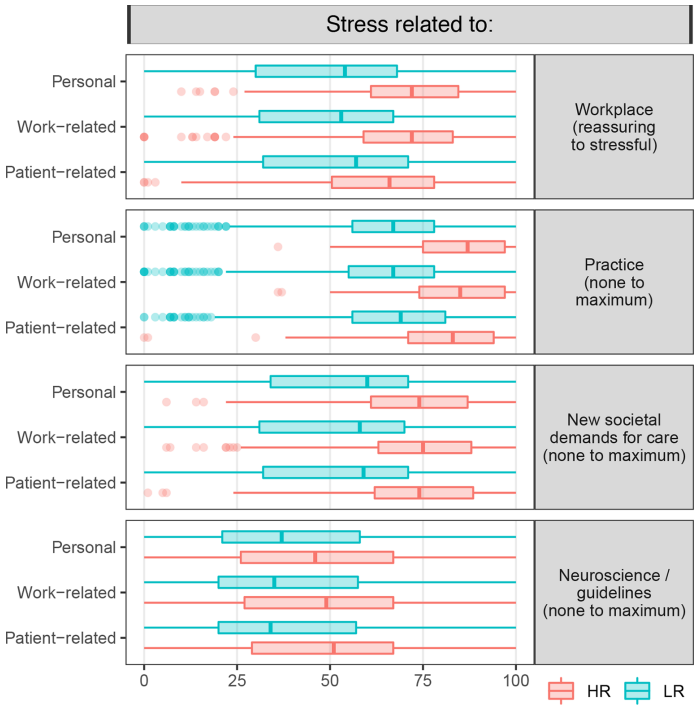

FIGURE 2 | Boxplot distribution of individual responses to the four additional questions appraising the working environment. The difference in the distribution of ratings on the visual analogue scale between the LR and HR groups was highly significant ($p < 0.001$) for each question.

the HR group than in the LR group. Public-sector practitioners in the HR group for both the personal and work-related dimensions treated more patients with schizophrenia than their LR counterparts.

The qualitative measures of potential stressors showed that a nonreassuring working environment and a greater number of stressors while treating patients each were significantly associated with HR. Social pressure and care expectations, together with new challenges to be addressed in psychiatric practice, were also seen as significant stressors. By contrast, paradigm shifts within psychiatry as a discipline were seen as less severe stressors, particularly among the private-sector practitioners.

Interestingly, in the present study, though most of the respondent in the HR group do not reach criteria for a high degree of burn out, the variables associated with this highest risk group overlap with those described in the published literature on burnout among healthcare professionals. Additional precipitating—or more severe existing—factors could be involved to reach the burnout threshold. Here, protected factors are also possibly involved. Although gender has not always been identified as an independent predictor of burnout, some studies have found that female physicians have an increased risk of fatigue, compared with men (24). This finding should be set against data showing that the suicide rate among female physicians is 2.27 times higher than that of women in the general population. It is 1.41 times higher for male physicians (25). Frequent call duties and long working hours have also been found to contribute to burnout (26).

A recent systematic review and meta-analysis exploring burnout among French physicians yielded an estimated prevalence of 49% for severe burnout, with higher levels among emergency practitioners and junior (27). These data are in line with a recent meta-analysis estimating the prevalence of burnout to be 44.2% (33.4–55.0%) among medical students before residency, questioning the assumption that residency plays an intrinsic and deleterious role in generating burnout (28). A group of psychiatry residents from 35 French medical faculties was recently compared with residents in other specialities (29). Comparisons revealed that the psychiatry residents had higher rates of drug use disorders and mental health issues. A national survey among Canadian psychiatry residents also found that one-fifth of respondents had high MBI scores for unhealthy coping strategies (30). The present results are in line with the literature showing that younger physicians run nearly twice the risk of burnout as their older colleagues, and onset may occur as early as residency training (31). Physicians working in outpatient settings are also described as experiencing higher burnout than those working in inpatient facilities (32). Some results were conceptually worrying, even if they did not reach significance. These concerned the excessive numbers of residents and heads of department in the HR group (**Tables 1** and **2**).

GENERAL CONSIDERATIONS AND CONCLUSION

Physician burnout has reached epidemic levels all over the world. Whereas burnout among the general working population of the US remained stable at around 28% between 2011 and 2014 (16, 33), the percentage of physicians reporting burnout rose from 45.5 to 54.4% during this period. Burnout rates are thus twice as high in medicine as in other fields. A recent study in China revealed that psychiatrists have a low level of satisfaction, with up to 20% of the studied population reporting that they intended to quit their jobs (34). Another study that also used the CBI questionnaire to examine burnout incidence, this time among psychiatrists in India, revealed that approximately 32% met the criteria for burnout using the total CBI score (35).

The rapid and worldwide spread of burnout among health practitioners evidenced by epidemiological studies and spontaneously perceived by disillusioned physicians is preoccupying and has a cost. At a personal level, burnout is associated with somatic and mental health comorbidities, particularly depression, suicide, and medication and substance abuse. Burnout also threatens the healthcare system, including patient safety, quality of care, and healthcare costs, as it leads to increased MD turnover, early retirement, less than fulltime work, and poor-quality care. High levels of physician burnout can thus be seen as an indicator of poor performance by the underlying system and environment (36). A blog published in September 2018 entitled "Physician Burnout Is A Public Health Crisis: A Message To Our Fellow Health Care CEOs" in the context of the CHCMS Physician Well-Being initiative provided compelling data on the extent of physician burnout and the consequences for healthcare delivery systems in the US. The authors unanimously concluded that physician burnout is a pressing issue of national importance both for these systems and for patients (37).

A recent systematic review and meta-analysis of the studies addressing this issue indicated that intervening to reduce burnout can be effective (38). Interesting prevention and treatment programs aimed at physicians have been developed in several institutions in the US and Europe (39). While most programs developed to reduce burnout in physicians focus on resilience and wellbeing, burnout is also—if not mainly—driven in the medical setting by stressful stimuli. Academic institutions in France could replicate the successful initiatives undertaken by the American College of Physicians, which recently published a position statement, entitled "Putting Patients First by Reducing Administrative Tasks in Health Care" (40). The National Academy of Medicine of the United States has also produced a discussion paper calling for increased research on how changes in physicians' organizational and practice environments are related to increasing rates of burnout (24). In this context, a recent editorial in *The Lancet* called for "enlightened leaders who recognize that medicine is a human endeavor and not an assembly line" (41).

The present study, designed to pinpoint the factors associated with higher burnout scores on the personal, work-, and patient-related dimensions within a substantial sample of French psychiatrists, yielded some interesting results. To our knowledge, it is the first to have examined factors for perceived work-related burnout among both public- and private-sector psychiatrists in France. However, because it was based on a nonrepresentative population, it had several limitations. In particular, the precise incidence of burnout among French psychiatrists cannot be extrapolated from the present data owing to a selection bias relating to the fact that participants were conference attendees. HR and LR populations were defined here solely for comparison purposes. Results for the HR group should not be unduly generalized as most of the CBI scores of individuals in this group were not high enough for them to have a high degree of burnout. Nevertheless, the present study opens up important avenues for future research on the issue of psychiatrist burnout in the French healthcare system.

There is a growing awareness worldwide of the alarming rate of burnout among practitioners, threatening the survival of many healthcare organizations. Programs need to be developed to reduce burnout in physicians, focusing jointly on increasing resilience and wellbeing, and on changing organizational factors. Several initiatives across the world involving clinicians, and deliberate, sustained, and comprehensive efforts at the highest levels of healthcare organizations will hopefully reverse the rising tide of burnout among clinicians.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are available upon request.

AUTHOR CONTRIBUTIONS

PN, MM, RG, PF and DG contributed to the conception and design of the study. CT organized the database. NL, CT, DG, and PN performed the statistical analysis and interpretation of data for the work. PN and CT wrote the first draft of the manuscript. PN, NL, and CT wrote sections of the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

REFERENCES

1. Schaufeli WB, Greenglass ER. Introduction to special issue on burnout and health. *Psychol Health* (2001) 16(5):501–10. doi: 10.1080/08870440108405523
2. Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. *Lancet* (2009) 374(9702):1714–21. doi: 10.1016/S0140-6736(09)61424-0
3. WHO. *Factors influencing health status or contact with health services"(11th Revision of the International Classification of Diseases (ICD-11)* (2019).
4. Maslach C, Jackson S. The measurement of experienced burnout. *J Occup Behav* (1981) 2:99–113. doi: 10.1002/job.4030020205
5. Freudenberger HJ. Staff Burn-Out. *J Soc Issue* (1974) 30(1):159–65. doi: 10.1111/j.1540-4560.1974.tb00706.x

6. Messias E, Flynn V. The Tired, Retired, and Recovered Physician: Professional Burnout Versus Major Depressive Disorder. *Am J Psychiatry* (2018) 175(8):716–9. doi: 10.1176/appi.ajp.2018.17121325
7. Bianchi R, Schonfeld IS, Laurent E. The Trouble With Burnout: An Update on Burnout-Depression Overlap. *Am J Psychiatry* (2019) 176(1):79. doi: 10.1176/appi.ajp.2018.18091026
8. Bianchi R, Schonfeld IS, Laurent E. Burnout or depression: both individual and social issue. *Lancet* (2017) 390(10091):230 doi: 10.1016/S0140-6736(17)31606-9
9. Bianchi R, Schonfeld IS, Laurent E. On the overlap of vital exhaustion and depression. *Eur Psychiatry* (2017) 44:161–3. doi: 10.1016/j.eurpsy.2017.04.007
10. Schonfeld IS, Bianchi R. Burnout and Depression: Two Entities or One? *J Clin Psychol* (2016) 72(1):22–37. doi: 10.1002/jclp.22229
11. Kumar S. Burnout in psychiatrists. *World Psychiatry* (2007) 6(3):186–9.
12. Ma H, Qiao H, Qu H, Wang H, Huang Y, Cheng H, et al. Role stress, social support and occupational burnout among physicians in China: a path analysis approach. *Int Health* (2019). doi: 10.1093/inthealth/ihz054
13. Hafner H. [Psychiatry as a profession]. *Nervenarzt* (2002) 73(1):33–40. doi: 10.1007/s115-002-8144-1
14. Deary IJ, Agius RM, Sadler A. Personality and stress in consultant psychiatrists. *Int J Soc Psychiatry* (1996) 42(2):112–23. doi: 10.1177/002076409604200205
15. Kumar S, Hatcher S, Huggard P. Burnout in psychiatrists: an etiological model. *Int J Psychiatry Med* (2005) 35(4):405–16. doi: 10.2190/8XWB-AJF4-KPRR-LWMF
16. Wright AA, Katz IT. Beyond Burnout - Redesigning Care to Restore Meaning and Sanity for Physicians. *New Engl J Med* (2018) 378(4):309–11. doi: 10.1056/NEJMp1716845
17. Fred HL, Scheid MS. Physician Burnout: Causes, Consequences, and (?) Cures. *Texas Heart Institute J* (2018) 45(4):198–202. doi: 10.14503/THIJ-18-6842
18. Shanafelt TD, Dyrbye LN, Sinsky C, Hasan O, Satele D, Sloan J, et al. Relationship Between Clerical Burden and Characteristics of the Electronic Environment With Physician Burnout and Professional Satisfaction. *Mayo Clin Proc* (2016) 91(7):836–48. doi: 10.1016/j.mayocp.2016.05.007
19. Shanafelt TD, Gorringe G, Menaker R, Storz KA, Reeves D, Buskirk SJ, et al. Impact of organizational leadership on physician burnout and satisfaction. *Mayo Clin Proc* (2015) 90(4):432–40. doi: 10.1016/j.mayocp.2015.01.012
20. Mellsop G, Kumar S. An axis for risk management in classificatory systems as a contribution to efficient clinical practice. *World Psychiatry* (2008) 7(3):182–4. doi: 10.1002/j.2051-5545.2008.tb00193.x
21. Berland A, Natvig GK, Gundersen D. Patient safety and job-related stress: a focus group study. *Intensive Crit Care Nurs* (2008) 24(2):90–7. doi: 10.1016/j.iccn.2007.11.001
22. Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of Burnout Among Physicians: A Systematic Review. *J Am Med Assoc* (2018) 320(11):1131–50. doi: 10.1001/jama.2018.12777
23. Kristensen TS, Hannerz H, Hogh A, Borg V. The Copenhagen Psychosocial Questionnaire–a tool for the assessment and improvement of the psychosocial work environment. *Scand J Work Environ Health* (2005) 31(6):438–49. doi: 10.5271/sjweh.948
24. Dyrbye LN, Shanafelt TD, Sinsky CA, Cipriano PF, Bhatt J, Ommaya A, et al. Burnout among health care professionals: A call to explore and address this underrecognized threat to safe, high-quality care. NAM Perspectives. Discussion Paper. *Natl Acad Med,* Washington (2017). doi: 10.31478/201707b
25. Schernhammer ES, Colditz GA. Suicide rates among physicians: a quantitative and gender assessment (meta-analysis). *Am J Psychiatry* (2004) 161(12):2295–302. doi: 10.1176/appi.ajp.161.12.2295
26. West CP, Dyrbye LN, Shanafelt TD. Physician burnout: contributors, consequences and solutions. *J Internal Med* (2018) 283(6):516–29. doi: 10.1111/joim.12752
27. Kansoun Z, Boyer L, Hodgkinson M, Villes V, Lancon C, Fond G. Burnout in French physicians: A systematic review and meta-analysis. *J Affect Disord* (2019) 246:132–47. doi: 10.1016/j.jad.2018.12.056
28. Frajerman A, Morvan Y, Krebs MO, Gorwood P, Chaumette B. Burnout in medical students before residency: A systematic review and meta-analysis. *Eur Psychiatry* (2019) 55:36–42. doi: 10.1016/j.eurpsy.2018.08.006
29. Fond G, Bourbon A, Micoulaud-Franchi JA, Auquier P, Boyer L, Lancon C. Psychiatry: A discipline at specific risk of mental health issues and addictive behavior? Results from the national BOURBON study. *J Affect Disord* (2018) 238:534–8. doi: 10.1016/j.jad.2018.05.074
30. Kealy D, Halli P, Ogrodniczuk JS, Hadjipavlou G. Burnout among Canadian Psychiatry Residents: A National Survey. *Can J Psychiatry* (2016) 61(11):732–6. doi: 10.1177/0706743716645286
31. Shanafelt TD, Sloan JA, Habermann TM. The well-being of physicians. *Am J Med* (2003) 114(6):513–9. doi: 10.1016/S0002-9343(03)00117-7
32. Lee RT, Seo B, Hladkyj S, Lovell BL, Schwartzmann L. Correlates of physician burnout across regions and specialties: a meta-analysis. *Hum Resour Health* (2013) 11:48. doi: 10.1186/1478-4491-11-48
33. Shanafelt TD, Hasan O, Dyrbye LN, Sinsky C, Satele D, Sloan J, et al. Changes in Burnout and Satisfaction With Work-Life Balance in Physicians and the General US Working Population Between 2011 and 2014. *Mayo Clin Proc* (2015) 90(12):1600–13. doi: 10.1016/j.mayocp.2015.08.023
34. Jiang F, Hu L, Rakofsky J, Liu T, Wu S, Zhao P, et al. Sociodemographic Characteristics and Job Satisfaction of Psychiatrists in China: Results From the First Nationwide Survey. *Psychiatr Serv* (2018) 69(12):1245–51. doi: 10.1176/appi.ps.201800197
35. Sarma PG. Burnout in Indian Psychiatrists. *Indian J psychol Med* (2018) 40(2):156–60. doi: 10.4103/IJPSYM.IJPSYM_265_17
36. Shanafelt TD, Mungo M, Schmitgen J, Storz KA, Reeves D, Hayes SN, et al. Longitudinal Study Evaluating the Association Between Physician Burnout and Changes in Professional Work Effort. *Mayo Clin Proc* (2016) 91(4):422–31. doi: 10.1016/j.mayocp.2016.02.001
37. Noseworthy J, Madara J, Cosgrove D, Edgeworth M, Ellison E, Krevans S, et al. Physician Burnout Is A Public Health Crisis: A Message To Our Fellow Health Care CEOs. *Health Affairs Blog* (2017). doi: 10.1377/hblog20170328.059397
38. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *Lancet* (2016) 388(10057):2272–81. doi: 10.1016/S0140-6736(16)31279-X
39. Squiers JJ, Lobdell KW, Fann JI, DiMaio JM. Physician Burnout: Are We Treating the Symptoms Instead of the Disease? *Ann Thoracic Surg* (2017) 104(4):1117–22. doi: 10.1016/j.athoracsur.2017.08.009
40. Erickson SM, Rockwern B, Koltov M, McLean RM. Medical Practice and Quality Committee of the American College of Physicians. Putting Patients First by Reducing Administrative Tasks in Health Care: A Position Paper of the American College of Physicians. *Ann Internal Med* (2017) 166(9):659–61. doi: 10.7326/M16-2697
41. Epstein RM, Privitera MR. Doing something about physician burnout. *Lancet* (2016) 388(10057):2216–7. doi: 10.1016/S0140-6736(16)31332-0

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 15 May 2020
doi: 10.3389/fpsyt.2020.00408

Relationship Between Kindergarten Organizational Climate and Teacher Burnout: Work–Family Conflict as a Mediator

Dongying Ji[1] *and Yaping Yue*[2]*

[1] Faculty of Education, Beijing Normal University, Beijing, China, [2] School of Education Science, Henan University, Kaifeng, China

Burnout in kindergarten teachers is influenced by individual factors, social factors, and organizational factors. Kindergarten organizational climate as an external work resource may cause teacher burnout when it cannot meet their work demands. To explore the mechanisms that underlie the effects of kindergarten organizational climate on teacher burnout, we investigated the mediating effect of work-family conflict (i.e., work interfering with family and family interfering with work) on the relationship between kindergarten organizational climate and teacher burnout. The study sample included 436 kindergarten teachers in Henan, China. The Chinese versions of the Kindergarten Organizational Climate Scale, Kindergarten Teachers Work-Family Conflict Scale, and Kindergarten Teachers Burnout Scale were applied. The results showed that kindergarten organizational climate was positively correlated with work–family conflict and teacher burnout. Work–family conflict was positively correlated with teacher burnout. Work–family conflict partially mediated the effects of kindergarten organizational climate on teacher burnout. The mediating effect of family interfering with work was significantly stronger than the mediating effect of work interfering with family. The results are discussed with respect to the general literature on the correlation between organizational climate, WFC, and burnout.

Keywords: kindergarten organizational climate, kindergarten teacher, burnout, work–family conflict, mediating effect

OPEN ACCESS

Edited by:
Christine Allwang, Technical University of Munich, Germany

Reviewed by:
Anubhuti Dubey, Deen Dayal Upadhyay Gorakhpur University, India
Andreas Dinkel, Technical University of Munich, Germany

***Correspondence:**
Yaping Yue
yyp@henu.edu.cn

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *14 November 2019*
Accepted: *22 April 2020*
Published: *15 May 2020*

Citation:
Ji D and Yue Y (2020) Relationship Between Kindergarten Organizational Climate and Teacher Burnout: Work–Family Conflict as a Mediator. Front. Psychiatry 11:408. doi: 10.3389/fpsyt.2020.00408

INTRODUCTION

Burnout represents a state of physical, mental, and emotional exhaustion that is caused by work stress (1, 2). It is generally thought to consist of three dimensions: emotional exhaustion, dehumanization, and a reduction of personal accomplishment (3). Teacher burnout refers to a negative reaction when a teacher is unable to cope with work-related stress. It is a state of emotional, attitudinal, and behavioral decline that is caused by a teacher's long-term experience with stress (4). Kindergarten teachers not only care for and teach children between the ages three and six, but also provide them with warm, nurturing and learning experience, and lay the foundation for their future social, emotional and academic success (5). Therefore, kindergarten teachers need to put in more

effort to care for children, which is easy to lead to physical and mental fatigue (6). Kindergarten teachers also experience tremendous pressure from children's parents (7), so they are more likely to suffer from burnout.

Organizational climate is often considered as relatively temporary, subject to direct control, and largely limited to those aspects of the social environment that are consciously perceived by organizational members (8). Its core focuses on the description of how organizational influences impact organizational members (9). Cropanzano et al. (10) reported perceived organizational support to be negatively related to burnout. Kanste, Kynga and Nikkila (11) found that support and respect from the supervisor protect organizational members from job burnout. Lee (12) found significant direct effects of a positive organizational climate predicting lower levels of burnout (12). Boamah et al. (13) also found that the adequate superior support was an effective resource for organizational members to relieve work pressure and reduce burnout. Kindergarten, as an organization, also relies on the teachers as the key employees, so the teacher's perception of the kindergarten's work environment is the core of kindergarten organizational climate (9). The organizational climate is a bridge between the kindergarten organizational system and teacher behavior. Based on the Job Demand–Resources Model, the kindergarten organizational climate belongs to an external work resource that can cause teacher burnout when it is unbalanced with work demand (14). A study of kindergarten teacher burnout in Beijing showed that organizational factors have a stronger impact on kindergarten teacher burnout compared with social factors, professional factors, and personal factors (15). Discussing kindergarten organizational climate as an antecedent of kindergarten teacher burnout at the organizational level is meaningful.

Work–family conflict (WFC) is experienced when demands of one role in one domain interfere with participation in or the performance of the other role (16). Compared with men, women experience more family interfering with work (FIW) and strain-based work interfering with family [WIF; (17)]. Female-dominated kindergarten teachers experience even more WFC. Even they have paid work, women have not relinquished the demands of their families (18). Work–family conflict is closely correlated with organizational factors, and increasingly more people realize that organizational climate plays an important role in the balance between work and family (19–21). Organizational support is considered one of the most effective factors in reducing WFC (22). WFC (includes WIF, FIW) is an important antecedent of burnout and has a significant impact on burnout (23, 24). Demerouti et al. stipulated a kind of "spiral relationship" between WFC and burnout. They found that WFC caused burnout among employees, and burnout resulted in a decline of employees' work performance. Thus, burnout aggravated WFC, and WFC generated higher burnout (14). Work–family conflict is clearly not only impacted by organizational climate—it also significantly impacts burnout. Additionally, some studies have considered that WFC might also act as a mediator of the relationship between work demand and turnover intention (25), job satisfaction (26), and happiness (27).

Frone (28) indicated that WFC was a bidirectional concept that consists of WIF and FIW. The two types of WFC have been examined in many studies. The degree of WIF that was perceived by adults was stronger than their perceived FIW (23, 24, 29–31). Both concepts, WIF and FIW, exert different effects on outcome variables. Some studies found that the predictive effect of WIF on turnover intention was stronger than FIW (32). The correlation between FIW and self-efficacy was significantly stronger compared with WIF (33). Work interfering with family had a significant impact on teachers' mental health, whereas FIW had no significant impact on teachers' mental health (34). The mediating effects of WIF and FIW have also been examined. Ford et al. (35) performed a meta-analysis of Frone's Work-Family Conflict Model and found that WIF partially mediated the relationship between antecedents of work factors and family satisfaction, whereas the mediating effect of FIW was not proven. Furthermore, Nie and Xie (36) tested a multiple mediator model of bidirectional WFC in a sample of 413 employees from 28 provinces in China. They found that WIF mediated the relationship between family-supportive supervisor behaviors and job satisfaction, whereas FIW did not.

Little research has explored work-family conflict of kindergarten teachers and its mediating effect between organizational climate and teacher burnout. This study hopes to expand the research on the work–family conflict, focuses on kindergarten teachers in particular to explore mediating role of WFC. The main purpose of this study is to examine the relationship between kindergarten organizational climate and teacher burnout, investigate the mediating role of WFC, WIF, and FIW in the relationship between kindergarten organizational climate and teacher burnout, further compare the mediating effects of WIF and FIW. Specifically, the study hypotheses are as follows:

Hypothesis 1: There are significant correlations between kindergarten organizational, WFC, and teacher burnout.

Hypothesis 2: Work–family conflict mediates the relations between kindergarten organizational climate and teacher burnout.

MATERIALS AND METHODS

Participants and Procedure

The participants were teachers from kindergartens in Henan province, China. About 30 kindergartens participated in this study, each kindergarten has 9–15 teaching classes. For example, some kindergartens have nine classes, some kindergartens have 12 classes, and others have 15 classes. Classes are guided by two professional teachers and one nurse. Thus, each of the participating kindergartens employs 18 to 30 professional teachers. This study focuses on the professional teachers, we did not approach nurses for study participation. The heads of these kindergartens were approached, and consent was obtained before conducting the survey. After obtaining informed consent

to conduct this survey, the kindergarten managers distributed the questionnaires to the teachers in 2017. The questionnaires were then collected within 2 weeks. A total of 485 questionnaires were administered to the kindergarten teachers, of which 450 were returned, indicating a response rate of 92.8%. Four hundred thirty-six of these 450 questionnaires were valid, indicating an effective rate of 89.9%. These 436 responses formed the final sample. The procedures followed were in accordance with the ethical standards of the Committee on Medical and Scientific Research of Medical College of Henan University. **Table 1** presents the demographic characteristics of the sample.

Organizational Climate Scale for Kindergartens

The Organizational Climate Scale for Kindergartens (37–39) was used to assess the teacher-perceived organizational climate of their kindergartens. The scale was adapted from the Organizational Climate Scale that was originally validated by Denison and Mishra (40). The scale was designed to assess four components of organizational climate that were perceived by kindergarten teachers: involvement (e.g., most teachers can participate in the decision-making and planning of the development of the kindergarten), consistency (e.g., most teachers' approach to doing work in the kindergarten is very consistent and predictable), adaptability (e.g., the kindergarten's decision-making and development are flexible and could be adjusted according to the situation), mission (e.g., kindergarten has long-term planning and development direction). The scale consisted of 60 items. All of the items were scored on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Items 15, 24, 29, 34, 39, 50, 60 will be scored in reverse. The higher the score of four dimensions, the better the organizational climate perceived by kindergarten teachers. In the present study, Cronbach's α was 0.90. Internal consistency was 0.81 for support climate, 0.86 for intimacy climate, 0.91 for adaptability climate, and 0.84 for development climate.

TABLE 1 | Demographic information of kindergarten teacher sample (n = 436).

Characteristics	*n* (%)
Kindergarten type	
Public	229 (52.5)
Private	207 (47.5)
Gender	
Male	7 (1.6)
Female	429 (98.2)
Age	
Under 20	45 (10.3)
20–29	272 (62.2)
30–39	97 (22.2)
40 and above	22 (5.1)
Education level	
≤High school	45 (10.3)
Vocational school	243 (55.7)
≥University degree	148 (33.9)
Teaching experience	
1–5 years	274 (62.8)
6–10 years	92 (21.1)
11–15 years	41 (9.4)
16–20 years	17 (3.9)
>20 years	12 (2.8)

Maslach Burnout Inventory

The Maslach Burnout Inventory (MBI) was developed by Maslach & Jackson and has three versions: MBI-Human Service Survey (MBI-SS), MBI-Educators Survey (MBI-ES), and MBI-General Survey [MBI-GS; (41)]. Among them, the MBI-ES has been reported to have good cross-cultural reliability and validity and is the most widely used measurement instrument for teacher burnout (42). The determination of kindergarten teacher burnout was adapted from the MBI-ES to fit the kindergarten teacher context. The MBI, consisting of 22 items, was designed to assess three components of burnout among kindergarten teachers: emotional exhaustion, depersonalization, and personal accomplishment. All of the items were scored on a 7-point Likert-type scale, ranging from 1 (never) to 7 (always). Items 4, 7, 8, 9, 12, 14, 17, 18 and 19 will be scored in reverse. The higher the score of three dimensions, the higher the degree of teacher burnout. In the present study, Cronbach's α was 0.75. Internal consistency was 0.87 for emotional exhaustion, 0.86 for depersonalization, and 0.68 for personal accomplishment.

Kindergarten Teacher Work–Family Conflict Scale

The Kindergarten Teacher Work–Family Conflict Scale was used to assess teacher-perceived conflict between kindergartens and their families. In the present study, the scale was adapted from the Teacher Work–Family Conflict Scale that was validated by Wu et al. (43), which was developed on the basis of the two directions (WIF and FIW) and three forms of work–family conflict (behavior-based conflict, time-based conflict, and stress-based conflict) that were proposed by Greenhaus et al. (16). The scale consisted of 22 items. All of the items were scored on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly disagree). Higher values indicate higher levels of work–family conflict. In the present study, Cronbach's α was 0.97. Internal consistency was 0.88 for WIF and 0.84 for FIW.

Data Analysis

The data were analyzed using PASW 18.0 software. Bivariate correlations were calculated to measure correlations between kindergarten organizational climate, WFC (WIF, FIW), and teacher burnout. The role of WFC, WIF, and FIW in mediating the association between kindergarten organizational climate and teacher burnout was tested by Bootstrap. Bootstrap and mediating model 4 were used in the present study. The "resampling size" was set at 1,000, which implied that the unstandardized indirect effect of the mediation path was computed for every 1,000 bootstrapped samples. The confidence interval (CI) was set at 95%, which implied that the indirect effects at the 2.5th and 97.5th percentiles were determined by computing a 95% CI. A statistically significant mediating effect was confirmed if the CI of the indirect path did not include 0 (44).

RESULTS

Correlation Analysis

The means, standard deviations, and intercorrelations among variables that were evaluated in the present study are presented in **Table 2**. The results showed that kindergarten organizational climate was negatively correlated with teacher burnout (r = −0.55, p <0.01), WFC (r = −0.25, p <0.01), WIF (r = −0.12, p <0.05), and FIW (r = −0.32, p <0.01). Work-family conflict, WIF, and FIW were positively correlated with teacher burnout (r_{WFC} = 0.48, r_{WIF} = 0.33, r_{FIW} = 0.50, all p <0.01).

Mediating Effect Analysis

Significant correlations were found between kindergarten organizational climate, WFC, and teacher burnout. We have hypothesized that work–family conflict plays a mediating role between kindergarten organizational climate and teacher burnout. Therefore, we further tested the mediating role of WFC (see **Supplementary Datasheet 1**).

In this mediating model, kindergarten organizational climate and WFC explained 43.69% of the variance of teacher burnout. Kindergarten organizational climate explained 1.51% of the variance of WIF. Kindergarten organizational climate explained 9.96% of the variance of FIW.

Mediating Effect of WFC

Table 3 shows that the direct path from kindergarten organizational climate to teacher burnout was significant (95% CI = [−0.92, −0.69], t = −13.89, p < 0.001) in a model that did not include WFC. The direct path between kindergarten organizational climate and teacher burnout remained significant (95% CI = [−0.76, −0.54], t = −11.89, p <0.001) when WFC was included in the model, indicating that WFC partially mediated the association between kindergarten organizational climate and teacher burnout.

Mediating Effect of WIF

Table 4 shows that the direct path from kindergarten organizational climate to teacher burnout was significant (95% CI = [−0.92, −0.69], t = −13.89, p <0.001) in a model that did not include WIF. The direct path between kindergarten organizational climate and teacher burnout remained significant (95% CI = [−0.86, −0.64], t = −13.43, p <0.001) when WIF was included in the model, indicating that WIF partially mediated the association between kindergarten organizational climate and teacher burnout. The bootstrapped standardized indirect effect on the path from kindergarten organizational climate to teacher burnout was significantly different from 0. The mediating effect of WIF was −0.06 ($a_1 * b_1$).

Mediating Effect of FIW

Table 5 shows that the direct path from kindergarten organizational climate to teacher burnout was significant (95% CI = [−0.92, −0.69], t = −13.89, p < 0.001) in a model that did not include FIW. The direct path between kindergarten organizational climate and teacher burnout remained significant (95% CI = [−0.73, −0.51], t = −10.93, p < 0.001) when FIW was included in the model, indicating that FIW

TABLE 2 | Means, standard deviations, and intercorrelations of the observed variables.

Variable	Mean	SD	1	2	3	4	5
1. KOC	3.73	0.48	–				
2. TB	2.69	0.76	−0.55***	–			
3.WFC	2.60	0.66	−0.29***	0.49***	–		
4. WIF	2.92	0.82	−0.15**	0.34***	0.87***	–	
5. FIW	2.28	0.72	−0.36***	0.51***	0.84***	0.46***	–

*Pearson correlations for kindergarten teachers (n = 436) are presented above the diagonal. **p < 0.01, ***p < 0.001. KOC, kindergarten organizational climate; TB, teacher burnout; WFC, work–family conflict; WIF, work interfering with family; FIW, family interfering with work.*

TABLE 3 | Mediating effect of WFC.

	Effect	SE	t	p	LLCI	ULCI
KOC → TB (c)	−0.80	0.06	−13.89	0.000	−0.92	−0.69
KOC → WFC (a)	−0.39	0.06	−6.28	0.000	−0.51	−0.27
WFC → TB (b)	0.39	0.04	9.55	0.000	0.31	0.47
KOC →TB (c')	−0.65	0.06	−11.89	0.000	−0.76	−0.54
KOC → WFC → TB	−0.15	0.03			−0.22	−0.10

LLCI, the lowest value of the confidence interval; ULCI, The highest value of the confidence interval; c, the total effect of kindergarten organizational climate on teacher burnout; a, the effect of kindergarten organizational climate on work–family conflict; b, the effect of work–family conflict on teacher burnout; c', the direct effect of kindergarten organizational climate on teacher burnout after the introduction of work–family conflict; KOC, kindergarten organizational climate; TB, teacher burnout; WFC, work–family conflict.

TABLE 4 | Mediating effect of WIF.

	Effect	SE	t	p	LLCI	ULCI
KOC→ TB (c)	−0.80	0.06	−13.89	0.000	−0.92	−0.69
KOC → WIF (a_1)	−0.24	0.08	−3.14	0.002	−0.40	−0.09
WIF → TB (b_1)	0.24	0.04	6.94	0.000	0.17	0.30
KOC → TB (c'_1)	−0.75	0.06	−13.43	0.000	−0.86	−0.64
KOC → WIF → TB	−0.06	0.02			−0.10	−0.02

LLCI, the lowest value of the confidence interval; ULCI, The highest value of the confidence interval; c, the total effect of kindergarten organizational climate on teacher burnout; a_1, the effect of kindergarten organizational climate on work interfering with family; b_1, the effect of work interfering with family on teacher burnout; c'_1, the direct effect of kindergarten organizational climate on teacher burnout after the introduction of work interfering with family; KOC, kindergarten organizational climate; TB, teacher burnout; WIF, work interfering with family.

TABLE 5 | Mediating effect of FIW.

	Effect	SE	t	p	LLCI	ULCI
KOC → TB (c)	−0.80	0.06	−13.89	0.000	−0.92	−0.69
KOC → FIW (a_2)	−0.53	0.07	−7.92	0.000	−0.66	−0.40
FIW → TB (b_2)	0.35	0.04	9.06	0.000	0.27	0.42
KOC → TB (c'_2)	−0.62	0.06	−10.93	0.000	−0.73	−0.51
KOC → FIW → TB	−0.18	0.03			−0.25	−0.13

LLCI, the lowest value of the confidence interval; ULCI, The highest value of the confidence interval; c, the total effect of kindergarten organizational climate on teacher burnout; a_2, the effect of kindergarten organizational climate on family interfering with work; b_2, the effect of family interfering with work on teacher burnout; c'_2, the direct effect of kindergarten organizational climate on teacher burnout after the introduction of family interfering with work; KOC, kindergarten organizational climate; TB, teacher burnout; FIW, family interfering with work.

partially mediated the association between kindergarten organizational climate and teacher burnout. The bootstrapped standardized indirect effect on the path from kindergarten organizational climate to teacher burnout was significantly different from 0. The mediating effect of FIW was −0.18 ($a_2 * b_2$).

Comparison of the Mediating Effects of WIF and FIW

The model of the relationship among kindergarten organizational climate, WIF, FIW, and teacher burnout is presented in **Figure 1**. The mediating effect of WIF was −0.06 (−0.24 · 0.24), and the mediating effect of FIW was −0.18 (−0.53 · 0.35). This implied that the mediating effect of FIW on the relationship between kindergarten organizational climate and teacher burnout was stronger than the mediating effect of WIF (the sign only represents positive and negative effects) on the relationship between kindergarten organizational climate and teacher burnout. Compared with WIF, kindergarten organizational climate had more of an influence on teacher burnout through FIW.

DISCUSSION

The present study investigated the correlation between kindergarten organizational climate, WFC, and teacher burnout. Kindergarten organizational climate was negatively correlated with teacher burnout. This finding is consistent with previous studies (45, 46), which reported that school organizational climate had a significant impact on burnout. A higher degree of non-supportive school organizational climate was associated with a stronger teachers' sense of stress and burnout. The present study also found that kindergarten organizational climate was significantly negatively correlated with the teachers' WFC, which was consistent with the conclusion of a previous study (47) that included a sample of clinical nurses. Both kindergarten teachers and clinical nurses engage in a nurturing profession and inevitably suffer conflicts between work and family. A supportive organizational climate can serve as a potential force to alleviate conflict when it arises. The present study found that WFC was positively correlated with teacher burnout, which was consistent with previous studies (48–50). Bagherzadeh et al. (24) reported that there was a significantly negative association between WIF and overall burnout, FIW was significantly associated with depersonalization.

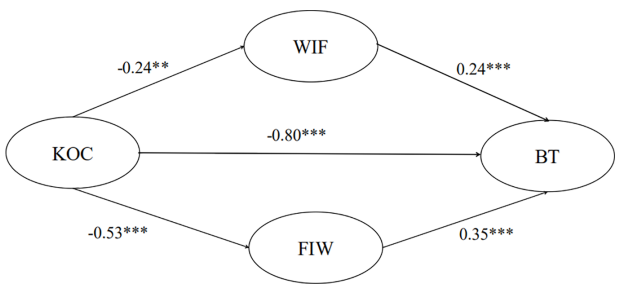

FIGURE 1 | Model of the relationship among kindergarten organizational climate, WIF, FIW, and teacher burnout. KOC, kindergarten organizational climate; TB, teacher burnout; WIF, work interfering with family; FIW, family interfering with work. $^{**}p < 0.01$, $^{***}p < 0.001$.

The present study found WFC mediated the relationship between kindergarten organizational climate and teacher burnout. The previous studies have focused more on the relationship between organizational climate and WFC or WFC and burnout. The relationship between the three constructs has not been reported in previous studies. According to Work-Family Boundary Theory, boundaries between work and family have certain permeability and flexibility. Permeability and flexibility determine the boundary strength between work and family (51). The greater the flexibility of the borders between work and home, the lower the level of work–family conflict (52). However, the permeability and flexibility of a weak boundary is high. If the boundary of kindergarten in the work domain is weak, then it is easy to be permeated by the role of the family domain and easier to adjust flexibly to meet the demands of family (51), thus alleviating possible conflict between family and work. Organizational support contributes to better flexibility of the work boundary, and instrumental support resources from managers can provide employees with the ability to engage in a flexible work boundary (53). Mansour (54) pointed out that supervisor support can permit employees to have more resources in work or family. When employees are faced with high family demands, in order to reduce the loss of family resources or to gain more resources, they will try to obtain support from their superiors. For instance, a teacher can take children to school and be a little late for work because of the supervisor's support for his family. WFC significantly positive effects burnout (50, 55), results in the emergence of emotional exhaustion, decreased response to others, and lack of performance (56). Thus, WFC is not only impacted by the organizational climate, but also has a significantly positive effect on burnout.

The present results indicated that the mediating effect of FIW was stronger than the mediating effect of WIF. This implies that WIF and FIW both have a significant impact on burnout, but the effect of FIW on burnout is stronger compared with WIF, consistent with domain specificity (cross-domain) perspective, which suggests that WIF predominantly influences the family, while FIW affects the work. These findings are consistent with previous studies (57, 58). The previous study pointed that organizational support contributes to better flexibility of the work boundary (53). Support from supervisors can act as the "passageways", which permit employees to have more resources in the family domain (54). When employees feel that the organization cares about them and their family, they invest more resources at home which can reduce stress due to FIW. Barnett et al. (59) found that FIW completely mediated the effect of work demands on distress. Especially, in a collectivist society like China, work is viewed primarily as contributing to family welfare (60). Hard work is thus the main way to promote happiness of the family and fulfill family responsibilities and

may bring glory and wealth to the family (61). When teachers are engaged in more family obligations that may interfere with their development demands in work, they are more likely to feel stressed as they struggle to meet job-related demands, which may in turn result in burnout (58). Meanwhile, China's collectivism advocates that people "sacrifice individual interests for public collective benefits" (62). The whole society, including organizations, usually praises the dedication of people who sacrifice their families for work (63). Thus, work that interferes with family is considered normal. Therefore, the influence of WIF on teacher burnout is not as strong as the influence of FIW on teacher burnout.

Limitations

This study has several limitations that need highlighting. First, the sample of 436 teachers was limited to urban kindergartens in three areas of Henan Province, which reduces the generalizability of the results. Future studies should include more geographic areas and possibly expand to the whole country. Rural kindergartens should also be involved in such studies to examine differences between urban and rural areas. Second, similar to other empirical studies, the present study used cross-sectional data at a certain point in time, which did not clarify the causality of variables. A cross-lagged panel correlation paradigm and longitudinal study should be used to further validate the effects of kindergarten organizational climate and work–family conflict on teacher burnout. Third, the present study only investigated organizational factors rather than family factors as antecedents of work–family conflict. It needs further investigation that which family factors are chief contributors in the conflict. Fourth, we did not delve deeply into the mechanism by which kindergarten organizational climate impacts teacher burnout. We only introduced WFC, but other mediating or moderating variables are likely involved in the effect of organizational climate on teacher burnout.

CONCLUSION

To conclude, this study fills the gap, which focused mostly on kindergarten teacher work-family conflict literature, and enriches our knowledge of the relationships between organizational climate, WFC and burnout to the context of Henan, the most populous province in China. We use Work-Family Boundary Theory and Chinese collectivism social culture to explain the mediating effect of WFC and comparison on the mediating effects of WIF and FIW. Effect difference of WIF and FIW on other outcome variables deserves follow-up research and more in-depth discussion.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Ethics Committee of Medical College of Henan University on Medical and Scientific Research with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of Medical College of Henan University on Medical and Scientific Research.

AUTHOR CONTRIBUTIONS

DJ and YY were responsible for the design of the study. DJ was responsible for the data analysis and writing of the manuscript. YY was responsible for revising of the manuscript.

FUNDING

The study was supported by the National Education Science Planning Project of China (BHA170142).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00408/full#supplementary-material

DATASHEET 1 | The original data.

REFERENCES

1. Lizano EL, Mor Barak M. Job burnout and affective wellbeing: a longitudinal study of burnout and job satisfaction among public child welfare workers. *Children Youth Serv Rev* (2015) 55:18–28. doi: 10.1016/j.childyouth.2015.05.005
2. Gharakhani D, Zaferanchi A. The effect of job burnout on turnover intention with regard to the mediating role of job Satisfaction. *J Health* (2019) 10 (1):109–17. doi: 10.29252/j.health.10.1.109
3. Maslach C. Job burnout: new directions in research and intervention. *Curr Dir psychol Sci* (2003) 12(5):189–92. doi: 10.1111/1467-8721.01258
4. Kalliath TJ, O'Driscoll MP, Gillespie DF, Bluedorn AC. A test of the maslach burnout inventory in three samples of health professionals. *Work Stress* (2000) 14(1):35–50. doi: 10.1080/026783700417212
5. Coplan RJ, Bullock A, Archbell KA, Bosacki S. Preschool teachers' attitudes, beliefs, and emotional reactions to young children\"s peer group behaviors. *Early Child Res Q* (2015) 30:117–27. doi: 10.1016/j.ecresq.2014.09.005
6. Wang D. Analysis on the Relationship between Job Satisfaction and Job Burnout of Kindergarten Teachers. *J Shaanxi Xueqian Normal Univ* (2017) 33 (08):88–94.
7. Hung CL. Job stress and coping strategies among early childhood teachers in central taiwan. *Educ Res Rev* (2012) 7(7):494–501. doi: 10.5897/ERR12.021

8. Denison DR. What is the difference between organizational culture and organizational climate? a native's point of view on a decade of paradigm wars. *Acad Manage Rev* (1996) 21(3):619–54. doi: 10.5465/amr.1996.9702100310
9. Ghavifekr S, Pillai NS. The relationship between school's organizational climate and teacher's job satisfaction: malaysian experience. *Asia Pacific Educ Rev* (2016) 17(1):87–106. doi: 10.1007/s12564-015-9411-8
10. Cropanzano R, Howes JC, Grandey AA, Toth P. The relationship of organizational politics and support to work behaviors, attitudes and stress. *J Organ Behav* (1997) 18:159–80. doi: 10.2307/3100247
11. Kanste O, Kynga H, Nikkila J. The relationship between multidimensional leadership and burnout among nursing staff. *J Nurs Manage* (2007) 15:731–9. doi: 10.1111/j.1365-2934.2006.00741.x
12. Lee E, Esaki N, Kim J, Greene R, Kirkland K, Mitchell-Herzfeld S. Organizational climate and burnout among home visitors: testing mediating effects of empowerment. *Children Youth Serv Rev* (2013) 35 (4):594–602. doi: 10.1016/j.childyouth.2013.01.011
13. Boamah SA, Read EA, Spence Laschinger HK. Factors influencing new graduate nurse burnout development, job satisfaction, and patient care quality: a time-lagged study. *J Adv Nurs* (2016) 73(5):1182–95. doi: 10.1111/jan.13215
14. Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. *J Appl Psychol* (2001) 86(3):499–512. doi: 10.1037/0021-9010.86.3.499
15. Liang HJ, Feng XX. Research on the situation and causes of burnout of preschool teachers in Beijing. *Stud Preschool Educ* (2004) 5:32–5 doi: 10.13861/j.cnki.sece.2004.05.012
16. Greenhaus JH, Beutell NJ. Sources of conflict between work and family roles. *Acad Manage Rev* (1985) 10(1):76–88. doi: 10.2307/258214
17. Carlson DS, Kacmar KM, Williams LJ. Construction and initial validation of a multidimensional measure of work -family conflict. *J Vocat Behav* (2000) 56 (2):249–76. doi: 10.1006/jvbe.1999.1713
18. Hochschild A. *The Managed Heart: Commercialization of Human Feeling*. Berkeley: University of California Press (1983).
19. Frone MR, Yardley JK, Markel KS. Developing and testing an integrative model of the work–family interface. *J Vocat Behav* (1997) 50(2):145–67. doi: 10.1006/jvbe.1996.1577
20. Bond JT, Galinsky E, Swanberg JE. *The 1997 National Study of the Changing Workplace*. New York: Families and Work Institute (1998).
21. Behson SJ. Coping with family-to-work conflict: the role of informal work accommodations to family. *J Occup Health Psychol* (2002) 7(4):324–41 doi: 10.1037//1076-8998.7.4.324
22. Colombo L, Ghislieri C. The work-to-family conflict: theories and measures. *TPM–Test Psychometrics Method Appl Psychol* (2008) 15:35–55.
23. Wang Y, Liu L, Wang J, Wang L. Work-family conflict and burnout among chinese doctors: the mediating role of psychological capital. *J Occup Health* (2012) 54(3):232–40. doi: 10.1539/joh.11-0243-oa
24. Bagherzadeh R, Taghizadeh Z, Mohammadi E, Kazemnejad A, Ebadi A. Relationship of work-family conflict with burnout and marital satisfaction: cross-domain or source attribution relations? *Health Promot Perspect* (2016) 6 (1):31–6. doi: 10.15171/hpp.2016.05
25. Jain S, Nair SK. The Mediating Role of Work -Family Conflict in the Relationship Between Demands and Turnover Intentions. *Int J Happiness Dev* (2017) 3(1):22–43. doi: 10.1504/IJHD.2016.076195
26. Gao L, Jin W. Work-Family Conflict Mediates the Association Between Job Demands and Life and Job Satisfaction in Chinese Middle-Level Managers. *Curr Psychol* (2015) 34(2):311–20. doi: 10.1007/s12144-014-9259-9
27. Geurts SAE, Kompier MAJ, Roxburgh S, Houtman ILD. Does work–home interference mediate the relationship between workload and well-being? *J Vocat Behav* (2003) 63(3):532–59. doi: 10.1016/s0001-8791(02)00025-8
28. Frone MR, Russell M, Cooper ML. Antecedents and Outcomes of work-family conflict: Testing a model of the work-family interface. *J Appl Psychol* (1992) 77:65–78. doi: 10.1037//0021-9010.77.1.65
29. Rotondo DM, Carlson DS, Kincaid JF. Coping with multiple dimensions of work-family conflict. *Pers Rev* (2003) 32(3):275–96. doi: 10.1108/00483480310467606
30. Burke RJ, Hassan Z, Dollard MF, Winefield AH. Work-family conflict in east vs western countries. *Cross Cult Manage: Int J* (2010) 17(1):30–49. doi: 10.1108/13527601011016899
31. Wei L. Investigation on work family conflict situation of clinical doctors. *Acta Univ Med Nanjing (Soc Sci)* (2012) 12(6):427–30 doi: 10.7655/NYDXBSS20120603
32. Chen ZW, Tian SQ. The Review of Work- Family Conflict Biphasic Theory. *Econ Manage* (2012) 26(07):58–63 doi: 10.3969/j.issn.1003-3890.2012.07.012
33. Netemeyer RG, Boles JS, Mcmurrian R. Development and validation of work – family conflict and family – work conflict scales. *J Appl Psychol* (1996) 81 (4):400–10. doi: 10.1037/0021-9010.81.4.400
34. Panatik SAB, Badri SKZ, Rajab A, Rahman HA, Shah IM. The impact of work family conflict on psychological well-being among school teachers in malaysia. *Proc Soc Behav Sci* (2011) 29(none):1500–7. doi: 10.1016/j.sbspro.2011.11.390
35. Ford MT, Heinen BA, Langkamer KL. Work and family satisfaction and conflict: a meta-analysis of cross-domain relations. *J Appl Psychol* (2007) 92 (1):57–80. doi: 10.1037/0021-9010.92.1.57
36. Nie Q, Xie Y. Family-Supportive Supervisor Behaviors and Turnover Intention: The Multiple Mediating Effects of Bidirectional Work-Family Conflict and Job Satisfaction. *Hum Resour Dev China* (2018) 35(01):48–59 doi: 10.16471/j.cnki.11-2822/c.2018.01.005
37. Qian Q, Jiang Y, Ruan T. A study of the structure model of kindergartens' organizational climate and teachers' professional development. *psychol Sci* (2007) 30(3):723–6 doi: 10.16719/j.cnki.1671-6981.2007.03.053
38. Lin ZL. Research on the Current Status of and the Relationship between the Organizational Climate of Preschools and their Teachers' Occupational Commitment. *East China Normal Univ* (2015) 4:21–2.
39. Jiang Y, Li P, Wang JY, Li H. Relationships Between Kindergarten Teachers' Empowerment, Job Satisfaction, and Organizational Climate: A Chinese Model. *J Res Child Educ* (2019) 3(22):1–14. doi: 10.1080/02568543.2019.1577773
40. Denison DR, Mishra AK. Toward a theory of organizational culture and effectiveness. *Organ Sci* (1995) 6:204–23. doi: 10.1287/orsc.6.2.204
41. Schutte N, Toppinen S, Kalimo R, Schaufeli W. The factorial validity of the maslach burnout inventory-general survey (mbi-gs) across occupational groups and nations. *J Occup Organ Psychol* (2000) 73(1):53–66. doi: 10.1348/096317900166877
42. Wang XC, Gan YQ. Review of Foreign Studies on What Causes Job Burnout. *Adv Psychol Sci* (2003) 11(5):567–72 doi: 10.3969/j.issn.1671-3710.2003.05.016
43. Wu MX, Zhang DJ, Chen X, Yu L, Guo C. The Measure of the Work-family Conflict of Chinese Elementary and Secondary School Teachers. *Psychol Dev Educ* (2009) 1:120–7.
44. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York, NY: Guilford Press (2013).
45. Zhou YJ. The influence of organizational climate perception on job burnout in tumor hospital nurses. *J Nurs Adm* (2015) 15(2):96–7.
46. Bilal A, Ahmed HM. Organizational structure as a determinant of job burnout. *Workplace Health Saf* (2017) 65(3):118. doi: 10.1177/2165079916662050
47. Ji WL. Correlation between nurses' perceived organizational climate and work–family conflict. *J Nurs Adm* (2014) 14(6):398–9.
48. Robinson LD, Magee C, Caputi P. Burnout and the work-family interface: a two-wave study of sole and partnered working mothers. *Career Dev Int* (2016) 1. doi: 10.1108/CDI-06-2015-0085
49. Smith TD, Dejoy DM, Dyal MA, Huang G. Impact of work pressure, work stress and work-family conflict on firefighter burnout. *Arch Environ Occup Health* (2017) 74(4):1–24. doi: 10.1080/19338244.2017.1395789
50. Wu TJ, Yuan KS, Yen DC, Xu T. Building up resources in the relationship between work–family conflict and burnout among firefighters: moderators of guanxi and emotion regulation strategies. *Eur J Work Organ Psychol* (2019) 28 (3):1–12. doi: 10.1080/1359432X.2019.1596081
51. Clark SC. Work/family border theory: a new theory of work/family balance. *Hum Relat* (2000) 53(6):747–70. doi: 10.1177/0018726700536001
52. Leung L, Zhang R. Mapping ict use at home and telecommuting practices: a perspective from work/family border theory. *Telemat Inf* (2017) 34(1):385–96. doi: 10.1016/j.tele.2016.06.001

53. Ferguson M, Carlson D, Kacmar KM. Flexing work boundaries: the spillover and crossover of workplace support. *Pers Psychol* (2015) 68(3):581–614. doi: 10.1111/peps.12084
54. Mansour S. Workload, generic and work–family specific social supports and job stress: mediating role of work–family and family–work conflict. *Int J Contemp Hosp Manage* (2016) 28(8). doi: 10.1108/IJCHM-11-2014-0607
55. Farradinna S, Halim FW. The consequences of work-family conflict, burnout and organizational commitment among women in indonesia. *Proc Soc Behav Sci* (2016) 219:241–7. doi: 10.1016/j.sbspro.2016.05.012
56. Gemlik NF, Ayanoğlu-Şişman SU. The relationship between burnout and organizational commitment among health sector staff in turkey. *J Global Strateg Manag* (2010) 4(2):137–49. doi: 10.20460/JGSM.2010415831
57. Mete M, Ünal ÖF, Bilen A. Impact of work-family conflict and burnout on performance of accounting professionals. *Proc Soc Behav Sci* (2014) 131:264–70. doi: 10.1016/j.sbspro.2014.04.115
58. Asiedu EEA, Annor F, Amponsah-Tawiah K, Dartey-Baah K. Juggling family and professional caring: role demands, work-family conflict and burnout among registered nurses in ghana. *Nurs Open* (2018) 7:1–10. doi: 10.1002/nop2.178
59. Barnett RC, Brennan RT, Gareis KC, Ertel KA, Berkman LF, Almeida DM. Conservation of resources theory in the context of multiple roles: an analysis of within- and cross-role mediational pathways. *Community Work Family* (2012) 15(2):131–48. doi: 10.1080/13668803.2010.539066
60. Yang N. Individualism-collectivism and work-family interfaces: a sino-u.s. comparison. *Work Family Int Res Perspect* (2005) 3(23):287–318. doi: 10.4324/9781410612601
61. Yang NN, Chen CC, Choi J, Zou YM. Sources of work-family conflict: A Sino-U.S. comparison of the effects of work and family demands. *Acad Manage J* (2000) 43(1):113–23. doi: 10.2307/1556390
62. Lv LY. Modern society, modernity and civil education. *J High Educ* (2007) 12:18–23.
63. Zhang M, Li H, Wei J, Yang BY. Cross-over Effects or Direct Effects? The Mechanism Linking Work-family Conflict with Outcomes. *Acta Psychol Sin* (2011) 43(5):573–88. doi: 10.1631/jzus.B1000278

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 03 June 2020
doi: 10.3389/fpsyt.2020.00512

Integration of a Return-to-Work Module in Cognitive Behavioral Therapy in Patients With Major Depressive Disorder and Long-Term Sick Leave—A Feasibility Study

Lotta Winter, Julia Geldmacher, Katharina Plücker-Boss and Kai G. Kahl*

Department of Psychiatry, Social Psychiatry and Psychotherapy, Hannover Medical School, Hannover, Germany

OPEN ACCESS

Edited by:
Preethi Premkumar, Nottingham Trent University, United Kingdom

Reviewed by:
Padmavati Ramachandran, Schizophrenia Research Foundation, India
Ibiyemi Arowolo, University of Winnipeg, Canada

***Correspondence:**
Lotta Winter
winter.lotta@mh-hannover.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *06 November 2019*
Accepted: *19 May 2020*
Published: *03 June 2020*

Citation:
Winter L, Geldmacher J, Plücker-Boss K and Kahl KG (2020) Integration of a Return-to-Work Module in Cognitive Behavioral Therapy in Patients With Major Depressive Disorder and Long-Term Sick Leave—A Feasibility Study. Front. Psychiatry 11:512. doi: 10.3389/fpsyt.2020.00512

Objective: Major depressive disorder (MDD) has a negative impact on individuals ability to work, and is often associated with long phases of sick leave. Consequently, interventions facilitating return to work in patients with MDD gained increased attention during last decades. We here report results of a feasibility study where a "return-to-work" (RTW) module published by Lagerveld and colleagues in the Netherlands was integrated in cognitive behavioral therapy in depressed patients with long-term sick leaves in Germany. Our study aimed to answer the following questions: Is RTW accepted by patients and therapists? Do RTW interventions lead to return-to-work? Do depressive symptoms improve?

Methods: Twenty patients with MDD (15 female; mean age, 45 ± 9 years) were included. Patients received cognitive-behavioral therapy with an integrated, standardized return-to-work module (W-CBT). Psychometric measurements included Beck Depression Inventory (BDI-2) and work ability index (WAI). Further, time until return-to-work was measured, and acceptability of W-CBT was assessed using visual analog scales and open questions.

Results: Mean sick leave days in depressed patients were 127 ± 97, and 75% of patients were sick leave for more than 6 weeks. After treatment, 11/20 patients had returned to their former occupation (55%), 5/20 were in occupational re-deployment or started a new job (25%), and 3/20 patients were still on sick leave (2/20; 10%) or received a pension (1/20; 5%). One patient dropped out. BDI-2 sum score improved from 23 ± 8 to 8 ± 5 ($p < 0.001$), and WAI improved from 28 ± 6 to 39 ± 7 ($p < 0.001$). Acceptability of W-CBT in patients and therapists was high.

Conclusion: We here demonstrate feasibility and acceptability of an RTW module integrated in standard cognitive behavioral therapy. W-CBT leads to improvement of work ability, paralleled by improvement of depressive symptoms. Despite the limitations of this uncontrolled study, the results propose that W-CBT may be feasible in the treatment of depressed patients with long sick leaves and justify a controlled trial evaluating the efficacy of W-CBT.

Keywords: return to work, major depressive disorder, feasibility, acceptability, work ability

INTRODUCTION

For the majority of people work is an important part in life. Work meets important psychosocial needs, is central to individual identity, and social role and employment is one of the main drivers of social gradients in physical and mental health and mortality (1). Decreased work participation due to mental illness has increased considerably in western countries (2). Associated with impaired work functioning and problems in work participation such as long-term sick leave are, e.g., depression, anxiety, and adjustment disorder (3, 4). Decreased work participation leads to an additional burden for the patient, fostering social isolation, and enhancing the risk for early retirement since only around 50% of people who are on long-term sick leave return into their occupation (5, 6). This indicates a risk of entering disability due to mental illnesses. Variables like symptom severity or comorbidity rate as part of illness characteristics explain part of disability processes, but contextual factors (personal and environmental factors like days out of role or work absence) also play an important role in the disablement process (7). For people suffering from depression several studies have shown increased difficulties to go back to their workplace or to keep their position when returning to work after depression-related unemployment or sick leave (8–10). Even the risk for further relapses of depression can be influenced by experiencing difficulties when going back to work (8). In a recent study Weziak-Bialowolska et al. (11) found that depression in life is likely to manifest itself at work. As listed above work participation provides health-promoting effects. Facilitating return to work and reducing the number of sick leave days is an objective shared by patients, companies, and the public health system.

Sick leave episodes in patients with mental illness are characterized by long duration and high frequency (12). In general, sick leave duration depends on several factors such as medical (e.g., diagnosis, presence of somatization, severity, comorbidity) (2, 5, 13), job-related (e.g., occupational stress, threat of unemployment, organizational structure) (5), socio-demographic (e.g., age, gender, educational level, marital status) (14), legislative and administrative factors (e.g., modality for paying) (15). However, studies indicate that an important factor in sick leave duration in people with mental disorders is delay in their management (16). The delay in treating patients with mental disorders may extend the time being on sick leave. Studies carried out with mentally ill workers found that a delay of more than 3 weeks in the medical consultation after going on sick leave was one of the main factors predicting a long sick leave of between 3 to 6 months (2). Besides reducing the time between beginning and diagnosis/treatment of mental disorders, integration of return to work aspects into treatment may facilitate occupational participation and reduce sick leave days due to mental disorders (17). In a recent study by Lagerveld and colleagues, a work-focused cognitive behavior therapy (W-CBT) in patients with minor mental illness (primarily adjustment disorder) was superior in terms of return to work compared to cognitive behavior therapy (CBT) alone. These results suggested that focusing more and earlier on work-related aspects in patients with mental disorder improved occupational participation within a regular psychotherapeutic setting, without negative side effects on psychological complaints (17). The "return-to-work" (RTW) module used in this study was developed by Lagerveld and colleagues (from Netherlands) to be integrated in standard CBT. This RTW module was translated into German language and published recently (18).

The aim of our study was to examine whether it is feasible to integrate the translated RTW module into CBT in Germany in the treatment of patients with major depressive disorder (MDD) who are on sick leave due to their mental illness. We aimed to examine whether W-CBT is accepted by patients and therapists, whether patients return to work, and whether reduction of depressive symptoms is impeded.

METHODS

For the first time an authorized translated version of the original RTW module developed in the Netherlands was applied by RTW-trained psychotherapists in Germany. The study was approved by the ethics committee of the Hannover Medical School, and all participants gave informed written consent prior to the beginning of the study. The psychotherapeutic intervention followed ethical guidelines for interventional studies according to the declaration of Helsinki.

Participants and Procedure

Inclusion criteria were the diagnosis of MDD, sick leave due to MDD, age >18 years, and outpatient treatment. Exclusion criteria were any substance-use disorder, bipolar disorder, any personality disorder, any eating disorder, and any acute or chronic physical disorder. During intake at the outpatient clinic, patients were screened for inclusion criteria. Further, acute suicidality (severe suicidal thoughts, suicide intention) was an exclusion criterion. All patients who fit criteria and agreed to be included into the study underwent a structured clinical interview according to DSM-IV (SCID-1 and SCID-2), and a thorough clinical examination to confirm in- and exclusion criteria. None of the patients who were invited refused to take part in the study.

Psychological assessments further comprised the Beck Depression Inventory-2 (BDI-2), and the work ability index (WAI). **Table 1** presents demographic information of the patients. The participants were asked to fill in the BDI-2 and the WAI before treatment started (T0), and after the last treatment session (T1). In addition, at T1 the patients and therapists were asked to reply to qualitative questions about the therapy process in written form. Patients received these questions by their therapists after the last psychotherapeutic session (T1), and the psychotherapists received the qualitative questions by the study leader after the last treatment session. These questions are listed in **Table 2**.

All participating psychotherapists were trained in cognitive behavioral therapy and had at least 3 years of working experience in psychotherapy in the Department of Psychiatry, Social

TABLE 1 | Baseline data of depressed patients included in the study.

	Patients with major depressive disorder (N= 20)
Female gender (N/%)	15 (75%)
Age (y)	45.8 ± 9.5
Mean BDI-2 sum score before treatment	23.6 ± 8.5
Marital status (N/%)	
Singled	4 (20%)
Partnered	6 (30%)
Married	7 (35%)
Divorced	3 (15%)
Average sick leave until study entry (d)	127 ± 97
Long-term sick leave (>6 week) (N/%)	15 (75%)
Graduation/schoolyears (N/%)	
Secondary modern school (5–9 years)	3 (15%)
Junior high school (10–11 years)	7 (35%)
Upper school (12–13 years)	10 (50%)
Occupation	
Blue collar	11 (55%)
White collar	9 (45%)

TABLE 2 | List of qualitative questions addressed to the patients and therapists.

Questions to the patients:	
1	How satisfied were you overall with your therapy? (VAS 0–15)
1.1	The following approaches in therapy have helped me a lot:
1.2	The following approaches in therapy have helped me less:
2	How much did the therapy support returning to work? (VAS 0–15)
2.2	What helped you in therapy with resuming your work?
2.3	Which aspects of the therapy have hindered the resumption of work?
3	How much did you feel supported outside the therapy (resettlement officer, doctor, supervisor, colleagues, etc.) in resuming work? (VAS 0–15)
3.1	What or who else helped you get back to work outside of therapy?
3.2	What or who has hindered the return to work?
4	How helpful did you think it was that the focus of the therapy was placed on the workplace and on professional reintegration? (VAS 0–15)
Questions to the therapists	
1	How helpful did you think it was that the focus of the therapy was placed on the workplace? (VAS 0–15)
2	Do you think the patient benefited from the RTW approach? (VAS 0–15)
2.1	What did the patient most benefit from?
2.2	Did the RTW approach in any way hinder the patient's recovery?
3	As a therapist, do you feel that the RTW approach has helped you in any way to treat this patient? (VAS 0–15) (Please describe.)
4	Despite the module, were there any obstacles in the reintegration of your patient? (Please describe.)

Psychiatry and Psychotherapy. They were trained in the "return-to-work" (RTW) module during a weekend course which was held by the inventors of the manual (SE Lagerveldt, RWB Blonk), and the psychotherapeutic process was continuously supervised.

Description of the Interventions in W-CBT

In short, W-CBT offers a manualized stepwise program that focusses on the process of returning to work from the first session on. Workplace and work-related issues are set in the center of the therapy, and classical CBT strategies, such as socratic dialogue, behavioral experiments, or disputation of dysfunctional thoughts, are used.

After assessment and diagnostics regular CBT was prepared. This included setting individual therapy goals and developing a treatment plan. Based on the "Return-to-work" protocol by Lagerveld and Blonk (9) the general treatment plan was supplemented by the manualized RTW elements (W-CBT). Following the protocol the psychotherapist conducted the process of returning to work. Therapists focused on work issues from the first session on and used work as a context to reach treatment goals (e.g., activation, time structure, social contact, regular activity, increasing self-esteem). Therefore, detailed information on the individual's work history as well as on the conditions and procedures at the workplace needed to be collected. Communication and cooperation with fellow-treating parties is obligatory. In the first session all issues were listed, and their relation to work was illustrated (e.g., "You said you often experience listlessness, in which situations do you notice it at work?"), information about the relationship between psychological well-being and work was shared (e.g., "Work can offer structure, social contacts, and self-esteem that are important for psychological well-being.") and for homework the patient prepared a detailed description of the conditions at the workplace. In the second session, the conditions at work got analyzed. Despite collecting information on the framework conditions all tasks were listed and ranked in a hierarchy comparable to an "anxiety hierarchy" used in exposure *in vivo* techniques. As homework the patient was motivated to contact the person in charge for reintegration at the company. In the third session to prepare occupational reintegration all generated information were used to develop a schedule for the reintegration process. Therefore, the needed period got estimated, the first step in its scope and schedule was planned as well as difficulties needed to be identified. The plan for the gradual reintegration process considered the activities or tasks that the patient would perform, the time that was spent on each task and whether modifications on workplace conditions were necessary. Once the patient had started with the reintegration schedule part of the therapy sessions were used to evaluate the process and adjust the schedule if necessary. The therapist supported the full procedure and new skills, alternative behavior, cognitive restructuring, etc. was applied to the examples confrontation with work generated. The German translation of the manual was followed (10). Therapy was finished when individual goals were achieved, and both therapists and patient agreed on ending the treatment. Supervisors trained by Lagerveld supervised the therapy processes on a regular basis.

Data Analysis

All statistical analyses were conducted using SPSS version 25. Descriptive analysis was performed for the whole group concerning age, gender, marital status, graduation, average days on sick leave, and visual analog scales of the qualitative questions. The responses to all other qualitative questions (open answer questions) were listed in the results.

Pre-post comparisons for the Beck Depression Inventory-2 (BDI-2) BDI sum score and for the WAI were performed with paired t-test.

To compare patients who successfully returned to work or were in occupational redeployment/new job (N = 16) with those who did not (early pension, N = 1; still on sick leave, N = 2) or dropped out (N = 1), baseline depression, and work-ability data were compared using Mann-Whitney U-test.

RESULTS

Is W-CBT Accepted by Patients and Therapists? Results of the Qualitative Questions

Out of 20 patients, only one dropped out during W-CBT treatment as he moved to a different city. To assess acceptability of W-CBT, patients and psychotherapists were asked to answer a qualitative questions after the last W-CBT session (after an average of 26 ± 14 weeks).

The patients could answer four of the qualitative questions with the use of 15 cm long visual analog scales ranging from "not at all" (11) to "very much" (15). The means and standard deviations are presented in **Figure 1**. Between the two poles all means lie above the middle presenting positive ratings. The patients experienced the focus on work as helpful (M = 12.5), supportive in the process of returning to work (M = 13.6), and were generally satisfied with their therapies (M = 13.4). The support outside therapy to resume to work was scored the lowest (M = 8.8). **Figure 2** shows the therapist's feedback on three visual analog scales. These means also lie above the middle towards the positive pole. Therapists evaluated the approach as helpful for the treatment (M = 10.7), believed the patients benefited from the approach (M = 10.4), and rated the work focus as helpful (M = 11).

To the question what helped you a lot during therapy patients replied: "having someone to talk about my challenges," "behavioral analysis," "following a weekly schedule," "developing alternative strategies and alternative appraisals," "learning to take more care of myself and my needs," "preparing difficult situations in role plays." The only answer given to the question what was less helpful was: "filling out questionnaires." What helped in therapy with resuming work was "to gain clarity on decisions," "role plays," "to feel prepared knowing new strategies," "learning how I can influence the situation at work." No answers were given to the question what aspects hindered the reintegration to work. Different family members were listed as people who have supported the process of reintegration to work. In addition some patients mentioned the representative for employees with disabilities, three patients listed their direct superiors, some listed their colleagues and some the company doctor. Seven patients reported that their direct supervisor hindered the resumption to work, two listed their colleagues. To the question "What did the patient most benefit from?" the therapist answered: "support and motivation to communicate with the employer," "developing a precise schedule for reintegration," "job analysis," "role plays," "precise analysis of obstacles at work," "the structured approach," "situation analysis," "changing beliefs." The question if the RTW-module in any way hindered the therapy process was consistently answered with "no." Aspects that helped the therapists in the treatment of the patients were "being obligated to focus on work from the first session on helped doing it and hindered avoiding it," "it helped keeping the focus on work even if the patient tried to avoid it," "it created a helpful structure even in the treatment of severe symptoms of depression," "the detailed information on the workplace prevented generalized assumptions," "the detailed information on the workplace helped to estimate chances and challenges," "the module helped me to feel more

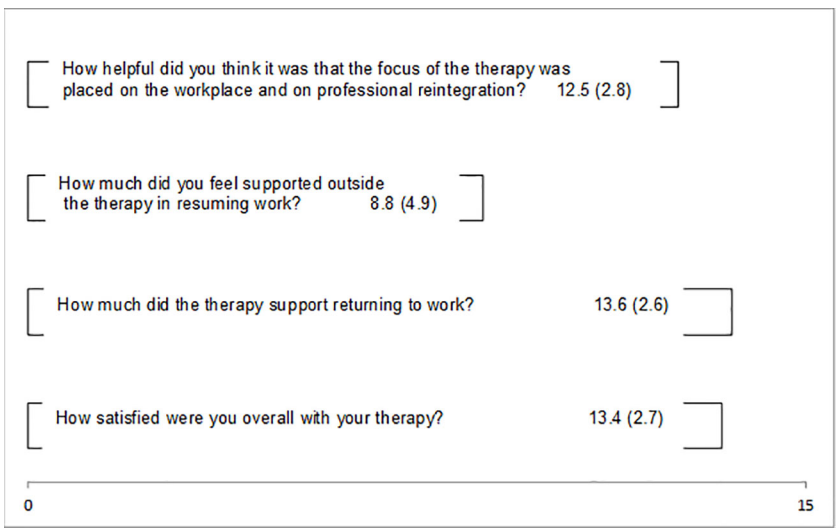

FIGURE 1 | Results of the acceptability questionnaire in patients.

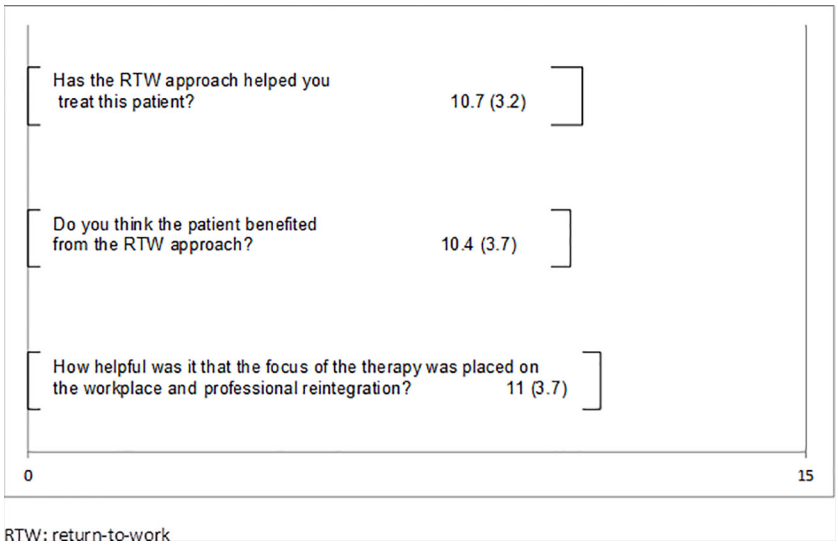

FIGURE 2 | Results of the acceptability questionnaire in therapists.

secure in the support of the reintegration process." As obstacles in the reintegration process, the therapists described that in five cases, the employer did not cooperate, e.g., terminated the job contracts or offered lower positions than expected. From one therapy the therapist reported that due to severe chronic depression with a comorbid personality disorder the approach was too demanding. In two cases the patients did not follow the plan, but tried to be faster. This led to overstress. In some cases bureaucracy was reported to be very slow which delayed the reintegration process.

Do RTW Interventions Lead to Return-to-Work?

After treatment, 11/20 patients had returned to their former occupation (55%), 5/20 were in occupational re-deployment or had started a new job (25%), and 3/20 (15%) patients were still on sick leave (2/20; 10%) or received a pension (1/20; 5%) (shown in **Figure 3**). Number of therapy sessions: 26 (± 14), sessions until RTW: 9 (± 9).

We found higher depression sum scores (31.5 ± 12.7 versus 23.1 ± 8.9) and lower work ability scores (23.2 ± 5.7 versus 28.5 ± 6.2) at baseline in those patients who failed to return to work. However, these differences did not reach significance.

Do Depressive Symptoms and Work Ability Improve?

Pre-post comparisons of 19 patients revealed a reduction of depressive symptoms ($T = 6.7$; $df = 18$; $p < 0.001$) (**Figure 4**). The sum scores of the WAI showed a significant improvement of the patient's work ability in the pre-post comparison ($T = 7.8$; $df = 18$; $p < 0.001$) (**Figure 5**).

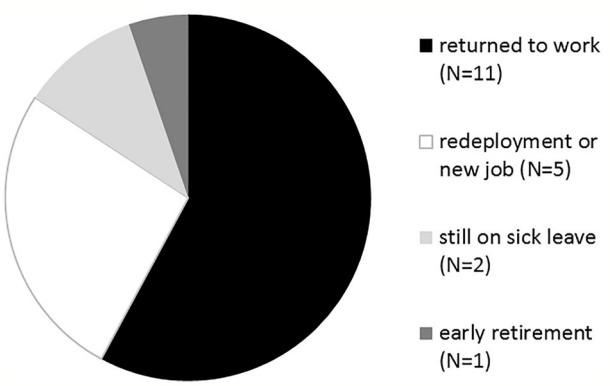

FIGURE 3 | Treatment outcome concerning return to work.

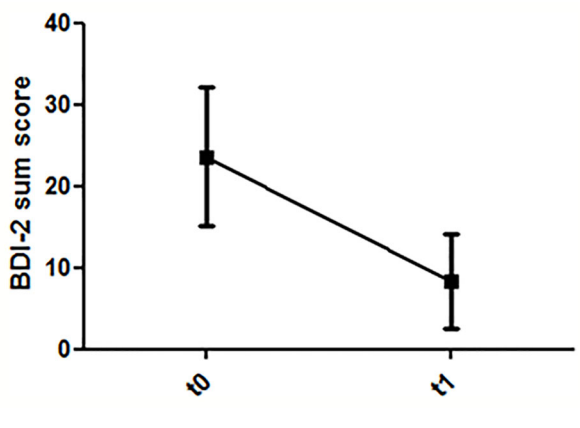

FIGURE 4 | Dynamics of depression ratings (T0: before first treatment session; T1: after last treatment session).

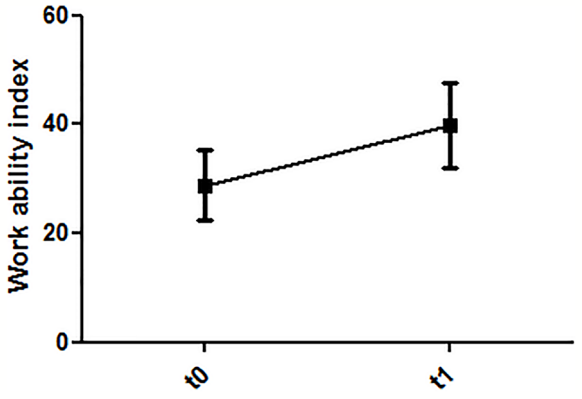

FIGURE 5 | Dynamics of work ability (T0: before first treatment session; T1: after last treatment session).

DISCUSSION

The main results of our study are: RTW module could successfully be integrated in CBT, and was highly accepted by patients and psychotherapists. Further, the majority of patients with MDD treated with W-CBT started occupational reintegration during treatment, or started occupational re-deployment/working in a new job. Depressive symptom severity was reduced, and work ability significantly increased.

Our results extend the existing literature on W-CBT. First, we included only patients with major mental disorder, i.e., MDD, with moderate symptom severity. In the initial study by Lagerveld and colleagues, mainly patients with minor mental disorders, i.e., adjustment disorder, were included, leaving the question open whether W-CBT could also be applied to patients with major depression (17).

In a recent study by Kröger and colleagues, a work-related CBT treatment was offered to 13 patients with MDD and compared to a matched control group (19). They found that days of incapacity to work were reduced in both groups, although employees in the work-related CBT group showed fewer days of incapacity to work, and significantly more employees were working in the work-related CBT group at 1 year follow-up (13/13 versus 8/13 in the control group). Depression severity scores were similarly reduced in both groups, leading to response (defined as 50% symptom reduction) in both groups at the end of treatment, and at 1 year follow-up. In this study, the majority of patients was mild-to-moderately depressed with a mean BDI sum score of 20 in both groups, and only short-term sick leaved patients (maximum 3 weeks sick leave) were included. Psychotherapists in this study received a 2-h workshop in which aims and procedures of work-related treatment were introduced. Measures of acceptability by patients and therapists were not assessed.

Our results demonstrate that W-CBT can also be integrated in the psychotherapeutic treatment of patients with more severe disorder and considerably longer sickness leave. In regular CBT offered by mental health professionals a focus on return to work is often lacking (20). The effectiveness of psychotherapy on return to work may therefore be enhanced when work is more explicitly addressed during treatment. The work-focused CBT intervention employs the same conceptual framework as is used for regular CBT, based in large on the work by Beck (21). In short, CBT states that dysfunctional behavior and mental health symptoms are not merely the consequence of a stressful situation (e.g., work pressure), but that appraisal of this situation plays a crucial role (21). Two main intervention approaches can be distinguished, targeting dysfunctional cognitions, and acquiring effective skills such as behavioral activation.

The central idea in work-focused CBT interventions is that any CBT technique may be applied to the work context, in order to achieve regular psychotherapy treatment goals (improvement in depressive symptoms) and to facilitate return to work (17). Several factors may impede return to work in patients with MDD, such as feelings of incompetency, feelings of excessive demands, lack of motivation, or lack of energy. CBT techniques can be applied to relieve feelings of incompetency, to change challenging/stressful work situations, to change dysfunctional avoidance behavior related to the workplace (such as procrastination), or to change the appraisal of work-related stressors (17). Hence, it is assumed that integrating return to work aspects in CBT would contribute to a change in dysfunctional work-related cognitions and behaviors, thereby facilitating return to work in MDD patients.

As from clinical experience we know that many patients come into treatment with the idea never being able returning to work as well as many therapists share the opinion that it may be beneficial for the patient to have a break from the stressful environment and have time to recover before confronting work issues we were interested in the acceptability of the RTW-module. The results show a high acceptability. Not all of the patients initially agreed to focus on work and reintegration to work, but by sharing information on the relationship between work and how it can support recovering from mental disorders, e.g., by providing structure, social contacts, opportunities to experience competence, and self-esteem, all patient became interested in the procedure. Not a single answer was given to the question if the RTW-module hindered the therapy process. No negative feedback could be found even though there was a certain level of skepticism in the beginning.

A potential concern against W-CBT might be that patients and therapists think that early return to work may increase relapse or worsen depressive symptoms. However, we found in our study that patients who successfully returned to work had responded to psychotherapeutic treatment, indicated by a >50% reduction in self-rated depressive symptoms. We conclude that W-CBT does not impede recovery from depressive symptoms in our patient sample. Of note, those patients who failed to return to work were more severely ill with a mean BDI sum score (on average 31.5) pointing to severe MDD. Further, these patients had lower work ability with a mean WAI score (on average 23.2) pointing critically reduced work

ability. In contrast, patients who successfully returned to work, were in occupational redeployment or starting in a new job, had moderate depression severity with an average BDI sum score of 23.1, and a better work ability (28.5 on average) pointing to a moderate reduction. Although the study group is too small to draw firm conclusions from this observation, one may speculate that W-CBT might be recommended rather in moderately ill patients with MDD, and in those with at least moderate work ability.

The main limitations of our study are: the small sample size and a missing control group. Further, we observed patients only for an average of 26 weeks. However, the principal aim of our study was to explore feasibility and patients and therapists acceptability. Therefore, future studies might take these limitations into account, using a greater sample size and a longer follow-up.

We conclude from our data that a Return-to-Work module can successfully be integrated in CBT in Germany, leading to work participation even in patients with long sick leave, and leading to a reduction of depressive symptoms. The focus on work from the start of psychotherapy on was well accepted by patients and therapists. However, due to the small number of participants the results of our feasibility study have to be interpreted carefully.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The study was approved by the local ethics committee at the Hannover Medical School. All patients/ participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors put up the study design and were involved translating the protocol. LW, JG, and KP-B screened the patients and were part of the group of therapists. JG and KP-B were responsible for data collection. LW and KK supervised the therapies, analyzed the data and wrote the manuscript.

REFERENCES

1. Waddell G, Burton K. *Is Work Good for Your Health and Wellbeing? An Independent Evidence Review*. London, UK: The Stationary Office (2006).
2. Brouwers EP, Terluin B, Tiemens BG, Verhaak PF. Predicting return to work in employees sick-listed due to minor mental disorders. *J Occup Rehabil* (2009) 19:323–32. doi: 10.1007/s10926-009-9198-8
3. Andrea H, Bultmann U, Beurskens AJ, Swaen GM, van Schayck CP, Kant IJ. Anxiety and depression in the working population using the HAD Scale, psychometrics, prevalence and relationships with psychosocial work characteristics. *Soc Psychiatry Psychiatr Epidemiol* (2004) 39:637–46. doi: 10.1007/s00127-004-0797-6
4. Boedeker W, Klindworth H. *Hearts and minds at work in Europe. A European work-related public health report on cardiovascular diseases and mental ill health*. Essen, Germany: BKK Bundesverband (2007).
5. Blank L, Peters J, Pickvance S, Wilford J, Macdonald E. A systematic review of the factors which predict return to work for people suffering episodes of poor mental health. *J Occup Rehabil* (2008) 18:27–34. doi: 10.1007/s10926-008-9121-8
6. Dekkers-Sanchez PM, Hoving JL, Sluiter JK, Frings-Dresen MH. Factors associated with long-term sick leave in sick-listed employees: a systematic review. *Occup Envorin Med* (2008) 65:153–7. doi: 10.1136/oem.2007.034983
7. van der Werff E, Verboom CE, Penninx BW, Nolen WA, Ormel J. Explaining heterogeneity in disability associated with current major depressive disorder: effects of illness characteristics and comorbid mental disorders. *J Affect Disord* (2010) 127:203–10. doi: 10.1016/j.jad.2010.05.024
8. Lerner D, Adler DA, Chang H, Lapitsky L, Hood MY, Perissinotto C, et al. Unemployment, job retention, and productivity loss among employees with depression. *Psychiatr Serv* (2004) 55:1371–8. doi: 10.1176/appi.ps.55.12.1371
9. Lépine J-P, Briley M. The increasing burden of depression. *Neuropsychiatr Dis Treat* (2011) 7:3. doi: 10.2147/NDT.S19617
10. Amos TB, Tandon N, Lefebvre P, Pilon D, Kamstra RL, Pivneva I, et al. Direct and Indirect Cost Burden and Change of Employment Status in Treatment-Resistant Depression: A Matched-Cohort Study Using a US Commercial Claims Database. *J Clin Psychiatry* (2018) 79:1–9. doi: 10.4088/JCP.17m11725
11. Weziak-Bialowolska D, Bialowolski P. Sacco PL, VanderWeele TJ and McNeely E. Well-Being in Life and Well-Being at Work: Which Comes First? Evidence From a Longitudinal Study. *Front Public Health* (2020) 8:103. doi: 10.3389/fpubh.2020.00103
12. van der Klink JJ, Blonk RW, Schene AH, van Dijk FJ. Reducing long term sickness absence by an activating intervention in adjustment disorders: a cluster randomised controlled design. *Occup Environ Med* (2003) 60:429–37. doi: 10.1136/oem.60.6.429
13. Flach PA, Groothoff JW, Krol B, Bultmann U. Factors associated with first return to work and sick leave durations in workers with common mental disorders. *Eur J Public Health* (2012) 22:440–5. doi: 10.1093/eurpub/ckr102
14. Nieuwenhuijsen K, Verbeek JH, de Boer AG, Blonk RW, van Dijk FJ. Predicting the duration of sickness absence for patients with common mental disorders in occupational health care. *Scand J Work Environ Health* (2006) 32:67–74. doi: 10.5271/sjweh.978
15. Krause N, Frank JW, Dasinger LK, Sullivan TJ, Sinclair SJ. Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. *Am J Ind Med* (2001) 40:464–84. doi: 10.1002/ajim.1116
16. Burstrom B, Nylen L, Clayton S, Whitehead M. How equitable is vocational rehabilitation in Sweden? A review of evidence on the implementation of a national policy framework. *Disab Rehabil* (2011) 33:453–66. doi: 10.3109/09638288.2010.493596
17. Lagerveld SE, Blonk RW, Brenninkmeijer V, Wijngaards-de Meij L, Schaufeli WB. Work-focused treatment of common mental disorders and return to work: a comparative outcome study. *J Occup Health Psychol* (2012) 17:220–34. doi: 10.1037/a0027049
18. Winter L, Kraft J, Boss K, Kahl KG. Return to Work: A Workplace Focused Module to be Integrated in Cognitive Behavioral Therapy. *Psychother Psychsom Med Psychol* (2015) 65:321–6. doi: 10.1055/s-0035-1545312

19. Kroger C, Bode K, Wunsch EM, Kliem S, Grocholewski A, Finger F. Work-related treatment for major depressive disorder and incapacity to work: preliminary findings of a controlled, matched study. *J Occup Health Psychol* (2015) 20:248–58. doi: 10.1037/a0038341
20. Rebergen DS, Bruinvels DJ, van Tulder MW, van der Beek AJ, van Mechelen W. Cost-effectiveness of guideline-based care for workers with mental health problems. *J Occup Environ Med* (2009) 51:313–22. doi: 10.1097/JOM.0b013e3181990d8e
21. Beck AT. *Cognitive therapy and the emotional disorders*. International Universities Press (1976).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 18 June 2020
doi: 10.3389/fpsyt.2020.00562

Employers With Metabolic Syndrome and Increased Depression/Anxiety Severity Profit Most From Structured Exercise Intervention for Work Ability and Quality of Life.

Sven Haufe[1†], Kai G. Kahl[2†], Arno Kerling[1], Gudrun Protte[1], Pauline Bayerle[1], Hedwig T. Stenner[1], Simone Rolff[1], Thorben Sundermeier[1], Julian Eigendorf[1], Momme Kück[1], Alexander A. Hanke[1], Katriona Keller-Varady[1], Ralf Ensslen[3], Lars Nachbar[3], Dirk Lauenstein[4], Dietmar Böthig[5], Christoph Terkamp[6], Meike Stiesch[7], Denise Hilfiker-Kleiner[8], Axel Haverich[5] and Uwe Tegtbur[1]*

[1] Institute of Sports Medicine, Hannover Medical School, Hannover, Germany, [2] Department of Psychiatry, Social Psychiatry and Psychotherapy, Hannover Medical School, Hannover, Germany, [3] Volkswagen AG, Wolfsburg, Germany, [4] Audi BKK Health Insurance, Ingolstadt, Germany, [5] Department of Cardiac, Thoracic, Transplantation, and Vascular Surgery, Hannover Medical School, Hannover, Germany, [6] Department of Gastroenterology, Hepatology and Endocrinology, Hannover Medical School, Hannover, Germany, [7] Department of Prosthetic Dentistry and Biomedical Materials Science, Hannover Medical School, Hannover, Germany, [8] Department of Cardiology and Angiology, Hannover Medical School, Hannover, Germany

Background: Major depressive disorder and anxiety disorders are associated with less productivity, earlier retirement, and more sick-days at the workplace. These associations also exist for patients with metabolic syndrome. For both, exercise is a generally recommended part of multimodal treatments. However, for individuals with metabolic syndrome, in which depression and anxiety is more prevalent and severe, evidence for the efficacy of exercise interventions is limited.

Methods: Company employees with diagnosed metabolic syndrome (n=314, age: 48 ± 8 yrs) were randomized to a 6-month exercise intervention (150 min per week) or wait-list control. Participants received individual recommendations for exercise activities by personal meetings, telephone, or *via* a smartphone app. Physical activities were supervised and adapted using activity monitor data transferred to a central database. Work ability (work ability index), depression severity and anxiety severity [hospital anxiety and depression scale (HADS)], and health-related quality of live [short form 36 (SF-36)] were assessed.

Results: We included 314 subjects from which 287 finished the intervention. Total work ability, depression- and anxiety severity, and the mental component score of the SF-36 improved after 6 months exercise compared to controls. After baseline stratification for normal (HADS scores 0–7) and increased depression- and anxiety scores (HADS scores 8–21) individuals with increased severity scores had similar age, body composition, blood lipids, and cardiorespiratory fitness compared to those with normal scores, but lower total work ability and component sum scores of health-related quality of life. After 6 months

OPEN ACCESS

Edited by:
Cynthia H. Y. Fu, University of East London, United Kingdom

Reviewed by:
Padmavati Ramachandran, Schizophrenia Research Foundation, India
Philipp Zimmer, German Sport University Cologne, Germany

***Correspondence:**
Sven Haufe
haufe.sven@mh-hannover.de

[†]These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *08 November 2019*
Accepted: *02 June 2020*
Published: *18 June 2020*

Citation:
Haufe S, Kahl KG, Kerling A, Protte G, Bayerle P, Stenner HT, Rolff S, Sundermeier T, Eigendorf J, Kück M, Hanke AA, Keller-Varady K, Ensslen R, Nachbar L, Lauenstein D, Böthig D, Terkamp C, Stiesch M, Hilfiker-Kleiner D, Haverich A and Tegtbur U (2020) Employers With Metabolic Syndrome and Increased Depression/Anxiety Severity Profit Most From Structured Exercise Intervention for Work Ability and Quality of Life. Front. Psychiatry 11:562. doi: 10.3389/fpsyt.2020.00562

total work ability increased in the exercise group compared to controls with the magnitude of the observed increase being significantly greater for subjects with increased depression- and anxiety severity at baseline compared to those with normal severity scores.

Conclusions: A 6-month exercise intervention for company employees with metabolic syndrome showed strongest effects on self-perceived work ability in individuals with mild to severe depression- and anxiety severity. This suggests exercise programs offered to workers with metabolic syndrome not only reduces individual disease risk but may also reduce healthcare and employers costs arising from metabolic syndrome and mental disease conditions.

Clinical Trial Registration: ClinicalTrials.gov, identifier NCT03293264.

Keywords: physical activity, telemonitoring, activity devices, productivity, mental health

INTRODUCTION

According to the Global Burden of Disease Study, major depressive disorder and anxiety disorders belong to the most frequent and burdensome disorders worldwide leading to premature mortality (1, 2). A recent representative community survey in Germany revealed 12-month prevalence rates as high as 15.3% for anxiety disorders and 7.7% for major depressive disorder (3). Major depressive disorder represents a significant economic burden estimated at 210 billion dollar, with presenteeism and absenteeism accounting for almost half of these costs (4). Current guidelines recommend psychopharmacological drugs and/or psychotherapy for the first line treatment of major depressive disorder and anxiety disorders (5).

A non-pharmacological intervention to ameliorate the severity of depression and anxiety is structured and regular exercise (6). Benefits of physical activity for the treatment and prevention of mental health have been shown for certain (7–9) but not for all subjects or interventions (10–12). Of note, several studies point to an association between major depressive disorder and metabolic syndrome (13, 14). However, for individuals with metabolic syndrome, in which depression and anxiety is more prevalent and severe (15, 16), evidence for the efficacy of exercise interventions is scarce. Metabolic syndrome, a cluster of different cardio-metabolic abnormalities affects about one third of today's population worldwide (17), with highest and still increasing numbers in the USA (18) and increased prevalence in older populations (19). Both, mental disorders and metabolic syndrome have socioeconomic relevance by affecting workers absenteeism and productivity (20), thereby increasing costs for employers and healthcare systems (13, 14, 21). Physical activity programs improve several cardio-metabolic outcomes in metabolic syndrome patients (22). For depressive patients we observed benefits for abdominal- and cardiac adipose tissues, skeletal muscle mass, aerobic capacity, and brain derived neurotrophic factor following structured exercise interventions (23–26). Recently, we also reported that self-perceived work ability and quality of life improved after a 6-month exercise-focused occupational health program in workers with metabolic syndrome which may be, at least partly, attributable to the effects of exercise on depression and anxiety severity (27). However, to date it is unclear to which extent individuals with higher anxiety and/or depressive symptom load take profit from exercise programs, particularly concerning indicators of work ability. Therefore, we re-analyzed questionnaires and cardio-metabolic data from the 6-month, telemonitoring-supported and exercise-focused lifestyle intervention in employees diagnosed with metabolic syndrome.

MATERIALS AND METHODS

Study Design and Participants

The present study is a secondary analysis of a recently published trial reporting the primary outcome metabolic syndrome severity after exercise training (27). This was a prospective, randomized, and single-blind (assessor blind) trial conducted as a collaborative project between Volkswagen AG and Hannover Medical School (ClinicalTrials.gov Identifier: NCT03293264). The study was carried out in accordance with the Declaration of Helsinki and current guidelines of good clinical practice. The institutional review board of Hannover Medical School approved the study (No. 7531) and written informed consent was obtained prior to inclusion of study participants.

Recruitment of volunteers was conducted at the main Volkswagen factory in Wolfsburg (Lower Saxony, Germany) by local information events during working hours as well as distribution of advertisements *via* email and intranet to employees. According to pre-study defined inclusion and exclusion criteria, we included female and male subjects over the age of 18 who fulfilled at least three of the five metabolic syndrome components according to the American Heart Association (AHA)/The National Heart, Lung, and Blood Institute (NHLBI) criteria, (28) and who were not participating in an ongoing occupational health program. Exclusion criteria were acute or chronic infections, oncological diseases, joint replacements or any surgery within the last 6 weeks, pregnant or breastfeeding women, and any condition that precluded participation in an exercise intervention.

Volunteers were randomized 1:1 to 6-months exercise (EG) or a waiting-control group (CG) using a computer-based list of random numbers generated by an external collaborator. Variable block length was used, to avoid selection bias due to predictability. Study nurses and physicians screening volunteers and assessing the primary outcome at baseline and after 6 months were blinded for the randomization sequence.

Anthropometric and Cardio-Metabolic Assessments

After a general medical examination by a physician (including ECG, case history, and physical examination), body weight, waist circumference, and height were measured in a standardized fashion. Fat-free and fat mass as markers of body composition were estimated by segmental, multi-frequency bio-impedance analysis (InBody720, Biospace, Seoul, Korea). After an overnight fast, venous blood samples were obtained to determine blood lipids, fasting glucose, and a safety blood profile using standard methods in a certified clinical chemistry laboratory. Office blood pressure was measured after 5 min rest with an appropriate-sized automatic blood pressure cuff (Critikon, Dynamap, Tampa, USA) as a mean of two consecutive records. To test exercise capacity (measured as peak power output in watt), participants performed an incremental exercise test on a bicycle ergometer (Schiller 911 BPplus, Feldkirchen, Germany). The test started with a work load of 50 watts (W) for males and 20 W for females and was increased in 10 W steps each minute until the subjects could not maintain the requested 60 rpm pedal frequency (voluntary exhaustion) or the test was prematurely stopped by the physician due to predefined stopping criteria (29). All assessments were repeated after the 6-month exercise intervention and control period, respectively.

Questionnaires

We distributed questionnaires for the estimation of anxiety severity and depression severity (HADS) (30), health-related quality of life [short form 36 (SF-36)] (31), as well as for daily physical activity (Freiburger Physical Activity questionnaire) and work ability [work ability index (WAI)] (32). The HADS consists of fourteen items pertaining to the two subscales for anxiety and depression. Scores for the anxiety and depression subscale range from 0 to 21, with higher score indicating more severe anxiety or depression. Values can be interpreted as normal from 0–7 points, mild (8–10 points), moderate (11–14 points), and severe (15–21 points). The SF-36 questionnaire measures health-related quality of life with eight subscales resulting in two sum scales, the mental- and physical component score. For both scales, a score of 0 points represents a minimum and a score of 100 points a maximum quality of life. The Freiburger activity questionnaire determines the total and exercise-related physical activity of adults, both of which are specified as metabolic equivalents of task (MET)-hours per week. The Work Ability Index (WAI) questionnaire contains seven questions concerning work, work ability, and health, resulting in a total score ranging from seven to 49, with higher values representing greater work ability.

Study Intervention

The study intervention was described in detail elsewhere (27). In brief, participants performing the 6-month exercise intervention received a personal counselling with recommendations aiming to perform 150 min of moderate-intense physical activity per week. For typical physical activities, an individual heart rate with a target range between 65 to 75% relative to measured maximum heart rate was advised, based on data from initial exercise tests, activity questionnaires, and medical history. The exercise scientist provided information on potential exercise training facilities in the vicinity of the participant's home and at the workplace (e.g. gyms, sport classes, rehabilitation courses) and gave tips to attain a high level of physical activity in daily routine.

The exercise group was equipped with an activity monitor (Forerunner 35, Garmin, Garching, Germany) and asked to wear the monitor throughout the intervention period. Wearing time, steps and preset or self-defined activities (e.g. cycling, cardio-training, walking outdoors and walking indoors) were recorded. Activity data were saved and directly forwarded *via* an interface (API) from the Garmin server to a server at Hannover Medical School with the aim of a regular feedback and activity adaptation from the supervisor. Participants were free to contact their supervisor per telephone or e-mail at any time in case of questions.

All participants of the exercise group received nutritional counseling, which provided background information on healthy food choices based on general recommendations issued by the German Society for Nutrition (https://www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/10-regeln-der-dge/10-guidelines-of-the-german-nutrition-society).

Statistical Analysis

The primary outcome of our study was the change in the metabolic syndrome severity following a 6-month exercise intervention compared to controls. Based on an earlier study using a similar intervention (33) a sample size of 264 participants was calculated to achieve a significant between-group difference for the primary outcome with 90% power and significance level of 0.05 (MedCalc Statistical Software version 17.6, Ostend, Belgium). With an anticipated dropout rate of 18% we calculated a final sample size of 312 subjects for inclusion in the study. For the analysis of the primary and all secondary outcomes, an analysis of covariance model (ANCOVA) was used with the change in the parameter of interest (6 months-baseline) as the response variable. Explanatory variables were gender, the respective parameter at baseline, and the study group (exercise- vs. control). Normality distribution was tested using the Kolmogorov-Smirnov-Test. For all outcomes the analysis was carried out according to the intention-to-treat (ITT) principle, including all randomized subjects. Missing values were replaced by the baseline observation carried-forward method. For descriptive analysis absolute frequencies were calculated for categorical variables and mean and standard deviation (SD) for continuous variables. To test for within-group differences from baseline to end of intervention, a two-sided *Students* T-Test for

paired samples was used. Univariate associations between parameters were tested using *Pearson's* correlation coefficient.

For the current secondary analysis, participants were stratified according to subgroups of normal versus mild to severe depression- or anxiety severity. Stratification was based on results from the baseline HADS questionnaire with scores from 0–7 points set as normal and scores from 8–21 as mild to severe. To analyze whether exercise versus control group changes over time were different for depression and anxiety subgroups, we used the interaction term: time (baseline-6 months) × study group (exercise or control) × subgroup (normal scores or mild to moderate scores) as calculated with the ANCOVA model. The type-I-error was set to 5% (two-sided). All statistical analyses were performed with IBM SPSS 25 Statistics (IBM Corporation, NY, US).

RESULTS

Of 314 randomized subjects, 274 (87%) completed the intervention, with 28 subjects in the exercise group and 12 in the control dropped out during the 6-month period. We documented no serious adverse event during the intervention in both groups. Subjects in the exercise and control group did not differ for gender distribution, age, body composition, daily physical activity, exercise capacity, and mental health at baseline (**Table 1**).

Adherence to Physical Activity, Exercise Training Characteristics, and Exercise Capacity

Questionnaire-estimated exercise activities increased more for subjects in the exercise group during the 6-month intervention (EG pre: 6.5 ± 13.7; post 15.9 ± 20.1 MET-hours/wk; CG pre: 6.4 ± 9.0, post: 10.5 ± 15.6 MET-hours/wk) ($p < 0.01$ compared to baseline for both groups, $p < 0.01$ between groups over time). As assessed by the activity monitor worn by the EG subjects, adherence to the scheduled target of 150 min of physical activities per week was 147 ± 46 min/wk. Average steps during the intervention was 9612 ± 2498 steps/day. The maximum power output during incremental exercise testing increased for the exercise- (pre: 1.66 ± 0.38, post: 1.89 ± 0.46 W/kg BW, $p < 0.01$) and the control group (pre: 1.69 ± 0.40, post: 1.77 ± 0.44 W/kg BW, $p < 0.01$) with a significant difference between groups of 0.16 W/kg BW [CI95%: 0.10; 0.21] ($p < 0.01$).

Health-Related Quality of Life and Mental Health

Seven from eight subscales of health-related quality of life (SF-36 questionnaire) increased in the EG and four subscales in the CG from baseline to 6 months (see **Figure 1A**), with significant differences between study groups over time for the subscales 1 (physical functioning), 4 (general health perceptions), 5 (vitality), and 8 (mental health), favoring exercise training. The physical- and mental component sum scores of the SF-36 increased after exercise training, with a significantly greater increase compared to CG for the mental component score (see **Figure 1B**).

Depression severity based on the HADS questionnaire decreased for the EG (–2.0 ± 2.4 points) and the CG (–0.6 ± 2.2 points) (both $p<0.01$), with a greater decrease over time for subjects in the EG (mean difference –1.4 points [CI95% –1.9; –0.9]; $p < 0.01$). Anxiety severity decreased for the EG (–1.5 ± 2.4 points) and the CG (–0.7 ± 2.0 points) (both $p < 0.01$), with a greater decrease over time for subjects in the EG (mean difference –0.9 points [CI95% –1.5; –0.3]; $p < 0.01$).

Subgroups of Normal Versus Increased Depression and Anxiety Severity

When stratified for the presence of mild to severe (HADS: 8–21 points) and normal scores (HADS: 0–7 points) of depression and anxiety, the majority of our subjects presented with mental conditions within the normal range of depression and anxiety severity scores (78 and 73%, respectively), and the remaining subjects with mild or moderate severity scores (8–14 points, 22 and 27% for depression and anxiety scores respectively).

TABLE 1 | Subject characteristics at baseline.

	Exercise group	Control group	p-value
Subjects (women/men)	160 (24/136)	154 (21/133)	p=0.730
Age (years)	48.3 ± 7.9	47.8 ± 8.5	p=0.624
Body weight (kg)	107.6 ± 18.3	106.1 ± 20,3	p=0.425
Body mass index (kg/m2)	33.6 ± 5.3	33.0 ± 5.4	p=0.281
Body fat (%)	33.0 ± 8.4	32.1 ± 8.0	p=0.317
Fat Free Mass (kg)	71.0 ± 11.4	71.3 ± 12.8	p=0.961
Systolic blood pressure (mmHg)	138 ± 13	137 ± 14	p=0.715
Diastolic blood pressure (mmHg)	88 ± 9	88 ± 9	p=0.341
HbA1c (%)	5.7 ± 1.0	5.6 ± 0.9	p=0.301
Total cholesterol (mg/dl)	215 ± 46	214 ± 46	p=0.839
LDL cholesterol (mg/dl)	138 ± 39	137 ± 40	p=0.886
Total physical activity (MET-h/wk)	25.9 ± 23.8	21.8 ± 16.5	p=0.966
Exercise activity (MET-h/wk)	6.5 ± 13.7	6.4 ± 9.0	p=0.081
Exercise capacity (peak watt)	174 ± 36	176 ± 37	p=0.906
Depression severity (points)	5.3 ± 3.2	5.0 ± 3.3	p=0.455
Anxiety severity (points)	4.6 ± 2.6	4.6 ± 3.1	p=0.215

MET, metabolic equivalent of task; differences between groups were analyzed with Students T-Test for unpaired samples or the chi-square test, data are mean ± SD.

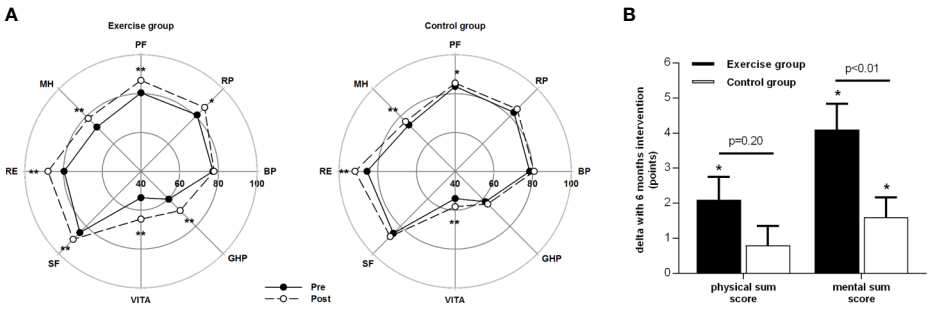

FIGURE 1 | Health-related quality of life as assessed with the SF-36 questionnaire before and after the 6-month intervention. **(A)**: Physical and psychosocial subscales: PF, physical functioning; RP, role physical; BP, bodily pain; GHP, general health perception; VITA, vitality; SF, social functioning; RE, role emotional; MH, mental health. **(B)**: Changes of the physical and mental component sum scores with the 6-month intervention. Data are mean ± SEM, * or ** = significant with $p < 0.05$ or $p < 0.01$ respectively from pre to post assessments as analyzed with T-tests for paired samples.

Before starting the intervention, similar values between subgroups were observed for age, body composition, blood lipids, glucose homeostasis, daily physical activity, and cardiorespiratory fitness (**Tables 2** and **3**). In contrast, the total work ability score (**Figure 2**) and sub-items from the work ability index questionnaire (**Tables 2** and **3**), were always lower in the subgroups with increased depression and anxiety severity at baseline (except for item 5 of anxiety, see **Table 3**). For the sub-scales and component sum scores (physical and mental component score) of the SF-36 questionnaire we observed the same pattern at baseline, with lower health-related quality of life for those individuals with increased depression and anxiety severity (**Tables 2** and **3**).

After the 6-month intervention, body mass index decreased and exercise capacity increased, irrespective of normal or increased baseline depression and anxiety severity (**Tables 2** and **3**). The total work ability score increased in the EG compared to the CG over time, in both the normal and mild to moderate baseline depression and anxiety subgroups (**Figure 2**, framed p-values). However, this increase in total work ability was significantly greater after exercise training for subjects with increased depression or anxiety scores at baseline compared to those with normal depression or anxiety severity (**Figure 2**, unframed p-value). For the physical component sum score of the SF-36 we observed no improvement of exercise training in neither depression nor anxiety subgroup (**Tables 2** and **3**). In contrast, the mental component sum score improved for subgroups with increased depression and anxiety severity and for the subgroup with normal depression severity at baseline (**Tables 2** and **3**).

DISCUSSION

We observed that individuals with increased depression or anxiety severity had a lower self-perceived work ability and health-related quality of life, despite comparable age, body mass index, and other traditional cardio-metabolic risk factors. Six-month telemonitoring-supported and individually guided exercise training improved work ability and health-related quality of life in employees with metabolic syndrome, and this effect was strongest for individuals with higher baseline depression severity or anxiety severity scores.

It is well known that patients with major depressive disorders have a more sedentary lifestyle and engage less in physical activity and healthy lifestyle (34–36). This effect is also observed in anxiety, although to a lesser extent (37). Exercise interventions have been effective in reducing symptoms of anxiety and depression, and in preventing anxiety disorder and major depressive disorders (35, 38, 39). A recent meta-analysis from the European Psychiatric Association regarding exercise in severe mental illness came to the conclusions that exercise as a treatment should be integral part of multimodal treatment for these disorders (40). However, studies concerning the effects of exercise interventions on work ability in psychologically burdened, non-clinical samples are scarce. Depression and anxiety are associated with more sick-days at the workplace, earlier retirement, and less productivity compared to individuals without diagnosed depression and anxiety (41–44). Some studies have been published highlighting psychotherapeutic approaches to improve return-to-work in patients with depression and anxiety, either using face-to-face psychotherapy or internet based devices (45, 46). In our study, a preventive exercise approach was used in non-clinical, but psychologically burdened subjects who were diagnosed with metabolic syndrome. In these individuals who are prone to develop apparent cardiovascular and metabolic diseases, evidence is limited concerning the effects of exercise interventions.

Before starting the intervention, we observed no distinct differences in known cardiovascular and metabolic risk factors like age, body composition, blood lipids, fasting glucose, or exercise capacity between subgroups of normal versus mild to moderate depression or anxiety severity. Notwithstanding these similarities, subjects with increased depression and anxiety manifestation at baseline demonstrated lower work ability and health-related quality of life, highlighting the independent

TABLE 2 | Measurements before and after the intervention for subjects with normal versus mild to moderate depression scores.

	Subjects without depression						Subjects with mild to moderate depression					
	Whole sub-group baseline	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**	**Whole sub-group baseline**	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**
n (men/ women)	242 (206/36)	129 (109/20)		113 (97/16)			53 (47/6)	29 (26/3)		24 (21/3)		
Age (years)	47.6 ± 8.5	47.9 ± 8.3		47.3 ± 8.8			49.9 ± 6.5	49.9 ± 6.1		49.8 ± 7.1		
Body weight (kg)	106.7 ± 19.6	107.1 ± 19.2	–4.1 ± 4.9**	105.9 ± 20.0	–1.0 ± 4.9*	<0.01	108.9 ± 16.8	109.4 ± 13.6	–4.1 ± 5.3**	108.4 ± 20.4	0.1 ± 5.1	0.01
Body mass index (kg/m2)	33.2 ± 5.5	33.6 ± 5.5	–1.5 ± 3.2**	32.8 ± 5.4	–0.3 ± 1.4*	<0.01	33.8 ± 5.3	33.4 ± 4.6	–1.2 ± 1.5**	34.3 ± 6.1	0.0 ± 1.6	<0.01
Body fat (%)	32.3 ± 8.4	33.1 ± 8.5	–2.2 ± 3.2**	31.5 ± 8.4	–0.3 ± 3.3	<0.01	33.8 ± 6.8	32.7 ± 7.3	–1.5 ± 2.8**	35.1 ± 6.0	–0.1 ± 6.0	0.44
Fat free mass (kg)	71.4 ± 12.3	36.3 ± 13.5	–3.7 ± 4.7**	34.2 ± 13.3	–0.6 ± 4.7	0.20	71.5 ± 9.2	36.9 ± 12.4	–3.0 ± 4.1**	39.0 ± 12.5	–0.3 ± 5.9	0.33
Fasting glucose (mmol/l)	6.1 ± 1.1	6.1 ± 1.3	–0.4 ± 0.8**	6.0 ± 1.0	0.0 ± 0.5	<0.01	6.3 ± 1.1	6.3 ± 1.1	–0.2 ± 0.5*	6.3 ± 1.0	–0.1 ± 0.9	0.55
HbA1c (%)	5.6 ± 0.8	5.7 ± 1.0	–0.2 ± 0.5**	5.5 ± 0.6	–0.1 ± 0.4	0.02	**5.9 ± 1.4**	5.6 ± 1.0	–0.3 ± 1.3	6.0 ± 1.6	–0.3 ± 0.9	0.79
Triglycerides (mmol/l)	2.3 ± 2.0	2.1 ± 1.5	–0.3 ± 1.0**	2.1 ± 1.3	–0.0 ± 0.8	<0.01	2.3 ± 1.6	2.2 ± 1.6	–0.2 ± 0.9	2.3 ± 1.3	–0.1 ± 0.7	0.29
Total cholesterol (mmol/l)	213.2 ± 45.9	215.6 ± 48.1	–9.1 ± 25.0**	211.3 ± 44.0	–1.0 ± 27.0	0.03	215.3 ± 40.7	215.0 ± 37.0	–3.8 ± 20.6	215.8 ± 45.6	–4.2 ± 24.2	0.88
Exercise activity (MET-h/wk)	6.7 ± 12.7	6.8 ± 15.2	10.2 ± 24.2**	6.7 ± 9.3	5.4 ± 17.7**	0.05	5.6 ± 7.4	5.6 ± 6.6	5.3 ± 14.5**	5.9 ± 8.4	0.1 ± 8.6	0.14
Exercise capacity (peak watt)	176.4 ± 37.1	174.6 ± 36.1	15.7 ± 20.0**	177.6 ± 38.0	7.9 ± 21.0**	<0.01	170.3 ± 33.1	175.9 ± 32.6	17.9 ± 21.9	163.5 ± 33.1	3.6 ± 19.8	0.02
MetS-z-Score (arbitrary units)	0.93 ± 0.63	0.92 ± 0.64	–0.29 ± 0.47**	0.93 ± 0.59	–0.05 ± 0.38	<0.01	1.04 ± 0.57	0.96 ± 0.64	–0.27 ± 0.44**	1.07 ± 0.45	–0.09 ± 0.41	0.16
Work ability (points)												
Current Work Ability	7.62 ± 1.53	7.66 ± 1.48	0.39 ± 1.27**	7.59 ± 1.59	0.36 ± 1.82	0.04	**6.71 ± 1.75**	6.66 ± 1.59	0.72 ± 1.39**	6.78 ± 1.98	–0.35 ± 1.30	<0.01
Work Ability In Relation To Demands	8.20 ± 1.22	8.21 ± 1.26	0.31 ± 1.10**	8.18 ± 1.18	0.12 ± 1.01	0.11	**7.14 ± 1.31**	7.00 ± 1.22	0.43 ± 1.51	7.30 ± 1.43	–0.22 ± 1.19	0.15
Number of Current Diseases	3.41 ± 1.92	3.39 ± 2.06	–1.15 ± 3.49**	3.45 ± 1.76	–1.26 ± 3.03**	0.93	**2.65 ± 1.76**	2.31 ± 1.95	0.83 ± 3.81	3.09 ± 1.41	0.09 ± 3.26	0.17
Work Impairment Due To Diseases	5.41 ± 0.77	5.39 ± 0.77	–1.80 ± 1.94**	5.44 ± 0.77	–1.74 ± 1.89**	0.79	**5.04 ± 0.84**	4.93 ± 0.84	–2.00 ± 2.17**	5.17 ± 0.83	–2.44 ± 2.13**	0.81
Sick Leaving Last Year	3.82 ± 1.00	3.73 ± 1.07	0.27 ± 1.03**	3.93 ± 0.91	0.05 ± 0.96	0.33	**3.40 ± 1.11**	3.38 ± 1.08	0.10 ± 1.21	3.43 ± 1.16	–0.04 ± 1.11	0.72
Own Prognosis Of Work Ability	6.61 ± 1.07	6.62 ± 1.02	0.13 ± 1.12	6.67 ± 1.05	–0.03 ± 1.03	0.06	**5.67 ± 1.72**	5.66 ± 1.72	0.62 ± 1.68	5.70 ± 1.77	0.39 ± 1.37	0.30
Mental Resources	3.00 ± 0.65	2.95 ± 0.60	0.33 ± 0.67**	3.05 ± 0.70	0.14 ± 0.71*	0.07	**2.37 ± 0.69**	2.28 ± 0.65	0.35 ± 0.61**	2.48 ± 0.73	0.09 ± 0.73	0.36
Health-related quality of life (points)												
Physical Functioning	84.3 ± 13.9	82.3 ± 15.0	6.3 ± 11.7**	86.6 ± 12.3	1.4 ± 8.5	0.01	**73.2 ± 19.2**	73.4 ± 18.9	4.5 ± 13.2	72.9 ± 20.0	3.3 ± 16.9	0.73
Physical Role	84.9 ± 26.7	84.1 ± 27.2	3.3 ± 27.2	84.9 ± 26.8	2.9 ± 29.3	0.99	**70.3 ± 32.9**	67.2 ± 31.4	13.8 ± 34.5	74.0 ± 35.0	8.3 ± 43.4	0.98
Bodily Pain	79.8 ± 21.5	78.7 ± 20.9	0.7 ± 17.8	80.4 ± 22.5	2.4 ± 18.8	0.22	**69.1 ± 24.2**	70.0 ± 23.7	–0.3 ± 21.1	68.0 ± 25.3	6.2 ± 21.7	0.29
General Health Perceptions	63.7 ± 16.2	62.6 ± 16.3	8.9 ± 13.0**	65.2 ± 15.8	2.0 ± 13.3	<0.01	**49.4 ± 14.3**	49.6 ± 14.5	6.7 ± 15.6*	49.1 ± 14.4	5.9 ± 13.9	0.78
Vitality	57.2 ± 16.4	57.2 ± 16.2	10.0 ± 16.8**	57.2 ± 16.7	3.7 ± 14.0**	<0.01	**38.6 ± 11.7**	37.4 ± 10.5	15.9 ± 15.4**	40.0 ± 13.2	8.5 ± 17.5*	0.16

(Continued)

TABLE 2 | Continued

	Subjects without depression						Subjects with mild to moderate depression					
	Whole sub-group baseline	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**	**Whole sub-group baseline**	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**
Social Role Functioning	89.9 ± 16.6	90.2 ± 16.3	3.0 ± 13.8*	89.7 ± 16.6	0.9 ± 14.9	0.12	**62.7 ± 23.9**	59.1 ± 24.3	14.3 ± 18.9**	66.9 ± 23.2	11.5 ± 22.4*	0.98
Emotional Role	88.0 ± 26.0	85.7 ± 29.0	7.3 ± 29.4**	90.0 ± 22.8	4.8 ± 18.5**	0.78	**57.8 ± 42.0**	50.6 ± 40.5	18.4 ± 34.1**	66.6 ± 43.9	13.9 ± 325.4	0.74
Mental Health	77.1 ± 11.9	76.9 ± 12.0	4.8 ± 10.1**	77.8 ± 11.7	1.8 ± 8.1*	0.02	**54.0 ± 16.1**	53.0 ± 14.0	10.6 ± 14.1**	55.3 ± 18.7	5.6 ± 16.9	0.31
Physical component score	49.0 ± 7.2	48.5 ± 7.3	2.1 ± 6.3**	49.7 ± 7.3	0.7 ± 5.6	0.20	**46.7 ± 8.4**	47.8 ± 8.7	1.1 ± 8.7	46.3 ± 8.6	1.7 ± 8.2	0.96
Mental component score	51.8± 7.2	51.7 ± 7.0	3.0 ± 6.8**	51.8 ± 7.7	1.3 ± 5.3*	0.03	**38.4 ± 11.1**	37.2 ± 9.5	10.2 ± 9.8**	40.9 ± 12.5	3.9 ± 9.1*	0.05

*MET, metabolic equivalent of task, Bold-marked values indicate differences at baseline between subgroups (normal versus mild to severe depression) ($p < 0.05$) as analyzed with Students T-Test for unpaired samples, *$p < 0.05$ and **$p < 0.01$ indicate within-group changes in the exercise or control group from baseline as analysed with Students T-Test for paired samples. Differences between the exercise and control groups over time (time × group) in the respective subgroup were analysed by an ANCOVA model controlled for baseline values and gender. Data are mean ± SD.*

TABLE 3 | Measurements before and after the intervention for subjects with normal versus mild to moderate anxiety scores.

	Subjects without anxiety						Subjects with mild to moderate anxiety					
	Group baseline	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**	**Group baseline**	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**
n (men/ women)	233 (200/33)	121 (104/17)		112 (96/16)			62 (53/9)	37 (31/6)		25 (22/3)		
Age (years)	47.4 ± 8.5						**50.2 ± 6.9**					
Body weight (kg)	106.9 ± 19.0	107.1 ± 18.5	–4.2 ± 5.1**	106.2 ± 19.6	–0.9 ± 5.1	<0.01	107.9 ± 19.6	108.6 ± 17.9	–4.2 ± 4.7**	106.9 ± 22.3	–0.5 ± 4.0	<0.01
Body mass index (kg/m2)	33.3 ± 5.3	33.5 ± 5.2	–1.5 ± 3.3**	33.0 ± 5.3	–0.3 ± 1.5*	<0.01	33.6 ± 6.0	33.9 ± 5.8	–1.3 ± 1.4**	33.2 ± 6.4	–0.2 ± 1.2	0.03
Body fat (%)	32.5 ± 8.2	33.0 ± 8.2	–2.3 ± 3.2**	32.0 ± 8.3	–0.4 ± 3.6	<0.01	33.0 ± 7.9	33.2 ± 8.7	–1.5 ± 2.7**	32.9 ± 7.0	–0.7 ± 5.1	0.04
Fat free mass (kg)	71.4 ± 12.2	71.0 ± 11.2	–0.2 ± 3.7	71.3 ± 13.0	0.6 ± 6.3	0.15	71.6 ± 10.2	71.0 ± 9.4	–1.4 ± 2.6**	71.6 ± 10.8	0.9 ± 4.7	0.69
Fasting glucose (mmol/l)	6.1 ± 1.2	6.1 ± 1.3	–0.4 ± 0.8**	6.1 ± 1.0	–0.1 ± 0.6	<0.01	6.1 ± 1.0	6.1 ± 1.1	–0.2 ± 0.4**	6.0 ± 0.7	0.1 ± 0.6	0.06
HbA1c (%)	5.6 ± 0.8	5.7 ± 1.0	–0.2 ± 0.5**	5.5 ± 0.7	–0.1 ± 0.4	0.10	5.8 ± 1.3	5.7 ± 1.2	–0.3 ± 1.1	5.8 ± 1.5	–0.2 ± 0.9	0.36
Triglycerides (mmol/l)	2.3 ± 1.6	2.2 ± 1.5	–0.3 ± 1.0**	2.1 ± 1.3	–0.02 ± 0.73	0.01	2.5 ± 2.8	2.0 ± 1.6	–0.3 ± 1.0	2.2 ± 1.2	–0.1 ± 0.8	0.19
Total cholesterol (mmol/l)	213.0 ± 45.6	216.3 ± 47.4	–8.5 ± 25.0**	209.9 ± 43.9	–0.4 ± 26.0	0.30	215.7 ± 43.2	213.1 ± 42.5	–6.6 ± 21.8	222.1 ± 44.9	–7.0 ± 28.3	0.88
Exercise activity (MET-h/wk)	6.4 ± 9.8	5.5 ± 10.1	11.3 ± 22.2**	7.5 ± 9.6	4.7 ± 17.9**	0.04	7.0 ± 17.7	10.1 ± 22.3	2.8 ± 23.6	2.8 ± 5.7	3.3 ± 8.6	0.09

(Continued)

TABLE 3 | Continued

	Subjects without anxiety						Subjects with mild to moderate anxiety					
	Group baseline	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**	**Group baseline**	**Exercise baseline**	**Exercise change from baseline**	**Controls baseline**	**Controls change from baseline**	**between groups over time**
Exercise capacity (peak watt)	176.4 ± 34.7	175.6 ± 32.4	14.8 ± 18.8**	176.4 ± 36.9	7.5 ± 21.7**	<0.01	171.1 ± 42.2	172.4 ± 44.3	20.5 ± 24.4**	169.2 ± 39.8	5.6 ± 16.4	<0.01
MetS-z-Score (arbitrary units)	0.97 ± 0.60	0.97 ± 0.62	–0.32 ± 0.47**	0.97 ± 0.58	–0.05 ± 0.38	<0.01	0.90 ± 0.77	0.83 ± 0.68	–0.20 ± 0.42**	0.93 ± 0.56	–0.08 ± 0.41	0.16
Work ability (points)												
Current Work Ability	7.61 ± 1.58	7.64 ± 1.53	0.43 ± 1.27**	7.60 ± 1.62	0.05 ± 1.86	0.03	**6.92 ± 1.62**	6.95 ± 1.49	0.51 ± 1.39	6.84 ± 1.84	–0.36 ± 1.11	0.01
Work Ability In Relation To Demands	8.23 ± 1.62	8.23 ± 1.25	0.29 ± 1.07**	8.25 ± 1.12	0.16 ± 1.04	0.30	**7.19 ± 1.37**	7.22 ± 1.32	0.46 ± 1.49	7.08 ± 1.44	–0.34 ± 0.99	0.02
Number of Current Diseases	3.43 ± 1.90	3.40 ± 2.07	–1.18 ± 3.52**	3.48 ± 1.72	–1.37 ± 2.98**	0.66	**2.68 ± 1.84**	2.51 ± 1.97	0.49 ± 3.69	3.00 ± 1.63	0.44 ± 3.24	0.02
Work Impairment Due To Diseases	5.44 ± 0.76	5.43 ± 0.76	–1.78 ± 2.03**	5.46 ± 0.75	–1.65 ± 1.91**	0.57	**5.00 ± 0.82**	4.92 ± 0.80	–2.03 ± 1.82**	5.12 ± 0.88	–2.76 ± 1.83**	0.13
Sick Leaving Last Year	3.78 ± 0.98	3.75 ± 1.03	0.29 ± 1.06**	3.81 ± 0.94	0.17 ± 0.92	0.44	3.63 ± 1.18	3.38 ± 1.19	0.05 ± 1.08	4.00 ± 1.12	–0.60 ± 1.00**	0.12
Own Prognosis Of Work Ability	6.63 ± 1.05	6.62 ± 1.02	0.18 ± 1.15	6.66 ± 1.06	–0.03 ± 0.96	0.11	**5.79 ± 1.69**	5.86 ± 1.64	0.32 ± 1.55	5.80 ± 1.73	0.36 ± 1.58	0.99
Mental Resources	3.00 ± 0.66	2.93 ± 0.65	0.33 ± 0.69**	3.06 ± 0.68	0.14 ± 0.70	0.12	**2.49 ± 0.69**	2.49 ± 0.61	0.32 ± 0.53**	2.46 ± 0.78	0.08 ± 0.78	0.09
Health-related quality of life (points)												
Physical Functioning	84.4 ± 13.8	82.8 ± 14.4	6.1 ± 11.7**	86.1 ± 13.0	0.4 ± 8.3	<0.01	**74.2 ± 19.1**	73.1 ± 19.3	5.4 ± 13.0*	75.6 ± 19.1	7.4 ± 15.7*	0.44
Physical Role	84.9 ± 26.7	84.7 ± 26.5	3.7 ± 26.2	84.5 ± 27.5	4.5 ± 30.3	0.80	**72.2 ± 32.4**	68.8 ± 32.4	10.4 ± 36.0	76.0 ± 32.7	1.0 ± 39.8	0.51
Bodily Pain	80.1 ± 21.3	79.1 ± 21.1	0.8 ± 18.4	80.5 ± 21.9	2.5 ± 18.2	0.25	**69.5 ± 24.2**	70.4 ± 22.2	–0.6 ± 18.6	68.2 ± 27.6	5.8 ± 23.8	0.28
General Health Perceptions	63.6 ± 16.5	63.0 ± 16.7	8.4 ± 12.5**	64.5 ± 16.2	2.7 ± 13.4*	<0.01	**51.9 ± 14.3**	50.8 ± 13.3	8.5 ± 16.5**	53.5 ± 16.1	2.4 ± 13.6	0.19
Vitality	56.9 ± 16.8	56.8 ± 17.1	10.1 ± 17.4**	57.1 ± 16.6	4.4 ± 15.2*	<0.01	**42.3 ± 13.4**	42.5 ± 12.2	14.3 ± 13.4**	41.2 ± 14.8	5.6 ± 12.8*	0.01
Social Role Functioning	90.9 ± 15.7	92.0 ± 14.7	2.1 ± 12.2	89.9 ± 16.2	2.7 ± 16.4	0.58	**62.9 ± 23.1**	59.5 ± 22.3	15.1 ± 20.5**	67.2 ± 24.2	3.1 ± 19.1	0.06
Emotional Role	89.8 ± 23.3	88.2 ± 25.4	4.9 ± 25.8*	91.2 ± 21.6	5.5 ± 20.0**	0.22	**55.4 ± 42.3**	49.1 ± 41.8	24.1 ± 39.5**	62.7 ± 42.3	10.6 ± 31.6	0.44
Mental Health	77.9 ± 11.3	78.1 ± 10.6	3.9 ± 8.6**	78.2 ± 12.0	2.3 ± 10.0*	0.19	**54.7 ± 15.2**	53.9 ± 14.5	12.4 ± 15.4**	55.7 ± 16.7	3.2 ± 11.3	0.02
Physical component score	49.1 ± 7.2	48.5 ± 7.2	2.3 ± 6.4**	49.4 ± 7.4	0.7 ± 5.4	0.06	**47.0 ± 8.4**	48.1 ± 8.5	0.6 ± 8.0	47.7 ± 8.5	1.6 ± 8.4	0.69
Mental component score	52.2 ± 6.6	52.2 ± 6.3	2.7 ± 6.5**	52.4 ± 7.1	1.7 ± 6.0**	0.20	**39.2 ± 11.2**	38.5 ± 10.2	9.7 ± 9.8**	39.7 ± 11.6	2.2 ± 7.3	<0.01

*MET, metabolic equivalent of task, Bold-marked values indicate differences at baseline between subgroups (normal versus mild to severe depression) ($p < 0.05$) as analyzed with Students T-Test for unpaired samples, *$p < 0.05$ and **$p < 0.01$ indicate within-group changes in the exercise or control group from baseline as analysed with Students T-Test for paired samples. Differences between the exercise and control groups over time (time × group) in the respective subgroup were analysed by an ANCOVA model controlled for baseline values and gender. Data are mean ± SD.*

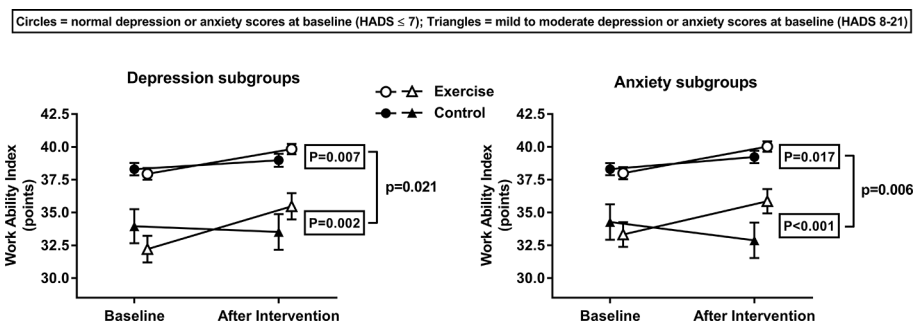

FIGURE 2 | Work ability (total score) as assessed with the work ability questionnaire before and after 6-month exercise training or control. Subjects are stratified according to baseline depression and anxiety severity derived from the HADS questionnaire in subgroups of normal scores (0–7 points, triangles) or mild to moderate scores (8–14 points, circles). Data are mean ± SEM. The framed p-values are given for between-group differences (exercise- versus control group) over time as analyzed with an ANCOVA model. The p-value behind the bracket is given for the interaction of time (baseline-6 months) × study group (exercise or control) × subgroup (normal scores or mild to moderate scores) as analyzed with an ANCOVA model, indicating the 6-month exercise versus control group change in the mild to moderate HADS subgroup is greater than the change in the normal HADS subgroup.

contribution of depression and anxiety on productivity-related outcomes in company workers with metabolic syndrome. These results also reveal that evaluating classical disease risk factors does not uncover limitations in an employee's ability to work. Measuring and relying on cardiovascular and metabolic parameters may therefore underestimate the impact of mental health on productivity at the workplace and associated costs for the employer and the healthcare system.

After the 6-month guided and telemonitoring-supported physical activity promotion, participants improved several anthropometric and cardio-metabolic outcomes, including body weight, blood pressure, fasting glucose, and blood lipids (27). As observed by the current analysis, the total work ability index increased for employees with both normal and increased depression and anxiety severity after exercise training. Noteworthy, the improvement in subgroups with mild to moderate severity scores was greater compared to that observed in subgroups with normal severity scores. This suggests that employees with metabolic syndrome and elevated depression and anxiety scores could most benefit from such interventions, and may be of particular interest for programs aiming at indicated prevention. Since these individuals (presenting both metabolic syndrome and mental disease severity) are at enlarged risk for disease progression, but also productivity-related limitations at the workplace, our study suggests to establish structured and guided lifestyle interventions especially for these employees.

Our study has strengths and limitations. Strengths include the randomized-controlled design with a large number of participants. The use of the HADS questionnaire is a limitation as it presents a rather rough estimation of anxiety and depression symptoms. Our observed results should be tested in further studies using a structured interview to confirm the diagnosis of major depressive disorders or anxiety disorders. Furthermore, we cannot discriminate whether the improvements in quality of life are due to the exercise intervention itself or secondary to the increased social support of participants. We observed weak correlations between changes in exercise capacity and changes in health-related quality of life subscales, but because we did not assess social support, we could not test the influence of this factor.

In conclusion, the present analysis of a randomized-controlled physical activity program for company employees with diagnosed metabolic syndrome reports strongest effects on work ability and overall quality of life for individuals with mild to moderate depression- and anxiety disorders. Of importance, the observed effects were most pronounced for participants with higher depression severity or anxiety severity scores at baseline. Our findings also indicate that a telemonitoring-supported physical activity intervention is feasible to guide and supervise lifestyle changes for a large number of individuals, irrespective of their residence or workplace Our results implicate to offer similar interventions to a broader workplace population, not only to reduce individual disease risk but also to possibly ease the burden in healthcare and employers costs arising from metabolic syndrome and mental disease conditions.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of Hannover Medical School. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SH, DB, CT, MS, DH-K, AH, and UT planned and designed the study. RE, LN, and DL recruited participants. AK, GP, PB, HS, SR, TS, JE, AAH, KK-V, and RE collected the data. AK, GP, PB, HS, SR, TS, JE, CT, AAH, KK-V, and MK processed the exercise test, anthropometric, body composition, metabolic data, and supervised the intervention. MK processed the dietary intake data. SH and DB calculated the sample size and were responsible for the statistical analyses. SH and KK wrote the first draft of the manuscript. LN, DH-K, AH, MS, and UT contributed to the discussion and reviewed/edited the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This study was supported and funded by grants from Audi BKK health insurance and the German Research Foundation through the Cluster of Excellence "REBIRTH". The funder Audi BKK health insurance was not involved in the study design, collection, analysis, interpretation of data, the writing of this article or the decision to submit it for publication.

ACKNOWLEDGMENTS

We thank Ina Wichmann-Behrendt for help with participant recruitment and Joachim Adam from Five Topics AG for expert technical help in building the Smartphone application, and Nina McGuinness for proof-reading the manuscript. We acknowledge the support of the volunteers. We thank Mark Dittmann, Cora Schulze, Nele Ruben, Lale Sander and Marion Pauly for their extensive help with data documentation and storage. We thank the nurses and technicians at Volkswagen occupational healthcare centers for collecting the anthropometric, body composition, and metabolic data, and collecting and analyzing blood samples.

REFERENCES

1. Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet* (2013) 382:1575–86. doi: 10.1016/S0140-6736(13)61611-6
2. Disease GBD, Injury I, Prevalence C. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* (2017) 390:1211–59. doi: 10.1016/S0140-6736(17)32154-2
3. Jacobi F, Hofler M, Siegert J, Mack S, Gerschler A, Scholl L, et al. Twelve-month prevalence, comorbidity and correlates of mental disorders in Germany: the Mental Health Module of the German Health Interview and Examination Survey for Adults (DEGS1-MH). *Int J Methods Psychiatr Res* (2014) 23:304–19. doi: 10.1002/mpr.1439
4. Greenberg PE, Fournier AA, Sisitsky T, Pike CT, Kessler RC. The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *J Clin Psychiatry* (2015) 76:155–62. doi: 10.4088/JCP.14m09298
5. Harter M, Klesse C, Bermejo I, Schneider F, Berger M. Unipolar depression: diagnostic and therapeutic recommendations from the current S3/National Clinical Practice Guideline. *Dtsch Arztebl Int* (2010) 107:700–8. doi: 10.3238/arztebl.2010.0700
6. Gartlehner G, Gaynes BN, Amick HR, Asher GN, Morgan LC, Coker-Schwimmer E, et al. Comparative Benefits and Harms of Antidepressant, Psychological, Complementary, and Exercise Treatments for Major Depression: An Evidence Report for a Clinical Practice Guideline From the American College of Physicians. *Ann Internal Med* (2016) 164:331–41. doi: 10.7326/M15-1813
7. Blumenthal JA, Babyak MA, O'Connor C, Keteyian S, Landzberg J, Howlett J, et al. Effects of exercise training on depressive symptoms in patients with chronic heart failure: the HF-ACTION randomized trial. *Jama* (2012) 308:465–74. doi: 10.1001/jama.2012.8720
8. Dillon CB, McMahon E, O'Regan G, Perry IJ. Associations between physical behaviour patterns and levels of depressive symptoms, anxiety and well-being in middle-aged adults: a cross-sectional study using isotemporal substitution models. *BMJ Open* (2018) 8:e018978. doi: 10.1136/bmjopen-2017-018978
9. Blumenthal JA, Babyak MA, Moore KA, Craighead WE, Herman S, Khatri P, et al. Effects of exercise training on older patients with major depression. *Arch Internal Med* (1999) 159:2349–56. doi: 10.1001/archinte.159.19.2349
10. Underwood M, Lamb SE, Eldridge S, Sheehan B, Slowther AM, Spencer A, et al. Exercise for depression in elderly residents of care homes: a cluster-randomised controlled trial. *Lancet* (2013) 382:41–9. doi: 10.1016/S0140-6736(13)60649-2
11. Chekroud SR, Gueorguieva R, Zheutlin AB, Paulus M, Krumholz HM, Krystal JH, et al. Association between physical exercise and mental health in 1.2 million individuals in the USA between 2011 and 2015: a cross-sectional study. *Lancet Psychiatry* (2018) 5:739–46. doi: 10.1016/S2215-0366(18)30227-X
12. Toseeb U, Brage S, Corder K, Dunn VJ, Jones PB, Owens M, et al. Exercise and depressive symptoms in adolescents: a longitudinal cohort study. *JAMA Pediatr* (2014) 168:1093–100. doi: 10.1001/jamapediatrics.2014.1794
13. Vancampfort D, Stubbs B, Mitchell AJ, De Hert M, Wampers M, Ward PB, et al. Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis. *World Psychiatry* (2015) 14:339–47. doi: 10.1002/wps.20252
14. Kahl KG, Greggersen W, Schweiger U, Cordes J, Balijepalli C, Losch C, et al. Prevalence of the metabolic syndrome in unipolar major depression. *Eur Arch Psychiatry Clin Neurosci* (2012) 262:313–20. doi: 10.1007/s00406-011-0277-4
15. Repousi N, Masana MF, Sanchez-Niubo A, Haro JM, Tyrovolas S. Depression and metabolic syndrome in the older population: A review of evidence. *J Affect Disord* (2018) 237:56–64. doi: 10.1016/j.jad.2018.04.102
16. Skilton MR, Moulin P, Terra JL, Bonnet F. Associations between anxiety, depression, and the metabolic syndrome. *Biol Psychiatry* (2007) 62:1251–7. doi: 10.1016/j.biopsych.2007.01.012
17. O'Neill S, O'Driscoll L. Metabolic syndrome: a closer look at the growing epidemic and its associated pathologies. *Obesity Rev* (2015) 16:1–12. doi: 10.1111/obr.12229
18. Mozumdar A, Liguori G. Persistent increase of prevalence of metabolic syndrome among U.S. adults: NHANES III to NHANES 1999-2006. *Diabetes Care* (2011) 34:216–9. doi: 10.2337/dc10-0879
19. Nolan PB, Carrick-Ranson G, Stinear JW, Reading SA, Dalleck LC. Prevalence of metabolic syndrome and metabolic syndrome components in young adults: A pooled analysis. *Preventive Med Rep* (2017) 7:211–5. doi: 10.1016/j.pmedr.2017.07.004
20. Burton WN, Chen CY, Schultz AB, Edington DW. The prevalence of metabolic syndrome in an employed population and the impact on health and productivity. *J Occup Environ Med* (2008) 50:1139–48. doi: 10.1097/JOM.0b013e318188b8eb
21. Schultz AB, Edington DW. Metabolic syndrome in a workplace: prevalence, co-morbidities, and economic impact. *Metab Syndrome Relat Disord* (2009) 7:459–68. doi: 10.1089/met.2009.0008
22. Ostman C, Smart NA, Morcos D, Duller A, Ridley W, Jewiss D. The effect of exercise training on clinical outcomes in patients with the metabolic

syndrome: a systematic review and meta-analysis. *Cardiovasc Diabetol* (2017) 16:110. doi: 10.1186/s12933-017-0590-y
23. Kahl KG, Kerling A, Tegtbur U, Gutzlaff E, Herrmann J, Borchert L, et al. Effects of additional exercise training on epicardial, intra-abdominal and subcutaneous adipose tissue in major depressive disorder: A randomized pilot study. *J Affect Disord* (2016) 192:91–7. doi: 10.1016/j.jad.2015.12.015
24. Kerling A, Hartung D, Stubbs B, Kuck M, Tegtbur U, Grams L, et al. Impact of aerobic exercise on muscle mass in patients with major depressive disorder: a randomized controlled trial. *Neuropsychiatr Dis Treat* (2018) 14:1969–74. doi: 10.2147/NDT.S167786
25. Kerling A, Kuck M, Tegtbur U, Grams L, Weber-Spickschen S, Hanke A, et al. Exercise increases serum brain-derived neurotrophic factor in patients with major depressive disorder. *J Affect Disord* (2017) 215:152–5. doi: 10.1016/j.jad.2017.03.034
26. Kerling A, von Bohlen A, Kuck M, Tegtbur U, Grams L, Haufe S, et al. Exercise therapy improves aerobic capacity of inpatients with major depressive disorder. *Brain Behav* (2016) 6:e00469. doi: 10.1002/brb3.469
27. Haufe S, Kerling A, Protte G, Bayerle P, Stenner HT, Rolff S, et al. Telemonitoring-supported exercise training, metabolic syndrome severity, and work ability in company employees: a randomised controlled trial. *Lancet Public Health* (2019) 4:e243–352. doi: 10.1016/S2468-2667(19)30075-1
28. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation* (2005) 112:2735–52. doi: 10.1161/CIRCULATIONAHA.105.169404
29. Trappe HJ, Lollgen H. [Guidelines for ergometry. German Society of Cardiology–Heart and Cardiovascular Research]. *Z fur Kardiologie.* (2000) 89:821–31. doi: 10.1007/s003920070190
30. Snaith RP. The Hospital Anxiety And Depression Scale. *Health Qual Life outcomes.* (2003) 1:29. doi: 10.1186/1477-7525-1-29
31. Bullinger M. [Assessment of health related quality of life with the SF-36 Health Survey]. *Rehabil (Stuttg)* (1996) 35:XVII–XXVII.
32. van den Berg TI, Elders LA, de Zwart BC, Burdorf A. The effects of work-related and individual factors on the Work Ability Index: a systematic review. *Occup Environ Med* (2009) 66:211–20. doi: 10.1136/oem.2008.039883
33. Jeejeebhoy K, Dhaliwal R, Heyland DK, Leung R, Day AG, Brauer P, et al. Family physician-led, team-based, lifestyle intervention in patients with metabolic syndrome: results of a multicentre feasibility project. *CMAJ Open* (2017) 5:E229–e236. doi: 10.9778/cmajo.20160101
34. Stubbs B, Vancampfort D, Firth J, Schuch FB, Hallgren M, Smith L, et al. Relationship between sedentary behavior and depression: A mediation analysis of influential factors across the lifespan among 42,469 people in low- and middle-income countries. *J Affect Disord* (2018) 229:231–8. doi: 10.1016/j.jad.2017.12.104
35. Schuch FB, Vancampfort D, Firth J, Rosenbaum S, Ward PB, Silva ES, et al. Physical Activity and Incident Depression: A Meta-Analysis of Prospective Cohort Studies. *Am J Psychiatry* (2018) 175:631–48. doi: 10.1176/appi.ajp.2018.17111194
36. Vancampfort D, Stubbs B, Firth J, Hallgren M, Schuch F, Lahti J, et al. Physical activity correlates among 24,230 people with depression across 46 low- and middle-income countries. *J Affect Disord* (2017) 221:81–8. doi: 10.1016/j.jad.2017.06.012
37. Stanczykiewicz B, Banik A, Knoll N, Keller J, Hohl DH, Rosinczuk J, et al. Sedentary behaviors and anxiety among children, adolescents and adults: a systematic review and meta-analysis. *BMC Public Health* (2019) 19:459. doi: 10.1186/s12889-019-6715-3
38. Schuch FB, Stubbs B, Meyer J, Heissel A, Zech P, Vancampfort D, et al. Physical activity protects from incident anxiety: A meta-analysis of prospective cohort studies. *Depression Anxiety* (2019) 36:846–58. doi: 10.1002/da.22915
39. Rebar AL, Stanton R, Geard D, Short C, Duncan MJ, Vandelanotte C. A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health Psychol Rev* (2015) 9:366–78. doi: 10.1080/17437199.2015.1022901
40. Stubbs B, Vancampfort D, Hallgren M, Firth J, Veronese N, Solmi M, et al. EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). *Eur Psychiatry* (2018) 54:124–44. doi: 10.1016/j.eurpsy.2018.07.004
41. Elinson L, Houck P, Marcus SC, Pincus HA. Depression and the ability to work. *Psychiatr Serv* (2004) 55:29–34. doi: 10.1176/appi.ps.55.1.29
42. Lee SA, Ju YJ, Han KT, Choi JW, Yoon HJ, Park EC. The association between loss of work ability and depression: a focus on employment status. *Int Arch Occup Environ Health* (2017) 90:109–16. doi: 10.1007/s00420-016-1178-7
43. Pranjic N, Males-Bilic L. Work ability index, absenteeism and depression among patients with burnout syndrome. *Mater Socio-med* (2014) 26:249–52. doi: 10.5455/msm.2014.249-252
44. Winter L, Kraft J, Boss K, Kahl KG. [Return to Work: A Workplace Focused Module to be Integrated in Cognitive Behavioral Therapy]. *Psychother Psychosom Medi Psychol* (2015) 65:321–6. doi: 10.1055/s-0035-1545312
45. Lagerveld SE, Blonk RW, Brenninkmeijer V, Wijngaards-de Meij L, Schaufeli WB. Work-focused treatment of common mental disorders and return to work: a comparative outcome study. *J Occup Health Psychol* (2012) 17:220–34. doi: 10.1037/a0027049
46. Hange D, Ariai N, Kivi M, Eriksson MC, Nejati S, Petersson EL. The impact of internet-based cognitive behavior therapy on work ability in patients with depression - a randomized controlled study. *Int J Gen Med* (2017) 10:151–9. doi: 10.2147/IJGM.S129710

Conflict of Interest: RN and LN were employed by company Volkswagen AG, and DL was employed by Audi BKK health insurance.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 23 June 2020
doi: 10.3389/fpsyt.2020.00594

Does Cardiorespiratory Fitness Buffer Stress Reactivity and Stress Recovery in Police Officers? A Real-Life Study

René Schilling[1]*, *Christian Herrmann*[2], *Sebastian Ludyga*[1], *Flora Colledge*[1], *Serge Brand*[1,3,4,5,6], *Uwe Pühse*[1] and *Markus Gerber*[1]

[1] Department of Sport, Exercise and Health, University of Basel, Basel, Switzerland, [2] Zurich University of Teacher Education, Zurich, Switzerland, [3] Center for Affective, Stress and Sleep Disorders, Psychiatric Clinics, University of Basel, Basel, Switzerland, [4] Substance Abuse Prevention Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran, [5] Sleep Disorders Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran, [6] School of Medicine, Tehran University of Medical Sciences, Teheran, Iran

OPEN ACCESS

Edited by:
Claas Lahmann,
Medical Center, University of Freiburg, Germany

Reviewed by:
Konstantinos Papazoglou,
Yale School of Medicine, United States
Christine Allwang,
Technical University of Munich, Germany

***Correspondence:**
René Schilling
rene.schilling@unibas.ch

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: 06 November 2019
Accepted: 09 June 2020
Published: 23 June 2020

Citation:
Schilling R, Herrmann C, Ludyga S, Colledge F, Brand S, Pühse U and Gerber M (2020) Does Cardiorespiratory Fitness Buffer Stress Reactivity and Stress Recovery in Police Officers? A Real-Life Study. Front. Psychiatry 11:594. doi: 10.3389/fpsyt.2020.00594

High levels of cardiorespiratory fitness have the potential to buffer against physical and mental health impairments, which can result from exposure to occupational stress. Police officers are especially at risk of high psychosocial stress; therefore, effective intervention strategies are warranted. Given this background, the purpose of the present study was to examine whether police officers with different levels of cardiorespiratory fitness differ with regard to their (a) physiological stress reactivity during acute real-life stress situations, and (b) physiological recovery related to acute and chronic work stress. In total, 201 police officers took part in this study (M = 38.6 years, SD = 10.1, 35.8% females). Officers were contacted eight times on a smartphone during their workday, and asked to report their current level of positive and negative affect, as well as feelings of stress and anger. Physiological stress responses and recovery (heart rate variability) were assessed using Movisens EcgMove3 devices. The Åstrand bicycle ergometer test was used to assess participants' cardiorespiratory fitness. Chronic work stress was assessed using the effort-reward imbalance model and the job strain model. Multilevel modeling was used to test buffering effects of cardiorespiratory fitness on physiological stress reactivity. Linear regression was applied to test stress-buffering effects of cardiorespiratory fitness on physiological recovery. Results showed lowered physiological stress reactivity to acute work stress in officers with higher levels of cardiorespiratory fitness. However, these results were not consistent, with no effects occurring for feelings of anger, positive affect, and negative affect. Chronic work stress (effort-reward imbalance) was related to lower physiological recovery. Cardiorespiratory fitness was positively related to physiological recovery. Data did not support interactions between work stress and cardiorespiratory fitness on physiological recovery. To some extent, cardiorespiratory fitness seems to have the potential to buffer stress reactivity in police officers in acute stress situations. Therefore, we encourage promoting fitness programs which aim to enhance cardiorespiratory fitness in stressful occupations such as law enforcement.

Improvements in cardiorespiratory fitness might further enhance physiological recovery from chronic work stress, which is thought to improve cardiovascular health.

Keywords: cardiorespiratory fitness, stress-buffer, cross-stressor adaptation, heart rate variability, occupational stress, stress reactivity, stress recovery, ecological momentary assessment, ambulatory assessment

INTRODUCTION

Psychosocial stress is ubiquitous in modern society (1). Although not regarded as negative *per se*, health complaints can occur when individual's coping capacities are exceeded. Documented links between psychosocial stress and health impairments range from physical (e.g. cardiorespiratory) and mental diseases (e.g. burnout) to all-cause mortality (2, 3). Consequently, the individual and societal burden is tremendous (4); hence, health services and researchers are keen to find ways to strengthen coping abilities (5).

Conceptualizations for pathways linking stress to health have historically developed from response (biopsychological) and stimulus (stressor) approaches to transactional processes, in which perceptions of stress play a key role (6). Berntson and Cacioppo (7) argue that mechanisms of stress which affect health involve at least four process components: exposure, reactivity, recovery, and restoration. Exposure is understood as a quantitative representation of perceived stressors. Reactivity refers to the strength of a (physiological) stress reaction in relation to a baseline value. This could be an elevated heart rate following a stress event. Recovery is understood the amount of time required until an individual has returned to baseline level following a stress reaction. Restoration, a more unique concept, refers to "anabolic processes that refresh or repair the organism, because stress may directly impede our ability to perform these functions (e.g., disturbed sleep and impaired wound healing)" (p. 609).

Cardiorespiratory fitness (CF) is understood as a potential buffer in the interplay between stress and health. In their review, Gerber and Pühse (8) gleaned evidence on positive moderation effects for exercise and resulting CF on the interplay between stress and health. Mechanisms of improved cardiovascular health are thought to relate to changes in the autonomic nervous system (8). The sympathetic and parasympathetic nervous system are main components in the sympathoadrenal-medullary (SAM) axis. In stressful situations, the SAM axis pathways increase heart rate, breathing pattern, and blood pressure (9). Recurring and excessive activity of the SAM contributes to increased cardiovascular risk, for example, by increasing the likelihood of hypertension (10). Findings further suggest that physical strain produced by regular engagement in exercise and improved physical fitness are associated with adaptations (i.e. lowered resting heart rate and blood pressure) that may counteract the negative consequences of stress. Furthermore, the cross-stressor adaptation hypothesis (11) suggests that repeated exposure to physical strain can result in at least partially unspecific adaptations, which may cross over to other areas of stress (e.g., psychosocial), and thus lead to more favorable adaptations associated with stress (12).

Research on stress-buffering mechanisms to enhance health has mainly focused on stress reactivity and recovery (2, 8). Previous investigations generally support stress-buffering effects associated with CF (13). However, evidence from three meta-analyses on the impact of CF on cardiovascular reactivity and recovery during and after exposure to experimentally induced stressor tasks have provided heterogeneous results (14–16). In their early work, Crews and Landers (14) showed that CF was associated with a blunted stress reactivity. Twenty years later, Forcier et al. (15) came to a similar conclusion when using more strict inclusion criteria. Thus, their meta-analysis found improved reactivity and some support for improved cardiovascular recovery among individuals with higher CF levels. Controversially, in a further meta-analysis, Jackson and Dishman (16) did not find support for an attenuated stress reactivity among fitter individuals. However, higher fitness levels were associated with a slightly better cardiovascular recovery from laboratory stressors. One strength of their results is the inclusion of studies using submaximal or maximal fitness tests, which, according to the American College of Sports Medicine (17), is a prerequisite for a valid determination of CF. Furthermore, in a recent systematic literature review, Mücke et al. (12) gathered evidence on the influence of CF on stress reactivity in response to the Trier Social Stress Test (TSST), a psychosocial laboratory stressor that has proven to elicit particularly strong stress reactions in previous studies (18). Approximately half of the studies included in this review showed that higher levels of fitness were related to attenuated stress reactivity, as measured *via* heart rate variability and salivary cortisol concentrations (12).

One possible explanation for the inconsistent results in the afore-mentioned meta-analyses might be seen in the diversity of stressors used in the laboratory (19). Artificial stressors are sometimes passive physical performance tasks (holding the hand in a bucket of ice water), and oftentimes consist of cognitive instead of psychosocial challenges. Furthermore, when measuring stress in a laboratory setting, even psychosocial stressors might not be personally relevant (20). Additionally, such stressors are mostly isolated events which are typically short-term, whereas the effects of long-term psychosocial stress are more important from a health perspective. Accordingly, due to limited external validity, results obtained in laboratory settings might not be generalizable to a real-life context. Scholars have therefore emphasized that more meaningful insights should be gained in research carried out in more naturalistic environments (20, 21).

Stress experiences at work are very common in adults (5). Two of the most recognized theoretical models in research on work stress are the effort-reward imbalance (ERI) model, which

assumes that stress is the consequence of an imbalance between perceived efforts and rewards at work, as well as the job demands and control (JDC) model, which states that stress occurs if perceived demands and control at work are outbalanced (22, 23). Kivimäki, Virtanen, Elovainio, Kouvonen, Vaananen, and Vahtera (24) showed that in both models increased stress is related to higher cardiovascular mortality. In a retrospective study, the authors examined approximately 800 (mainly male) workers in the metal industry, with an average follow-up time of 25 years. Mortality risk ratios increased to 2.4 (95% CI: 1.3, 4.4) for high ERI, and 2.2 (95% CI: 1.2, 4.2) for high job strain (JDC imbalance), respectively. Furthermore, the risk associated with higher stress levels decreased by 30% in the intermediately physically active group, and by 60% in the highly physically active group.

In order to assess physiological stress reactivity and recovery objectively in real-life, heart rate variability (HRV) has become a popular and frequently used parameter in stress research (25). HRV refers to fluctuations in time intervals of successive heart beats (N-N intervals), measured in milliseconds. These differences can be attributed to branches of the aforementioned SAM axis (sympathetic and parasympathetic nervous system) (26). The Root Mean Squares of Successive N-N Differences (RMSSD), a measure of parasympathetic activity, is used frequently as an indicator of physiological stress reactivity and recovery in real-life measurements (27). Studies assess HRV-based physiological reactivity as hourly (28) and daily (29) aggregations of HRV values, or as the differences between day and night HRV values (29, 30). HRV-based physiological recovery is often assessed as aggregated night HRV levels (28, 29, 31), as well as balance indices between day and night HRV (32). Existing evidence suggests that stress-related differences in HRV are significantly associated with cardiovascular disease (33) and mortality (34).

In their review, Tonello, Rodrigues, Souza, Campbell, Leicht, and Boullosa (35) reported strong negative correlations between work stress and HRV. However, the authors stated that optimal methods for detecting adaptations related to cardiac autonomous stress *via* HRV still need to be developed. A more recent review by Järvelin-Pasanen et al. (27) on work stress and HRV corroborated the general results of Tonello et al. (35), and added more detailed information on the specific HRV parameters that were evidently influenced by chronic and acute work stress. Vrijkotte et al. (32), for example, assessed chronic and acute work stress in a sample of 109 male white-collar workers, which were followed-up for two consecutive workdays. Stress levels were matched to RMSSD, as a HRV parameter reflecting vagal tone. The high ERI group showed lower RMSSD, pointing towards decreased parasympathetic activity in individuals with higher chronic work stress. Work stress of the current day was assessed using the Profile of Mood States (assessed in the evening, retrospectively for the day). Although ERI scores were associated with negative mood states, no significant relationships were observed between mood states and HRV (32). Finally, the randomized controlled trial by von Haaren et al. (28) for the first time points towards the stress-buffering potential of increased CF when objective stress markers are assessed in a real-life context. More specifically, in a sample of 61 sedentary university students, an increase in CF after a standardized physical activity (PA) intervention was associated with higher RMSSD ($\beta = 0.15$) during a period of heightened academic stress (exam period).

The existing literature on real-life stress is often based on cross-sectional designs, with single work stress scores or aggregated HRV-values, respectively. Järvelin-Pasanen et al. (27) explicitly highlighted the lack of longitudinal studies. However, studies with longitudinal designs are important for at least two reasons: First, single chronic stress scores or aggregated mean levels in outcomes might show different associations than multiple acute stress perceptions/responses (36). Second, the individual evaluation of the predictability and controllability of stressors is fundamental for the reaction to them (37). Nevertheless, these intra-individual differences are not sufficiently accounted for by inter-individual study designs. In order to highlight differences between situations that are considered highly stressful *versus* not stressful, participants have to function as their own controls. Hence, studies with within-subject designs become necessary (38).

While traditional methods have applied retrospective self-reports, technological improvements enable real-life measurements *via* ecological momentary assessment (EMA). Using portable devices, experiences can be assessed in real-time, rather than necessitating long-term recall (39). Consequently, stress research has experienced a growing interest in state variables, such as emotional reactions and changing mood states (40). Emotions and mood states are understood as cognitively mediated psychophysiological reactions that are limited in time (40). Emotions (i.e. anger, fear) are situational and intense, whereas mood states are longer-lasting, rather unspecific background phenomena, and not consistently cued by specific events (40).

In an ambulatory research study with 73 teachers ($M = 46.7$ years, $SD = 9.5$; 67% male), Pieper, Brosschot, van der Leeden, and Thayer (41) showed independent associations of stressful events and worry episodes with lowered HRV (measured as RMSSD). Uusitalo, Mets, Martinmaki, Mauno, Kinnunen, and Rusko (42) examined the relationship between emotions (stress, irritation, satisfaction) during two workdays using mean values of emotions and HRV in a sample of 19 hospital workers. A strong negative correlation between feelings of stress during work and RMSSD ($r = -0.70$ to $r = -0.80$) indicated lowered parasympathetic activity in an acute stress response. Similarly, chronic work stress, measured as imbalance between efforts and rewards, was strongly related to RMSSD ($r = -0.53$).

Taken together, there is still a marked lack of research addressing the stress-buffering effect of CF in real-life contexts. Therefore, the purpose of the present study is to examine whether police officers with different levels of CF differ with regard to their (a) physiological stress reactivity during acute real-life stress situations, and (b) physiological recovery related to acute and chronic work stress. Based on the aforementioned literature, two hypotheses were tested:

- With the first hypothesis, we expected individuals to show a greater physiological stress reactivity (decrease in HRV) in acute work stress situations with lower group levels of CF (28).
- With the second hypothesis, we expected improved physiological recovery (increased HRV) in groups with higher levels of CF when exposed to acute and chronic work stress situations (30).

MATERIALS AND PROCEDURES

Participants

Participants were recruited from the police force of the canton Basel-Stadt, a German-speaking city in Switzerland. All employees were invited to participate *via* intranet, internal newspaper, internal TV-adverts, and during team meetings. The present data is part of a voluntary health-check in a bigger project (HERO-study). Additionally, a lifestyle coaching and a second health check were offered to interested officers. Data presented in this article are based on the first health check, which took place between October 2017 and March 2018. Following the invitation, officers had the opportunity to use an e-learning tool, consisting of short text modules and video sequences, in which the general purpose and procedures of the study were explained. Furthermore, information was provided regarding the voluntary nature of participation, the absence of negative consequences in case of non-participation, benefits and risks, rights and obligations, as well as detailed information about the measurements. No monetary incentives were provided to the officers. However, the health check was performed during (paid) working hours and participants received a personalized health profile. At the end of the e-learning phase, participants had the possibility to schedule their own assessment. To participate in the submaximal CF test, participants had to pass a PA readiness check, based on the Physical Activity Readiness Questionnaire (PAR-Q) (43). Participants who did not pass the PAR-Q had to provide a doctor's certificate, attesting that the treating doctor considers it safe for the participant to participate in a submaximal fitness test.

The Basel-Stadt police force consists of approximately 1,000 officers. From these, 227 agreed to obtain more detailed information *via* the e-learning tool (approx. 23%), and 201 officers decided to participate in the study (88%). All participants provided written informed consent prior to data assessment. All procedures followed the ethical principles of the Declaration of Helsinki. The Ethics Committee for Northwest/Central Switzerland approved the study (EKNZ: Project-ID: 2017-01477).

Procedures

Data used in the present paper was acquired during the laboratory session and in real-life. The laboratory session took place at the education and training center of the police force; all tests were performed in a private setting in the same specially equipped room. All assessments were carried out by the same investigator. In real-life, heart rate was monitored for 48 h. To ensure the assessment of full (daytime) working days among shift-workers, the real-life assessment started on their first day of a shift cycle. By contrast, among participants with regular office shifts, the real-life assessment started on a day before two full working days (usually Monday, Tuesday, or Wednesday). To ensure comparability, we analyzed the full workday, following the first night. Furthermore, this procedure may have served to limit low stress measurements, since participants might have scheduled the laboratory session (health check) on days with relatively low workload. At the end of the laboratory session, participants received the sensors and smartphones, as well as oral and written instructions regarding smartphone usage. The real-life measurement started immediately after the laboratory session. Participants wore the heart rate monitor for 48 h consecutively, and answered questions regarding their stress emotions and affect states on a smartphone (see *Measures* section for more specific information).

Measures

Cardiorespiratory Fitness

Cardiorespiratory fitness (CF) was measured with the validated and internationally applied Åstrand Fitness Test (44). In a submaximal performance test on a bicycle ergometer, maximal oxygen consumption (VO_2max) is estimated by standardized extrapolations of heart rates at certain resistances (45, 46). Standardized instructions prior to the testing included the avoidance of any strenuous PA for 24 h, as well as heavy meals, and liquids other than water for 3 h. For the test, participants were equipped with a heart rate monitor. Standardized workloads were set for men (150 watts) and women (100 watts). This workload was adjusted to keep the heart rate in the range of 130–160 (bpm) for participants <40 years, and 120–150 (bpm) for participants ≥40 years. Cycling cadence was set at 60 rotations per minute. At the end of each minute, heart rate was noted, and participants stated their perceived exertion on a Borg scale (47). Prior to the test, participants were instructed that perceived exertion should be between 11 to 16 on the Borg scale (below the maximum range) (47). Standardized encouragements were used and participants were controlled for cancelation criteria (17). After 6 min, the test ended if heart rate over the last 2 min did not vary by more than 5 beats per minute. Otherwise, participants were asked to proceed for another minute until this criterion was met. The mean heart rate of the final 2 min was compared against the final stage watts to achieve a gender adjusted VO_2max (ml/kg/min). These values were matched with CF percentiles using age and gender specific norm values presented by the ACSM (17). Following ACSM recommendations, we further classified participants' CF levels as "very poor," "poor," "fair," "good," "excellent," and "superior" (17).

Chronic Work Stress

Chronic work stress was measured at the end of the laboratory session. Hereby, the Effort-Reward Imbalance (ERI) scale (22)

and the Job Demand and Control (JDC) scale (48) were administered using an online questionnaire. The ERI scale consists of 5 items for efforts (i.e. "I have a lot of responsibility in my job") and 11 items for rewards (i.e. "I receive the respect I deserve from my superior or a respective relevant person."). Answers are given on a five-point Likert-scale ranging from 1 (none) to 5 (very high). After summing up each dimension, the ratio was calculated using the factor 0.4545 to counterbalance the unequal number of questions (effort/[reward*0.4545]). Ratios above 1 reflect high levels of job stress (22). The JDC scale consists of five items for demands (i.e. "My job requires me to work very fast") and six items for control (i.e. "I have freedom to make decisions about my job"). Answers are given on a four-point Likert-scale ranging from 1 (never) to 4 (often). Sum scores for each dimension were calculated. As for ERI, the JDC-ratio was calculated using the factor 0.8333 to balance the unequal numbers of questions (demands/[control*0.8333]). JDC Ratios >1 indicate high work stress (49). The validity and reliability of this instrument has been described previously (50).

Ecological Momentary Assessment

Psychological variables in real-life were assessed *via* the EMA method. Each time they were contacted, participants answered different sets of questions on a smartphone (Moto G, 3d Generation) *via* Movisens*XS* (movisens GmbH, Karlsruhe, Germany), an app for Android Smartphones. Movisens*XS* offers a web-based software solution for question settings, sampling contingents, and management of participants; at a later stage, the software processes and prepares data output for analysis. Three sets of questions were triggered in the morning, during the workday, and in the evening. The present paper considers the workday set, which will now be described in detail. The workday set sampled between 12 am and 7 pm for all shift workers (matching their shift schedule) and between 9 am and 5 pm for regular office workers. Sets were time-triggered once per hour with a random appearance of +/− 15 min. The participants responded to an alarm (tone and vibration), which otherwise would repeat every 5 min; if participants did not complete the survey after 15 min, the current assessment was closed. Additionally, participants had the opportunity to postpone the first alarm for up to 15 min. In this case, only one further alarm was triggered 15 min later.

Acute Work Stress

In the present study, acute work stress is used as an umbrella term for affective states, as well as feelings of stress, and feelings of anger. The term "feelings of stress" is specifically used for the acute feeling of being stressed, as a single variable only. Approximately 2 min were needed to answer an entire set of questions. Instructions on how to respond to questions associated with the assessment of acute work stress were given during the laboratory session. More specifically, participants were asked to refer to the current situation right before the assessment when answering questions on affect states, feelings of stress, and anger. Since psychological variables were linked to HRV, we controlled for PA as a possible confounder, using two control questions: "Have you been physically active during the past 15 minutes?" and "Have you been physically inactive during the past 15 minutes?" For these questions, participants were instructed to ignore very short walks and standing periods.

Positive and negative affect states were assessed using an adapted German version of the Positive And Negative Affect Schedule (PANAS) (51). Validity of this instrument has been presented previously (52). Participants were asked how they feel at the moment. The items were reflective of five positive (i.e. "content," "delighted") and five negative affect states (i.e. "irritable," "hostile"). Items were answered on a five-point Likert scale, ranging from 1 (not at all) to 5 (very).

Feelings of stress was assessed with a single item: "How stressed do you feel at the moment?" Answers are given on a five-point Likert scale from 1 (not at all) to 5 (very). Validity of single items for the assessment of stress symptoms has been provided previously (53). "Feelings of anger" was assessed with the item "How angry did you get during the last 10 minutes?" Again, items were answered on a five-point Likert scale, ranging from 1 (not at all) to 5 (very).

Ambulatory Assessment

Heart rate was assessed using ecgMove3 (movisens GmbH, Karlsruhe, Germany). This sensor records a full one-channel ECG waveform (1024 Hz), 3-dimensional acceleration (63 Hz), and barometric altitude (8 Hz) as raw data on internal memory. Evidence about validity and reliability to accurately capture heart rate and PA has been provided previously (54, 55). At the end of the laboratory session, participants were asked to put on the device, which was worn on a textile dry electrode chest belt.

For heart rate variability (HRV) analysis, two HRV subsets were calculated: (i) 10-min HRV (linked to acute work stress during the workday assessed *via* EMA), and (ii) night HRV (following the workday). We applied the same data processing procedure for both subsets. As mentioned above, the full workday and the following night were considered for data analysis. Accordingly, participants became accustomed to the sensors on the first night. In a first step, the *DataAnalyzer* (movisens GmbH, Karlsruhe, Germany) detected sleep periods and non-wear time (56). In a second step, *UnisensViewer* (movisens GmbH, Karlsruhe, Germany), a software for Windows, was applied to view and edit the data. For calculations of HRV subsets, we stored separate files based on tailored sample limits.

Night HRV sample limits were based on accelerometry sleep detection and set between 8 pm and 8 am. Valid night HRV consisted of at least 4 h of detected sleep, with disruption of no more than 10 min. We assessed all participants individually to detect implausible sleep values. Sample limits for 10-min HRV are taken on the complete workdays, between 12 am to 7 pm for shift workers, and 9 am to 5 pm for workers with regular office shifts. Sample limits begin 10 min before the start times of each acute work stress measurement. We calculated raw interbeat intervals using *DataAnalyzer* (movisens GmbH, Karlsruhe, Germany). The interbeat intervals were exported to Kubios version 3.1.0 (57). Automatic threshold based artefact correction was set at 0.15 s (strong) (57). Frequency-domain parameters are based on Fast Fourier Transformation with

frequency bands defined in accordance with the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (58). Welch method was used to calculate spectral parameters (segments 300 seconds, 50% window overlap, 5 Hz Sampling frequency). For further analyses, we extracted time-domain parameter RMSSD.

Statistical Analyses

Descriptive statistics (M, SD, Range, Skewness, Kurtosis), group differences in outcome variables (t-test, ANOVA), and correlations (Pearson) of outcome variables (HRV night, HRV of the past 10 mi) and predictors (acute work stress, chronic work stress, CF) were calculated using SPSS 26 (IBM Corporation, Armonk NY, USA). For correlations, within subject variables (level 1) were aggregated over the entire day. Distributions of all variables met standards (skewness <2 and kurtosis <7) recommended for parametric testing (59). Univariate analysis of variance was applied to examine group differences in study variables for different CF levels. Probability levels of $p < 0.05$ were interpreted as statistically significant in all statistical analyses.

Stress Reactivity (First Hypothesis)

To examine stress-buffering effects of CF on physiological stress reactivity in acute work stress situations, multilevel modelling was calculated with HLM 7.03 (Scientific Software International Inc., Lincolnwood, IL) for Windows. We applied two-level random intercept models. All predictor and outcome variables were standardized (z-scores) (60). HRV (RMSSD), which is nested within persons (level 1), was set as an outcome. CF (6 class equivalent) was set as a predictor on the between-person level (level 2). First, acute work stress variables, which are nested within persons (level 1), were included in both levels, with no significant relations occurring. We then calculated our hypothesized model with preceding acute work stress as the assumed causal variable (level 1), CF (level 2) as moderator, and HRV (level 1) as outcome. Random variations were allowed for predictors; however, interactions were set as fixed effects for causality assumptions. Outcome variables were controlled for gender, age, body mass index (BMI), shift work status, years of service, and PA status during the past 15 min in separate predictor models respectively. With none of these covariates being related to the outcome, they were removed in favor of a parsimonious model. Missing data on level 2 was deleted listwise during calculation. First, the null model and intraclass correlation (ICC = $\tau_{00}/(\tau_{00}+\sigma^2)$) was calculated for the outcome variable (10-min RMSSD). Second, each predictor variable (level 1: feelings of stress, feelings of anger, positive affect, negative affect; level 2: CF) was included in a separate model. Third, for the between person predictor CF (level 2), four separate models were calculated, each including one of the four acute work stress variables as within-person predictor (level 1). Reported coefficients (pseudo R^2) refer to estimations with robust standard errors.

Stress Recovery (Second Hypothesis)

To examine stress-buffering effects of CF on physiological stress recovery (night HRV), several (four-stage) regression analyses were performed using SPSS 26 (IBM Corporation, Armonk NY, USA). The first stage included all demographic and social background variables, if they were significantly related to the HRV outcome. In the second stage, we entered occupational stress (chronic work stress as ERI ratio and JDC ratio; feelings of stress). Feelings of stress, originally assessed as a within-subject variable, was now aggregated as mean value over the entire workday. The third stage included CF. The fourth stage included an interaction between CF and each work stress variable. In the fourth stage, centered variables of occupational stress and CF were used. We report stepwise changes in R^2 with the according p-values, and the standardized regression weights with the according *p*-values for each predictor variable in the final model.

RESULTS

Sample Description, Group Differences, and Bivariate Correlations

Descriptive statistics are presented in **Table 1**. Overall, 201 officers participated in the study. Participants stating current use of medication (17 participants) or employment status lower than 50% (11 participants) were excluded from data analysis. The remaining sample consists of 115 men (66.5%), and 58 women (33.5%), mean age 37.64 years (*SD* = 9.80), mean years at service 12.32 (*SD* = 8.56). The sample was compared to the entire police corps of Basel-Stadt (*N* = 980 officers), showing significantly younger mean age (*t*-test compared to 41.88 years: $t(172) = -5.69$, $p < 0.01$), but no significant differences in gender ratio (*t*-test compared to 29.6% women).

Five participants (2.7%) did not answer any acute work stress assessments. Additionally, 13 (7.5%) acute work stress datasets

TABLE 1 | Participants' distribution across the six fitness groups and group characteristics in significantly different variables.

Fitness groups based on ACSM standards	*n*	%	Men	Women	Ratio	BMI (*M* ± *SD*)	Heart rate at night (*M* ± *SD*)
Very poor	30	17.3	27	3	90/10	28.58 ± 4.48	74.34 ± 25.12
Poor	13	7.5	7	6	54/46	25.79 ± 4.11	83.39 ± 29.09
Fair	26	15	20	6	77/23	26.00 ± 3.56	83.99 ± 28.61
Good	28	16.2	18	10	64/36	25.94 ± 2.99	64.95 ± 15.91
Excellent	25	14.5	13	12	52/48	24.66 ± 2.33	73.11 ± 30.11
Superior	51	29.5	30	21	59/41	24.64 ± 2.64	66.56 ± 23.15

ACSM, American College of Sports Medicine; BMI, Body Mass Index.

TABLE 2 | Descriptive statistics for and bivariate correlations between independent and dependent variables.

Variable	Range							Bivariate correlations between the study variables								
	n	*M*	*SD*	Min	Max	Skew	Kurt	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Cardiorespiratory fitness class	173	45.34	11.40	21.90	89.40	0.66	0.71	–								
Chronic work stress																
2. Job Demand Control ratio	162	0.96	0.19	0.54	1.55	0.77	0.46	0.13	–							
3. Effort Reward Imbalance ratio	162	0.89	0.25	0.33	2.02	1.03	2.33	-0.03	0.28**	–						
Acute work stress (aggregated mean values per workday)																
4. Feelings of stress	155	1.70	0.62	1.00	3.86	0.96	0.48	-0.04	0.08	0.28**	–					
5. Feelings of anger	155	1.61	0.52	1.00	3.20	0.77	0.04	-0.03	0.21**	0.20*	0.66**	–				
6. Positive affect	155	16.50	2.57	5.86	23.00	-0.37	1.33	0.00	-0.12	-0.13	-0.34*	-0.15	–			
7. Negative affect	155	7.58	2.38	5.00	15.71	1.13	0.95	0.00	0.13	0.28**	0.74*	0.58**	-0.39**	–		
Heart rate variability																
8. Night RMSSD	156	45.81	17.32	10.60	98.84	0.85	0.60	0.08	0.13	-0.29**	-0.85	0.08	0.04	-0.05	–	
9. 10-min RMSSD	154	34.70	11.05	5.00	75.00	0.24	0.64	0.17*	0.15	-0.02	-0.09	0.01	0.03	-0.03	0.40**	–

RMSSD, Root Mean Squares of Successive N-N Differences.
*$p < 0.01$; **$p < 0.001$.*

were missing due to software problems (n = 7, 4.0%) or invalid data on heart rate variability (n = 6, 3.5%). On average, participants answered 6.47 (SD = 1.34) acute work stress measurements (of a possible 8) over the course of the study. Following Lüdtke, Trautwein, Kunter, and Baumert (61), we calculated ICC(1)[1] for within-level and ICC(2)[2] for between-level reliability of the psychometric measures. ICC(1) can be interpreted as the percentage of variance that can be accounted for by differences between persons. ICC(1) values were 0.19 (19%) for anger, 0.45 (45%) for stress, 0.67 (67%) for positive affect, and 0.61 (61%) for negative affect. Applying ICC(1) to the Spearman Brown formula, we calculated ICC(2) to estimate the accuracy of the mean values across all individuals. ICC(2) values were 0.60 (moderate) for anger, 0.84 (good) for stress, 0.93 (excellent) for positive affect, and 0.91 (excellent) for negative affect (62). Missing data in night heart rate parameters occurred for 17 participants (9.8%), whereas five (2.9%) datasets were excluded due to artefacts and in 12 cases (6.9%), sensors did not provide data for unknown reasons.

The overall mean of fitness percentiles for CF was 62.93 (SD = 33.37). The participants' distribution across the six-group classification recommended by the ACSM is described in **Table 1**. Group values and standard deviations are presented for variables in which the groups differed significantly. Significant differences occurred for gender ratio ($F(5,167) = 2.81$, $p < 0.05$), body mass index ($F(5,167) = 6.13$, $p < 0.01$), and heart rate at night ($F(5,150) = 2.45$, $p < 0.05$). No significant between-group differences were found for age, shift work status, years of service, HRV parameters at night, and any acute or chronic work stress variables. Interestingly, the very poor fitness group showed lower levels of heart rate at night compared to the poor and fair fitness group. However, *post-hoc* tests did not reach significance (Tukey, Bonferroni).

The bivariate correlations between the different study variables are presented in **Table 2**. These findings show that CF levels (percentiles) were positively related to the aggregated mean values of HRV during the workday. The two chronic work stress questionnaires (JDC, ERI) were positively correlated with each other. While the JDC ratio was only correlated with the acute work stress measure feelings of anger, the ERI ratio was similarly associated with feelings of stress, feelings of anger, and negative affect. Acute work stress parameters and the JDC ratio were not significantly related to HRV outcomes. By contrast, the ERI ratio was negatively associated with night HRV.

Multilevel Model to Examine Physiological Stress Reactivity (First Hypothesis)

Results of the multilevel modelling are presented in **Table 3**. The intraclass correlation provided evidence for a two-level hierarchical structure, showing that 63% of variance in the outcome can be accounted for by intra-individual variables (RMSSD ICC = 0.63) (63). Results of multilevel models are described for CF and acute work stress (gender, age, BMI, shift work status, years of service, and PA during the past 15 min controlled for in separate models; see *Methods*). In accordance with the hypothesis, a cross-level interaction for CF suggests a moderation effect, with higher levels of RMSSD being predicted by higher levels of CF when participants perceived stronger feelings of stress. On the contrary, no interaction effect occurred for feelings of anger, positive affect, and negative affect. Between-subject differences (level 2) in CF were a significant predictor of 10-min RMSSD during the workday. The direction of the association of feelings of stress, as a within-subject (level 1) predictor, and 10-min RMSSD was negative, but not statistically significant. Surprisingly, 10-min RMSSD during the day was not significantly affected by the acute work stress measures.

Regression Analyses to Examine Physiological Stress Recovery (Second Hypothesis)

The results of the regression analyses are provided in **Table 4**. In all models, age significantly explained night HRV levels, with

[1] $ICC(1) = \tau 2/(\tau 2 + \sigma 2)$
[2] $ICC(2) = k \times ICC(1) / (1 + (k - 1) \times ICC(1))$

TABLE 3 | Estimated effects in multilevel models using restricted maximum likelihood with predictors CF, feelings of anger, positive affect, and negative affect on HRV outcome variable RMSSD over the past 10 min.

Outcome	Null model				Level 2				Level 1				Full model							
													Level 1				Cross-level interaction			
	β	*SE*	*T*	*p*	β	*SE*	*T*	*p*	β	*SE*	*T*	*p*	β	*SE*	*T*	*p*	β	*SE*	*T*	*p*
					Cardiorespiratory fitness class				Feelings of stress								Cardiorespiratory fitness class × feelings of stress			
10-min RMSSD	0.03	0.07	0.52	0.751	0.14	0.07	2.00	0.045	-0.02	0.03	-0.51	0.437	-0.03	0.03	-1.02	0.324	0.06	0.03	2.04	0.043
									Feelings of anger								Cardiorespiratory fitness class × feelings of anger			
									-0.02	0.02	-0.69	0.407	-0.02	0.02	-0.69	0.433	-0.00	0.03	-0.69	0.372
									Positive affect								Cardiorespiratory fitness class × positive affect			
									-0.06	0.04	-1.34	0.357	-0.06	0.04	-1.34	0.397	-0.01	0.05	-0.15	0.469
									Negative affect								Cardiorespiratory fitness class × negative affect			
									0.03	0.03	0.83	0.395	0.03	0.03	0.83	0.375	-0.00	0.03	-0.00	0.148

RMSSD, Root Mean Squares of Successive N-N Differences.

TABLE 4 | Linear regression analyses predicting night RMSSD with occupational stress and cardiorespiratory fitness.

	ΔR^2	β	*p*	ΔR^2	β	*p*	ΔR^2	β	*p*
Step 1	0.29		0.000	0.29		0.000	0.31		0.000
Years of service		-0.01	0.905		-0.01	0.905		-0.01	0.947
Age		-0.51	0.000		-0.51	0.000		-0.52	0.000
Shift work		-0.05	0.553		-0.05	0.553		-0.07	0.381
Step 2	0.00		0.384	0.02		0.048	0.00		0.872
Occupational stress									
JDC ratio		0.07	0.384						
ERI ratio					-0.14	0.048			
Feelings of stress								0.00	0.872
Step 3	0.02			0.02		0.006	0.03		0.002
Cardiorespiratory fitness class		0.12	0.006		0.12	0.006		0.17	0.002
Step 4	0.00		0.839	0.00		0.902	0.01		0.092
Occupational stress × cardiorespiratory fitness class		-0.04	0.839		0.01	0.902		0.11	0.092

JDC, Job Demand Control; ERI, Effort Reward Imbalance; RMSSD, Root Mean Squares of Successive N-N Differences.

lower levels of HRV in older individuals. ERI significantly explained variance in night RMSSD. The JDC ratio and feelings of stress did not significantly predict night HRV. CF significantly explained variance in participants' night RMSSD levels, after controlling for feelings of stress. Finally, the interaction terms did not significantly account for variance in the outcomes in any of the calculated models.

DISCUSSION

The aim of the present study was to examine the stress-buffering effects of cardiorespiratory fitness (CF) under realistic conditions. CF significantly moderated physiological stress reactivity (in RMSSD) when participants perceived elevated feelings of stress at work, with higher levels of CF predicting higher levels of parasympathetic activity. However, no direct effects occurred for perceived feelings of stress, feelings of anger, positive affect, or negative affect. Interestingly, the physiological stress reactivity was not significantly affected by acute psychological work stress. Chronic work stress, measured as effort reward imbalance (ERI), was negatively related to physiological recovery at night. While CF was associated with increased physiological recovery at night, no effects on recovery appeared for interactions between CF with chronic and acute work stress. The present pattern of results adds to the current literature in an important way, as one of the first real-life studies examining stress-buffering effects of CF in police officers. With these results, we add distinct insights into the influence emotional and affective states. Our results are novel, because the study design and statistical analysis further accounts for intra-individual differences in the stress response.

With our first hypothesis, we expected stress-buffering effects of CF on HRV in acute work stress situations. CF showed the expected effect when feelings of stress increased, with lower

physiological stress reactivity (higher parasympathetic activity) in more fit individuals. The present results corroborate previously proposed stress-buffering effects of CF on cardiovascular stress reactivity (12, 15, 28). However, these results only appeared for feelings of stress, whereas no effects appeared for feelings of anger, and affective states. Since affective states are understood to be less cognitively presented in stress perception, emotions might be more closely related to acute work stress (40). The missing effects for feelings of anger might be related to individual differences in adaptive pathways in the regulation of the stress response (64). As mentioned in the introduction, cognitive processes are key ingredients in the emergence of stress. Anger is linked to a cognitive appraisal (65) of causality and responsibility (66), for example when another person is (perceived to be) responsible for an event with negative consequences for oneself (66, 67). This accountability can discriminate anger from other emotions, such as fear or anxiety, when attributions are not possible (67, 68). Thus, stress can even predispose an individual towards anger (65). However, accountability is, by definition, related to higher perceived controllability and predictability of events, which are key factors in the stress process (37). In line with this, Wu, Gu, Yang, and Luo (69) showed that anger was associated with a higher HRV (higher parasympathetic activity) compared with fear. Consequently, a relatively low reactivity to anger, compared to other emotions, would result in weaker associations, in line with the anticipated buffering effects of CF. In sum, theoretical assumptions and evidence regarding ANS reactions encourage a differentiated, nuanced contemplation of the emotions referred to here (70, 71). Furthermore, no direct effects of acute work stress appeared on HRV. This result is somewhat counterintuitive. In their systematic review, Jarczok et al. (72) showed that adverse psychosocial work conditions were associated with lowered HRV. However, in a 3-day EMA study by Kamarck, Muldoon, Shiffman, Sutton-Tyrrell, Gwaltney, and Janicki (73), the association between demands and physiological parameters reflecting cardiovascular health was not limited to the workplace. Further research is needed to further examine the influence of psychosocial stress during leisure time.

While the present sample represented the overall gender ratio in the police corps, it was also significantly younger. Due to some promising results in older populations (32, 74), our findings might understate possible relevant health effects. Furthermore, police officers have to take physical examinations in the early stages of their career; hence, relatively high CF levels can be expected among study participants. As a consequence, the detected effects of CF as a stress-buffer might be rather conservative in the present study.

With our second hypothesis, we expected improved stress-related physiological recovery patterns (increased parasympathetic activity in high stress levels) with higher levels of CF. Although chronic work stress (ERI) showed negative associations with night HRV, no support of stress-buffering effects appeared for CF. However, CF predicted improved physiological recovery for night RMSSD. Interestingly, chronic work stress measured *via* the JDC ratio, and acute work stress, were not related to night HRV. These results are partly in line with the findings of two reviews (27, 75). Loerbroks et al. (75) found significant age-related partial correlations with ERI and HRV, but not JDC in the age group of 35 to 44 years. The review of Järvelin-Pasanen et al. (27) contained five studies assessing RMSSD. Of these studies, two studies unanimously reported lower RMSSD levels in stressed individuals. However, two studies only found partial support, whereas in one study no significant effect of chronic work stress on RMSSD was detected (76). Interestingly, in the real-life study by von Haaren et al. (28), the control group showed lower levels of night RMSSD during the examination period, compared to the intervention group. These previous results support the present finding, that chronic work stress is associated with reduced physiological recovery processes, measured as HRV.

One explanation for these results might be related to the components of the stress-health relationship (7). As mentioned previously, research on stress-buffering effects of CF mainly focus on physiological stress reactivity and recovery. Nevertheless, with the present paper, we want to encourage researchers to place a stronger focus on restoration processes in future investigations. The descriptions by Berntson and Cacioppo (7) indicate that CF might be related to improved cardiac vagal activity (parasympathetic influence on cardiovascular stress reactivity and recovery) due to anabolic processes. These adaptations might be rather long-term, hence, health-related improvements might be less affected by short-term changes in stress levels. The present study supports this notion, since chronic work stress levels showed more consistent associations with favorable HRV patterns than acute work stress. Interestingly, CF levels did not consequently predict night HRV in all models, whereas mean levels of heart rate at night differed significantly between CF groups. Hence, CF might have different influences on heart rate and HRV (8, 77). These differences are important to understand, since high heart rate and low HRV have been shown to be independent risk factors for cardiovascular disease (33, 41, 78).

Strengths

One of the key strengths of this study is constituted by the methodological advancements in relation to previous research. With the application of real-time assessments of stress reactivity, and with the co-assessment of physiological and psychological parameters, we tackled several gaps in previous research. For instance, using EMA techniques has the potential to minimize bias related to recall times, which constitutes a huge improvement in allowing the examination of the "experiencing self" in contrast to the "reflecting self" (79). Furthermore, our statistical analyses took into account the individuality of the stress-health relationship by statistically accounting for intra-individual changes in stress perceptions and reactions. A further strength of our study is the improved quality of night HRV assessment by including an additional night of acclimatization. Additionally, the present results are based on a rigorous assessment of study variables, with standardized, reliable, and valid tools that are widely applied in

international research. The homogeneity of the present sample further allows cohort-specific interpretations in a highly stressful occupation.

Limitations

However, some limitations may affect the generalizability of our data. First, we tested stress reactivity and recovery independently. However, some scholars suggest that these phenomena are interdependent. The "*DynAffect*" model by Kuppens, Oravecz, and Tuerlinckx (80) states that stress responses are dynamic, fluctuating around an individual's emotional "home base." In this sense, reactivity and recovery are understood as the sensitivity to withdraw from, and the attractor strength that ties back to, the home base (80). Furthermore, Smyth, Sliwinski, Zawadzki, Scott, Conroy, Lanza (81) recently introduced their stress response assay that comprises both stress reactivity and recovery. The assay additionally captures pile-up, which accounts for multiple stress responses within a defined time-period. Second, controlling for extraneous variables was not feasible, given the nature of our study design. However, using real-life stressors increases the ecological validity of our findings. Third, although HRV assessments followed the recommendations of the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (58), breathing patterns and physical activity were not controlled for objectively. To improve the quality of subjective physical activity reports, all participants received verbal and written instructions prior to the assessments. Fourth, our results might include errors due to multiple testing on the same dataset. With regards to the associated effect sizes and *p*-values, our results must be interpreted with caution. In this respect, future observations in police officers may benefit from larger sample sizes.

Practical Implications

Occupational stress among police officers may have a more direct impact on society than that of other occupations, since job performance is closely linked to public safety (82). However, police officers have been shown to be at risk for maladaptive coping strategies (83). Associated organizational costs are considerable due to reduced productivity, absence, and early retirement (84). In this respect, self-regulatory processes to manage emotions and sustain resilience are highly important (85). Self-regulatory techniques primarily aim for an efficient systemic recalibration to physiological and psychological balance after intense stress experiences (85). Furthermore, successful recovery from stress is associated with more favorable physiological stress markers, i.e. cortisol, which is evidently linked to improved functioning of higher-order cognitive tasks. Optimal brain functioning has been related to enhancements in concentration, planning abilities, memory, decision making, moral reasoning, inhibition of inappropriate responses, and inhibition of distractions (85).

Applying HRV biofeedback to successfully enhance coping is well-documented (86). Firstly, monitoring the physiological stress reaction could increase self-awareness of stress experiences (86). Secondly, specific techniques which enhance the regulation of physiological function can be learned (86). These improvements in the physiological stress reaction can complement further psychological self-regulatory techniques (85). In the present results, partial support appeared for CF as a physiological resilience factor, helpful for managing stress in police officers.

Hence, one potential way for police health authorities to enhance self-awareness is to encourage employees to monitor day and night values of HRV. We further emphasize the importance of interventions that focus on improved CF. The present results have shown the association of increased fitness and several known risk markers of cardiovascular health.

CONCLUSION

Our results showed partial support for the potential of CF to buffer cardiovascular reactivity when police officers are exposed to acute work-related stress. Higher levels of CF were related to enhanced physiological recovery, which might have further important implications for participants' health. Therefore, we encourage the promotion of fitness programs with the aim of enhancing CF in stressful occupations such as law enforcement. Finally, we encourage the assessment of HRV for the early detection of maladaptive acute physiological stress reactivity, as well as physiological recovery related to chronic work stress.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee for Northwest/Central Switzerland (EKNZ: Project-ID: 2017-01477). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RS, SB, and MG made substantial contributions to conception and design of the study. RS, SL, and MG were responsible for the acquisition of data. RS, CH, and FC were responsible for the analysis and interpretation of data. RS and CH drafted the manuscript. FC, SB, MG, and UP wrote sections of the manuscript. CH, SB, SL, UP, MG, and FC critically reviewed and revised the initial draft. All authors contributed to the article and approved the submitted version.

REFERENCES

1. Lahmann C, Gebhardt M, Sattel H, Dinkel A, Pieh C, Probst T. A randomized controlled trial on functional relaxation as an adjunct to psychoeducation for stress. *Front Psychol* (2017) 8:1553. doi: 10.3389/fpsyg.2017.01553
2. Uchino BN, Smith TW, Holt-Lunstad J, Campo R, Reblin M. *Stress and illness. Handbook of psychophysiology. 3rd ed.* New York, NY: Cambridge University Press; (2007) p. 608–32.
3. Shirom A. Job-related burnout: A review. In: Quick C, LE T, editors. *Handbook of occupational health psychology*. Washington, DC: American Psychological Association. (2003).
4. Guazzi M, Faggiano P, Mureddu GF, Faden G, Niebauer J, Temporelli PL. Worksite health and wellness in the European Union. *Prog Cardiovasc Dis* (2014) 56(5):508–14. doi: 10.1016/j.pcad.2013.11.003
5. American Psychological Association. *Stress in America: The state of our nation*. American Psychological Association (2017).
6. Lazarus RS. *Stress, appraisal and coping*. Folkman S, editor. New York, NY: Springer; (1984).
7. Berntson GG, Cacioppo JT. Integrative Physiology. In: Berntson G, Cacioppo JT, Tassinary LG, editors. *Handbook of psychophysiology, 3 ed.* Cambridge: Cambridge University Press; (2007). p. 433–52.
8. Gerber M, Pühse U. Review article: Do exercise and fitness protect against stress-induced health complaints? A review of the literature. *Scand J Public Health* (2009) 37(8):801–19. doi: 10.1177/1403494809350522
9. Pruessner JC, Ali N. *Neuroendocrine mechanisms of stress regulation in humans. Neuroendocrinology of Stress*. Chichester, UK: John Wiley & Sons, Ltd (2015) p. 121–42.
10. Fredrikson M, Matthews K. Cardiovascular responses to behvioral stress and hypertension: A meta-analytic review. *Ann Behav Med* (1990) 12:30–9. doi: 10.1207/s15324796abm1201_3
11. Sothmann MS. The cross-stressor adaptation hypothesis and exercise training. In: Acevedo EO, Ekkekakis P, editors. *Psychobiology of physical activity*. Champaign: Human Kinetics; (2006). p. 149–60.
12. Mücke M, Ludyga S, Colledge F, Gerber M. Influence of regular physical activity and fitness on stress reactivity as measured with the Trier social stress test protocol: A systematic review. *Sports Med* (2018) 48(11):2607–22. doi: 10.1007/s40279-018-0979-0
13. Klaperski S. Exercise, stress and health: The stress-buffering effect of exercise. In: Fuchs R, Gerber M, editors. *Handbuch Stressregulation und Sport*. Berlin, Heidelberg: Springer; (2018). p. 227–49.
14. Crews DJ, Landers DM. A meta-analytic review of aerobic fitness and reactivity to psychosocial stressors. *Med Sci sports Exercise* (1987) 19(5 Suppl):S114–20. doi: 10.1249/00005768-198710001-00004
15. Forcier K, Stroud LR, Papandonatos GD, Hitsman B, Reiches M, Krishnamoorthy J, et al. Links between physical fitness and cardiovascular reactivity and recovery to psychological stressors: A meta-analysis. *Health Psychol* (2006) 25(6):723–39. doi: 10.1037/0278-6133.25.6.723
16. Jackson EM, Dishman RK. Cardiorespiratory fitness and laboratory stress: A meta-regression analysis. *Psychophysiology.* (2006) 43(1):57–72. doi: 10.1111/j.1469-8986.2006.00373.x
17. Ferguson B. *ACSM"s guidelines for exercise testing and prescription. 9th Ed.* Vol. 58. Philadelphia, PA: The Journal of the Canadian Chiropractic Association (2014) p. 328–.
18. Dickerson SS, Kemeny ME. Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *psychol Bull* (2004) 130(3):355–91. doi: 10.1037/0033-2909.130.3.355
19. Gerber M. Sportliche Aktivität und Stressreaktivität: Ein Review. *Deutsche Z für Sportmedizin* (2008) 59(H. 7/8):168–74.
20. Zanstra YJ, Johnston DW. Cardiovascular reactivity in real life settings: measurement, mechanisms and meaning. *Biol Psychol* (2011) 86(2):98–105. doi: 10.1016/j.biopsycho.2010.05.002
21. Lucini D, Norbiato G, Clerici M, Pagani M. Hemodynamic and autonomic adjustments to real life stress conditions in humans. *Hypertension (Dallas Tex : 1979)* (2002) 39(1):184–8. doi: 10.1161/hy0102.100784
22. Siegrist J. Adverse health effects of high effort - low reward conditions at work. *J Occup Psychol* (1996) 1:27–43. doi: 10.1037/1076-8998.1.1.27
23. Karasek R. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Admin Sci Q* (1979) 24(2):285. doi: 10.2307/2392498
24. Kivimäki M, Virtanen M, Elovainio M, Kouvonen A, Vaananen A, Vahtera J. Work stress in the etiology of coronary heart disease–a meta-analysis. *Scand J Work Environ Health* (2006) 32(6):431–42. doi: 10.5271/sjweh.1049
25. Verkuil B, Brosschot JF, Tollenaar MS, Lane RD, Thayer JF. Prolonged non-metabolic heart rate variability reduction as a physiological marker of psychological stress in daily life. *Ann Behav Med* (2016) 50(5):704–14. doi: 10.1007/s12160-016-9795-7
26. Shaffer F, Ginsberg JP. An overview of heart rate variability metrics and norms. *Front Public Health* (2017) 5:258–. doi: 10.3389/fpubh.2017.00258
27. Järvelin-Pasanen S, Sinikallio S, Tarvainen MP. Heart rate variability and occupational stress-systematic review. *Ind Health* (2018) 56(6):500–11. doi: 10.2486/indhealth.2017-0190
28. von Haaren B, Ottenbacher J, Muenz J, Neumann R, Boes K, Ebner-Priemer U. Does a 20-week aerobic exercise training programme increase our capabilities to buffer real-life stressors? A randomized, controlled trial using ambulatory assessment. *Eur J Appl Physiol* (2016) 116(2):383–94. doi: 10.1007/s00421-015-3284-8
29. Riese H, Van Doornen LJ, Houtman IL, De Geus EJ. Job strain in relation to ambulatory blood pressure, heart rate, and heart rate variability among female nurses. *Scand J Work Environ Health* (2004) 30(6):477–85. doi: 10.5271/sjweh.837
30. Hynynen E, Konttinen N, Kinnunen U, Kyrolainen H, Rusko H. The incidence of stress symptoms and heart rate variability during sleep and orthostatic test. *Eur J Appl Physiol* (2011) 111(5):733–41. doi: 10.1007/s00421-010-1698-x
31. Lindholm H, Sinisalo J, Ahlberg J, Hirvonen A, Hublin C, Partinen M, et al. Attenuation of vagal recovery during sleep and reduction of cortisol/melatonin ratio in late afternoon associate with prolonged daytime sleepiness among media workers with irregular shift work. *Am J Ind Med* (2012) 55(7):643–9. doi: 10.1002/ajim.22042
32. Vrijkotte TG, van Doornen LJ, de Geus EJ. Effects of work stress on ambulatory blood pressure, heart rate, and heart rate variability. *Hypertension (Dallas Tex : 1979).* (2000) 35(4):880–6. doi: 10.1161/01.HYP.35.4.880
33. Hillebrand S, Gast KB, de Mutsert R, Swenne CA, Jukema JW, Middeldorp S, et al. Heart rate variability and first cardiovascular event in populations without known cardiovascular disease: Meta-analysis and dose-response meta-regression. *Europace : Eur Pacing Arrhythmias Cardiac Electrophysiol : J Working Groups Cardiac Pacing Arrhythmias Cardiac Cell Electrophysiol Eur Soc Cardiol* (2013) 15(5):742–9. doi: 10.1093/europace/eus341
34. La Rovere MT, Bigger JTJr., Marcus FI, Mortara A, Schwartz PJ. Baroreflex sensitivity and heart-rate variability in prediction of total cardiac mortality after myocardial infarction. ATRAMI (Autonomic Tone and Reflexes After Myocardial Infarction) Investigators. *Lancet (London England).* (1998) 351 (9101):478–84. doi: 10.1016/S0140-6736(97)11144-8
35. Tonello L, Rodrigues F, Souza J, Campbell C, Leicht A, Boullosa D. The role of physical activity and heart rate variability for the control of work related stress. *Front Physiol* (2014) 5(67):1–6. doi: 10.3389/fphys.2014.00067
36. Lischetzke T. Daily diary methodology. In: Michalos AC, editor. *Encyclopedia of quality of life and well-being research*. Dordrecht: Springer Netherlands; (2014). p. 1413–9.
37. Miller SM. Predictability and human stress: Toward a clarification of evidence and theory. In: Berkowitz L, editor. *Advances in Experimental Social Psychology*, New York: Academic Press. vol. 14 (1981). p. 203–56.
38. Dunton GF, Whalen CK, Jamner LD, Floro JN. Mapping the social and physical contexts of physical activity across adolescence using ecological momentary assessment. *Ann Behav Med* (2007) 34(2):144–53. doi: 10.1007/BF02872669
39. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annu Rev Clin Psychol* (2008) 4:1–32. doi: 10.1146/annurev.clinpsy.3.022806.091415
40. Kasten N, Fuchs R. Methodische Aspekte der Stressforschung. In: Fuchs R, Gerber M, editors. *Handbuch Stressregulation und Sport*. Berlin, Heidelberg: Springer; (2018). p. 1–30.
41. Pieper S, Brosschot JF, van der Leeden R, Thayer JF. Cardiac effects of momentary assessed worry episodes and stressful events. *Psychosom Med* (2007) 69(9):901–9. doi: 10.1097/PSY.0b013e31815a9230
42. Uusitalo A, Mets T, Martinmaki K, Mauno S, Kinnunen U, Rusko H. Heart rate variability related to effort at work. *Appl Ergon* (2011) 42(6):830–8. doi: 10.1016/j.apergo.2011.01.005

43. Thomas S, Reading J, Shephard RJ. Revision of the Physical Activity Readiness Questionnaire (PAR-Q). *Can J Sport Sci = J Can Des Sci du Sport* (1992) 17 (4):338–45.
44. Nordgren B, Fridén C, Jansson E, Österlund T, Grooten WJ, Opava CH, et al. Criterion validation of two submaximal aerobic fitness tests, the self-monitoring Fox-walk test and the Åstrand cycle test in people with rheumatoid arthritis. *BMC Musculoskel Disord* (2014) 15:305. doi: 10.1186/1471-2474-15-305
45. Åstrand P-O, Rodahl K. *Textbook of work physiology: Physiological bases of exercise*. Champaign: Human Kinetics; (2003) p. 1–92.
46. Foss MLK SJ. *Fox"s physiological basis for exercise and sport. 6th Edition*. Boston: McGraw-Hill; (1998).
47. Borg G. *Borg"s perceived exertion and pain scales*. Champaign, IL, US: Human Kinetics; (1998) p. viii, 104–viii.
48. Karasek R, Baker D, Marxer F, Ahlbom A, Theorell T. Job decision latitude, job demands, and cardiovascular disease: a prospective study of Swedish men. *Am J Public Health* (1981) 71(7):694–705. doi: 10.2105/AJPH.71.7.694
49. Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. *J Occup Health Psychol* (1998) 3(4):322–55. doi: 10.1037/1076-8998.3.4.322
50. Van der Doef M, Maes S. The the job demand-control (-support) model and psychological well-being: A review of 20 years of empirical research. *Work Stress* (1999) 13(2):87–114. doi: 10.1080/026783799296084
51. Krohne H, Egloff B, Kohlmann C-W, Tausch A. Untersuchungen mit einer deutschen Version der "Positive and Negative Affect Schedule" (PANAS). *Diagnostica*. (1996) 42:139–56. doi: 10.1037/t49650-000
52. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol* (1988) 54(6):1063. doi: 10.1037/0022-3514.54.6.1063
53. Elo A-L, Leppänen A, Jahkola A. Validity of a single-item measure of stress symptoms. *Scand J Work Environ Health* (2004) 29:444–51. doi: 10.5271/sjweh.752
54. Härtel S, Gnam J-P, Löffler S, Bös K. Estimation of energy expenditure using accelerometers and activity-based energy models—validation of a new device. *Eur Rev Aging Phys Act* (2011) 8(2):109–14. doi: 10.1007/s11556-010-0074-5
55. Gharbi A, Hey S, Jatoba L, Grossmann U, Ottenbacher J, Kuncoro C, et al. (2008). “System for Body and Mind Monitoring in coaching process,” in *ISSS-MDBS 2008 - 5th International Summer School and Symposium on Medical Devices and Biosensors*, Hong Kong, China, 1- 3 June 2008. 89–91.
56. Barouni A, Ottenbacher J, Schneider J, Feige B, Riemann D, Herlan A, et al. Ambulatory sleep scoring using accelerometers-distinguishing between nonwear and sleep/wake states. *PeerJ* (2020) 8:e8284–e. doi: 10.7717/peerj.8284
57. Tarvainen MP, Lipponen J, Niskanen J-P-, Perttu OR. Kubios HRV: User's Guide (Nr. ver. 3.3)2019 18.10.2019.
58. Malik M. Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. *Circulation* (1996) 93:1043–65. doi: 10.1161/01.CIR.93.5.1043
59. West SG, Finch JF, Curran PJ. Structural equation models with nonnormal variables: Problems and remedies. In: Hoyle RH, editor. *Structural equation modeling Concepts, issues, and applications*. Thousand Oakes: Sage; (1995). p. 56–75.
60. Nezlek JB. *Multilevel modeling for social and personality psychology*. Thousand Oaks, CA: Sage Publications Ltd; (2011).
61. Lüdtke O, Trautwein U, Kunter M, Baumert J. Analyse von Lernumwelten. Ansätze zur Bestimmung der Reliabilität und Übereinstimmung von Schülerwahrnehmungen. *Z für pädagogische Psychol* (2006) 20:85–96. doi: 10.1024/1010-0652.20.12.85
62. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* (2016) 15(2):155–63. doi: 10.1016/j.jcm.2016.02.012
63. Hox JJ. *Multilevel analysis: Techniques and applications. 2nd ed.* New York, NY, US: Routledge/Taylor & Francis Group; (2010) p. x, 382–x.
64. Moons WG, Eisenberger NI, Taylor SE. Anger and fear responses to stress have different biological profiles. *Brain Behav Immun* (2010) 24(2):215–9. doi: 10.1016/j.bbi.2009.08.009
65. Williams R. Anger as a basic emotion and its role in personality building and pathological growth: The neuroscientific, developmental and clinical perspectives. *Front Psychol* (2017) 8:1950–. doi: 10.3389/fpsyg.2017.01950
66. Starbuck J. Attribution Theory. In: Hopkins B, editor. *Restorative theory in practice: Insights into what works and why*. London and Philadelphia: Jessica Kingsley Publishers; (2016). p. 46–62.
67. Smith C, Haynes K, Lazarus R, Pope L. In search of the "hot" cognitions: Attributions, appraisals, and their relation to emotion. *J Pers Soc Psychol* (1993) 65:916–29. doi: 10.1037/0022-3514.65.5.916
68. Wagner M. Fear and anger in Great Britain: Blame assignment and emotional reactions to the financial crisis. *Pol Behav* (2014) 36(3):683–703. doi: 10.1007/s11109-013-9241-5
69. Wu Y, Gu R, Yang Q, Luo Y-J. How do amusement, anger and fear influence heart rate and reart rate variability? *Front Neurosci* (2019) 13(1131):1–6. doi: 10.3389/fnins.2019.01131
70. Levenson RW. Autonomic nervous system differences among emotions. *psychol Sci* (1992) 3(1):23–7. doi: 10.1111/j.1467-9280.1992.tb00251.x
71. Kreibig SD. Autonomic nervous system activity in emotion: A review. *Biol Psychol* (2010) 84(3):394–421. doi: 10.1016/j.biopsycho.2010.03.010
72. Jarczok MN, Jarczok M, Mauss D, Koenig J, Li J, Herr RM, et al. Autonomic nervous system activity and workplace stressors–a systematic review. *Neurosci Biobehav Rev* (2013) 37(8):1810–23. doi: 10.1016/j.neubiorev.2013.07.004
73. Kamarck TW, Muldoon MF, Shiffman S, Sutton-Tyrrell K, Gwaltney C, Janicki DL. Experiences of demand and control in daily life as correlates of subclinical carotid atherosclerosis in a healthy older sample. *Health Psychol* (2004) 23(1):24–32. doi: 10.1037/0278-6133.23.1.24
74. Clays E, De Bacquer D, Crasset V, Kittel F, de Smet P, Kornitzer M, et al. The perception of work stressors is related to reduced parasympathetic activity. *Int Arch Occup Environ Health* (2011) 84(2):185–91. doi: 10.1007/s00420-010-0537-z
75. Loerbroks A, Schilling O, Haxsen V, Jarczok MN, Thayer JF, Fischer JE. The fruits of ones labor: Effort-reward imbalance but not job strain is related to heart rate variability across the day in 35-44-year-old workers. *J Psychosom Res* (2010) 69(2):151–9. doi: 10.1016/j.jpsychores.2010.03.004
76. Borchini R, Bertu L, Ferrario MM, Veronesi G, Bonzini M, Dorso M, et al. Prolonged job strain reduces time-domain heart rate variability on both working and resting days among cardiovascular-susceptible nurses. *Int J Occup Med Environ Health* (2015) 28(1):42–51. doi: 10.2478/s13382-014-0289-1
77. Strahler J, Doerr JM, Ditzen B, Linnemann A, Skoluda N, Nater UM. Physical activity buffers fatigue only under low chronic stress. *Stress (Amsterdam Netherlands).* (2016) 19(5):535–41. doi: 10.1080/10253890.2016.1192121
78. Singh JP, Larson MG, Tsuji H, Evans JC, O'Donnell CJ, Levy D. Reduced heart rate variability and new-onset hypertension: insights into pathogenesis of hypertension: the Framingham Heart Study. *Hypertension (Dallas Tex : 1979).* (1998) 32(2):293–7. doi: 10.1161/01.HYP.32.2.293
79. Kahnemann DR J. Living, and thinking about it: Two perspectives on life. In: F.A. Huppert NB, Keverne B, editors. *The science of well-beeing*. Oxford (2005).
80. Kuppens P, Oravecz Z, Tuerlinckx F. Feelings change: Accounting for individual differences in the temporal dynamics of affect. *J Pers Soc Psychol* (2010) 99(6):1042–60. doi: 10.1037/a0020962
81. Smyth JM, Sliwinski MJ, Zawadzki MJ, Scott SB, Conroy DE, Lanza ST, et al. Everyday stress response targets in the science of behavior change. *Behav Res Ther* (2018) 101:20–9. doi: 10.1016/j.brat.2017.09.009
82. Waters J, Ussery W. Police stress: History, contributing factors, symptoms, and interventions. *Pol: Int J Pol Strat Manag* (2007) 30:169–88. doi: 10.1108/13639510710753199
83. Aaron J. Stress and coping in police officers. *Pol Q* (2000) 3:438–50. doi: 10.1177/109861110000300405
84. Collins PA, Gibbs A. Stress in police officers: A study of the origins, prevalence and severity of stress-related symptoms within a county police force. *Occup Med* (2003) 53:256–64. doi: 10.1093/occmed/kqg061
85. McCraty R, Atkinson M. Resilience training program reduces physiological and psychological stress in police officers. *Global Adv Health Med* (2012) 1 (5):44–66. doi: 10.7453/gahmj.2012.1.5.013

86. Goessl VC, Curtiss JE, Hofmann SG. The effect of heart rate variability biofeedback training on stress and anxiety: A meta-analysis. *psychol Med* (2017) 47(15):2578–86. doi: 10.1017/S0033291717001003

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 31 July 2020
doi: 10.3389/fpsyt.2020.00740

Identifying Individuals at High Risk for Permanent Disability From Depression and Anxiety

*Eva Behrens-Wittenberg and Felix Wedegaertner**

Department of Psychiatry, Social Psychiatry and Psychotherapy, Hannover Medical School, Hannover, Germany

Mental illnesses, among which depression and anxiety are most common, are the leading cause for permanent disability. It is of interest to know what case characteristics determine if a person returns to the work force in spite of mental illness to tailor specific interventions. So far, there has been little research into this field. In the present study a sample of 202 workers who had permanent disability due to depression/anxiety were followed-up on. 22% started some kind of work during follow-up in a period of 30 to 75 months. Logistic regression analyses showed that quick progression into disability, short period of disability, younger age, adequacy of income replacement through insurance benefits and no previous disability predicted return to work. These findings also allow to identify individuals at high risk for progression into permanent disability that can benefit from supporting interventions.

Keywords: absenteeism, disability, depression, anxiety, mental health, return to work

OPEN ACCESS

Edited by:
Undine E. Lang,
University Psychiatric Clinic Basel, Switzerland

Reviewed by:
Michael Deuschle,
University of Heidelberg, Germany
Steffi Riedel-Heller,
University Hospital Leipzig, Germany

***Correspondence:**
Felix Wedegaertner
wedegaertner.felix@mh-hannover.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *17 December 2019*
Accepted: *14 July 2020*
Published: *31 July 2020*

Citation:
Behrens-Wittenberg E and Wedegaertner F (2020) Identifying Individuals at High Risk for Permanent Disability From Depression and Anxiety. Front. Psychiatry 11:740. doi: 10.3389/fpsyt.2020.00740

INTRODUCTION

With 17% mental health issues, primarily depression and anxiety, have a high prevalence within the working population (1). They are associated with long sick leave periods (2). Affective disorders are the most common (1).

One of the major consequences of mental disorders is the loss of one's ability to work and hence the loss of the various positive aspects associated with work (3). Work can have a therapeutic effect without actually being therapy. As sense of accomplishment and effectiveness at work rise, feelings of overwhelming exhaustion and cynicism, which are typical aspects of depression, decline (4). Good work mobilizes, provides a daily routine and has a stabilizing effect (5). In contrast, work that is experienced as straining and psychologically demanding while at the same time as uncontrollable and lacking social support is predictive for depression (6–8). The experiences an individual makes are highly dependent on biological disposition and psychological constitution, which determine individual coping strategies (9). Work also provides financial security, which protects against social decline (10). It enables participation in society and provides a sense of purpose and identity (11). Accordingly, people with mental issues who are not in the workforce lack a major aspect of recovery, namely "good" work. Even those employees with mental issues that cannot show their full potential benefit from working or returning to work rather than not doing so (12–14). Not surprisingly, the association between unemployment and its negative health consequences has been confirmed by numerous studies (15).

It is in the general interest to prevent long-term sick leave from work or retirement as this causes costs for everyone (16, 17). This is even more important for mental disorders as their occurrence earlier in the life-span increases the associated costs (18). Programs that promote reactivation are well investigated and mainly include therapeutic interventions focused on work-related strategies (11, 19–21). The evidence for subject-related variables, however, is heterogeneous (2). It is assumed that younger age and higher premorbid income are beneficial (22). Eventual permanent disability is more likely if 42 or more sick days are accumulated (23). There seems to be no evidence for an effect of occupational status and educational level on reactivation (22). Findings concerning socioeconomic status and reactivation are inconsistent (24).

Still some individuals affected by mental disorder return to work quickly despite of great adversity whereas others retire permanently. A systematic analysis of why these people reactivate has not been made to date. This is most likely due to a very limited sample of those who un-retire (25). The reactivation rate from statutory occupational disability pensioning has been estimated at less than 6% (26).

The present study identifies factors that influence permanence of occupational disability for the first time. The individual characteristics of those who returned to work and those who do not are reported.

METHOD

Design

The prospective cohort study was done with data from a German insurance company. Sample size was determined by power analysis for an effect size of 1.3 at $\beta = 0.800$ and $\alpha = 0.050$. Data was sampled in spring 2018. Included were cases that held a private occupational disability insurance and had occupational disability due to an affective (ICD-10: F3, 73%) or neurotic disorder (ICD-10: F4, 27%). Exclusion criteria were comorbid substance use disorders (ICD-10: F1) and/or schizophrenic disorders (ICD-10: F2). The morbidity was extracted from the subjects' files which included medical reports, self-disclosures, written correspondence and insurance documents. Cases were sampled from May 2018 backwards by date at application for disability benefits until the required sample size was slightly overreached as determined by power analysis ($N = 206$). From these 4 were excluded because of missing or implausible data. The flow chart (**Figure 1**) illustrates the sampling procedure.

Variables

The following variables were examined.

Disability at the time of data collection versus return to work.

Sick days: days from start of absenteeism from work until either the date of reactivation or end of observation period.

Income replacement rate: the proportion of insurance benefits to premorbid net income.

Age at onset of disability: age at recognition of disablement was determined from medical statements from the files.

The insurance value is the discounted sum of future pension payments. It was obtained from the insurance documents.

Socioeconomic status (SES): SES was determined with the International Socio-Economic Index of occupational status [ISEI-08, (27)]. The ISEI-08 scale ranges from 13 = *worker in agriculture and animal husbandry* to 78 = *doctor, university professor*. 7 cases were excluded from the analysis due to missing values.

Sick days until disability were calculated from start of mental illness until recognition of disablement. This date was naturally *before* the day of application for benefits.

If a period of previous disablement was present could be determined from the records.

Residency was obtained through the zip codes of the postal address. We differentiated between the states of the former East and West Germany. Post codes with first digits 39, 1-19, 98 and 99 were classified as the former, the remaining codes as the latter.

Unterminated employment was obtained from the records. Subjects had to report when applying for disability benefits if their place of work was still available to them.

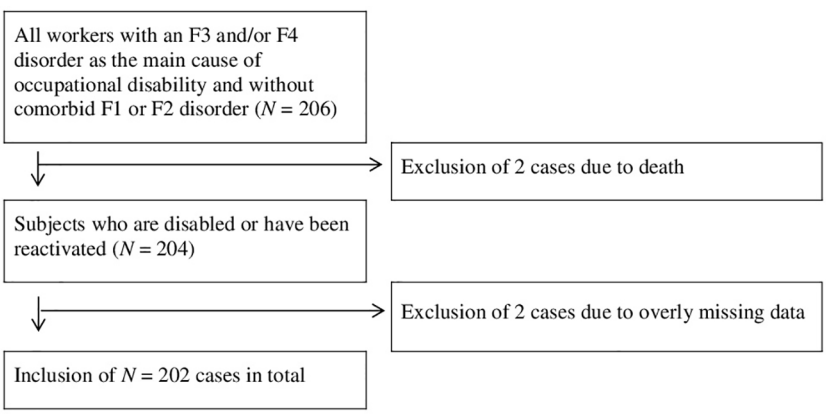

FIGURE 1 | Sampling strategy.

The information on the main diagnosis for occupational disability was extracted from the subjects' medical reports.

Statistical Analyses

Statistical advisory and verification of statistical procedures were conducted by the Institute for Biometrics of the Hannover Medical School. Data was analyzed using SPSS® 25 (IBM Corporation, Armonk NY, USA) for Windows®. Single missing values were assumed to be missing at random.

The sample was split by disability (yes/no) at the time of data acquisition. Examined variables were split at the median if the values were interval scaled to obtain binary variables for logistic regression analyses. Variables with p-values ≤ 0.200 were included into multivariate logistic regression modeling as recommended by Hosmer, Lemeshow und Sturdivant (28). The least significant variables were eliminated using stepwise backward selection. Only statistically significant design variables with $p \leq 0.050$ were added to the final multivariable binary logistic regression model.

Ethics Committee Approval

The study was approved by the Ethics Committee of the Hannover Medical School (approval number: 3679-2017).

RESULTS

Sample Characteristics

51% of the subjects were female. Age ranged from 24 to 61 years with a mean age of 43 years (*SD* = 8). 60% had completed 10 years of schooling while 31% had 12 or more years of schooling (9% indicated to have other schooling). 80% had some form of additional vocational training. All but two subjects were German citizens (99%). Subjects were located representatively in East (23%) and West (77%) Germany (29).

73% of the sample was disabled predominantly due to an affective disorder (F3) while the rest had other disorders of the neurotic spectrum. At the time of data acquisition 77% of subjects were still disabled, 22% un-retired during the period of observation. The mean period of disability was *M* = 1.393 days (*SD* = 530, *Med* = 1501) or 46 months. This means that each subject had received around 4 years of disability benefits by the end of observation. On average, 1.575 days (*SD* = 1.709, *Med* = 974 days), or 52 months, passed between onset of psychiatric problems and recognition of disability. Subjects' average and median age at the time of disablement was 39 years (*SD* = 8, *Min* = 18, *Max* = 56). In total, 41 subjects (20%) had one or more previous periods of surmounted disability. Subjects' average SES was 46 ISEI-08 status points (*SD* = 13). The sample was split at the median SES (*Med* = 45) into two groups with *low* and *high* SES. Premorbid net income was 35.861 Euro/a (*SD* = 20.712). The average insurance value was 135.815 Euro (*SD* = 84.754). The median income replacement rate was 31%, i.e., half of the subjects received only 11.117 Euro of insurance benefits or less. At the time of data collection 54% of the subjects indicated that their old job was still available. See **Table 1** for the descriptive statistics.

TABLE 1 | Descriptive statistics.

	Mean	*SD*	*Min*	*Max*
Age (years)	43	8	24	61
Sick days	1.393	530	59	2.125
Sick days until disability	1.575	1.709	212	12.327
SES (SES status points)	46	13	19	70
Premorbid net income (Euro)	35.861	20.712	5.056	119.647
Insurance value (Euro)	135.815	84.754	13.694	379.995
Income replacement rate (%)	31	21	6	130
Gender (% female)	51			
Education (%)				
10 years	60			
12+ years	31			
Other	9			
Vocational training (% yes)	80			
Citizenship (% German)	99			
Residency (% West Germany)	77			
Reason of disablement (% F3)	73			
Disability status (% return to work)	22			
Previous disablement (% yes)	20			
Unterminated employment (% yes)	54			

SD, standard deviation; SES, Socioeconomic status; F3 affective disorder.

Logistic Regression

The results of the univariate logistic regression analysis are shown in **Table 2**. 8 of 12 variables had an isolated significant effect on disability with $p \leq 0.200$: Duration of disability, income replacement rate, sick days until disability, age at onset of disability, insurance value, previous occupational disability, place of residence, and unterminated employment.

Multivariate logistic regression analysis revealed the final prognostic model for continuous disability. 4 variables were included in the final model as listed in **Table 3**. Shorter period of disability, faster progression into disability, young age and no preceding disability were all independent factors that promoted

TABLE 2 | Results of univariate logistic regression analysis.

Univariate logistic regression analysis: Influence of subject characteristics on disability (working vs. disabled)

	p-value	*OR*	*95% CI*
Dichotomous variables			
Less than 1.501 sick days during current period of disability (yes)	0.000*	15.625	5.348–45.455
Income replacement rate greater than 25% (yes)	0.062*	1.926	0.968–3.831
Less than 974 sick days from onset until disability (yes)	0.000*	4.926	2.208–10.989
Age at onset of disability younger than 38 years (yes)	0.035*	2.132	1.054–4.310
Insurance value greater than 147.428 Euro (yes)	0.018*	2.254	1.151–4.417
Socioeconomic status ISEI-08 > 45 (yes)	0.666	1.158	0.596–2.248
Preceding period of occupational disability (no)	0.090*	2.381	0.874–6.494
Residence in East Germany (yes)	0.161*	1.697	0.810–3.546
Unterminated employment (yes)	0.077*	1.882	0.933–3.796
Main diagnosis of occupational disability is affective disorder (yes)	0.452	1.353	0.615–2.976

*The dichotomous dependent variable is disability at the time of data collection. *Results with p ≤ 0.200 are significant. Abbreviations: OR, odds ratio; CI, confidence interval.*

TABLE 3 | Results of multivariate logistic regression analysis.

Multivariate logistic regression analysis: Influence of subject characteristics on disability (working vs. disabled)			
	p-value	***OR***	***95% CI***
Dichotomous Variables			
Less than 1.501 sick days during current period of disability (yes)	0.000	14.265	4.622–44.028
Less than 974 sick days from onset of illness until disability (yes)	0.000	5.200	2.087–12.955
Age at onset of disability younger than 38 years (yes)	0.020	2.856	1.182–6.897
Preceding period of occupational disability (no)	0.033	3.760	1.115–12.685

The dichotomous dependent variable is pension status at the time of data collection. Abbreviations: OR, odds ratio; CI, confidence interval.

rehabilitation from disability. Longer period of disability, slower progression into disability, older age and preceding disability worsened prognosis strongly. The model fit can be considered good (Nagelkerke's R^2 = 0.418; Hosmer-Lemeshow χ^2 (7) = 5.073, p = 0.651).

DISCUSSION

Although the most common mental illnesses of the affective and neurotic spectrum are treatable and many patients can enjoy full recovery some cases take long or chronify on a bad functional level. The present study provides an insight into the impact of individual aspects that promote or impede reactivation after disablement. The present study takes into account to what extent the previous place of work is still available after prolonged absence from work and insurance benefits that replace premorbid income. These are, of course, aspects of a society with strong employees' rights and social security. A study including these important factors of well-being has not been published, presumably because it is difficult to obtain this data.

Our results show that a fast progression from onset of illness to disablement as well as a short period of disability, a younger age and no preceding period of disability increase the chances of overcoming occupational disability and returning to the workforce. Interestingly, no effects were found for socioeconomic status, suggesting that the societal factors mentioned above may ameliorate the additive detrimental effects of low SES and illness on re-employment. Main cause of occupational disability (F3 and/or F4) had no statistically significant differentiating effect either, which is plausible because the prognosis of loss of function may be regarded as independent from diagnosis. Isolated effects with $p \leq 0.200$ were found for income replacement rate, insurance value, place of residence and for unterminated employment.

Some of these findings replicate results from literature and some are new.

It was surprising to find differentiating factors in these subjects, who were - on average - ill for more than three years. The finding that a relatively swift move from absence from work to disability enhances the likelihood of reactivation corresponds with notions about chronification of depression (3). It is not surprising to see that the likelihood to return to work decreases with length of disability. It has been shown that the risk of premature retirement highly increases if absence from work exceeds 42 days (23). We show that the risk increases even more with each passing day. Furthermore, the finding that a younger age increases the likelihood of reactivation was replicated (22). Those who were in their first period of disability had a higher chance to overcome it. This finding is in line with previous research (2) and general medical experience. Still, it was surprising to find such a strong effect size. All these results underscore the necessity for return to work interventions that occur: 1. early after onset of psychiatric problems, 2. are targeted especially at younger and middle-aged employees and 3. are sustainable to prevent repeated disablement.

Another finding that partly goes along with previous research concerns socioeconomic and monetary variables. In our sample socioeconomic status had no effect on reactivation. This means that reactivation seems to be no more likely for subjects with higher income than for those with lower income. Interestingly, higher insurance value was associated with better outcome and, to a lesser extent, income replacement rate. It is understandable that high insurance value is confounded by age because it is the product of the remaining contract term and annuity. However, the income replacement rate was surprisingly low. Half of the subjects only received monthly benefits around 250 Euro and those who received more seemed to fare better with regard to reactivation. At first, this seemed counterintuitive. One might think that the smaller the loss of income the smaller one's incentive to return to work in spite of illness. Instead, the higher reactivation rate of the well-insured suggests that not having to face the double jeopardy of mental illness and financial difficulties may have more capacity to focus on recovery.

These isolated effects merit further investigation. In the multivariate model a lower number of sick days, younger age and no preceding disability were found to be strong predictors for the reversibility of invalidity.

In the different systems of social security therapeutic interventions for those who have left the workforce because of health reasons are rare. There exist, of course, many interventions with the goal of return to work during the period of absenteeism from work (30, 31). However, these interventions target employees before occupational disability formally recognized. The present sample was already disabled and most likely took part in most of these interventions. For these people there simply exist no structured interventions. Probably, this group is generally assumed to have little chances of reactivation, not least because of reported low reactivation rates.

It is quite astonishing that, in the present sample of private occupational disability insurance clients, the reactivation rate was 22%. This is almost four times higher than what is expected in the public disability insurance. The most likely cause for this is that disability is not a permanent state in private occupational disability insurance. All rehabilitative interventions end in public disability insurance when premature retirement is reached. Subjects in private occupational disability generally stay in

contact with their insurer. In the public disability insurance the status of being disabled is typically not questioned once reached and clients get transferred into old-age pensioning later on. While retirees are reexamined in both systems at regular intervals one may assume that the rehabilitative impetus is smaller in the public insurance sector.

When interpreting the present findings, some considerations also have to be made with regard to data quality. It is worth mentioning that contracts in private occupational disability insurance may be terminated by settlement. These cases would have been lost to follow-up. In our sample we found no cases that ended in settlement simply because the insurance doesn't use this practice, which can be used to the disadvantage of the client.

Although the reactivation rate is already very high, it may still be underestimated. Clients are obligated to report, if they resume work, but may not always have done so. This would only become known when the insurer re-evaluates the cases which it does roughly every two years. Therefore, it is possible that the real number of reactivated subjects is higher than the one seen in the data.

Furthermore, the amount of sick days until disability might not depict the onset of mental illness correctly. Sick days were computed based on data obtained from claim forms and medical records. Although this is a relatively reliable source, the number of days under morbidity can safely be assumed to be higher than indicated. Absence from work typically occurs at latency after the onset of psychiatric problems. This makes early interventions seem even more important.

In 2017, 26% of the households in Germany had private occupational disability insurance (32). Although the results of this study strictly speaking only apply to those privately insured, it shows that interventions for people with occupational disability in general have great economic potential. Subjects with depression and/or anxiety retire early and lose many productive years. At the same time the situation of these people is different from those who suffer from the other major causes of disability: musculoskeletal disorders, cerebrovascular diseases and cancer. Their disability is not due to the physical loss of a functionally relevant part and should be reversible.

Therefore, it is of great interest not only for the individual but also for the general public to encourage and support people with mental illness even after retirement. This study did one of the first steps in this field of research. It examined workers who are or were on permanent occupational disability and tried to identify variables that facilitate or impede the return into the workforce. The findings should be used to develop interventions that target middle-aged or younger workers at the beginning of psychiatric impairment.

Future research should examine additional variables that might predict return to work. For example, monetary variables should be investigated even more. The precise interaction between monetary incentive and reactivation is still unclear. At least our results don't support the opinion that smaller disability pensions incentivize. Instead, financial security seems to be helpful during rehabilitation from psychiatric disablement.

The results should help to identify individuals at high risk for long-term chronification at low functional level at an early stage and tailor specific interventions. The authors currently test such an intervention with the goal of reactivation and placement into a problem-compatible value-generating new job. The intervention targets employees at the beginning of their absence from work. It focuses on the individual fit between personal resources, appropriate treatment and work-related factors with the goal of vocational reintegration and to ensure social participation as a major factor of recovery. If this is able to increase the ratio of those who stay in the work force remains to be seen. First results, though not yet statistically significant, are encouraging.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The study was approved by the Ethics Committee of the Hannover Medical School (approval 131 number: 3679-2017). Written informed consent was not required as per local legislation and national guidelines.

AUTHOR CONTRIBUTIONS

EB-W collected and analyzed the data and wrote the manuscript. FW designed the study, interpreted the data, and wrote the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

Data acquisition was funded and supported by Debeka Versicherungsverein a. G. The funder Debeka Versicherungsverein a. G. was not involved in the study design, collection, analysis, interpretation of data, the writing of this article or the decision to submit it for publication.

ACKNOWLEDGMENTS

The authors wish to thank Siegfried Geyer for fruitful discussions of methodology.

We thank Toralf Darr and Julia Lindner for cooperation in the design and application of the interventions mentioned at the end of this manuscript.

We also thank the Institute for Biometrics of the Hannover Medical School for their support during data analysis. This work would not have been possible without the support of Debeka Life

Insurance, namely Ullrich Gottwald, Frank Wiesen, Michael Specht, Heiko Krenzer, Stephanie Gilles and Astrid Joel, who have our deep gratitude. Special thanks go to Nicola A. Sittaro, our long-term spiritus rector.

EB: Special thanks go to my partner and parents, in particular, who dedicated their time to help me write this piece during my parental leave. Thank you, Lukas, for pushing me to my limits to be the most efficient me.

REFERENCES

1. DAK-Gesundheit. *Gesundheitsreport 2017. Analyse der Arbeitsunfähigkeitsdaten*. Hamburg: Beiträge zur Gesundheitsökonomie und Versorgungsforschung (2017).
2. Cornelius LR, van der Klink JJL, Groothoff JW, Brouwer S. Prognostic Factors of Long Term Disability Due to Mental Disorders: A Systematic Review. *J Occup Rehabil* (2011) 21(2):259–74. doi: 10.1007/s10926-010-9261-5
3. Gühne U, Riedel-Heller SG. *Die Arbeitssituation von Menschen mit schweren psychischen Erkrankungen in Deutschland*. Berlin: DGPPN–Deutsche Gesellschaft für Psychiatrie und Psychotherapie, Psychosomatik und Nervenheilkunde (2015).
4. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. *World Psychiatry* (2016) 15(2):103–11. doi: 10.1002/wps.20311
5. Lagerveld SE, Blonk RW, Brenninkmeijer V, Wijngaards-de Meij L, Schaufeli WB. Work-focused treatment of common mental disorders and return to work: A comparative outcome study. *J Occup Health Psychol* (2012) 17 (2):220–34. doi: 10.1037/a0027049
6. Stuke H, Bermpohl F. Welche Arbeitsbedingungen begünstigen die Entwicklung einer depressiven Störung? *Psychiatr Praxis* (2016) 43 (05):245–52. doi: 10.1055/s-0035-1552769
7. Ndjaboué R, Brisson C, Vézina M. Organisational justice and mental health: a systematic review of prospective studies. *Occup Environ Med* (2012) 69 (10):694–700. doi: 10.1136/oemed-2011-100595
8. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environment and stress-related disorders, a systematic review. *Occup Med* (2010) 60(4):277–86. doi: 10.1093/occmed/kqq081
9. Kilian R, Becker T. Die Prävention psychischer Erkrankungen und die Förderung psychischer Gesundheit. In: Kirch W, Badura B, editors. *Prävention*. Heidelberg: Springer, Berlin (2006).
10. Moore THM, Kapur N, Hawton K, Richards A, Metcalfe C, Gunnell D. Interventions to reduce the impact of unemployment and economic hardship on mental health in the general population: a systematic review. *Psychol Med* (2017) 47(6):1062–84. doi: 10.1017/S0033291716002944
11. Riedel-Heller SG, Stengler K, Seidler A. Psychische Gesundheit und Arbeit. *Psychiatr Praxis* (2012) 39:103–5. doi: 10.1055/s-0032-1304894
12. Kroll LE, Lampert T. Unemployment, Social Support and Health Problems: Results of the GEDA Study in Germany, 2009. *Deutsches Ärzteblatt Int* (2011) 108(4):47–52. doi: 10.3238/arztebl.2011.0047
13. Rueda S, Chambers L, Wilson M, Mustard C, Rourke SB, Bayoumi A, et al. Association of Returning to Work With Better Health in Working-Aged Adults: A Systematic Review. *Am J Public Health* (2012) 102(3):541–56. doi: 10.2105/AJPH.2011.300401
14. Milner A, Page A, LaMontagne AD. Long-term unemployment and suicide: a systematic review and meta-analysis. *PloS One* (2013) 8(1):e51333. doi: 10.1371/journal.pone.0051333
15. Paul KII, Moser K. Unemployment impairs mental health: Meta-analyses. *J Vocational Behav* (2009) 74(3):264–82. doi: 10.1016/j.jvb.2009.01.001
16. Seymour L, Grove B. Workplace interventions for people with common mental health problems: evidence review and recommendations. *Br Occup Health Res Foundation* (2005).
17. Zijlstra F, Houtman I, Wynne R, McAnaney D, Joensuu M. Integrated report of Stress Impact: On the impact of changing social structures on stress and quality of life, individual and social perspectives. In: *Work Package 8. Work and Social Psychology*. University of Surrey (2006).
18. Gum AM, King-Kallimanis B, Kohn R. Prevalence of mood, anxiety, and substance-abuse disorders for older Americans in the national comorbidity survey-replication. *Am J Geriatric Psychiatry* (2009) 17(9):769–81. doi: 10.1097/JGP.0b013e3181ad4f5a
19. Winter L, Kraft J, Boss K, Kahl KG. Ruckkehr ins Erwerbsleben: Ein Arbeitsplatz-bezogenes Modul zur Integration in die kognitiv-behaviorale Therapie bei psychischen Erkrankungen. *Psychother Psychosom Med Psychol* (2015) 65321-6(8):321–26. doi: 10.1055/s-0035-1545312
20. Siegrist J. Burn-out und Arbeitswelt. *Psychotherapeut* (2013) 58(2):110–6. doi: 10.1007/s00278-013-0963-y
21. Nieuwenhuijsen K, Faber B, Verbeek JH, Neumeyer-Gromen A, Hees HL, Verhoeven AC, et al. Interventions to improve return to work in depressed people. *Cochrane Database Syst Rev* (2014) 12. doi: 10.1002/14651858.CD006237.pub3
22. Streibelt M, Egner U. A systematic review of the predictors of return to work following vocational retraining. *Rehabilitation* (2013) 52:111–8. doi: 10.1055/s-0032-1323670
23. Behrens J, Dreyer-Tümmel A. Ermittlung von Indikatoren der Rehabilitationsbedürftigkeit aus Routinedaten der gesetzlichen Krankenversicherung (GKV-Daten). *Deutsche Rentenversicherung* (1995), 413–43.
24. Linder A, Gerdtham U-G, Trygg N, Fritzell S, Saha S. Inequalities in the economic consequences of depression and anxiety in Europe: a systematic scoping review. *Eur J Public Health* (2019) 0:1–11. doi: 10.1093/eurpub/ckz127
25. Deutscher Bundestag. *Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Markus Kurth, Corinna Rüffer, Beate Müller-Gemmeke, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN (Drucksache 19/924). BT-Drucks. 19/1208*. (2018). p. 11.
26. Kobelt A, Grosch E, Hesse B, Gebauer E, Gutenbrunner C. Wollen psychisch erkrankte Versicherte, die eine befristete Rente wegen voller Erwerbsminderung beziehen, wieder ins Erwerbsleben eingegliedert werden? *Psychother Psychosom Med Psychol* (2009) 59(7):273–80. doi: 10.1055/s-2008-1067457
27. Ganzeboom HBG. *A new International Socio-Economic Index (ISEI) of occupational status for the International Standard Classification of Occupation 2008 (ISCO-08) constructed with data from the ISSP 2002–2007*. Vol. 1. Lisbon: Annual Conference of International Social Survey Programme. (2010).
28. Hosmer DW Jr., Lemeshow S, Sturdivant RX. *Applied logistic regression* Vol. 398. Hoboken, NJ: John Wiley & Sons (2013). doi: 10.1002/9781118548387
29. Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder. *Bruttoinlandsprodukt, Bruttowertschöpfung in den Ländern der Bundesrepublik Deutschland 1991 bis 2017, Reihe 1, Länderergebnisse Band 1, Berechnungsstand August 2017 / Februar 2018*. Stuttgart (2018).
30. Hallwachs H. Potenziale Beruflicher Trainingszentren. *Die Rehabil* (2003) 42 (05):301–13. doi: 10.1055/s-2003-42855
31. Brieger P, Hoffmann H. Was bringt psychisch Kranke nachhaltig in Arbeit? *Der Nervenarzt* (2012) 83(7):840–6. doi: 10.1007/s00115-011-3470-9
32. Statistisches Bundesamt. *Wirtschaftsrechnungen*. (2018).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 08 September 2020
doi: 10.3389/fpsyt.2020.00867

Effectiveness of a Brief Psychotherapeutic Intervention for Employees With Psychosomatic and Psychosocial Complaints—Pilot Study of a Consultation Off the Workplace

Christine Allwang[1], Birgitt Marten-Mittag[1], Andreas Dinkel[1], Daniel Mauss[2] and Claas Lahmann[3]*

[1] Department of Psychosomatic Medicine and Psychotherapy, Klinikum rechts der Isar, School of Medicine, Technical University of Munich, Munich, Germany, [2] Medical Faculty Mannheim, Mannheim Institute of Public Health, Social and Preventive Medicine, Heidelberg University, Heidelberg, Germany, [3] Department of Psychosomatic Medicine and Psychotherapy, University Medical Center Freiburg, Freiburg, Germany

OPEN ACCESS

Edited by:
Cynthia H. Y. Fu, University of East London, United Kingdom

Reviewed by:
Eva Rothermund, Ulm University Medical Center, Germany
Florian Junne, Tübingen University Hospital, Germany

***Correspondence:**
Christine Allwang
c.allwang@tum.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *03 December 2019*
Accepted: *10 August 2020*
Published: *08 September 2020*

Citation:
Allwang C, Marten-Mittag B, Dinkel A, Mauss D and Lahmann C (2020) Effectiveness of a Brief Psychotherapeutic Intervention for Employees With Psychosomatic and Psychosocial Complaints—Pilot Study of a Consultation Off the Workplace. Front. Psychiatry 11:00867. doi: 10.3389/fpsyt.2020.00867

Employees' mental health impairments are a leading reason for sickness-leave and early retirement. This is why a large number of different intervention programmes have evolved in recent years with the aim of counteracting this development. Our study evaluates a short-term cognitive-behavioral psychotherapeutic intervention off the workplace. We investigated improvement of mental and physical health in psychologically strained employees of a white collar company. Depressive symptoms (PHQ-9), anxiety symptoms (GAD-7), somatic symptoms (PHQ-15), and perceived stress (PSQ-20) were assessed at the beginning and after the intervention. Patient satisfaction (recommendation - likeliness) was also measured after the intervention. In a second step, we have looked at potential determinants of therapy outcome. Changes in the symptom measures were assessed using t-tests, MANOVA, and Chi²-tests. Cohen's d was computed as effect size measure. One-hundred twenty-seven participants completed the assessment before, and 66 participants post intervention. Mean age of the participants was 44.6 (SD = 9.8) years, 54% were men. 89.7% of the patients attended one to five sessions. Depressive, anxiety, somatic symptoms, and perceived stress significantly declined from baseline to end of intervention. Effect sizes ranged from d = 0.49 (perceived stress) to d = 0.72 (depressive symptoms). Moreover, 93% of the patients stated that they were satisfied with the intervention and would recommend it to a friend. Previous uptake of psychiatric/psychotherapeutic treatment moderated the effect of the intervention on depressive symptoms, i.e., patients without previous experience showed a stronger reduction in symptoms of depression. The results tentatively suggest that the intervention is effective in reducing a broad range of psychological symptoms. Future research could investigate preferences and different outcomes of on-site and off-site work place interventions.

Keywords: work-stress, psychotherapeutic intervention, mental health, occupational health, patient satisfaction

INTRODUCTION

Mental health impairments are a relevant problem in an occupational health context and are one of the leading reasons for sickness-leave and early retirement in developed countries (1–5). In Germany, mental disorders accounted for 17% of sickness-leave days in 2014 (6), and 42% of early retirement is due to a mental health diagnosis (7).

The two most prevalent mental health diagnoses are depression and anxiety, followed by somatoform disorders (8–10). Somatoform disorders, not only predominantly pain but also other bodily symptoms, occur in the vast majority of the working population. Between 10 and 20% of employees reported to suffer from high levels of pain (11–13). These are major concern for all parties involved, as the chronic impairment at work does not only means a direct impact for the person affected but also implies a tremendous effect on the productivity of the companies, the compensation authorities, and the social welfare system (1, 5).

Although the prevalence of mental disorders is high, there is still an enormous and alarming discrepancy between demand and utilisation of mental health services (14). The consequent treatment gap is estimated between 10 and 50% (15, 16). Two prominent reasons for this are the fear of stigmatization (17) and the difficulty to access appropriate treatment options (18, 19). Fear of stigmatization withholds people to start seeing a psychotherapist at all or leads to a prolonged decision process to do so. This seems to be more prevalent in men than in women (20–22). Another reason is the difficulty and effort to access applicable therapies quickly due to long waiting periods. In Germany, the health care system covers outpatient and inpatient psychotherapy, which is provided by specialists in psychosomatic medicine, by specialists in psychiatry, or by clinical psychologists who qualify as licensed psychotherapist. Almost 100% of the German population is covered by a health insurance, which principally provides access to treatment (23). Thus, outpatient psychotherapeutic treatment should be easily available and accessible. Despite this, the average waiting time to start psychotherapy is 4.6 months, and the waiting time for a first consultation 1.9 months (19).

In light of the high prevalence of mental health problems and their impact on the affected persons and consequently on the companies, it seems to be a plausible step to address this problem in the workplace. The workplace has been identified as a suitable place to both identify mental impairments and also to initiate support at an early stage (24, 25). Therefore, some German companies started to implement a psychosomatic consultation opportunity for their employees with the idea to bypass long waiting times in the ambulatory system and to prevent long absence periods or early retirement (26).

The current common model is a so-called psychosomatic consultation in the workplace (PSIW), where employees see a specialist for mental disorders on the company grounds usually embedded in the occupational medicine clinic. Models of PSIW are already in use, scientifically evaluated, and show effective improvement of employee's clinical and functional status (26, 27). This established model has not only a number of advantages but also some disadvantages. On one hand, it enables participants to easily access the mental health specialist on site without significant loss of travel time, the closeness to the occupational health department may create a familiar feeling and makes the first step in reaching out for help more easy. However, on the other hand, the proximity to colleagues and supervisors could also mean a disadvantage with regard to stigmatization fear. Persons who consider seeking help might be afraid as regards anonymity and a potential discrimination that may arise (17).

Our program differs from the PSIW first and foremost in terms of location, as participants see the specialist away from their workplace. A second significant variation and advantage to the referral in regular outpatient mental health care is that participants receive an appointment within only 2 weeks after they have called the clinic. Thirdly, even if the program is financed by the employer, there is strict confidentiality and anonymity toward the employer. This means in particular that the employer will not be informed whether an employee has joined the program or not, and no findings or contents of sessions are exchanged.

This pilot study investigates the effectiveness of such a short-term psychotherapeutic intervention for strained employees off the company grounds. We expected that this intervention would improve depressive, anxiety, and somatic symptoms and the level of perceived stress. Furthermore, we tried to identify determinants that could potentially have an impact on therapy outcome.

METHODS

Design

Study participants were strained employees of an international company. Due to legal restrictions of the company involved, it was not possible to conduct a randomized controlled trial. Enrolment in the study took place consecutively between February 2014 and February 2017. The study was approved by the ethics committee of the Technical University of Munich. As this was a study within the clinical routine practice, there were no definite exclusion nor inclusion criteria. Every person referred by the company was seen and had at least one appointment with a mental health specialist. Outcome parameters, which were measures of psychological and bodily distress, were assessed immediately before the intervention (t1) and following the last intervention session (t2). In addition, patient satisfaction was measured post intervention.

Procedure

Participants in the intervention program were employees of an international company who attended either the company's occupational health physician or the social service department. Attendance to these services was initiated through the participants themselves or *via* the direct supervisor. Supervisors recommended a consultation with the social service department or company physician when an employee started to have noticeable problems at work, e.g., lower productivity, high error rate, or increasing number of sick-leave days.

With a referral letter of the social service department or the company's occupational health physician, participants scheduled an appointment with our outpatient clinic themselves. The first appointment generally took place within 2 weeks depending on availability of participant and therapist, and the following sessions were scheduled individually. Participants completed self-report questionnaires upon the first appointment (t1) and following the last intervention session (t2). The post intervention assessment was sent out *via* mail. If there was no reply to the questionnaires, a reminder call was made 2 weeks later. During the initial appointment, a clinical interview and a comprehensive problem analysis were conducted. Patients were informed that the intervention comprised one to five sessions and that it would be possible to extend the intervention to a sum of 10 sessions if both the patient and the clinician would decide that this would be useful.

Participants were informed that questionnaire data will only be analyzed anonymously on a group basis. In case participants did not want to fill in the questionnaires, it had no impact on the participation in the intervention program. Participants could withdraw consent at any time for analyzing their data without any effect on their treatment in the program.

The intervention was conducted by six experienced clinicians who had at least 5 years of clinical training. Clinicians were physicians with a special training in psychosomatic medicine and psychotherapy and by clinical psychologists. They all applied cognitive behavioural interventions. The therapy content was not limited to work related problems, but attending employees could address all kinds of problems they currently saw as relevant.

Measures

Psychological and somatic symptoms were assessed by self-report questionnaires, with modules of the patient health questionnaire (PHQ) (28) and a short version of the perceived stress questionnaire (PSQ-20).

The PHQ is widely used in different health care settings and is well-validated for clinical settings (29–31) and within the occupational field (32). Besides these questionnaires, we also assessed sociodemographic data including previous therapeutic experience, meaning previous psychosomatic or psychiatric therapeutic experience either outpatient or inpatient treatment (see **Table 1**).

Depressive symptoms were captured by the module PHQ-9. This measure comprises nine items for screening, diagnosing, monitoring, and measuring the severity of depressive symptoms during the previous 2 weeks. The questionnaire covers the frequency of the symptoms which is rated on a four-point scale from 0 (not at all) to 3 (nearly every day). The items are summed, and a score of 10 is regarded as cut-off for a clinically relevant level of depressive symptoms. Reliability in our sample was high with Cronbach's alpha = 0.83.

Anxiety symptoms were assessed with the generalized anxiety disorder questionnaire (GAD-7), also a module of the PHQ. This is a seven-item questionnaire designed to assess the severity of anxiety symptoms during the previous 2 weeks (33, 34). The items are rated on a four-point scale ranging from 0 (not at all) to 3 (nearly every day). A summary score of 10 represents a cut-off for clinical levels of anxiety. The scale showed high reliability in our sample (Cronbach's alpha = 0.87).

TABLE 1 | Sociodemographic and clinical characteristics of the study sample.

	Study group n = 127		Cases post intervention n = 66		Missing postintervention n = 61		p
	M	**SD**	**M**	**SD**	**M**	**SD**	
Age (years)	44.6	9.8	47.1	8.4	41.9	10.5	0.003
Range	18-65		18-65		20-62		
	N	%	n	%	n	%	
Gender							
Female	58	46	23	35	35	57	0.011
Male	69	54	43	65	26	43	
Current Relationship							
No	32	27	14	23	18	31	0.295
Yes	88	73	48	67	40	69	
Family status							
Single	49	40	19	29	30	51	0.059
Married	60	48	38	59	22	37	
Divorced	14	11	7	11	7	12	
Widowed	1	1	1	1	0	0	
Children							
Yes	61	50	34	53	27	46	0.415
Educational level							
Secondary school	17	13	8	12	9	15	0.915
Middle school	35	28	18	28	17	28	
Higher school certificate	22	18	12	18	10	17	
University degree	51	41	27	42	24	40	
Employment status							
Full time	94	76	51	80	43	73	0.687
Part time	24	20	10	16	14	24	
In training	2	2	1	2	1	2	
Miscellaneous	3	2	2	3	1	2	
Current sickness leave							
Yes	40	55	22	33	18	30	0.174
≤2 weeks	18	45	8	36	10	56	
>2 weeks	15	38	9	41	7	39	
No information on duration	7	18	5	23	1	6	
Previous therapeutic experience							
Yes	64	53	32	50	32	55	0.568
	M	SD	M	SD	M	SD	
Number of intervention sessions	2.9	2.3	3.7	2.7	2.1	1.4	<0.001
Anxiety	9.4	5.2	8.9	4.9	10.0	5.4	0.253
Depression	11.3	5.7	11.2	5.5	11.3	5.9	0.899
Somatic symptoms	10.4	6.08	10.9	6.5	9.9	5.6	0.393
Perceived stress	58.5	19.9	58.1	22.9	58.9	17.0	0.862

The module PHQ-15 assesses 15 common bodily symptoms. Participants were asked to rate their severity in the past 4 weeks on a three-point scale from 0 (not bothered at all) to 2 (bothered a lot). As with the other two PHQ modules, a summary score of 10 indicates clinical levels of impairment due to bodily symptoms. Again, internal consistency was high with Cronbach's alpha = 0.76.

Perceived stress was measured with the short version of the PSQ-20, an instrument to assess subjectively experienced stress independent of a specific and objective occasion (35). The items were rated on a four-point scale from 1 (almost never) to 4 (usually). Cronbach's alpha in our study population was 0.91.

We also surveyed patient satisfaction with the intervention program post intervention using a ten point scale of recommendation likeliness (0 = very unlikely to 10 = very likely).

Statistical Analysis

Data for sample characteristics are presented as absolute and relative frequencies or means and standard deviations. Mean differences were analyzed using t-tests, and proportions of categorical variables were compared using Chi^2-tests. Paired sample t-tests were used to investigate changes in depression, anxiety, somatic symptoms, and perceived stress from baseline to post treatment. Correlations of depression, anxiety, somatic symptoms, and perceived stress at baseline with number of treatment sessions were reported as Pearson's correlations coefficients r.

Repeated measures analyses of variance (MANOVA) were performed with time as the within-subject factor and one of the following categories as between-subjects factor: age (≤47 vs. >47 years), gender, number of sessions, and previous psychotherapeutic experience. Effect sizes (ESs) were computed for the pre to post changes of all outcome variables. ESs for time effects were reported by means of Cohen's d for all outcomes ($d \leq 0.2$ small effect; $d = 0.5$ medium effect; $d \geq 0.8$ large effect). Changes in prevalence rates between baseline and post intervention were analyzed by McNemar tests. All statistical tests were two tailed. Results of $p < 0.05$ were regarded as statistically significant. All analyses were conducted using SPSS 22.0.

RESULTS

An overall number of n = 133 participants was included in the intervention program. Due to non-completion of the assessment measures, n = 6 participants (5, no data at pre-intervention; 1, not fluent in German) had to be excluded from the analyses.

Thus, n = 127 participants completed the initial assessment, n = 61 (48.0%) participants missed to fill in the t2 assessment, so n = 66 participants (52.0%) could be included in the pre-post analysis. Due to a technical mishap, the PSQ data were only available for n = 78 participants at baseline.

The participants who failed to fill in the post-intervention assessment did not differ significantly from those who filled in the second assessment except for age, sex, and number of sessions attended (see **Table 1**).

Participants were between 18 and 65 years of age, average age was 44.6 years (SD = 9.8), 54% of participants were male. Any history of outpatient psychotherapy had 45 (35.4%) out of the 127 participants. Nineteen (15.0%) of the participants reported previous inpatient psychosomatic or psychiatric treatment. Nine participants (7.1%) were in current outpatient psychotherapy, and n = 4 (3.1%) participants were in outpatient psychiatric care at the time of intervention. In summary, n = 64 (50.4%) participants had any kind of psychotherapeutic/psychiatric experience.

Sixty-nine participants (54.8%) made use of only one to two intervention sessions, another 44 (34.9%) took three to five sessions, and n = 13 (10.3%) took 6–10 sessions. The mean number of sessions attended in our treatment program was 2.9 (SD = 2.3) (see **Table 1**). There was no significant correlation of the number of treatment sessions with somatic symptom burden ($r = 0.11$, $p = 0.246$), with depressive ($r = -0.01$, $p = 0.935$) and anxiety ($r = 0.04$, $p = 0.624$) symptoms and perceived stress ($r = 0.04$, $p = 0.710$). At baseline depression, anxiety, somatic symptoms, and perceived stress did not differ according to gender, age, relationship status, and previous therapeutic experience (**Table 2**).

We found a significant reduction in the level of depression, anxiety, somatic symptoms, and perceived stress from baseline to end of intervention (**Figure 1**). Depression dropped from M = 11.2 (SD = 5.6) to M = 7.2 (SD = 5.7); $p < 0.001$; ES = 0.72. Anxiety declined from M = 8.8 (SD = 4.9) to M = 5.6 (SD = 4.6); $p < 0.001$; ES = 0.68. Somatic symptoms decreased from M = 11.0 (SD = 6.5) to 7.7 (SD = 5.7); $p < 0.001$; ES = 0.54. Finally, perceived stress fell from M = 55.8 (SD = 22.9) at baseline to M = 44.1 (SD = 25.1) at end of intervention; $p < 0.001$; ES = 0.49.

In a second step, we investigated the change in prevalence rates for psychological and somatic symptoms. The prevalence at baseline ranged from 44.6% for anxiety to 54.8% for severe somatic symptoms. We found a significant decrease in prevalence rates from baseline to end of intervention in depression, anxiety and somatic symptoms (**Table 3**). Due to the lack of an agreed-upon cut-off score, this analysis was not performed on the PSQ.

For exploratory reasons, we investigated whether gender and previous experience with psychiatric/psychotherapeutic treatment exerted a moderating effect on the outcome variables. Due to the low number of available data, this analysis was not performed for perceived stress.

We found only one significant result. A significant interaction of time by previous therapy experience emerged for depressive symptoms ($p = 0.018$). Participants without previous therapeutic experience showed a stronger reduction of mean depression score at the end of the intervention [from M = 11.9 (SD = 5.7) to M = 6.0 (SD = 4.7)] than participants with previous use of therapies [from M = 10.9 (SD = 5.3) to M = 8.4 (SD = 6.3)] (**Figure 2**).

Regarding patient satisfaction the responses of n = 56 (84.8%) were available.

The results showed that 52 participants (92.9%) would recommend the program to a friend (recommendations score ≥ 8).

TABLE 2 | Means (M) and standard deviations (SDs) of depression (PHQ), anxiety (GAD), and somatic symptoms (PHQ) and perceived stress (PSQ) at baseline for the total sample and stratified by gender, age groups, relationship status, and previous therapeutic experience.

	Depression		Anxiety		Somatic symptoms		Perceived stress	
	n = 126		n = 126		n = 122		n = 78	
	M	SD	M	SD	M	SD	M	SD
Total sample	11.27	5.68	9.43	5.17	10.42	6.08	58.52	19.90
Gender								
Male	11.61	5.88	9.33	5.29	10.15	6.52	60.94	20.88
Female	10.85	5.46	9.55	5.06	10.77	5.51	55.26	18.67
Age								
≤ 47 years	11.84	5.65	10.17	5.50	11.06	6.46	61.41	16.09
≥ 48 years	10.47	5.68	8.41	4.53	9.54	5.44	54.38	24.04
Relationship status								
No partner	12.21	5.91	8.48	4.87	10.65	6.67	57.96	22.50
Partner	11.23	5.67	9.90	5.18	10.61	6.02	59.93	19.21
Previous therapeutic experience								
No	11.55	5.53	9.14	5.14	10.30	5.74	61.75	17.98
Yes	11.39	5.79	10.05	5.10	11.08	6.29	57.55	19.84

None of the scale means differs significantly between the groups.

DISCUSSION

Mental health problems in the occupational context are problematic not only for the affected employees but also for the companies being concerned with presenteeism, long times of sickness absence, and early retirement eventually. Therefore, it seems to be a plausible step for companies to prevent a lack of performance due to presenteeism or imminent absences and to create a professional setting for strained employees to address their problems with a specialist.

Our study examined a novel approach where employees got the opportunity to see a mental health specialist off site within a narrow time frame. The main finding of our study was a significant reduction of depressive, anxiety, and somatic symptoms and perceived stress from the beginning to the end

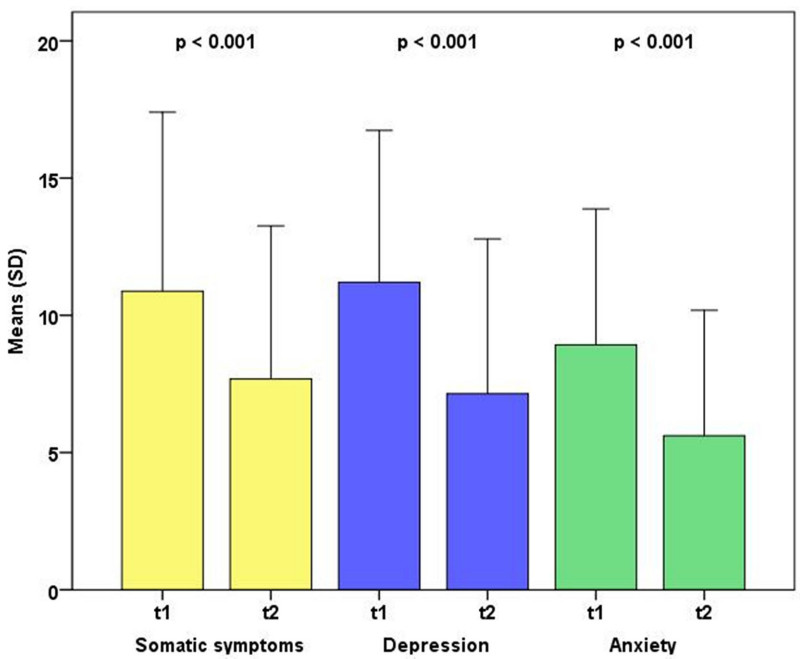

FIGURE 1 | Changes in somatic, depressive, and anxiety symptoms from baseline to follow-up (n = 62–65).

TABLE 3 | Prevalence rates (%) of clinical levels of somatic symptoms, depression (PHQ) and anxiety (GAD) at baseline and end of intervention.

	n	Baseline	End of intervention	p
Severe somatic symptoms	62	54.8	29.0	<0.001
Depression	64	54.7	28.1	0.001
Anxiety	65	44.6	20.0	<0.001

McNemar test; exact significance two-sided.

of the intervention sessions, with moderate to large effect sizes. Our results support findings seen in other studies showing that a short-term psychotherapeutic intervention can improve the wellbeing of employees and support their psychological health in a positive way (26, 27).

Rothermund et al. (26) showed also that the workplace is a well-suited place to identify persons at risk for developing mental health problems who require treatment and to introduce them quickly to professional mental health services (26). This is highly important as even mild depressive symptoms result in reduced work productivity (36); on top of that, it is well known that mental health disorders are best treated in their early stages to prevent chronification that implies the risk of long-term absence from work or even early retirement (37–39).

We obtained one interaction effect. Participants without previous therapeutic experience had a significantly higher benefit out of the intervention program than participants who had any kind of previous psychiatric/psychotherapeutic treatment. This might be due to a more chronic course of psychosocial problems in patients with previous use of therapy, indicating that a short-term intervention might be less effective in patients with long-lasting symptoms.

The vast majority of participants (93%) was satisfied with the intervention program and would recommend it to a friend. This is a clearly positive criterion for the feasibility and quality of our intervention program.

Employees who attended our short-term intervention program were guaranteed to get a quick appointment with a specialist of mental health care. The service offered is located off the company grounds and participation is absolutely anonymous to the employer. These two factors could be important in the decision making process to venture into the program. Especially, the option to see a mental health specialist away from the company's premises and the easy access to our program seems to be a potential factor that reduces the inhibition threshold toward psychotherapy in general but in particular in men and their stigmatization fear.

This could be one reason for the high rate of men in our study. Fiftyfour percent (54%) of participants were male, which is different from regular outpatient psychotherapy. Here, men account for about 25–30% of attendees (22, 40). Studies show that the male population has still a very sceptic attitude toward psychotherapy, whereas females are more open to begin psychotherapy (41).

In future studies it could be of interest to look further into the question if there are certain characteristics that influence the preference of therapy location, meaning whether an employee prefers an on-site or off-site consultation.

Clearly, there are some limitations to our study. First, we used only self-report measures and did not apply a structured clinical

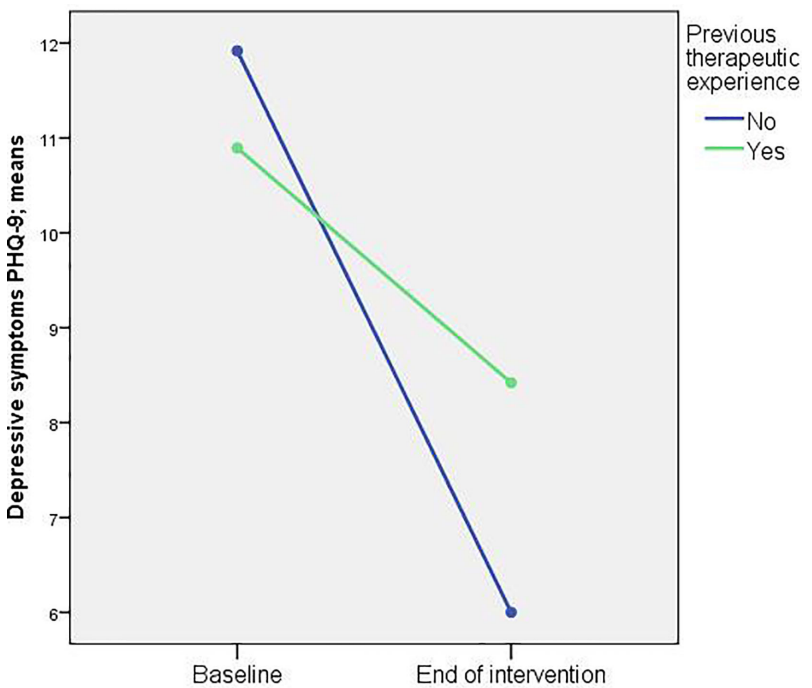

FIGURE 2 | Changes in depressive symptoms stratified by previous psychotherapeutic/psychiatric experience (n = 62).

interview for diagnosing mental disorders. Second, the response rate at the end of intervention was low, which limits the significance of our results. Third, we did not have a control group as this was an employer funded program and which did not allow to apply a randomized controlled trial or a wait-list design. Fourth, a "healthy worker effect" could have led to a selection bias and underestimation of effect sizes, meaning that employees with severe health complains have been sick at home or had already left the company and therefore did not participate in this study. Finally, only individuals who presented to a company-physician or the social service department were included.

In conclusion, our program is a quick and easy access for strained employees to mental health care specialists at an early stage of mental distress. Furthermore, the results of this off-site intervention tentatively suggest that it constitutes an effective and well-accepted way of alleviating symptom burden, and it seems to be especially attractive to male employees.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethikkommission an der Technischen Universität München. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

CA and CL designed and planed the study. CA conducted the study. The data was analyzed by CA, BM-M, and AD, and the first draft was written by CA. All authors contributed to the article and approved the submitted version.

FUNDING

The publication of this work as an open access article will be supported by the German Research Foundation (DFG) and the Technical University of Munich (TUM) within the funding programme Open Access Publishing.

REFERENCES

1. Harvey SB, Henderson M, Lelliott P, Hotopf M. Mental health and employment: much work still to be done. *Br J Psychiatry* (2009) 194:201–3. doi: 10.1192/bjp.bp.108.055111
2. Cattrell A, Harris EC, Palmer KT, Kim M, Aylward M, Coggon D. Regional trends in awards of incapacity benefit by cause. *Occup Med* (2011) 61:148–51. doi: 10.1093/occmed/kqr008
3. Murray CJL, Vos T, Lozano R, Naghavi M. Disability adjusted live years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* (2012) 380:2197–223. doi: 10.1016/S0140-6736(12)61899-6
4. Brouwers EPM, Terluin B, Tiemens BG, Verhaak PFM. Predicting return to work in employees sick-listed due to minor mental disorders. *J Occup Rehabil* (2009) 19:323–32. doi: 10.1007/s10926-009-9198-8
5. Ekberg K, Wåhlin C, Persson J, Bernfort L, Öberg B. Early and late return to work after sick leave: predictors in a cohort of sick-listed individuals with common mental disorders. *J Occup Rehabil* (2015) 25:1–11. doi: 10.1007/s10926-015-9570-9
6. Hildebrandt S, Marschall J, Nolting H-D, Schmuker C. *DAK Gesundheitsreport 2014*. German Health Insurance Company for Employees - Health Report 2014 (2014).
7. BPtK–Studie zur Arbeits- und Erwerbsunfähigkeit, Psychische Erkrankungen und gesundheitsbedingte Frühverrentungen. *Bundespsychotherapeutenkammer*. (2013).
8. Jacobi F, Höfler M, Strehle J, Mack S, Gerschler A, Scholl L, et al. Twelve-months prevalence of mental disorders in the German Health Interview and Examination Survey for Adults – Mental Health Module (DEGS1-MH): a methodological addendum and correction. *Int J Methods Psychiatr Res* (2015) 24:305–13. doi: 10.1002/mpr.1479
9. Wittchen HU, Jacobi F, Rehm J, Gustavsson A, Svensson M, Jönsson B, et al. The size and burden of mental disorders and other disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* (2011) 21(9):655–79. doi: 10.1016/j.euroneuro.2011.07.018
10. Lahmann C, Henningsen P, Noll-Hussong M, Dinkel A. Somatoforme Störungen [Somatoform disorders]. *Psychother Psychosom. Med. Psychol* (2010) 60:227–34. doi: 10.1055/s-0030-1248479
11. Sterud T, Johannessen HA, Tynes T. Do Work Related Mechanical and Psychosocial Factors contribute to the Social Gradient in Low Back Pain?: A 3-Year Follow-Up Study of the General Working Population Norway. *Spine* (2016) 41:1089–95. doi: 10.1097/BRS.0000000000001451
12. Sundstrup E, Andersen LL. Hard Physical Work Intensifies the Occupational Consequence of Physician-Diagnosed Back disorder: Prospective Cohort Study with Register Follow-Up among 10,000 Workers. *Int J Rheumatol* (2017) 2017:1037051. doi: 10.1155/2017/1037051
13. Garcia M-G, Graf M, Läubi T. Lower limb pain among workers: a cross-sectional analysis of the fifth European Working Conditions Survey. *Int Arch Occup Health* (2017) 90:575–85. doi: 10.1007/s00420-017-1220-4
14. Jacobi F. Nehmen psychische Störungen zu? [Do mental disorders increase?]. *Rep Psychol* (2009) 34:16–28.
15. WHO. *Depression*. (2017). Available at: http://www.who.int/mediacentre/factsheets/fs369/en.
16. Kohn R, Saxena S, Levav I, Saraceno B. The treatment gap in mental health care. *Bull World Health Organisation* (2004) 82:858–66.
17. Clement S, Schauman O, Graham T, Maggioni F, Evans-Lacko S, Bezborodovs N, et al. What is the impact of mental health-related stigma on help-seeking?: A systematic review of quantitative and qualitative studies. *Psychol Med* (2015) 45:11–27. doi: 10.1017/S0033291714000129
18. Schulz H, Barghaan D, Harfst T, Koch U. Psychotherapeutische Versorgung [Psychotherapeutic healthcare]. *Gesundheitsberichterstattung Des Bundes* (2008) 41:1–47.
19. Kruse J, Herzog W. *Zur ambulanten psychosomatischen/psychotherapeutischen Versorgung in der kassenärztlichen Versorgung in Deutschland – Formen der Versorgung und ihre Effizienz – Zwischenbericht 2012*. Gutachten im Auftrag der Kassenärztlichen Bundesvereinigung (KVB) (2012). Available at: http://www.kbv.de/media/sp/Gutachten_Psychosomatik_Zwischenbericht.pdf.
20. Harris MG, Baxter AJ, Reavley N, Diminic S, Pirkis J, Whiteford HA. Gender-related patterns and determinants of recent help-seeking for past-year affective, anxiety and substance use disorders: findings from a national epidemiological survey. *Epidemiol Psychiatr Sci* (2016) 25:548–61. doi: 10.1017/S2045796015000876
21. Azagba S, Sharaf MF. Psychosocial working conditions and the utilization of health care services. *BMC Public Health* (2011) 11:642–9. doi: 10.1186/1471-2458-11-642
22. Mack S, Jacobi F, Gerschler A, Strehle J, Höfler M, Busch MA, et al. Self-reported utilization of mental health services in the adult German population – evidence for

unmet needs? Results of the DEGS1-Mental Health Module (DEGS1-MH). *Int J Methods Psychiatr Res* (2014) 23(3):289–303. doi: 10.1002/mpr.1438
23. Busse R, Blümel M. Germany: health system review. *Health Syst Transition* (2014) 16:1–296.
24. OECD. *Fit Mind, Fit Job: From Evidence to Practice in Mental Health and Work*. Paris: OECD Publishing (2015). doi: 10.1787/9789264228283-en
25. Proper KI, van Oostrom SH. The effectiveness of workplace health promotion interventions on physical and mental health outcomes – a systematic review of systematic reviews. *Scand J Work Environ Health* (2019) 45:546–59. doi: 10.5271/sjweh.3833
26. Rothermund E, Gündel H, Rottler E, Hölzer M, Mayer D, Rieger M, et al. Effectiveness of psychotherapeutic consultation in the workplace: a controlled observational trial. *BMC Public Health* (2016) 16:891. doi: 10.1186/s12889-016-3567-y
27. Preiser C, Rothermund E, Wittich A, Gündel H, Rieger MA. Psychosomatic consultation in the workplace: opportunities and limitations of the service offered – results of a qualitative study. *Int Arch Occup Environ Health* (2016) 89:599–608. doi: 10.1007/s00420-015-1098-y
28. Löwe B, Kroenke K, Herzog W. *PHQ-D: Gesundheitsfragebogen für Patienten*. Karlsruhe: Pfizer (2002). 2002.
29. Kroenke K, Spitzer RL, Williams JB. The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Med* (2002) 64:258–66. doi: 10.1097/00006842-200203000-00008
30. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. *J Gen Internal Med* (2001) 16:606–16. doi: 10.1046/j.1525-1497.2001.016009606.x
31. van Ravesteijn H, Wittkampf K, Lucassen P, van de Lisdonk E, van den Hoogen H, van Weert H, et al. Detecting somatoform disorders in primary care with the PHQ-15. *Ann Fam Med* (2009) 7(3):232–8. doi: 10.1370/afm.985
32. de Vroege L, Hoedeman R, Nuyen J, Sijtsma K, van der Feltz-Cornelis CM. Validation of the PHQ-15 for somatoform disorder in an occupational care health setting. *J Occup Rehabil* (2012) 22:51–8. doi: 10.1007/s10926-011-9320-6
33. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Internal Med* (2006) 166:1092–7. doi: 10.1001/archinte.166.10.1092
34. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Internal Med* (2007) 146:317–25. doi: 10.7326/0003-4819-146-5-200703060-00004
35. Fliege H, Rose M, Arck P, Walter O, Kocalevent R-D, Weber C, et al. The Perceived Stress Questionnaire (PSQ) reconsidered: validation and reference values from different clinical and healthy adult samples. *Psychosomatic Med* (2005) 67:78–88. doi: 10.1097/01.psy.0000151491.80178.78
36. Jain G, Roy A, Harikrishnan V, Yu S, Dabbous O, Lawrence C. Patient-reported depression severity measured by the PHQ-9 and impact on work productivity: Results from a survey of full-time employees in the United States. *Occup Environ Med* (2013) 32:67–74. doi: 10.1097/JOM.0b013e31828349c9
37. Rothermund E, Kilian R, Rottler E, Mayer D, Hölzer M, Rieger MA, et al. Improving access to Mental Health Care by delivering psychotherapeutic care in the workplace: a cross-sectional exploratory trial. *PloS One* (2017) 12(1): e0169559. doi: 10.1371/journal.pone.0169559
38. Dell'Osso B, Glick ID, Baldwin DS, Altamura AC. Can long-term outcomes be improved by shortening the duration of untreated illness in psychiatric disorders? A conceptual framework. *Psychopathology* (2013) 46:14–21. doi: 10.1159/000338608
39. Kivimäki M, Forma P, Wilkström J, Halmeenmäki T, Pentti J, Elovainio M, et al. Sickness absence as a risk marker of future disability pension: the 10-town study. *J Epidemiol Community Health* (2004) 58:205–12. doi: 10.1136/jech.2003.015842
40. Albani C, Blaser G, Geyer M, Schmutzer G, Goldschmidt S, Brähler E. Who is Using Outpatient Psychotherapy in Germany? *Psychother Psychosomatik Medizinische Psychol* (2009) 59:281–3. doi: 10.1055/s-0028-1103267
41. Albani C, Blaser G, Rusch BD, Brähler E. Einstellung zu Psychotherapie. [Attitude towards psychotherapy]. *Psychotherapeut* (2013) 58:466–73. doi: 10.1007/s00278-012-0944-6

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 05 October 2020
doi: 10.3389/fpsyt.2020.00861

A Two-Day Acceptance and Commitment Therapy (ACT) Workshop Increases Presence and Work Functioning in Healthcare Workers

Rainer Gaupp[1], *Marc Walter*[1], *Klaus Bader*[1], *Charles Benoy*[1] *and Undine E. Lang*[1,2*]

[1] University Psychiatric Clinics (UPK) Basel, Basel, Switzerland, [2] University of Basel, Basel, Switzerland

OPEN ACCESS

Edited by:
Rakesh Pandey,
Banaras Hindu University, India

Reviewed by:
Kate L. Morrison,
Utah State University, United States
Hitesh Khurana,
Pandit Bhagwat Dayal Sharma University of Health Sciences, India

***Correspondence:**
Undine E. Lang
undine.lang@upk.ch

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *03 November 2019*
Accepted: *07 August 2020*
Published: *05 October 2020*

Citation:
Gaupp R, Walter M, Bader K, Benoy C and Lang UE (2020) A Two-Day Acceptance and Commitment Therapy (ACT) Workshop Increases Presence and Work Functioning in Healthcare Workers. Front. Psychiatry 11:861. doi: 10.3389/fpsyt.2020.00861

Background: In this controlled naturalistic study performed in healthcare workers we examined the effect of a two-day acceptance commitment therapy (ACT) workshop on work presence and productivity, i.e. the influence the workshop had on treatment efficacy in a routine hospital care setting.

Aim: To examine the influence of ACT on productivity and presence in healthcare workers.

Method: Study participants were all healthcare workers (nurses, medical doctors, physiotherapists, social workers, and art therapists) of four inpatient wards for depression. Half of the healthcare workers attended the workshop. Measures were evaluated 3 months after the intervention in the study participants and the patients treated by them in the same time period.

Results: A significantly higher treatment efficacy [as measured with HoNOS (Health of the nation outcome scales) change in the patients treated by the participants] has been observed in the healthcare workers who attended the ACT workshop when compared to the control group who did not attend the workshop. Moreover, the work presence of the participants of the ACT workshop was increased when compared with the time period before the intervention and with the presence of the control group. A cost analysis showed that ACT workshops lead to a significant return of investment for the employer as the costs for the workshop were ten times compensated by the increase of work presence in participants of the workshop.

Conclusion: These findings provide support that ACT interventions motivate healthcare workers to work and increase their patients' treatment quality. To our knowledge this is the first study showing an ACT workshop in healthcare workers can influence HoNOS outcome in the treated patients.

Keywords: stress, work, costs, ACT, acceptance commitment therapy, depression, employees, mental health

INTRODUCTION

In Europe, the costs of 12 most relevant groups of mental health disorders were conservatively estimated on 386 billion Euros per year (1). About half of these costs were caused by anxiety disorders, depressive disorders, and addiction and more than half of these costs are paid by the employer due to productivity losses (1). In Switzerland, the costs of depression at the workplace have been estimated on 8 billion Euros per year (2). The ultimate payer for the costs is the employer and not the health system since the majority of the costs are not incurred within the health care systems but in the workplace. Indeed, in Switzerland a study estimated, that the mean total direct costs for the treatment of depression range from 3.561 to 16.240 Euros from mild to severe depression per person per year (2). The mean indirect costs that are due to workdays lost range from 8.730 to 16.669 Euros for mild to severe depression per person per year (2). Therefore, at least in Switzerland, the treatment of depression is connected to lower costs than the amount of money the employer pays for the disorder. In conclusion, the economic burden of mental health disorders is high, i.e. the relative returns from investing in mental health to fight depression and anxiety lead to a four-fold return in better health and ability to work of every dollar invested (3, 4). Especially healthcare workers experience high rates of burn out, anxiety disorders, stress, and depression, e.g. half of the physicians at least in America experience symptoms of burn out and this situation even seems to worsen over the last years (5). Workplace conditions that compromise mental health in the healthcare system are especially excessive workloads, increase of bureaucracy, working in emotionally-charged situations, stigma against seeking care, low job control and high job demand, an imbalance between effort and reward and night shifts (4). In conclusion, healthcare staff has been consistently shown to experience above average rates of mental health problems. Mental health disorders in psychiatric staff again affect the quality of patient care, patient satisfaction, and organizational success. Indeed, the mental health of healthcare workers has been reported to be associated with patient safety outcomes, therapeutic incidents, quality of care, patient satisfaction, medical errors, and infections (4, 6–9). In contrast to a huge financial and qualitative damage caused by these disorders, there is only a small proportion of clinically distressed workers that gain access to evidence-based psychotherapeutic interventions (4).

Cognitive behavioral therapy programs that focus on mental health conditions in work-related environment have a strong level of evidence. They reduce presenteeism (presenteeism relates to working employees with reduced productivity due to illness), absenteeism, work disability costs, and loss of time (10). Moreover, work functioning has been shown to be improved by work-related cognitive behavioral programs (11). In contrast, it has been shown recently that non-specific workplace wellness programs did not succeed in terms of clinical measures of health and employment outcomes after 18 months (12). This was shown in 28.937 employees in a recent study including 20 primary control worksites of a large US warehouse retail company (11).

Acceptance and Commitment Therapy (ACT) might be successful as transdiagnostic group-based program because individuals on sick leave often have combinations of health complaints. Indeed, they suffer commonly from multiple symptom disorders and medically unexplained physical symptoms (12, 13). In 106 Swedish social workers, a brief stress management intervention based on the principles of ACT was performed. In this study, the perceived clinical stress was reduced in participants with high stress levels (14). Furthermore in 311 local government employees, where a stress management training and mindfulness and value-based skills have been implemented, a significant clinical improvement has been shown in initially distressed participants of the study (15).

ACT reduces distress associated with a range of physical and mental health difficulties (16). It uses a transdiagnostic framework and is successful in the treatment of anxiety and depression (17), pain (18), addiction (19), obsessive compulsive disorder (20), irritable bowel syndrome (21), diabetes, epilepsy (22), and cancer (23). ACT is based on a dimensional understanding of psychiatric disorders and therefore does not necessarily require categorical diagnoses and diagnostic screening. In this context ACT meets the demand for a treatment of comorbidity in affected populations which is essential as studied disabled populations at the work place display a high symptom overlap. Indeed, ACT might be particularly sufficient as it was conceptualized especially for comorbidity, treatment resistant situations, and disorders with complex symptoms (24). While there is substantial research literature available on ACT in psychiatric and somatic patients, there are a small number of workplace-based intervention studies involving healthy workers (25). Efforts to improve employee health and productivity have been hampered by the failure of early detection of psychiatric diagnoses, the stigma of psychiatry and psychiatric treatment and compartmentalization of medical costs. In this context, an ACT intervention in healthy and not yet diagnosed or screened or selected populations might be successful and effective.

Whilst there are clear insights into the effectiveness of ACT in different treatment settings and diagnostic groups in patients, we are not aware of a study where in a naturalistic design, i.e. without diagnostic evaluation and classification of the study participants, the cost-effectiveness of an ACT intervention in the workplace has been evaluated. Moreover, the influence of ACT on treatment outcomes, i.e. the HoNOS scale (Health of the Nation Outcome Scales) has not been evaluated yet. Accordingly, in our study we were interested in the influence of ACT on 1.) lost time, i.e. the amount of time spent away from the workplace (sick leave over the given time period); 2.) work functioning, i.e. the ACT-related increase of productivity as measured with a given patient outcome parameter (HoNOS) and 3.) costs of the intervention, i.e. costs of the absence rates versus costs of the workshop and its compensation time.

MATERIALS AND METHODS

Study Design

A controlled naturalistic study was performed. For this study we compared findings of four wards of the same hospital, all with a

focus on depression. Two wards, i.e. the intervention group (IG) received a 2-day workshop on ACT between May and October 2018. The control group (CG) did not receive any specific training during the study period. In both groups we measured sick leave hours and therapeutic outcome (HoNOS) at baseline (T0) and 3 months after the intervention (T1). There were no inclusion or exclusion criteria for attending the ACT intervention or participating in the research project, as the workshop was part of a routine and integral part of an organization's qualification program which was obligatory for all members of the staff of the two treatment teams.

Participants

All participants were employees of the University Psychiatric Clinics (UPK) in Basel. During the period of the study, a total of 28 employees attended an ACT workshop (IG). The majority (79%) of the IG was female. Twenty-two (79%) were registered nurses, 6 (21%) were nursing assistants. The mean age of the participants was 43.8 years (SD = 9.61). Two other depression wards were used as the control group (n = 30). The CG was comparable to the IG with regard to age and sex. Mean age was 45.0 years (SD = 12.12), 73% were female. The qualification of the participants in the CG was slightly different when compared to the IG, as 93% were registered nurses and only 7% were nursing assistants. **Table 1** shows the sociodemographic data of the sample.

Patients

Patients routine data were evaluated in the same time period. Eighty-one patients were included in the intervention group and 91 patients in the control group. Patients in the IG were significantly [$t(171) = 7.042$, $p < 0.001$, $d = 1.20$] older (mean = 58.6, SD = 15.5) when compared to patients in the CG (mean = 42.0, SD = 11.8). Gender distribution was comparable (IG: 58.5% female; CG: 53.8% female), as was the most common ICD diagnosis (F3, affective disorders in 72.8% of the IG and 79.1% of the CG). **Table 2** displays the sociodemographic data and principle diagnosis of the evaluated patient groups.

Intervention

The two-day ACT workshop was being delivered by the leading psychologists of the department, i.e. experienced ACT clinicians, between 9am–5pm. Groups included between 8 and 16 participants. The workshop evaluated in this study was delivered by an in-house ACT therapist, who had extensive experience in delivering individual and group psychotherapy and supervision. Participants were introduced to various techniques. Firstly, the concept of unhelpful thoughts was explained to them and a risk-benefit analyses of psychological impediments. Moreover, mindfulness based practices have been introduced, cognitive defusion was explained, personal values have been evaluated and strategies developed to engage in valued action. In conclusion, the trainer focused on the six main ACT approaches and metaphors (26). After the workshop had been delivered to the participants, individual nurses have been encouraged to assist in a weekly performed ACT group, which had been implemented for the ACT based treatment of patients on both units. Towards the end of the workshop, participants were invited to reflect and share within the group how they might transfer the learning, and further cultivate mindfulness and valuing skills, in their daily lives.

TABLE 1 | Sociodemographic data of the sample.

		Intervention group (IG) n = 28		Control group (CG) n = 30	
Age (years)		43.8 (SD = 9.61)		45.9 (SD = 12.12)	
Gender	female	78.6%	n = 22	73.3%	n = 22
	male	21.4%	n = 6	26.7%	n = 8
Professional qualification	Registered nurse	78.6%	n = 22	93.3%	n = 28
	Nursing assistant	21.4%	n = 6	6.7%	n = 2

TABLE 2 | Sociodemographic data and principle diagnosis of the evaluated patients.

		Intervention groupn = 81		Control groupn = 91	
Age (years)		58.6 (SD = 15.5)		42.0 (SD = 11.8)	
Gender	female	58.0%	n = 47	53.8%	n = 49
	male	42.0%	n = 34	46.2%	n = 42
Principal diagnosis	F0 (Organic, including symptomatic, mental disorders)	6.2%	n = 5	1.1%	n = 1
	F1 (Mental and behavioral disorders due to psychoactive substance use)	6.2%	n = 5	6.6%	n = 6
	F2 (Schizophrenia, schizotypal, and delusional disorders)	6.2%	n = 5	2.2%	n = 2
	F3 (affective disorders)	72.8%	n = 59	79.1%	n = 72
	F4 (Neurotic, stress-related, and somatoform disorders)	7.4%	n = 6	7.7%	n = 7
	F6 (Disorders of adult personality and behavior)	0.0%	n = 0	3.3%	n = 3
	Missing	1.2%	n = 1	0.0%	n = 0

Measures

Health of Nation Outcome Scales (HoNOS)

For routine outcome measures assessments of patients with severe mental illness, the HoNOS (27) has been used in Switzerland in all psychiatric hospitals. The HoNOS comprises 12 items, each with five response options (scoring range is 0–48), and has good psychometric properties (28, 29). Outcome on clinical problems and psycho-social functioning is assessed by comparing pre-test and post-test total scores on the HoNOS for each patient. The simplest, most straightforward and most commonly used outcome indicator in treatment outcome research is the mean delta from pretest to posttest score.

Sick Leave Hours

We used data of the hospital wide attendance recording system and extracted the registered sick leave hours in all four wards for T0 and T1. One day of sick leave is equal 8 h and 24 min. We summed up the time for the intervention and control group.

Data Analyses

Data were analyzed with IBM SPSS Statistics 26 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY : IBM Corp.). Data were analyzed in two stages. First, we examined the effects of

the ACT intervention on employees' presence and cost factors for the employer across the 3-month evaluation period. Secondly, we evaluated the therapeutic progress and therapy effects using the HoNOS scale as a "productivity measure". Chi-square tests were used for categorical variables. As basic assumptions for Analysis of covariances (ANCOVA) were met and covariates (except for age) were independent, we conducted ANCOVA to test the effects on HoNOS. In the analysis we adjusted for symptom severity at T0, age and sex of the patient and type of discharge. Prior to data analysis, cases with missing values >30% were excluded (30). For the remaining data, Little's Missing Completely At Random (MCAR) test was non-significant [$\chi 2$ (2) = 4.866, p = .088], indicating that the data was indeed missing at random. Hence, missing HoNOS values were imputed using the expectation maximization algorithm (31).

RESULTS

Work Presence and Costs of the Intervention

At T0, the total amount of sick leave hours was comparable in the intervention (478 h) and control group (486 h). In the 3 months after the intervention, the amount of sick leave hours dropped to 391 h in the intervention group, but increased to 643 h in the control group [$\chi 2$ (1, n = 58) = 28.12, p <.001]. Based on these figures, the gross costs of the intervention are more than amortized within three months. As continuous education is mandatory at our hospital, the costs of the intervention consist of working time of the workshop faculty only (two trainers with 20 h each).

TABLE 3 | Descriptive statistics and p-values for outcome measures.

Measure	T0		T1		p
	IG	CG	IG	CG	
Sick Leave hours	478	486	391	643	<.001
HoNOS delta	7.72 (SD = 4.80)	8.24 (SD = 6.28)	8.98 (SD = 4.61)	7.75 (SD = 6.55)	.036

IG, intervention group; CG, control group.

Productivity/Treatment Outcome

Results of the HoNOS comparisons support our hypothesis that professionals trained in ACT could show improved performance or productivity: A two-way ANCOVA revealed a minor, yet statistically significant, interaction between time and group, controlling for sex, type of discharge, age and symptom severity at time of hospitalization [F (1;163) = 4.451, p = .036, partial η^2= .03]. The achieved HoNOS delta in the intervention group improved significantly in the intervention group (T0: 7.72 vs. T1: 8.98), whereas there was a slight reduction of the achieved HoNOS delta in the control group (T0: 8.24 vs. T1: 7.75) (**Table 3**; **Figure 1**).

DISCUSSION

Our results indicate that ACT was effective in improving the general work presence in a sample of employees across a three months evaluation period and when compared with a control condition. Moreover, the work productivity, as measured with a patient outcome (HoNOS) significantly improved in the three months period and was increased when compared with the control condition. Because of the high efficacy and brevity of the intervention, the costs of the intervention were significantly lower when compared with the losses in the control group; i.e. the intervention was cost effective. In this context ACT might be an appropriate tool to increase treatment quality and efficacy at least in depression and in transdiagnostic wards in psychiatric hospitals.

Our data are in line with a recent study, where ACT reduced levels of work stress in 91 individuals in a randomized controlled clinical trial (32). Moreover, according to our findings a university-based ACT training has been shown to increase self-care, clinical competencies, and therapist skill development in clinical psychology trainees (33). Our data are further in line with a study, where 90 volunteers in a media organization were

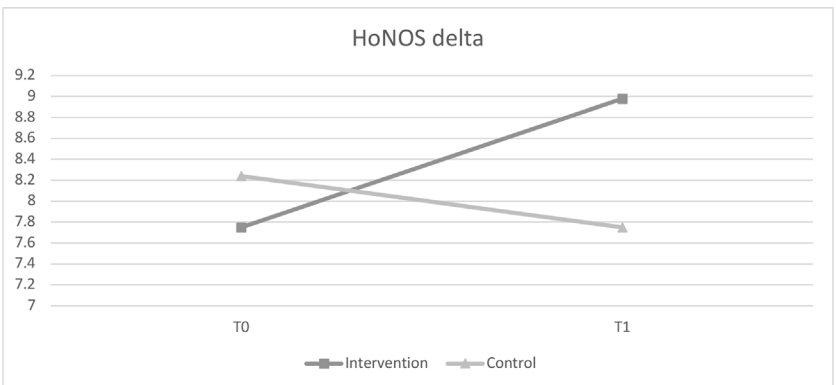

FIGURE 1 | Comparison of HoNOS delta values before and after intervention.

randomly allocated to an ACT group, an Innovation Promotion Program and a waitlist control group. In this study, both interventions showed improvements in mental health, presence and work-related variables (34). Additionally, another study showed that an ACT intervention decreased experiential avoidance, perceived stress, and burnout in 113 nursing students (15). In line with our data it has also been shown that an ACT intervention led to significantly greater reduction in distress in staff working with individuals with intellectual disability which was maintained within a six-week period (35). In addition, the employability has been increased in patients with mental illness and/or chronic pain by an ACT intervention in a randomized controlled trial (36).

Moreover, our findings indicate that the beneficial effects of an ACT workshop on employees' in a psychiatric hospital were linked to improvements in specific treatment skills, i.e. help people pursue and expand personally valued patterns of behavior. Indeed, ACT was successful in expanding the therapeutic benefits of the participants as measured objectively in the work performance of the study participants, i.e. the HoNOS change in the treated patients, which is an indicator for therapeutic success at least in Switzerland, where it is measured in all hospitals as a qualitative and financial outcome variable.

In a new report of 2010, European costs of mental health disorders were estimated on 798 billion Euros (37). In this report direct health care cost were 37%, direct non-medical cost 23%, and indirect cost 40%. Total annual costs per disorder were 65.7 billion Euros for addiction, 74.4 billion Euros for anxiety, 113.4 billion Euros for depression, 27.3 Euros for personality disorders, 93.9 Euros for psychotic disorders, 35.4 Euros for sleep disorders, and 21.2 Euros for somatoform disorders. These data reveal that psychiatric disorders overall are much more costly than previously estimated and they constitute a major health economic challenge for Europe (31). In another corresponding study, conditions with the highest estimated daily productivity loss and annual cost per person were chronic back pain, mental illness, general anxiety, migraines or severe headaches, neck pain, and depression (32). In our study, we also question the return of investment concerning the influence of the workshop on presence on the workspace. In this context our data are in line with a recent study, where the cost-effectiveness of ACT for employees on sickness absence has been considered favorable in terms of cost-utility analyses (38).

However, these rising costs of healthcare employees increase the direct cost burden of the medical health system and presentism is a relevant factor in this context. Presenteeism, which is commonly referred to as an employee at work who has impaired productivity due to health considerations, has been identified as an indirect but relevant factor influencing productivity and human capitol (39). Especially in psychiatry the human capitol is necessary to help patients, to be optimistic, to build constructive therapeutic relationships and to prevent patients from fatal complications.

However, in our study we posed the question if ACT is effective in a naturalistic setting, where all healthcare workers of a team are included, without stratifying them at baseline in order to exclude non-distressed individuals. This concept makes sense as in daily business screening might lead to drop out rates as employers might not be willing to be "diagnosed" and "treated" but rather be a part of a qualification program of the whole treatment team. This makes sense as the rate of psychiatric and somatic disorders—which can all be treated by ACT—are high in the general working population. In this context, the inclusion of all potentially suffering individuals might be more effective than excluding the healthy individuals. We promote that an integration of highly effective treatment options irrespective of diagnostic or disease entities in the workplace is an efficacious strategy to save costs, motivate workers, and increase work productivity. In this context the aim might not primarily be to screen diagnoses on the workplace and reference employees to a psychiatric treatment but implement high quality and highly evidenced transdiagnostic programs payed by the employer. A transdiagnostic approach to work disability may be desirable also from a participant perspective of view since loss of work capacity is equally validated regard-less of cause, rather than dichotomized into somatic or mental type and help to avoid treatment barriers associated with stigma of psychiatric disorders and psychiatry as a discipline.

Limitations

It is important to note also limitations in the design of the current study. Our sample size is relatively small, and although we were able to make use of a control group, who has not been qualified in ACT, participants were not randomly allocated to the condition. Moreover, an effect of seasonal variation might not be ruled out and we did not evaluate protocol adherence of the professionals in the intervention group. However, we followed a naturalistic design and it might also be an advantage that all members of the treatment teams were included in the ACT and control condition. Generalizability of the results may be limited, as the sample included only healthcare professionals from two professions, all of them working in the same hospital. Another limitation is that we did not focus on the psychopathological state of the health workers and did not measure perceived stress or other health outcome parameters of the employees. In this context the influence of our intervention on known ACT variables as mindfulness and acceptance processes, values and committed action elements has not been evaluated in our study.

CONCLUSIONS

In conclusion, the present study provides preliminary practice-based evidence that a brief ACT intervention can be effective in improving productivity, employers' costs, and work presence of healthcare employees. We recommend implementing work-focused ACT interventions to help to increase work time and motivation at work and decrease costs associated with absence from work (3). Practitioners should consider implementing these programs to help improve work functioning, work quality, and patient outcome in a clinical setting (3). To integrate disease prevention with disease management in different

work environments, we propose a procedure where all members of a treatment team are being skilled and show in this paper that this is still cost effective and might discharge the health care system and prevent disease progress. We propose that ACT as a transdiagnostic program performed in all staff members of a treatment team irrespective of their individual health status might be a successful and efficient procedure to reach the distressed individual, to increase work productivity and work presence, and to decrease employers costs. Moreover, we show for the first time that treatment effects on HoNOS outcome in the treated patients.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/ participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

KB and CB invented the whole ACT concept and established it in Basel and trained the trainer and therapists in this approach. MW is Co-Chief und UL is Chief of the department where the organizational procedures were implemented. UL wrote the manuscript together with RG and MW. RG and MW made the statistic measurements. All authors contributed to the article and approved the submitted version.

REFERENCES

1. Gustavsson A, Svensson M, Jacobi F, Allgulander C, Alonso J, Beghi E, et al. Cost of disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* (2001) 21:718–79. doi: 10.1016/j.euroneuro.2011.08.008
2. Tomonaga Y, Haettenschwiler J, Hatzinger M, Holsboer-Trachsler E, Rufer M, Hepp U, et al. The economic burden of depression in Switzerland. *Pharmacoeconomics* (2013) 31:237–50. doi: 10.1007/s40273-013-0026-9
3. WHO. *Mental Health: Massive Scale-up of Resources Needed if Global Targets Are to ;Be Met*. World Health Organization. Mental Health ATLAS (2018). Available online: http://www.who.int/mental_health/evidence/atlas/atlas_2017_web_note/en/.
4. Gray P, Senabe S, Naicker N, Kgalamono S, Yassi A, Spiegel JM. Workplace-Based Organizational Interventions Promoting Mental Health and Happiness among Healthcare Workers: A Realist Review. *Int J Environ Res Public Health* (2019) 16:4396. doi: 10.3390/ijerph16224396
5. Shanafelt TD, Mungo M, Schmitgen J, Storz KA, Reeves D, Hayes SN, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work e_ort. *Mayo Clin Proc* (2016) 91:422–31. doi: 10.1016/j.mayocp.2016.02.001
6. Panagioti M, Geraghty K, Johnson J, Zhou A, Panagopoulou E, Chew-Graham C, et al. Association Between Physician Burnout and Patient Safety, Professionalism, and Patient Satisfaction: A Systematic Review and Meta-analysis. *JAMA Intern Med* (2018) 178:1317–31. doi: 10.1001/jamainternmed.2018.3713
7. Fahrenkopf AM, Sectish TC, Barger LK, Sharek PJ, Lewin D, Chiang VW, et al. Rates of medication errors among depressed and burnt out residents: Prospective cohort study. *BMJ* (2008) 336:488–91. doi: 10.1136/bmj.39469.763218.BE
8. Tawfik DS, Profit J, Morgenthaler TI, Satele DV, Sinsky CA, Dyrbye LN, et al. Physician Burnout, Well-being, and Work Unit Safety Grades in Relationship to Reported Medical Errors. *Mayo Clin Proc* (2018) 93:1571–80. doi: 10.1016/j.mayocp.2018.05.014
9. Nantsupawat A, Nantsupawat R, Kunaviktikul W, Turale S, Poghosyan L. Nurse burnout, nurse-reported quality of care, and patient outcomes in Thai hospitals. *J Nurs Scholarsh* (2016) 48:83–90. doi: 10.1111/jnu.12187
10. Cullen KL, Irvin E, Collie A, Clay F, Gensby U, Jennings PA, et al. Effectiveness of Workplace Interventions in Return-to-Work for Musculoskeletal, Pain-Related and Mental Health Conditions: An Update of the Evidence and Messages for Practitioners. *J Occup Rehabil* (2018) 28:1–15. doi: 10.1007/s10926-016-9690-x
11. Song Z, Baicker K. Effect of a Workplace Wellness Program on Employee Health and Economic Outcomes: A Randomized Clinical Trial. *JAMA* (2005) 321:1491–501. doi: 10.1001/jama.2019.3307
12. Waters CS, Frude N, Flaxman P, Boyd J. Acceptance and commitment therapy (ACT) for clinically distressed health care workers: Waitlist-controlled evaluation of an ACT workshop in a routine practice setting. *Br J Clin Psychol* (2018) 57:82–98. doi: 10.1111/bjc.12155
13. Aamland A, Malterud K, Werner EL. Patients with persistent medically unexplained physical symptoms: a descriptive study from Norwegian general practice. *BMC Fam Pract* (2014) 15:107. doi: 10.1186/1471-2296-15-107
14. Brinkborg H, Michanek J, Hesser H, Berglund G. Acceptance and commitment therapy for the treatment of stress among social workers: a randomized controlled trial. *Behav Res Ther* (2011) 49:389–98. doi: 10.1016/j.brat.2011.03.009
15. Flaxman PE, Bond FW. Worksite stress management training: moderated effects and clinical significance. *J Occup Health Psychol* (2010) 15:347–58. doi: 10.1037/a0020522
16. A-Tjak JG, Davis ML, Morina N, Powers MB, Smits JA, Emmelkamp PM. A meta-analysis of the efficacy of acceptance and commitment therapy for clinically relevant mental and physical health problems. *Psychother Psychosom* (2015) 84:30–6. doi: 10.1159/000365764
17. Twohig MP, Levin ME. Acceptance and Commitment Therapy as a Treatment for Anxiety and Depression: A Review. *Psychiatr Clin North Am* (2017) 40:751–70. doi: 10.1016/j.psc.2017.08.009
18. Hughes LS, Clark J, Colclough JA, Dale E, McMillan D. Acceptance and Commitment Therapy (ACT) for Chronic Pain: A Systematic Review and Meta-Analyses. *Clin J Pain* (2017) 33:552–68. doi: 10.1097/AJP.0000000000000425
19. Lee EB, An W, Levin ME, Twohig MP. An initial meta-analysis of Acceptance and Commitment Therapy for treating substance use disorders. *Drug Alcohol Depend* (2015) 155:1–7. doi: 10.1016/j.drugalcdep.2015.08.004
20. Bluett EJ, Homan KJ, Morrison KL, Levin ME, Twohig MP. Acceptance and commitment therapy for anxiety and OCD spectrum disorders: an empirical review. *J Anxiety Disord* (2014) 28:612–24. doi: 10.1016/j.janxdis.2014.06.008
21. Sánchez B, Gil Roales-Nieto J, Ferreira NB, Gil Luciano B, Sebastián Domingo JJ. New psychological therapies for irritable bowel syndrome: mindfulness, acceptance and commitment therapy (ACT). *Rev Esp Enferm Dig* (2017) 109:648–57. doi: 10.17235/reed.2017.4660/2016
22. Montgomery KL, Kim JS, Franklin C. Acceptance and commitment therapy for psychological and physiological illnesses: a systematic review for social workers. *Health Soc Work* (2011) 36:169–81. doi: 10.1093/hsw/36.3.169
23. Fashler SR, Weinrib AZ, Azam MA, Katz J. The Use of Acceptance and Commitment Therapy in Oncology Settings: A Narrative Review. *Psychol Rep* (2018) 121:229–52. doi: 10.1177/0033294117726061

24. Hara KW, Borchgrevink PC, Jacobsen HB, Fimland MS, Rise MB, Gismervik S, et al. Transdiagnostic group-based occupational rehabilitation for participants with chronic pain, chronic fatigue and common mental disorders. *A Feasibility Study Disabil Rehabil* (2018) 40:2516–26. doi: 10.1080/09638288.2017.1339298
25. Sullivan S. Promoting Health and Productivity for Depressed Patients in the Workplace. *Supplement to J Managed Care Pharm JMCP* (2005) 11:3. doi: 10.18553/jmcp.2005.11.3.S12
26. Hayes H. (1999). Strosahl, & Wilson
27. Wing JK, Beevor AS, Curtis RH, Park SB, Hadden S, Burns A. Health of the nation outcome scales (HoNOS). Research and development Br. *J Psychiatry* (1998) 172:11–8. doi: 10.1192/bjp.172.1.11
28. Pirkis JE, Burgess PM, Kirk PK, Dodson S, Coombs TJ, Williamson MK. A review of the psychometric properties of the health of the nation outcome scales (HoNOS) family of measures. *Health Qual Life Outcomes* (2005) 3:1–12. doi: 10.1186/1477-7525-3-76
29. Andreas S, Harfst T, Dirmaier J, Kawski S, Koch U, Schulz H. A Psychometric Evaluation of the German Version of the 'Health of the Nation Outcome Scales, HoNOS-D': On the Feasibility and Reliability of Clinician-Performed Measurements of Severity in Patients with Mental Disorders. *Psychopathology* (2007) 40:116–25. doi: 10.1159/000098492
30. Lüdtke O, Robitzsch A, Trautwein U, Köller O. Umgang mit fehlenden Werten in der psychologischen Forschung: Probleme und Lösungen. *Psychologische Rundschau* (2007) 58:103–17. doi: 10.1026/0033-3042.58.2.103
31. Lou W, Wan L, Abner EL, Fardo DW, Dodge HH, Kryscio RJ. Multi-state models and missing covariate data: Expectation-Maximization algorithm for likelihood estimation. *Biostat Epidemiol* (2017) 1:20–35. doi: 10.1080/24709360.2017.1306156
32. Wersebe H, Lieb R, Meyer AH, Hofer P, Gloster AT. The link between stress, well-being, and psychological flexibility during an Acceptance and Commitment Therapy self-help intervention. *Int J Clin Health Psychol* (2018) 18:60–8. doi: 10.1016/j.ijchp.2017.09.002
33. Pakenham KI. Effects of Acceptance and Commitment Therapy (ACT) Training on Clinical Psychology Trainee Stress, Therapist Skills and Attributes, and ACT Processes. *Clin Psychol Psychother* (2015) 22:647–55. doi: 10.1002/cpp.1924
34. Bond FW, Bunce D. Mediators of change in emotion-focused and problem-focused worksite stress management interventions. *J Occup Health Psychol* (2000) 5:156–63. doi: 10.1037/1076-8998.5.1.156
35. McConachie DA, McKenzie K, Morris PG, Walley RM. Acceptance and mindfulness-based stress management for support staff caring for individuals with intellectual disabilities. *Res Dev Disabil* (2014) 35:1216–27. doi: 10.1016/j.ridd.2014.03.005
36. Berglund E, Anderzén I, Andersén Å., Carlsson L, Gustavsson C, Wallman T, et al. Multidisciplinary Intervention and Acceptance and Commitment Therapy for Return-to-Work and Increased Employability among Patients with Mental Illness and/or Chronic Pain: A Randomized Controlled Trial. *Int J Environ Res Public Health* (2018) 31:15. doi: 10.3390/ijerph15112424
37. Olesen J, Gustavsson A, Svensson M. The economic cost of brain disorders in Europe. *Eur J Neurol* (2012) 19:155–62. doi: 10.1111/j.1468-1331.2011.03590.x
38. Finnes A, Enebrink P, Sampaio F, Sorjonen K, Dahl J, Ghaderi A, et al. Cost-Effectiveness of Acceptance and Commitment Therapy and a Workplace Intervention for Employees on Sickness Absence due to Mental Disorders. *J Occup Environ Med* (2017) 59:1211–20. doi: 10.1097/JOM.0000000000001156
39. Allen D, Wandtke Hines E, Pazdernik V, Tierney Konecny L, Breitenbach E. Four-year review of presenteeism data among employees of a large United States health care system: a retrospective prevalence study. *Hum Resour Health* (2018) 16:59. doi: 10.1186/s12960-018-0321-9

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychiatry

HYPOTHESIS AND THEORY
published: 09 December 2020
doi: 10.3389/fpsyt.2020.519237

The Burnout Phenomenon: A Résumé After More Than 15,000 Scientific Publications

Andreas Hillert[1]*, *Arnd Albrecht*[2] *and Ulrich Voderholzer*[1]

[1] Schön Klinik Roseneck, Prien am Chiemsee, Germany, [2] Munich Business School, München/Munich Business Coaching Institute, München, Germany

The "burnout" phenomenon, supposedly caused by work related stress, is a challenge for academic psychiatry both conceptually and professionally. Since the first description of burnout in 1974 until today, more than 140 definitions have been suggested. Burnout–symptomatology's main characteristic, the experience of exhaustion, is unspecific. Different development–models of burnout were proposed, assumed to depict a quasi-natural process. These could not be confirmed empirically. An expert consensus on the diagnostic criteria and the conceptual location, whether as an independent disorder or as a risk, could not be agreed on. Nevertheless, the phenomenon of burnout in the ICD-11 is considered to be categorized as a work-related disorder. Psychiatric research on the burnout–phenomenon ignores problems of definition resulting from different perspectives: It may meet societal expectations, but does not fulfill scientific criteria, and therefore is not suitable to establish an objective diagnosis and treatment. Parallel detection of ICD/DSM diagnoses from an expert perspective and subjective perturbation models are considered appropriate.

Keywords: burnout, depression, concepts of mental illness, subjective disease models, work-related disorders, scientific conceptualization of psychic phenomena, stress

OPEN ACCESS

Edited by:
Elisabeth Schramm, University of Freiburg Medical Center, Germany

Reviewed by:
Ulrich Sprick, Alexius/Josef Hospital, Germany
Nadia Sosnowsky-Waschek, SRH Hochschule Heidelberg, Germany

***Correspondence:**
Andreas Hillert
ahillert@schoen-klinik.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: *05 August 2020*
Accepted: *09 November 2020*
Published: *09 December 2020*

Citation:
Hillert A, Albrecht A and Voderholzer U (2020) The Burnout Phenomenon: A Résumé After More Than 15,000 Scientific Publications. Front. Psychiatry 11:519237. doi: 10.3389/fpsyt.2020.519237

INTRODUCTION

Since the first publication on the burnout topic 1974, in which the psychotherapist Herbert Freudenberger literally described the phenomenon in relation to his own body and mental state, an infinite amount on the subject of burnout has been published (1). Burnout was first recognized in social professions, later in all occupational related subjects where people experienced stress and in situations of perceived overwork. In these contexts "burnout" was discussed and expected to be treated, preferably by methods aiming for relief, rest and relaxation (2, 3). There are more than 140 suggested burnout definitions in the literature (2, 4). Nevertheless, the hope that "burnout research" in psychiatry, psychology, psychotherapy, neurophysiology and the social sciences will find a concrete concept that is viable for various scientific and therapeutic issues and ultimately also for political implications has not been fulfilled. Concrete diagnostic criteria to categorize burnout as a disorder according to DSM or ICD standards does not exist to this day. Often references are made to burnout questionnaires, in particular to the Maslach Burnout Inventory (MBI) (5). Although a lot of authors struggle with the burnout definition, many of them believe to know what burnout is and publish articles about it ("I can't define it, but I know what it is!"). This leads to the questions on which this article is based: How realistic is it to come closer to an unambiguous medical-psychotherapeutic definition or even standard? Is a clear definition of

burnout even possible–based on established scientific criteria? To what extent can consideration of the respective research or observer perspective, i.e., the perspective from which burnout is perceived or processed, contribute to clarifying the question?

A systematic review on the entire burnout research history since 1974 and more than 15,000 references on the subject (in PubMed 17,836 citations are available, October, 28nd 2020) is not possible to streamline in this paper.

I. Physicians and academic psychotherapists: They are currently working based on DSM-5 / ICD-10. According to the ideas of some colleagues, burnout - beyond the mention of an undefined Z-category (Z 73.0) - would have to be or become a separate F-diagnosis of the ICD 10 chapter.

II. Psychologists: Beyond psychotherapy financed by health insurance funds, especially in the context of occupational psychology, burnout is not a diagnosis but a parameter which a) is relevant as a risk factor for health aspects (manifest illnesses, incapacity for work, etc.) and b) as a conceptual reference for interventions.

III. Social scientists: They explain and critically discuss terms that identify social developments. Therefore, burnout is seen as an indicator for negative trend and should drive also politicians taking actions in respect of deployment of workforce and stabilization of health of the society.

IV. Perspective of those, who are affected respectively who feel to be suffered from burnout. The employee, the family of the employee, friends, boss, colleagues, etc. they try to understand the burnout-affected person and their responsibility and role in this context, in the private as well as in business life. This ultimately also gives rise to the political and professional implications of the topic.

V. Business Coach, Mentor, Boss: These stakeholders support the burnout candidate to cope with the situation, help to stabilize them and to accompany them during burnout episode. After burnout they have to support successful reintegration into the life as well as avoidance of burnout relapses.

FIGURE 1 | Perspectives on burnout.

In order to at least indicate the heterogeneity and distribution of the burnout-related questions characteristic of the topic, here is a list of the contents and questions of the last publications on the topic listed in medline. On medline, February 10.02.20, the 100 most recent publications on burnout (in the sense of a psychic phenomenon) were as follows: 57 studies based on surveys of circumscribed groups of doctors, students, teachers, administrative staff, etc., partly with the question how burnout values are related to other recorded parameters; 31 discussion contributions on the subject without own data; 7 prevention or therapy studies (mostly based on mindfulness based stress reduction); 3 reviews on burnout-exposure and changes in special groups, and 3 methodical works (evaluation of burnout questionnaires). Most of the empirical studies are using the Maslach burnout inventory or related instruments. The data are used to show and discuss the particular relevance of special group's burdens and to consider possible solutions.

In this paper an exemplary selection of publications depicting the spectrum of publications on the topic is quoted with the aim of showing the urgency of standardizing the definition of burnout for scientific and therapeutic procedure.

MATERIAL: SCIENTIFIC-CONCEPTUAL, THERAPEUTIC AND PERSONAL PERSPECTIVES

Freudenberger introduced the "burnout"–phenomenon in 1974 (1). Since then, numerous more or less scientifically designed, more or less professionally accentuated studies on the subject have been conducted and published. Here already the problem starts with the fact that authors of scientific papers about burnout do not usually define burnout or at least not explain in which category the burnout definition is allocated.

The definition and description depend on the authors' business perspective, profession and his personal point of view as pointed out elsewhere (6). They are correspondingly highly heterogeneous (**Figure 1**).

Medical and Psychotherapeutic Perspective

Diagnoses should be objective, reliable and valid. Ideally, different examiners will recognize the same central symptoms (objectivity) in a patient. Findings must be reproducible and reliable, i.e., confirmed by retests. A diagnosis is valid if it depicts a disease that can be treated with a certain method and/or can be traced back to a defined etiology. This is not usually the case with mental disorders (biopsychosocial phenomena). Robert L. Spitzer (1932–2015) was clear about this when preparing the DSM-III (7, 8). As long as one started from etiological models (for example, "neurotic" vs. "endogenous" depression), the diagnosis could be made by reading tea leaves. Since the DSM-III, psychiatric disorders have been defined based on symptoms and of course, the reliability has increased and is regarded as a milestone in psychiatric research. The ICD diagnostic system has followed this logic. Based on this, what would a burnout diagnosis look like?

TABLE 1 | Burnout symptoms [based on Burisch (4, 9)].

- Exhaustion, lack of energy, sleep disorders
- Concentration and memory problems, feelings of insufficiency, inability to make decisions
- Reduced initiative and imagination, indifference, boredom, disillusionment, inclination to cry, weakness, restlessness, despair
- Greater distance from clients, emphasis on jargon, accusations against others, loss of empathy, cynicism, loss of idealism, bitterness, "dehumanization"
- Partnership and/or family issues
- Feeling of lack of recognition
- Physical symptoms such as: tightness in the chest, difficulty breathing, back pain, nausea, increased nicotine and alcohol consumption

Table 1 calls the most frequent burnout symptoms according to literature:

The reason why burnout cannot be diagnosed on the basis of symptoms is:

1) All symptoms according to Burish–and many other authors–are non-specific. For example, symptoms like exhaustion, concentration problems, and reduced initiative could be caused by a viral infection, hypothyroidism, or low blood pressure.
2) No specific symptom combination or syndromes can be identified. According to this Herbert Freudenberger, in the very first essay on the subject (1), assumed that the symptoms of burnout were different for each person affected and proposed defining burnout based on etiology: He supposed burnout to be the result of occupational overload in previously committed individuals. Better working conditions and coaching might be an effective and efficient response (10). The perception that burnout is the result of long-term occupational overload appears particularly plausible and imperative if you assume that people work like batteries: the more demand is placed on them, the faster their energy is drained. On the other hand, such causal connections are methodologically difficult to detect and do not solve the definition problem.

- Is anyone who feels overloaded a burnout-case?
- In what context are the demands, the individual coping strategies and the motivation to cope with these demands?
- To what extent do non-sensical work tasks lead to burnout experience?
- How is the experience of effort-reward imbalance associated with burnout constellations? (11).

Since 1990 at least, there have been studies that show that it is less the "dedicated" employees who burn out (12). Many years of work in stressful occupations does not necessarily increase the burnout risk (13). Empirically, younger people experience burnout more often than older ones. This is then hardly compatible with the "battery model" of burnout (14, 15).

Herbert Freudenberger and many others divide the burnout course into stages or phases. At least the DIMDI Report of 2011 (16) shows how heterogeneous the authors' opinions are regarding the development

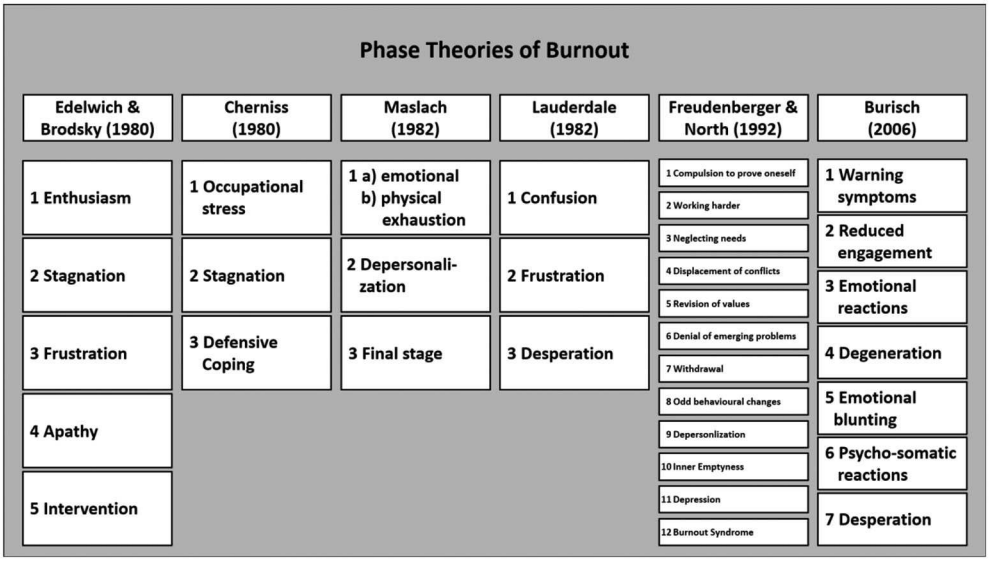

FIGURE 2 | Overview on most common burnout phase theories.

of burnout. Two to more than twelve stages were proposed (**Figure 2**).

Here, there is little attempt to operationalize and demarcate the various stages: Who does not occasionally feel exhausted, helpless, unsuccessful and less friendly? In any case, follow-up studies show that regular "burnout processes" do not exist. People have quite stable patterns of deal with occupational demands (17).

Burnout or Exhaustion or Depression?

The question of what distinguishes the symptoms of burnout and depression, and how the two phenomena can be distinguished from each other, has been discussed extensively (18–21). Attempts to differentiate between burnout and depression only convince on theoretical level (22). Therefore, for instance, an inadequate "adaptation to high stress," is a burnout risk factor is an insufficient "adaptation to aversive pressures" in depression risk. Lack of mental drive may lead to exhaustion, or vice versa. In a depression, this is defined as "motivation deficits." Evaluation has never been established by the authors so far. Endogenous (morning depression, feeling of numbness, etc.) and neurotic depression are hardly distinguishable. Therefore, it cannot be used as clear diagnostic criteria. Should an episode of lack of drive experienced as an exhaustion or to be caused by a lack of motivation?

Whether exhaustion is caused by a lack of drive or a lack of motivation, probably reflects the introspection patterns of those affected. In any case, it can be assumed that a reliable differentiation of the constellations outlined here is ultimately impossible!

With the Position-Paper of 2012, the German Association for Psychiatry, Psychotherapy and Psychosomatics (German Association for Psychiatry, Psychotherapy and Psychosomatics–DGPPN) claimed the burnout interpretive sovereignty in German-speaking countries (23). Burnout is defined as a risk state in the transition area of (still) acceptable stress and already manifest of diseases/disorders. Unfortunately, the position paper does not mention any corresponding criteria or symptoms. What is beyond an experienced fatigue in the face of chronic stress, could be characterized by risk factors? And what would be the added value of this, since the phenomenon of chronic stress alone has been shown to be a health risk factor already (24, 25). Should every stress-risk state be named burnout, no matter how healthy or ill the concerning person is?

Psychological Perspective

Is burnout what is measured by a burnout questionnaire? In this is the case, it is easier for psychologists than medical doctors and psychotherapists to define burnout. According to Christina Maslach, burnout is characterized by emotional exhaustion, depersonalization, and reduced capacity (occupational overload) (5, 26). The more MBI items are approved, the more burned out you are. The objectivity and reliability of the questionnaires had several times be statistically proven by (5).

But until today, there have been no representative MBI-reference values established and the validity has never been proved (27). Various burnout questionnaires have been developed which are similar to the MBI, such as the Tedium Measure/Scale. Most of these did not gain acceptance as research instruments (28). In addition to the MBI, currently the questions in the Copenhagen Burnout Inventory are (often) discussed in the scientific literature (29, 30).

On the one hand, the structure of burnout (as described in the literature) leads to an adequately depict work-related stress. On the other hand, it is assumed that burnout is suitable for predicting health status. Obviously high burnout

values correlate in the middle range with depression and anxiety, with professional dissatisfaction, etc. (31, 32). Results of burnout questionnaires compared with those e.g., of depression questionnaires, have often been published. However what lies behind these findings? Just a glance at the items used to measure burnout answers this question: most of the questions in burnout questionnaires capture aspects that are symptoms of mood disorders. In the same question, the participant should then decide whether these symptoms are due to occupational burdens or not. The questions of burnout questionnaires mix symptom assessment and causal attribution. Burnout questionnaires thus do not measure objective work-related burdens and their consequences, but subjective perception of symptoms and subjective causal attributions! From a methodological point of view, it would therefore not be permissible to conclude from high rates of burnout directly to objective overload or health-endangering working conditions.

> For example, a quarter of Bavarian students becoming a teacher have "burned out" before they were even confronted with real teaching experience. It would be appropriate to offer these students already stress management training during their study program (27, 33).

The standard in the everyday life of current burnout research is to question circumscribed groups with the MBI or another burnout-instrument. In each case, it is hypothesized that these very groups are particularly burdened, which is then usually confirmed in a differentiated form. Traditionally, social professions, particularly teachers and physicians, continue to be at the center of this internationally driven research interest. Over the last 15 years, many investigations have been published about burnout among teachers (34–40) and physicians (41, 42). Often the researchers themselves are members of the profession which has been investigated: All of the studies on burnout by doctors cited in this article come from employees of medical institutes; half of the cited studies on teacher health are done by employees of educational institutes, the others by employees of institutes in the mental health framework (focusing on a relevant study population that is claimed to be particularly vulnerable to burnout). The fact that the selection of the respective study population is not coincidental and ultimately also involves (professional) political aspects is scientifically difficult and should be taken into account when interpreting them.

For several years, causes of burnout and possible correlation to neurophysiological parameter has been investigated (43, 44). The findings are heterogeneous, and a practice-relevant summary is difficult. The patterns associated with burnout in a group comparison of those less afflicted (parallel control group), point to chronic stress. Some of the results are similar to those obtained in depressed patients, others are not. The samples are usually small and almost always–in terms of professional group, etc.–selective. As long as the burnout criteria are vague, even with subtle neuropsychological methods, no groundbreaking results can be achieved: Depending on the (design of the) study different aspects of chronic stress and depression are measured. "Large prospective cohort studies examining both conditions in parallel rigorously controlling for confounders are required to further elucidate the differences and similarities of the HPA axis in MDD and the burnout syndrome," as quoted by a leading group of scientists in this field (44), for the reasons mentioned, cannot lead to further results.

Social Science Perspective

In postmodern society and the world of work, individual social ties and security (45), technical and social (including the half-life of knowledge content and values) are demanding and stressing the individual (46, 47). With regard to property and power structures, Zygmunt Bauman characterized these phenomena with the term "liquid modernity" (48). From this perspective, burnout is impressive as a logical consequence of the performance-based company that has reached its limits. Academic social scientists diverge strongly in terms of their perspective and weighting of individual factors: to bring the effects of postmodernism on the individual to a certain extent reflected in burnout (49). To what extent this promotes a differentiated social scientific discourse, has to be clarified within the researchers' community.

Burnout-Affected Perspective

Herbert Freudenberger, although he was a psychological psychotherapist himself, wrote his first essay on the subject, published in 1974, from the perspective of those affected. He was able to flee Germany from the Holocaust, went to New York, studied psychology and worked as a psychotherapist. He worked more than 10 h a day to earn enough money for his family. After this, at night, he worked as a volunteer for socially disadvantaged people. In the face of such working hours, he experienced burnout at first hand. He wrote the famous first essay being apparently unaware concerning his very own biographical motives behind his destructive working behavior (a) security at any price for his family and (b) to support young people, because he himself had been in a similar situation after leaving Germany during the war. Freudenberger (1) was convinced that he had no "neurosis." And he was convinced that people with burnout do not need a therapist but better working conditions. As a psychotherapist he was an expert. But he experienced and published papers on burnout from the perspective of a person concerned, i.e., as a patient! The picture of a burned-out house fit his concept, (exhaustion, physical complaints, etc.). Burned out: that is exactly how he felt. Expert standards, objectivity and reliability were irrelevant to Freudenberger's burnout-feelings. Burnout was and is individually "discovered" and "suffered" by those affected. The expert perspective on burnout is secondary, attempting to meet the feelings of the "affected person" and at the same time to meet the internal standards of his discipline. In practice this cannot work.

When Expert Perspectives Get Mixed Up

If authors unthinkingly switch from their primary to other burnout perspectives, it becomes methodically critical: therapists become social scientists, boldly criticizing societal aberrations. Psychologists who misunderstand burnout as a diagnosis build on neurophysiological research. Social scientists argue that

Burnout is a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed. It is characterized by three dimensions:

- feeling of energy depletion or exhaustion;
- increased mental distance from one`s job, or feeling of negativism or cynicism related to one`s job; and
- reduced professional efficacy.

Burnout refers specifically to phenomena in the occupational context and should not be applied to describe experiences in other areas of life."

FIGURE 3 | ICD-11 for mortality and morbidity statistics (54).

burnout is a stress-related disease (50). Conversely, it is like in the fairy tale "The Emperor's New Clothes": no matter which expert's perspective you consider in terms of burnout, as soon as you do so in a naively critical way, it becomes obvious that the emperor is naked. Moreover, the unabated popularity of the burnout paradigm is surprising. It is precisely this constellation that characterizes the burnout research itself, as it were, "burned out": if the respective perspective of an author on the topic is not explicated, another 15,000 publications will not lead to a sustainable burnout concept. The background to the persistently high popularity of the burnout phenomenon is foreseeable complex. Perhaps most important: a concise, immediately understandable picture is used. Since the symptoms are unspecific, practically everyone can identify with burnout, the socio-political implications are far-reaching, among other things (as discussed in the following section). The dimension, which ultimately affects everyone themselves, and the breadth of the term apparently make a scientifically abstract approach to the topic fundamentally difficult.

BURNOUT: A SELF-CONCEPT!

Why is there no definition of burnout that is capable of consensus in the sense of scientific criteria? Why, despite excessive research in this area (>15,000 publications), has it not been possible to develop a workable concept in this regard? Ultimately, Herbert Freudenberger answered this question in his first essay on the subject, published in 1974: *"Anyone who has ever seen a burned-out house knows how devastating it looks"*. Freudenberger associated a concise picture to characterize his state of health (51). Any attempt to question this image inevitably leads to–scientifically speaking–untenable dimensions. If burnout was taken literally it would be a process that ultimately leads to destruction of nerve cells. Neurophysiological findings indicate that there may be abnormalities (52, 53). However, substantial brain damage looks different. At the same time, burnout postulate that exhaustion manifests itself in work-related contexts rather than in private life (ICD-11—**Figure 3**). This reflects the area in which burnout has been located in the past decades, based on a "working population" who preferably experiences stress there.

But why and how should professional, not private stress lead to burnout or specific damage (to the brain)? Or is burnout a dissociative disorder? Old fashion established hypothesis that burnout only meets particularly committed persons (55) are disrespectful and not acceptable! As already mentioned, considerations of this kind, which would be important from an expert's perspective, play no role in subjective perturbation models. Speaking at a Burnout Support Group meeting, a spokesperson summed it up: *"I do not care how experts define burnout, I know what it is, I feel it."*

Finally, the following aspects determine burnout as a self-concept:

- symptoms become causally understandable, referring to models that are established in the respective social group (*"too much work, the batteries are empty"*).
- emotional relief: "the pointer of guilt" does not point to oneself but to the circumstances, work overload, a bad boss, the company, the negative developments in the working world.
- problems can be communicated with poor risk of stigmatization, respectively, with some aspects of self-increasing values.
- and, last but not least, burnout ideas provide a guide to treatment and all that the patient desperately needs: stress reduction, support, recovery, etc. hoping that an early retirement can be averted.

> *"There is nothing left. I was much more committed than others. I need to rest. I have to pay attention to myself... I just burned out" - that's why I fell ill with burnout.*

Burnout is a currently convincing subjective disorder model. No more but no less. Burnout is more than a "fashion diagnosis" and points out that the DSM/ICD approach bypasses patient needs.

True	not et all	hardly	a little	quite	much
I feel exhausted (Gefühl "ausgebrannt" zu sein)	1	2	3	4	5
I suffer from a burnout syndrome Experienced Burnout ("Burnout Erleben")	1	2	3	4	5

FIGURE 4 | Burnout self-identification questionnaire.

A DSM/ICD-10/11 diagnosis says someone has the symptoms he reported and does not provide any additional information regarding causes, prognosis and therapy. In view of this, it is not surprising that people who experience themselves at the limit of their resilience in the face of professional and other stresses find themselves appropriately in the concise image of "burnout." And burnout questionnaires? As discussed above, they capture a mixture of symptom experience together with burnout self-identification, such as *"I feel drained from my work"* (MBI). As long as the majority of the population experiences work stress, many symptoms will be explained spontaneously as caused by stress (56). The burnout-Emperor (we have met him already in the fairy tale), does not have any clothes but a highly cotemporary image.

Burnout Experience and Depression

The fact that burnout is genuinely a subjective disorder model does not mean that this cannot be a subject of empirical research. Burnout is a subjective "disturbance model" and can be examined as such. Practically, burnout-self-identification has to be asked for directly. This was realized as part of a large online survey ("Stress Monitor Project") (57). On behalf of a company health insurance fund, an instrument was developed which was also used in a project with the Bavarian civil service. Currently, more than 40,000 data sets are available. In addition to basic social and occupational data, the stress monitor includes a screening sheet (Depression, anxiety disorders and stress: DASS) (58). In addition, the gratification experience is recorded (59). Self-identification with the terms burnout and "ausgebrannt"—the German terms for burnout—were asked for in the survey conducted in Germany (**Figure 4**) [for a methodically similar approach to capture burnout see (26), an overlap in terms of memory bias (60)]. After entering the data (processing time 5–9 min.) the participants immediately receive personal feedback. The client receives an anonymized summary at defined times.

About every second person who feels affected with burnout, but only one in five who feels "ausgebrannt" meets the screening criteria for depression (the results are similar in relation to panic disorder) (**Figure 5**).

Obviously, from the perspective of German interviewees, the term burnout is more than a translation of "ausgebrannt." For German people burnout is perceived as a "technical term." Because of this, people who feel more serious affected, tend to come closer to what the expert understands as "depression." If the stress monitor data are differentiated according to occupational groups there are clear differences regarding the burnout-identification patterns. This is how, for example, teachers feel more burdened occupationally than employees in a large electrical company, but at the same time experience less burnout. As expected with a subjective model of perturbation, patterns communicated in society, the media, and the respective reference group have an influence on whether and how perturbation models are experienced as individually appropriate and are referred to as discomfort. Overall, with significantly varying, all conceivable constellations can be found: Depressed subjects who experience themselves as "ausgebrannt" and not burned out, non-depressive who experience burnout and not as "ausgebrannt" (rare) etc.

Summary and Scientific Perspectives

Burnout *per se* only works as subjective model of disruption. Used as medical or psychotherapeutic expert category, burnout remains a blurred, natural-scientifically useless "diagnosis." Burnout cannot be reliably and validly diagnosed. Notwithstanding the image of burnout is apparently so self-evident that it immunizes some experts against burnout-relativizing arguments. If it were accepted that burnout is a subjective phenomenon and could not been captured in DSM/ICD diagnoses or in a quasi-scientific category, the burnout discussion would have lost some of its attraction but

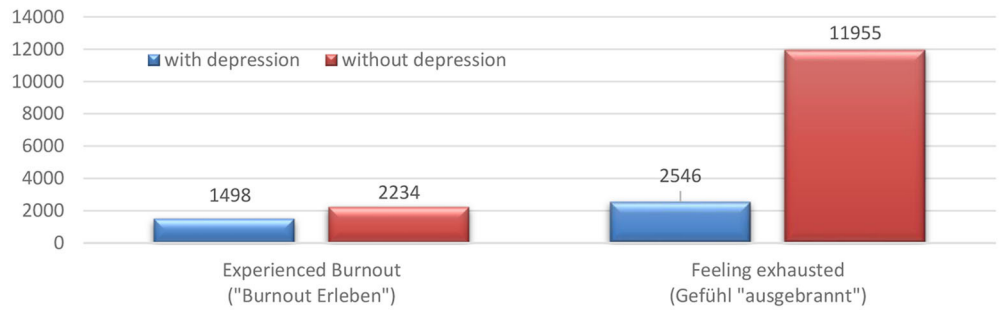

FIGURE 5 | Depression incidences experienced burnouts vs. feeling exhausted (57, 61).

gained some medical-therapeutic basis. The attempt of some experts to refer burnout solely to professional work in the ICD-11 (**Figure 3**) obviously obscures large parts of the discussion outlined here and will not be successful because burnout is the experience of those affected.

As explained, burnout was and is genuinely a subjective disorder model that, due to its conciseness and public reputation, has been "adopted" in the course of various scientific disciplines, from industrial and organizational psychology to psychiatry. From the point of view of the history of science, it is remarkable that a scientific paradigm, the stress model developed by Hans Selye, was transferred from "those affected" to a problem constellation that is diffuse in terms of symptoms, but frequent in the social context of achievement societies, in order to address them in the given social context to make it understandable and manageable. Seen in this way, burnout is a modern variant of lay models that have by no means lost their function due to the successes of medicine and psychotherapy (62, 63), but rather develop dynamically, reflecting current scientific paradigms, and vice versa have a retroactive effect on–supposedly purely scientific–paradigms. In the context of the discussion about disorder and disease models (64–66), appropriate consideration of this dynamic aspect of the relevant terms would be important; The conceptualization of personalized medicine will foreseeably become even more complex as a result (67).

The burnout burden of students has been intensively researched for several years (37, 68, 69). Surprisingly, high school students measured by the MBI in a student-version (70) experience significantly more burnout than students at University (71, 72). Students who do not know which occupation they want to take later feel considerably (and statistically significantly) more burned out than those who named specific career goals. In such cases, which are becoming increasingly common in postmodern societies, burnout therapy would not reduce the amount those affects allowing them to recover, but rather to enable them to clarify their perspectives (business coaching might have positive effects) (73, 74).

The MBI relationships with depression and workload must be interpreted to be pseudo-correlations already created in the item texts. Based on empirical data, neither the risk status model of DGPPN nor a categorical separation of burnout and depression postulating concepts can be confirmed. There are intersections but also discrepancies between the expert (depression) and the burnout-affected perspectives, whereby the affected person's perspective is highly socio-culturally determined. The discrepancies could only be resolved if either experts unconditionally took over the patient's perspective (*"Everyone who feels burned out is burned out!"*). This would have advantages: patients would feel understood and experience therapists as competent and empathetic. Alternatively, experts could deny the patient's competence to feel burnout, according to the motto: *"I decide based on defined criteria whether you have burnout or not*!," what is of course non-sense. Both scenarios would be grotesque. Therefore, it is important to understand, why burnout occurs and what the patient's perspective is toward his/her situation and future perspective as well as the environment. It is necessary to support people with burnout by coaching (10, 75) and guiding them on the one hand and with medical/psychological/psychiatric aid on the other hand to establish whether manifest depression or other disease could have been diagnosed.

Burnout is neither an independent diagnosis nor a risk stage. It is a "subjective disorder model" and as such belongs to a fundamentally different category than diagnoses conceptualized from an expert's perspective. Burnout reflects the experience of symptoms of any kind, which are experienced as a result of overload, especially in the professional field. The relevant individual criteria depend, among other aspects, on the social and occupational group-specific framework conditions of an individual. On the other hand, an assessment of whether the same individual is at risk of health or sick is done from an

expert perspective. There are overlaps between the experience of the affected and expert assessments. However, there cannot be "transitions" or "intermediate stages" simply because there are different perspectives, which in turn are based on different framework conditions and criteria. Experts' perspectives are hypotheses that can be right or wrong. Perspectives of affected persons are correct *per se*, they correspond to a subjective location without explicit criteria, which can fluctuate depending on the changing context.

The burnout experience, meaning and importance within society underlies a change of the socio-cultural environment. However, from our point of view, it makes no sense to continue researching a conceptualization of burnout as a diagnosis. It is a subjective phenomenon whose value lies in the better acceptance of psychological limitations by those affected. Burn-out can therefore contribute to de-stigmatization and facilitate access to therapy for those affected. In addition, burnout reflects negative developments in the world of work and society. As a socio-scientific and science-historically, exciting phenomenon it should be further explored and discussed as such.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

AH conceptualized and wrote the manuscript. AA and UV contributed with critical discussion, literature search and improving the final version of the manuscript. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

The authors cordially thank the editors of the magazine Prof. Dr. Elisabeth Schramm, Prof. Claas Lahmann, Prof. Undine Lang and Dr. Ing. Christine Allwang for their initiative and support.

REFERENCES

1. Freudenberger HJ. Staff burn-out. *J Soc Issues.* (1974) 30:159–65.
2. Schaufeli, WB, Buunk, BP. Burn-out: an overview of 25 years of research theorizing. In: Marc Schabracq J, Jacques Winnubst AM, Cooper CL, editrs. *(Hrsg.): The Handbook of Work and Health Psychology. 2. Auflage*. John Wiley & Sons: Chichester. (2003). p. 382–425. doi: 10.1002/0470013400.ch19
3. Hillert A, Marwitz M. *Die Burn-out-Epidemie. Oder: Brennt Die Leistungsgesellschaft aus*? München: Beck (2006).
4. Burisch M. *Das Burn-Out-Syndrom. Theorie der Inneren Erschöpfung (5. Aufl.)*. Heidelberg: Springer. (2014). p. 14–78. doi: 10.1007/978-3-642-36255-2
5. Maslach C, Jackson SE, Leiter MP. *Maslach Burn-Out Inventory Manual*, 3rd Edn. Palo Alto: Consulting Psychologists Press. (1996).
6. Albrecht A, Hillert A, Albrecht E. Burnout: Coaching versus Psychotherapie PiD. *Psychother Dialog*. (2018) 19:80–4. doi: 10.1055/a-0556-2563
7. Spitzer RL, Endicott J, Robins E. Clinical criteria for psychiatric diagnosis DSM-III. *Am J Psychiatry*. (1975) 132:1187–92. doi: 10.1176/ajp.132.11.1187
8. Spitzer RL. Values and assumptions in the development of DSM-III and DSM-III-R: an insider's perspective and a belated response to sadler, Hulgus, and Agich's "On values in recent American psychiatric classification. *J Nervous Ment Dis*. (2001) 189:351–9. doi: 10.1097/00005053-200106000-00002
9. Burisch M. (2001). Available online at: https://www.socialnet.de/lexikon/Burnout-Syndrom (accessed October 14, 2020).
10. Albrecht E. *Business Coaching*. Boston: Walter de Gruyter. (2018). p. 26–37. doi: 10.1515/9783110353389
11. Siegrist J. The effort-reward imbalance model. *Occupat Med State Art Rev*. (2000) 15:83–87.
12. Schmitz E, Leidl J. Brennt wirklich aus, wer entflammt war? Eine LISREL-analyse zum burn-out-prozess bei sozialberufen. *Psychol Erziehung Unterricht*. (1999) 45:129–42.
13. Wright J. Stress in the workplace: a coaching approach. *Work*. (2007) 28:279–84.
14. Aronsson G, Theorell T, Grape T, Hammarström A, Hogstedt C, Marteinsdottir I, et al. A systematic review including meta-analysis of work environment and burn-out symptoms. *BMC Public Health*. (2017) 17:264. doi: 10.1186/s12889-017-4153-7
15. Shoji K, Cieslak R, Smuktunowicz E, Rogala A, Benight C, Luszczynska A. Associations between job burn-out and self-efficacy: a meta-analysis. *Anxiety Stress Coping*. (2016) 29:367–86. doi: 10.1080/10615806.2015.1058369
16. Korczak D, Kister C, Huber B. *Differentialdiagnostik des Burn-out-Syndroms. Schriftenreihe Health Technology Assessment (HTA) in der Bundesrepublik Deutschland (Bd. 105)*. Köln: Deutsches Institut für Medizinische Dokumentation und Information (DIMDI). (2010).
17. Koch S, Lehr D, Hillert A. *Burn-out und Chronischer Beruflicher Stress*. Göttingen: Hogrefe. (2015). doi: 10.1026/02650-000
18. Leiter MP, Durup J. The discriminant validity of burn-out and depression. *Anxiety Stress Coping*. (1994) 7:357–73. doi: 10.1080/10615809408249357
19. Wurm W, Vogel K, Holl A, Ebner C, Bayer D, Morkl S, et al. Depression-burn-out overlap in physicians. *PLoS ONE*. (2016) 11:e0149913. doi: 10.1371/journal.pone.0149913
20. Bianchi R, Schonfeld IS, Laurent E. Burn-out symptoms: depressive manifestations under psychosocial labels? *Asia Pac Psychiatry*. (2017) 9:187–202. doi: 10.1111/appy.12280
21. Melnick ER, Powsner SM, Shanafelt TD. In reply—defining physician burn-out, and differentiating between burn-out and depression. *Mayo Clin Proc*. (2017) 92:1456–8. doi: 10.1016/j.mayocp.2017.07.005
22. Schulz P. *Burn-Out Oder Depression? Wie Sich Entstehung, Prävention und Therapie Beider Störungen Unterscheidet*. Lengerich: Pabst (2017).
23. Deutsche Gesellschaft für Psychiatrie, Psychotherapie und Nervenheilkunde (Hrsg.): Positionspapier der Deutschen Gesellschaft für Psychiatrie, Psychotherapie und Nervenheilkunde (DGPPN) zum Thema Burn-out. Berlin. (2012). Available online at: https://www.dgppn.de/_Resources/Persistent/7e810b2fd033c8a7d0b13479dc516ad310e11fa1/2012-09-12-dgppn-positionspapier-migration.pdf
24. Lohmann-Haislah A. *Stressreport Deutschland. Psychische Anforderungen, Ressourcen und Befinden*. Dresden: Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund. (2012).
25. Mariotti A. The effects of chronic stress on health: new insights into the molecular mechanisms of brain-body communication. *Future Sci OA*. (2015) 1:FSO23. doi: 10.4155/fso.15.21
26. Rohland BM, Kruse GR, Rohrer JE. Validation of a single-item measure of burn-out against the maslach burn-out inventory among physicians. *Stress Health*. (2004) 20:75–9. doi: 10.1002/smi.1002
27. Hillert A, Marwitz M. *Die Burn-Out-Epidemie. Oder: Brennt Die Leistungsgesellschaft Aus*? München: Beck. (2006). p. 100–123.
28. Pines AM, Aronson E, Kafry D. *Burn-Out: From Tedium to Personal Grow*. New York, NY: Free Press. (1981).
29. Kristensen TS, Borritza M, Villadsen E, Christensen KB. The copenhagen burn-out inventory: a new tool for the assessment of burn-out. *Work Stress*. (2005) 19:192–207. doi: 10.1080/02678370500297720

30. Milfont TL, Denny S, Ameratunga S, Robinson E, Merry S. Burn-out and wellbeing: testing the copenhagen burn-out inventory in New Zealand teachers. *Soc Indicat Res*. (2007) 89:169–77. doi: 10.1007/s11205-007-9229-9
31. Hillert A, Marwitz M. *Die Burn-Out-Epidemie. Oder: Brennt Die Leistungsgesellschaft Aus*? München: Beck. (2006).
32. Maslach C, Leiter MP. Understanding the burn-out experience: recent research and its implications for psychiatry. *World Psychiatry*. (2016) 15:103–11. doi: 10.1111/j.1540-4560.1974.tb00706.x
33. Hillert A. *Burnout: Zeitbombe oder Luftnummer? Persönliche Strategien und Betriebliches Gesundheitsmanagement Angesichts Globaler Beschleunigung*. Stuttgart: Schattauer. (2014).
34. Hakanen JJ, Bakker AB, Schaufeli WB. Burn-out and work engagement among teachers. *J Sch Psychol*. (2006) 43:495e513. doi: 10.1016/j.jsp.2005.11.001
35. Skaalvik E, Skaalvik S. Teacher self-efficacy and teacher burn-out: a study of relations. *Teach Teacher Educ*. (2010) 26:1059–69. doi: 10.1016/j.tate.2009.11.001
36. Kutsal D, Bilge F. A study on the burn-out and social support levels of high school students. *Educ Sci*. (2012) 37:283–97.
37. Kadi A, Ferda Beytekin O, Arslan H. A research on the burn-out and the teaching profession attitudes of teacher candidates. *J Educ Train Stud*. (2015) 3:2:107–13. doi: 10.11114/jets.v3i2.677
38. Gluschkoff K, Elovainio M, Kinnunen U, Mullola S, Hintsanen M, Keltikangas-Järvinen L, et al. Work stress, poor recovery and burn-out in teachers. *Occup Med*. (2016) 66:564–70. doi: 10.1093/occmed/kqw086
39. Lauermann F, König J. Teachers professional competence and wellbeing: understanding the links between general pedagogical knowledge, self-efficacy and burn-out. *Learn Instr*. (2016) 45:9–19. doi: 10.1016/j.learninstruc.2016.06.006
40. Arvidsson I, Leo U, Larsson A, Håkansson C, Persson R, Björk J. Burn-out among school teachers: quantitative and qualitative results from a follow-up study in southern Sweden. *BMC Public Health*. (2019) 19:655. doi: 10.1186/s12889-019-6972-1
41. Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of burn-out among physicians: a systematic review. *JAMA*. (2018) 320:1131–50. doi: 10.1001/jama.2018.12777
42. Dyrbye LN, Burke SE, Hardeman RR, Herrin J, Wittlin NM, Yeazel M, et al. Association of clinical specialty with symptoms of burn-out and career choice regret among US resident physicians. *JAMA*. (2018) 320:1114–30. doi: 10.1001/jama.2018.12615
43. Bellingrath S, Kudielka BM. Psychobiological pathways from work stress to reduced health: naturalistic experimental studies on the model of effort-reward-imbalance. In: Siegrist J, Wahrendorf M, editors. *Work Stress and Health in a Globalized Economy - The Model of Effort-Reward Imbalance*. Berlin: Springer. (2016). p. 145–70.
44. Rothe N, Steffen J, Penza M, Kirschbaum C, Walther A. Examination of peripheral basal and reactive cortisol levels in major depressive disorder and the burnout syndrome: a systematic review. *Neurosci Biobehav Rev*. (2020) 14:232–70. doi: 10.1016/j.neubiorev.2020.02.024
45. Sennett R. *Der Flexible Mensch. Kultur des Neuen Kapitalismus (= The Corrosion of Character. New York: W.W: Norton 1998)*. Berlin: Berlin Verlag. (1998).
46. Rosa H. *Beschleunigung. Die Veränderung der Zeitstruktur in der Moderne*. Frankfurt am Main: Suhrkamp. (2012).
47. Hillert A. *Gebrauchsanweisung für das Leben in der Postmoderne*. Stuttgart: Schattauer/Klett-Cotta. (2019).
48. Bauman Z. *Liquid Life*. Cambridge: Polity Press. (2005).
49. Ehrenberg A. *Das erschöpfte Selbst. Depression und Gesellschaft in der Gegenwart. Frankfurt am Main: Suhrkamp* (La Fatigue d'être soi – dépression et société, 1998). Paris: Odile Jacob. (2008).
50. Rosa H. *Beschleunigung. Die Veränderung der Zeitstruktur in der Moderne*. Frankfurt Main: Suhrkamp. (2012).
51. Freudenberger HJ, Richelson G. *Burnout: The High Cost of High Achievement*. New York, NY: Anchor Press. (1980).
52. Bellingrath S, Kudielka BM. Psychobiological pathways from work stress to reduced health: naturalistic experimental studies on the model of effort-reward-imbalance. In: Siegrist J, Wahrendorf M, editors. *Work Stress and Health in a Globalized Economy - The Model of Effort-Reward Imbalance*. Berlin: Springer. (2016). p. 145–70.
53. Verhaeghe J, Van Den Eede F, van den Ameele H, Sabbe B. Neuro-endocrine correlates of burnout. *Tijdschr Psychiatr*. (2012) 54:517–26.
54. ICD-11 for Mortality and Morbidity Statistics Version 04/2019: Available online at: https://www.who.int/mental_health/evidence/burnout
55. Schmitz E, Leidl J. Brennt wirklich aus, wer entflammt war? Eine LISREL-analyse zum burn-out-prozess bei sozialberufen. *Psychol Erziehung Unterricht*. (1999) 45:129–42.
56. Lohmann-Haislah A. *Stressreport Deutschland. Psychische Anforderungen, Ressourcen und Befinden. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin*. Dresden: Dortmund. (2012).
57. Hillert A, Bäcker K. Burn-out - a fashionable term or an illness concept? Background and data from the "Stress Monitor" project. *JATROS Neurol Psychiatr*. (2015) 2:24–7.
58. Antony MM, Bieling PJ, Cox BJ, Enns MW, Swinson RP. Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales (DASS) in clinical groups and a community sample. *Psychol Assess*. (1998) 10:176–81. doi: 10.1037/1040-3590.10.2.176
59. Siegrist J, Wege N, Pühlhofer F, Wahrendorf M. A short generic measure of work stress in the era of globalization: effort-reward imbalance. *Int Arch Occup Environ Health*. (2008) 82:1005–13. doi: 10.1007/s00420-008-0384-3
60. Bianchi R, Laurent E, Schonfeld IS, Bietti LM, Mayor E. Memory bias toward emotional information in burnout and depression. *J Health Psychol*. (2020) 25:1567–75. doi: 10.1177/1359105318765621
61. Kiel E, Braun A, Hillert A, Bäcker K, Weiß S. Gratifikation und befindlichkeit – ein berufsgruppenvergleich von verbeamteten lehrkräften, angestellten im öffentlichen dienst und erwerbstätigen in wirtschaftsunternehmen. *Z Arb Wiss*. (2019) 73:324–36. doi: 10.1007/s41449-019-00159-w
62. Hörmann G. Laienkonzepte von Gesundheit und Krankheit (Lay concepts of health and disease). In: Laaser U, Sassen G, Murza G, Sabo P, editors. *Prävention und Gesundheitsförderung*. Heidelberg: Springer. (1987). p. 21–33. doi: 10.1007/978-3-642-73096-2_3
63. Rüdiger J, Eirmbter WH, Hahn A. Laienvorstellungen von Krankheit und Therapie. Ergebnisse einer bundesweiten Repräsentativbefragung (Lay ideas of illness and therapy. Results of a nationwide representative survey). *Zeitschr Gesundheitspsychol*. (1999) 7:105–19. doi: 10.1026//0943-8149.7.3.105
64. Hadler NM. The illness of work incapacity. *Occup Med*. (2016) 66:346–8. doi: 10.1093/occmed/kqw060
65. Hofmann B. Do health professionals have a prototype concept of disease? The answer is no. *Philos Ethics Humanit Med*. (2017) 12:6. doi: 10.1186/s13010-017-0047-7
66. Seidlein AH, Salloch S. Illness and disease: an empirical-ethical viewpoint. *BMC Med Ethics*. (2019) 20:5. doi: 10.1186/s12910-018-0341-y
67. Vogt H, Hofmann B, Getz L. Personalized medicine: evidence of normativity in its quantitative definition of health. *Theor Med Bioeth*. (2016) 37:401–16. doi: 10.1007/s11017-016-9379-3
68. Dyrbye LN, Thomas MR, Massie FS, Power DV, Eacker A, Harper W, et al. Burn-out and suicidal ideation among U.S. medical students. *Ann Intern Med*. (2008) 149:334–41. doi: 10.7326/0003-4819-149-5-200809020-00008
69. Galán F, Ríos-Santos JV, Polo J, Rios-Carrasco B, Bullón P. Burn-out, depression and suicidal ideation in dental students. *Med Oral Patol Oral Cir Bucal*. (2014) 19:e206–11. doi: 10.4317/medoral.19281
70. Wörfel F, Gusy B, Lohmann K, Kleinber D. Validierung der deutschen kurzversion des maslach-burn-out-inventars für studierende. *Z Gesundheitspsychol*. (2015) 23:191–6. doi: 10.1026/0943-8149/a000146
71. Hillert S, Wörfel F, Weiß S. Exposure and burn-out experience of pupils in the 5th - 10th grade of a bavarian gymnasium. Influence of framework conditions and individual goals. *Präv Rehabil*. (2018) 30:83–90. doi: 10.5414/PRX0528

72. Kutsal D, Bilge F. A study on the burn-out and social support levels of high school students. *Educ Sci.* (2012) 37:283–97.
73. McGonagle AK, Beatty JE, Joffe R. Coaching for workers with chronic illness: evaluating an intervention. *J Occupat Health Psychol.* (2014) 19:385–98. doi: 10.1037/a0036601
74. Grant AM. Solution-focused cognitive-behavioral coaching for sustainable high performance and circumventing stress, fatigue, and burnout. *Consulti Psychol J.* (2017) 69:98–111. doi: 10.1037/cpb0000086
75. Hillert A, Albrecht A. *Burn-out – Stress. Depression. Interdisziplinäre Strategien für Ärzte, Therapeuten und Coaches.* München: Elsevier. (2020).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor declared a past collaboration with one of the authors UV.

frontiers in Psychiatry

ORIGINAL RESEARCH
published: 28 May 2021
doi: 10.3389/fpsyt.2021.510183

Teacher Self-Efficacy and Mental Health—Their Intricate Relation to Professional Resources and Attitudes in an Established Manual-Based Psychological Group Program

*Sophia von Muenchhausen[1], Matthias Braeunig[1], Ruth Pfeifer[1], Anja S. Göritz[2], Joachim Bauer[1,3], Claas Lahmann[1] and Alexander Wuensch[1]**

[1] Department of Psychosomatic Medicine and Psychotherapy, Faculty of Medicine, Medical Center—University of Freiburg, Freiburg, Germany, [2] Occupational and Consumer Psychology, University of Freiburg, Freiburg, Germany, [3] International Psychoanalytic University, Berlin, Germany

OPEN ACCESS

Edited by:
Preethi Premkumar,
London South Bank University,
United Kingdom

Reviewed by:
Reiji Yoshimura,
University of Occupational and Environmental Health Japan, Japan
Veena Kumari,
Brunel University London,
United Kingdom

***Correspondence:**
Alexander Wuensch
alexander.wuensch@uniklinik-freiburg.de

Specialty section:
This article was submitted to Psychological Therapies, a section of the journal Frontiers in Psychiatry

Received: 05 November 2019
Accepted: 06 April 2021
Published: 28 May 2021

Citation:
Muenchhausen Sv, Braeunig M, Pfeifer R, Göritz AS, Bauer J, Lahmann C and Wuensch A (2021) Teacher Self-Efficacy and Mental Health—Their Intricate Relation to Professional Resources and Attitudes in an Established Manual-Based Psychological Group Program. Front. Psychiatry 12:510183. doi: 10.3389/fpsyt.2021.510183

Introduction: Teaching is considered a mentally challenging occupation. Teacher self-efficacy is a personal resource which buffers the experience of stress and may be important in maintaining mental health. The preventive intervention "Manual-Based Psychological Group Program for Teachers" (MBPGPT) was applied and evaluated state-wide to improve the mental health of teachers. This study aims to investigate the intricate relation between teacher self-efficacy and mental health and their changes in the course of the intervention.

Method: Using a single-group pre-/post-design, the relation between teacher self-efficacy and mental health was investigated in 742 teachers. Pre- and post-changes in teacher self-efficacy and their interaction with mental health were examined in a subsample of 171 teachers, who met the conservative inclusion criteria. In ancillary analyses, correlations with underlying changes in work-related behavior and experience patterns were analyzed to better understand the intricate link between teacher self-efficacy and mental health.

Results: Teacher self-efficacy showed a significant, moderate correlation with mental health. Self-efficacy was moderately higher after the intervention than before the intervention, but independent of changes in mental health. Teacher self-efficacy was related to work-related psychological resistance and positive emotions. An increase in teacher self-efficacy was accompanied by an improvement in life satisfaction and distancing ability. A decrease in teacher self-efficacy went hand in hand with reduced experience of social support.

Discussion: This study confirmed teacher self-efficacy as an important, reliable resource and its correlation with psychological resistance. The absence of a control group limits

what causal conclusions can be drawn from the study. Nevertheless, self-efficacy seems to be a worthwhile goal of preventive interventions for teachers and should be promoted due to its wide-ranging implications. Suggestions for further studies and interventions are made.

Keywords: teachers, self-efficacy, mental health, teacher health, prevention, manual-based intervention, work-related behavior and experience patterns

INTRODUCTION

Teaching is a profession characterized by daily emotional interactions and is accompanied by a variety of demands regarding cultural, societal, and social aspects. Teachers are influenced by different role expectations, such as being an educator, mediator, and manager. These roles include coping with a variety of tasks, challenges, and multifactorial demands (1, 2). Consequently, teaching is regarded as a profession with high psycho-emotional stress (2–5). Teachers often experience intense work-related stress which, if experienced chronically, may result in burnout (6). Resignation and exhaustion are higher among teachers compared with other highly psycho-socially demanding professions (7). Ten to Fifteen years ago, ∼30% of German teachers reported burnout symptoms (8–11). In 2005, 60% of German teachers retired early, and among these, 52% retired prematurely due to mental illnesses such as recidivated depression and burnout (12). These rates have remained high: From 2011 to 2013, 9–13% of teachers in the German state of Baden–Württemberg retired early due to health issues, and among these, 55–57% retired prematurely because of mental illnesses and behavioral disorders (13).

The socio-psychological stress in teaching results from structural factors such as time pressure, workload, role conflict, and increasing class sizes (6, 14, 15). Additionally, due to the daily interpersonal interactions, negative experiences in the relationship with students, parents, and colleagues are risk factors (3, 16, 17). Destructive student behavior is one of the most important determinants of teacher health (3, 17, 18). However, positive feedback from students, parents, and colleagues counts as an important resource to prevent mental and physical strain (19). There is a negative correlation between perceived social support and mental health as well as with the number of sick days (20). Moreover, experienced social support decreases the taxing effect of destructive student behavior (ibid.). Thus, the quality of the relationship between teacher and students influences teacher health: A successful teacher–student relationship may reduce the straining effect of destructive student behavior and, thus, mediate the negative relationship between destructive student behavior and teacher health (21). Additionally, a successful teacher–student relationship boosts student performance. Teachers who act in a person-centered and relationship-oriented way create an open learning situation in which students show less defiant behavior and higher commitment, respect, and performance (22).

The Manual-Based Psychological Group Program for Teachers (MBGPT) (23) aims at fostering teacher's competency in relationship-building to maintain their long-term mental and physical health (23, 24). The intervention consists of five modules that focus on how negative and positive relationships affect teacher health: (1) basic knowledge of stress physiology and effects on health parameters, (2) mental attitudes focusing on authenticity and identification, (3) competence in handling relationships with students, (4) competence in handling relationships with parents, and (5) collegiality and social support among the staff (23). A main feature of the intervention is Balint group work [e.g., (25, 26)]. Balint group work fosters the transfer of the perspective of all people who are involved in a discussion of a specific situation; furthermore, it facilitates insight into defective relationship processes and enhances solution-oriented approaches (23). Significant improvements in mental health have been demonstrated in a RCT on teachers who participated in five of ten sessions of the MBPGPT (27, 28). However, for practical reasons the current program has been shortened to six consecutive sessions. There were two versions: Participants could choose between participating in either a compact version with the six sessions delivered over a day and a half or in a version that was stretched out over an extended time period with, e.g., one session a month.

In addition to improving mental health in general (27, 28), the baseline of the assessed health measures was the strongest predictor of health improvement (29). Consequently, teachers who suffered most benefited most from the intervention. Moreover, participating teachers changed work-related behavior and experience patterns (30) as measured by the AVEM inventory ("Arbeitsbezogene Verhaltens- und Erlebensmuster") (31). Teachers whose mental health improved showed a reduced willingness to work until exhaustion, reduced perfectionism, and a reduced tendency for resignation in the face of failure. Moreover, those teachers increased their ability to distance themselves from occurrences in school, their inner calm and balance, and general life satisfaction (30).

The aim of this study was to investigate how the intervention impacted teachers' mental health by exploring correlations with and changes in teacher self-efficacy. General self-efficacy, as part of Bandura's (32) social cognitive theory, is a key element in self-regulated motivational and volitional goal orientation (33). Teacher self-efficacy describes a teacher's confidence in his or her capabilities to successfully carry out goal-oriented, occupation-related activities and to positively influence students' learning behavior (34). The construct of teacher self-efficacy can change depending on personal attributions and environmental circumstances (35). Also, as individual

work-related tasks ask for different competencies, teacher self-efficacy can vary between different task areas and, thus, shows a high specificity (36).

Teacher self-efficacy is a personal resource (37). High teacher self-efficacy protects against occupational and health-related strains (38–40). It correlates positively with work satisfaction (34, 41, 42), engagement (35, 43), occupational commitment (44, 45), a proactive attitude, and school-related activities beyond the school environment (46). Moreover, teacher self-efficacy correlates negatively with stress and the burnout factors leading to reduced personal accomplishment, emotional exhaustion, and depersonalization (38, 46, 47). Along with the health benefits, teachers with high self-efficacy tend to be more efficient (48) and interact more effectively with their students (49). These teachers create an advantageous learning environment where destructive student behavior is reduced (39) and higher student performances may result (50).

Within the modules of the MBOGPT (15), teacher self-efficacy is not explicitly addressed. However, implicit and plausible connections between teacher self-efficacy and the group intervention could be identified. For example, the intervention supports teachers' confidence to actively access resources to feel competent, capable of acting, and goal-oriented. Moreover, the intervention aims at fostering teachers' capabilities for building successful relationships that provide social support, which in turn acts as an important source of teacher self-efficacy (51).

Specifically, we postulated four hypotheses: H1: There is a negative correlation between self-efficacy and mental health (correlational hypothesis). H2: As mental strain decreased pre- and post-intervention by a medium effect (27, 28) and as teacher self-efficacy is thought to protect against mental health impairments, teacher self-efficacy was expected to increase from pre- to post-intervention by a medium effect (growth hypothesis). H3: Along with the finding that teachers who suffered most benefited most from the intervention, baseline self-efficacy negatively predicts the pre-/post-change in teacher self-efficacy (regression hypothesis). H4: Teacher self-efficacy and mental health interact such that the pre-/post-change in mental health influences how teacher self-efficacy changes: Teachers whose mental health had improved post-intervention experienced a stronger growth in their self-efficacy post-intervention than teachers whose mental health did not change or worsened post-intervention (moderation hypothesis).

To better understand the relationship between teacher self-efficacy and mental health, we explored the relationships between teacher self-efficacy and work-related attitudes and behavior patterns as measured by the AVEM inventory (31) in two ancillary analyses. The first ancillary analysis examined how teachers with low, medium, and high self-efficacy differed on AVEM subscales or features before the intervention. The second ancillary analysis examined how and how much (in terms of effect size) particular work-related attitudes and behavior patterns changed as teacher self-efficacy improved or worsened from pre- to post-intervention.

MATERIALS AND METHODS

Sample and Design

The data resulted from the preventive coaching offered to all school teachers in the state of Baden-Württemberg, Germany, by the State Ministry of Culture (Ministerium für Kultur, Jugend und Sport Baden-Württembergs). Teachers who registered for MBPGPT (23) participated in the intervention and its accompanying evaluation study. Recruitment and data collection took place from April 2016 to July 2019, comprising two consecutive school years (2017/2018 and 2018/2019). Within each of the 2 school years, the program ran from October to April. Every group consisted of up to 12 teachers, whereas school principals formed separate groups to prevent conflicts of interest and to respond to their different needs. Licensed psychotherapists with a psychological or medical background delivered the intervention. By means of the manual (23), the psychotherapists presented the theoretical input of each module and facilitated the Balint group work later on.

Teachers who registered for the intervention filled out an online questionnaire before the intervention to measure psychological factors at baseline (t_0) and again 2 weeks after completing the intervention (t_1). No control group existed as the intervention was offered as a preventive program for everybody. Teachers participated voluntarily. To remain anonymous, each teacher generated an individual code according to a given pattern. Across both school years, $N_{t0} = 742$ registered for the intervention and answered the pre-intervention questionnaire. $N_{t1} = 375$ participants remained who answered the post-questionnaire. Both questionnaires were matched by the teacher-generated code and their sex. Furthermore, other sociodemographics were examined with filters to ensure that all data were matched correctly. High standards for inclusion in the pre- and post-analyses were applied: participation in at least five out of six sessions or, alternatively, the full-day seminar plus submitted data from both pre- and post-questionnaire. A total of $n = 172$ teachers met the inclusion criteria for the pre- and post-analyses. For an overview of the phases of data assessment and analyses, see **Figure 1**.

The subgroup of the 172 teachers differed from the 742 teachers who had participated at t_0: The subgroup was older and had a higher percentage of elementary school teachers and a higher percentage of part-time teachers. However, they were comparable in the fraction of principals and in their family status. Moreover, the key variables teacher self-efficacy (TSE), $t_{\mathrm{TSE}}(740) = -0.72$, $p = 0.4$, and GHQ-12 (general mental health) did not differ, $t_{\mathrm{GHQ-12}}(740) = 0.63$, $p = 0.52$.

Within the subsample of 172 teachers, 142 were women (82.6%). The age category "55 years and older" was most frequent with 48 teachers (27.9%), followed by the age category "45–49 years" with 43 teachers (25%). The age category "under 35 years" was least frequent with 13 teachers (7.6%). The teachers had taught 16.5 years on average. The majority (141) was in a relationship (82%), and 116 teachers were married (67.4%). Most teachers (52) taught in elementary school (34.9%), 34 in professional school (19.8%), 29 in junior high school (16.9%), 26 in high school (15.1%), 17 in special needs education

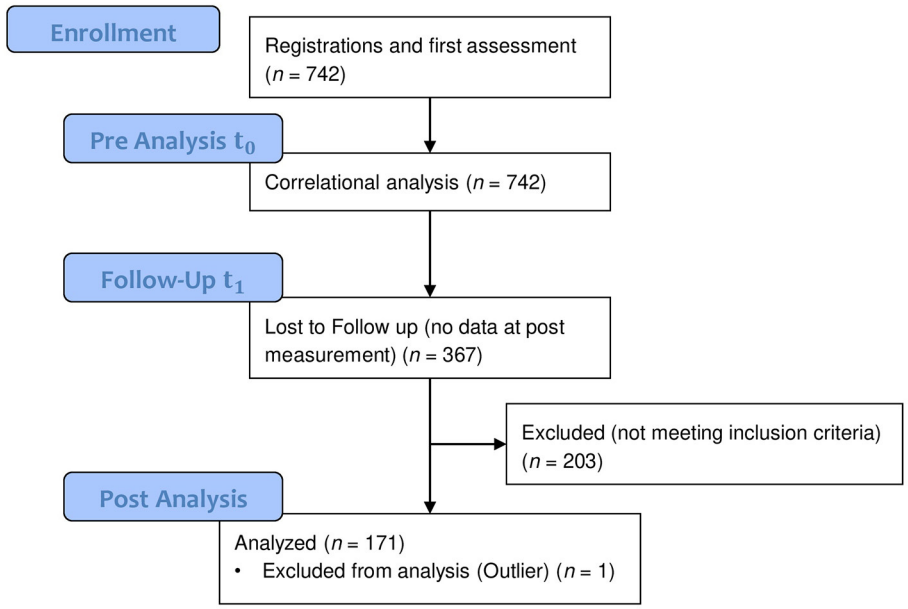

FIGURE 1 | Phases of data assessment and analyses.

school (9.9%), 5 in community school (2.9%), and 1 in school kindergarten (0.6%). Nearly half of the teachers (82) were employed full time (47.7%), about one third (53) were employed part-time at 50–75% (31.4%), 24 taught part-time at >75% (14%), and 12 taught part time at <50%. Among the participants, 21 were school principals (12.2%).

Measures

Data were collected on teacher self-efficacy, general mental health, work-related attitudes, behavior patterns, and sociodemographics.

Teacher Self-Efficacy

TSE was measured with LehrWirk (54). This inventory consists of 10 items that are answered on a four-point scale (1 = does not apply to 4 = does apply very much) and capture teacher self-efficacy as a general, one-dimensional construct. Sample items are as follows: "I am certain that I can build a good relationship even with the most problematic students" and "Even if my lessons are disturbed, I am certain to maintain inner calmness." The inventory is based on four competency demands within the teaching profession: social interaction, expectations on performances, handling of emotions, and innovation. Internal consistency varies between $\alpha = 0.76$ and 0.82 (54). A 3-year retest reliability varies between $r_{tt} = 0.65$ and 0.61 (54). In the present study, internal consistencies were $\alpha = 0.79$ at t_0 and $\alpha = 0.81$ at t_1.

General Mental Health

The German version of the General Health Questionnaire (GHQ-12) (55) was administered. GHQ-12 is a screening instrument and measures the current mental health status by one general factor. It shows a reliability of $\alpha = 0.89$ (56). WHO studies confirmed the validity of the GHQ-12 as a screening instrument (56, 57). GHQ-12 allows dichotomizing the score at a cutoff value ≥4: A GHQ-12 score ≥4 indicates a mental health status at risk, while a score < 4 indicates good mental health status (57).

Work-Related Behaviors and Experience Patterns

Work-related behavior and experience patterns (AVEM) were measured using the AVEM-44 scale (31). This short version of the AVEM includes 11 subscales with four items each that are answered on a five-point scale (1 = applies completely, 5 = applies not at all). The subscales or AVEM features are as follows: (1) subjective importance of work (BA), (2) professional ambition (BE), (3) willingness to work to exhaustion (VB), (4) striving for perfection (PS), (5) distancing ability (DF), (6) tendency for resignation in the face of failure (RT), (7) proactive problem-solving (OP), (8) inner calm and balance (IR), (9) experience of success at work (EE), (10) general life satisfaction (LZ), and (11) experience of social support (SU). The first four features represent the resource work commitment, 5–8 indicate the resource psychological resistance, and the last three features capture the resource emotions. Normed scales with stanine values ($M = 5$, SD = 2) are available for German teachers. AVEM-44 shows good internal consistency for all 11 subscales (α = 0.76–0.83). The stability is lower due to the subscales' variability regarding time and context. Therefore, AVEM-44 is a reliable measure as well as sensitive toward changes.

Data Analyses

Analyses were performed using IBM SPSS Statistics 25 and PROCESS macro 3.3 (53). Prior to the analyses, the data were

investigated descriptively to examine the statistical assumptions and identify potential outliers. The distributions of the data within the variables were non-normal, except for teacher self-efficacy at t_0. Therefore, mostly nonparametric tests were used [cf. (58)]. One outlier was identified whose self-efficacy worsened dramatically. A screening of the other variables revealed that this person also reported worsening of her already at-risk mental health status as well as her work-related attitudes, and behavioral patterns worsened. Because the group program is designed as a preventive intervention and has been proven to foster teacher's health, we concluded that the explanation for the person's reports lies elsewhere. Therefore, this case was excluded from the analyses, and the pre-/post-sample reduced to $n = 171$.

To test the correlational hypothesis H1, we correlated GHQ-12 and teacher self-efficacy at both measurement points. To test the growth hypothesis H2, Wilcoxon signed-rank tests with dependent samples were conducted to test pre- and post-changes in teacher self-efficacy. To test the regression hypothesis H3, we first calculated an indicator of the pre-/post-change in teacher self-efficacy (δTSE), which was the difference between measurement t_1 and t_0 (δTSE = TSEt_1 – TSE$_{t0}$). The higher the value of δTSE, the higher the improvement in self-efficacy throughout the intervention. Next, we regressed δTSE on self-efficacy at t_0 (TSE$_{t0}$). To test the moderation hypothesis H4, which postulates that a change in mental health has an effect on the relationship between teacher self-efficacy t_0 and pre-/post-change in teacher self-efficacy, we first calculated an indicator of the change in mental health (δGHQ), which was the difference between GHQ-12 pre- and post-intervention (δGHQ = GHQ-12t_1 – GHQ-12t_0). Because lower values of GHQ-12 indicate a better mental health status, δGHQ was negative if a participant improved his or her mental health status throughout the intervention. With PROCESS (53), the multiplicative term (δGHQ × TSE$_{t0}$) was entered to test the moderating effect of the change in mental health. To ensure homoscedasticity, PROCESS uses heteroskedastic robust standard deviations (Huber–White). To investigate the form of the moderation, a simple slope test was performed, again using the PROCESS macro 3.0. We analyzed the conditional effects via simple slopes for low (16th percentile), medium (50th percentile), and high (84th percentile) levels of the moderator (δGHQ).

For the ancillary analysis, we performed a discriminant analysis based on all registered teachers before the intervention (t_0) $n = 742$.

In the ancillary analyses, we first grouped the 742 teachers pre-intervention (t_0) according to their self-efficacy at baseline (TSE$_{t0}$): very low (TSE$_{t0} \leq M$ – 2 SD), low (TSE$_{t0} \leq M$ – 1 SD), medium (M – 1 SD < TSE$_{t0}$ < M + 1 SD), high (TSE$_{t0} \geq M$ + 1 SD), and very high (TSE$_{t0} \geq M$ + 2 SD). Based on these levels of self-efficacy at baseline, we calculated means and standard deviations and estimated 95% confidence intervals for each group on each AVEM subscale. Second, we grouped the participants with both pre- and post-data ($n = 171$) according to whether their self-efficacy improved (dTSE $\geq M$ + 1 SD), remained constant (M – 1 SD $\leq$ dTSE $\leq M$ + 1 SD), or deteriorated (dTSE $\leq M$ – 1 SD). Again, based on these levels of change in teacher self-efficacy pre- and post-intervention, we calculated means and standard deviations for each group on each AVEM subscale, separately for t_0 and t_1. Next, we compared the means of t_0 and t_1 and calculated the effect size d for each AVEM subscale to examine how the scores on the subscales changed for each of the three groups.

TABLE 1 | Estimates of the main effect of teacher self-efficacy at baseline measure (TSE$_{t0}$) and the interaction effect of pre-/post-change in mental health (dGHQ) on pre-/post-change in teacher self-efficacy.

Variables	Pre-/post-change in teacher self-efficacy	
	***b* (95% CI)**	**SE *b***
Step 1: simple regression analysis		
Teacher self-efficacy baseline (TSE$_{t0}$)	−0.25** (−0.37, −0.13)	0.06
	$R^2 = 0.091$	
Step 2: moderation analysis		
Teacher self-efficacy baseline (TSE$_{t0}$)	−0.23** (−0.35, −0.10)	0.06
Pre-/post-change in mental health status (dGHQ)	−0.34 (−1.57, 0.89)	0.62
TSE$_{t0}$ × dGHQ	0.01 (−0.03, 0.05)	0.02
	$R^2 = 0.096$	

*TSE$_{t0}$, teacher self-efficacy at baseline measurement; dGHQ, pre-/post-change in mental health status. **$p < 0.001$.*

RESULTS

Correlations and Pre- and Post-changes in Teacher Self-Efficacy

First, at both time points, the higher the teachers' self-efficacy, the better their general mental health (GHQ-12) (t_0: $r_s = -0.285$, $p < 0.001$, t_1: $r_s = -0.270$, and $p < 0.001$). This supports the correlation hypothesis H1. Second, teacher self-efficacy was higher at t_1 (median = 30) than at t_0 (median = 28), $z = 5.81$, $p < 0.001$, and $r = 0.31$. These results support the growth hypothesis H2. The change was medium in size (59). Third, in the regression analysis, teacher self-efficacy at t_0 predicted the pre-/post-change in teacher self-efficacy ($b = -0.253$, 95% CI = −0.37, −0.132, $t = -4.11$, and $p < 0.001$), thus supporting the regression hypothesis H3 (**Table 1**). Fourth, the moderation hypothesis H4 was not supported, as the interaction between teacher self-efficacy at baseline and pre-/post-change in mental health was not significant ($b = 0.01$, 95% CI = −0.03, 0.05, $t = 0.45$, and $p = 0.64$; **Table 1**). The simple slope analysis of the conditional effect for low (16th percentile = −5.48), medium (50th percentile = −1), and high (84th percentile = 1) levels of the moderator (i.e., pre-/post-change in mental health) revealed that as teacher self-efficacy was already fairly high at t_0 (M + 1 SD, TSE$_{t0}$ = 32), it remained the same at t_1, independent of how the mental health status had changed before and after (not shown).

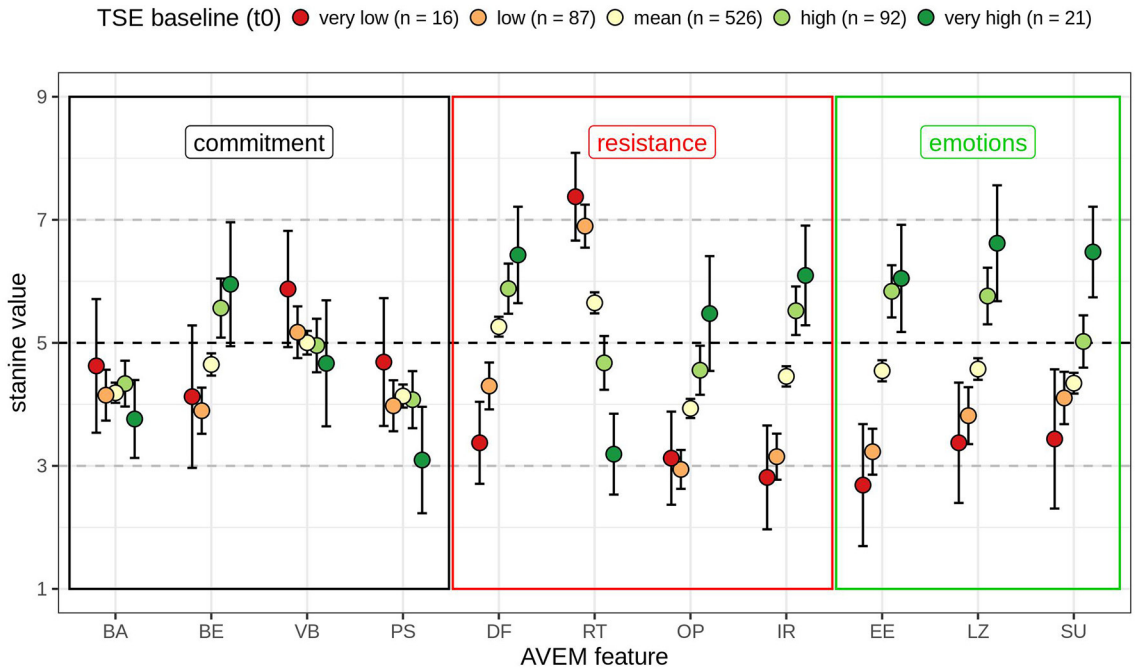

FIGURE 2 | Teacher self-efficacy at t_0 ($N = 742$; very low: $TSE_{t0} \leq M - 2$ SD; low: $M - 2$ SD $< TSE_{t0} \leq M - 1$ SD; mean: $M - 1$ SD $< TSE_{t0} < M + 1$ SD; high: $M < TSE_{t0} \leq M + 1$ SD; very high: $M + 2$ SD $\leq TSE_{t0}$) with mean stanine values ($M = 5$, SD = 2) and 95% confidence interval by AVEM subscale or feature (BA, subjective importance of work; BE, professional ambition; VB, willingness to work to exhaustion; PS, striving for perfection; DF, distancing ability; RT, resignation tendency toward failure; OP, proactive problem-solving; IR, inner calm and balance; EE, experience of success at work; LZ, general life satisfaction; SU, experience of social support). The AVEM subscales or features are grouped within their corresponding resources: commitment, work commitment (black); resistance, psychological resistance factors (red), and emotions (green).

Ancillary Analyses of Self-Efficacy and AVEM Subscales or Features

First, the discrimination analysis with all 742 registered teachers showed how teachers differed by AVEM subscale or feature, as teachers were divided into five groups based on their baseline score of self-efficacy (**Figure 2**).

Teachers with (1) *very low teacher self-efficacy* ($n = 16$) had average scores on the AVEM features that make up the resource work commitment. Only subjective importance of work (BE) was low, though still within the normal range ($M_{BE} = 4.13$, 95% CI = 2.97, 5.28). Scores on AVEM features that represent the resource psychological resilience were mostly outside the normal range. These teachers also had low distancing ability (DF, $M_{DF} = 3.38$, 95% CI = 2.71, 4.04), a high tendency for resignation (RT, $M_{RT} = 7.38$, 95% CI = 6.66, 8.09), low proactive problem-solving (OP, $M_{OP} = 3.13$, 95% CI = 2.37, 3.88), and low inner calm and balance (IR, $M_{IR} = 2.81$, 95% CI = 1.97, 3.66). Scores on AVEM features that represent the resource emotions were rather low, and all scores were below the mean (experience of success at work, EE, $M_{EE} = 2.69$, 95% CI = 1.70, 3.68; general life satisfaction, LZ, $M_{LZ} = 3.38$, 95% CI = 2.4, 4.35; experience of social support, SU, $M_{SU} = 3.44$, 95% CI = 2.31, 4.57). Teachers with (2) *low teacher self-efficacy* ($n = 87$) scored within the normal range on the AVEM features that indicate work commitment. By contrast, scores on AVEM features that represent psychological resilience were mostly outside the normal range, but less extreme than in the group with very low self-efficacy. Only distancing ability (DF) was fairly low, but within the normal range ($M_{DF} = 4.3$, 95% CI = 3.92, 4.68). Scores on the AVEM features that indicate emotions were also lower than the mean, but only experience of success at work was outside the normal range ($M_{EE} = 3.23$, 95% CI = 2.86, 3.6). Teachers with (3) *medium teacher self-efficacy* ($n = 526$) scored within the normal range on all AVEM subscales. Teachers with (4) *high teacher self-efficacy* ($n = 92$), just like the group with medium self-efficacy, had average scores on all AVEM subscales. However, as the confidence intervals indicate, some AVEM subscales differed as compared with the group with medium self-efficacy. On the features that represent the resource work commitment, teachers with high teacher self-efficacy had more professional ambition (BE, $M_{BE} = 5.57$, 95% CI = 5.08, 6.05). On the features that reflect psychological resilience, these teachers had higher distancing ability (DF, $M_{DF} = 5.88$, 95% CI = 5.74, 6.29), lower tendency for resignation (RT, $M_{RT} = 4.67$, 95% CI = 4.24, 5.11), higher proactive problem-solving (OP, $M_{OP} = 4.55$, 95% CI = 4.16, 4.95), and higher inner calm and balance (IR, $M_{IR} = 5.52$, 95% CI = 5.13, 5.92). On the features that represent the resource emotions, they reported to experience more success at work (EE, $M_{EE} = 5.84$, 95% CI = 5.41, 6.26), higher general life satisfaction (LZ, $M_{LZ} = 5.76$, 95% CI = 5.3,

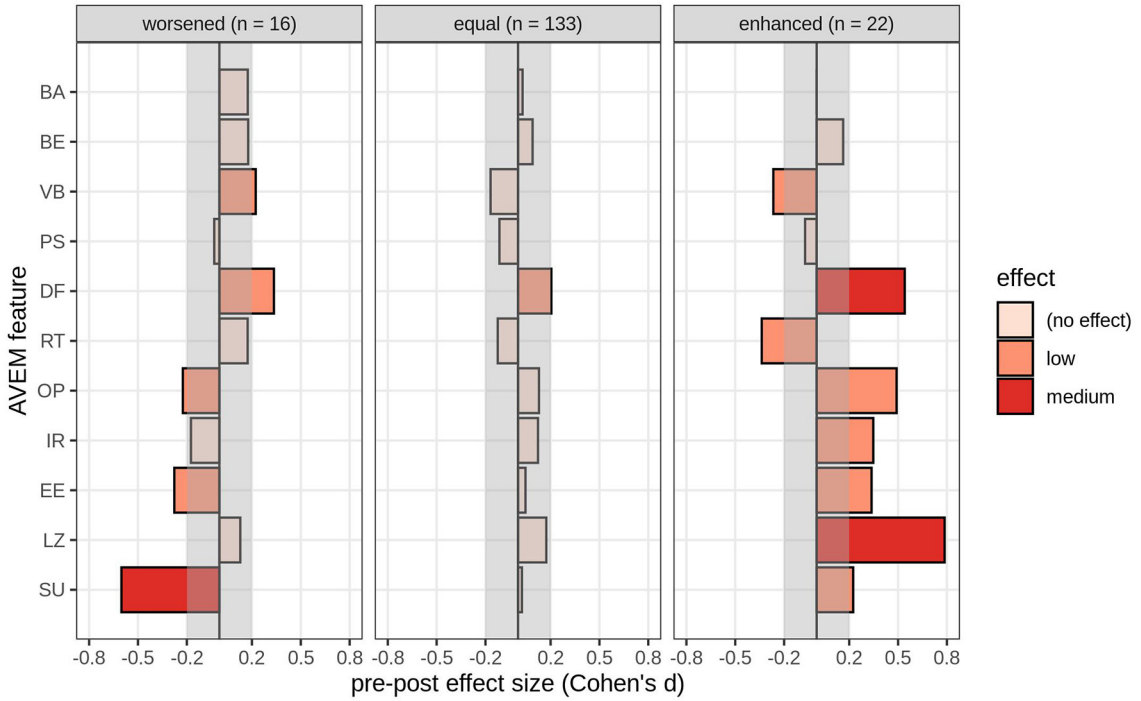

FIGURE 3 | Effect sizes pre- and post-intervention on each AVEM subscale or feature (BA, subjective importance of work; BE, professional ambition; VB, willingness to work to exhaustion; PS, striving for perfection; DF, distancing ability; RT, resignation tendency toward failure; OP, proactive problem-solving; IR, inner calm and balance; EE, experience of success at work; LZ, general life satisfaction; SU, experience of social support), grouped by how teacher self-efficacy changed pre- and post-intervention (δTSE; worsened: $\delta TSE \leq M - 1$ SD; equal: $M - 1$ SD $< \delta TSE < M + 1$ SD; enhanced: $\delta TSE \geq M + 1$ SD).

6.22), and higher experience of social support (SU, $M_{SU} = 5.02$, 95% CI = 4.6, 5.45). Teachers with (5) *very high teacher self-efficacy* showed scores similar to teachers with high teacher self-efficacy, but the confidence intervals on some subscales indicate values out of the normal range. Among the features that represent work commitment, professional ambition (BE) was rather high, though still within the normal range ($M_{BE} = 5.95$, 95% CI = 4.94, 6.96). Striving for perfection (PS) was rather low with confidence intervals indicating scores outside the normal range ($M_{PS} = 3.1$, 95% CI = 2.23, 3.96). Among the features that reflect psychological resilience, these teachers showed rather high distancing ability (DF, $M_{DF} = 6.43$, 95% CI = 5.64, 7.21) and rather low tendency for resignation (RT, $M_{RT} = 3.19$, 95% CI = 2.53, 3.85). On the features that represent emotions, these teachers reported high life satisfaction (LZ, $M_{LZ} = 6.62$, 95% CI = 5.68, 7.56) and high experience of social support (SU, $M_{SU} = 6.48$, 95% CI = 5.74, 7.21).

Second, **Figure 3** shows the effect sizes Cohen's *d* for the pre-/post-change within each AVEM subscale or feature, based on the grouping of how teacher self-efficacy changed from pre- to post-intervention (δTSE; worsened: $\delta TSE \leq M - 1$ SD; constant: $M - 1$ SD $< \delta TSE < M + 1$ SD; improved: $\delta TSE \geq M + 1$ SD). **Table 2** shows the means and confidence intervals for the AVEM subscales or features by group. In teachers whose *teacher self-efficacy worsened pre- and post-intervention* ($n = 16$), social support (SU) decreased by a medium effect size, $d = -0.6$, and experience of success at work (EB) and proactive problem-solving (OP) decreased by a small effect size ($d_{EB} = -0.28$, $d_{OP} = -0.22$). Distancing ability (DF) and willingness to work to exhaustion (VB) increased by small effect sizes ($d_{DF} = 0.34$, $d_{VB} = 0.22$). In teachers whose *self-efficacy remained constant* ($n = 133$), only distancing ability (DF) improved by a small effect size ($d_{DF} = 0.2$). In teachers whose teacher *self-efficacy improved pre- and post-intervention* ($n = 22$), distancing ability (DF) and general life satisfaction (LZ) increased by medium effect sizes ($d_{DF} = 0.54$, $d_{LZ} = 0.79$). Experience of social support (SU), experience of success at work (EE), inner calm and balance (IR), and proactive problem-solving (OP) increased by a small effect size each ($d_{SU} = 0.22$, $d_{EB} = 0.34$, $d_{IR} = 0.35$, $d_{OP} = 0.49$). Tendency for resignation in the face of failure (RT) and willingness to work to exhaustion (VB) shrunk by small effect sizes ($d_{RT} = -0.34$, $d_{VB} = -0.27$).

DISCUSSION

This study investigated, first, how teacher self-efficacy was related to general mental health and how it changed in the course of the preventive MBPGT (23). Furthermore, to better understand the relationship between teacher self-efficacy and mental health, we explored how teacher self-efficacy and its pre- and post-changes were related to work-related attitudes and behavior patterns.

TABLE 2 | Means, estimated confidence intervals, and effect sizes for each AVEM feature at both measurement points (baseline t_0 and post-intervention t_1), within the groups of change in teacher self-efficacy pre- and post-intervention (worsened, dTSE ≤ M − 1 SD; constant, M − 1 SD < dTSE < M + 1 SD; enhanced, dTSE ≥ M + 1 SD).

Group pre-/post-change in teacher self-efficacy (dTSE)		Worsened (n = 16)		Constant (n = 133)		Enhanced (n = 22)	
AVEM feature		***M* (95% CI)**	***d***	***M* (95% CI)**	***d***	***M* (95% CI)**	***d***
BA	t_0	3.88 (2.96, 4.79)	0.17	4.09 (3.75, 4.43)	0.03	4.14 (3.13, 5.14)	0
	t_1	4.19 (3.34, 5.03)		4.14 (3.84, 4.45)		4.14 (3.23, 5.04)	
BE	t_0	4.06 (2.94, 5.19)	0.18	4.59 (4.21, 4.97)	0.09	4.95 (4.04, 5.87)	0.16
	t_1	4.44 (3.46, 5.38)		4.78 (4.45, 5.11)		5.32 (4.37, 6.27)	
VB	t_0	3.38 (2.56, 4.19)	**0.22**	4.89 (4.49, 5.28)	−0.17	5.73 (4.65, 6.8)	**−0.27**
	t_1	3.75 (2.92, 4.58)		4.51 (4.15, 4.87)		5.05 (3.98, 6.11)	
PS	t_0	3.69 (2.6, 4.77)	−0.03	4.26 (3.88, 4.64)	−0.11	4.91 (3.9, 5.92)	−0.07
	t_1	3.63 (2.79, 4.46)		4.02 (3.66, 4.37)		4.73 (3.6, 5.85)	
DF	t_0	5.06 (4.11, 6.02)	**0.34**	5.38 (5.05, 5.7)	**0.2**	5.32 (4.58, 6.05)	**0.54**
	t_1	5.69 (4.82, 6.56)		5.77 (5.44, 6.09)		6.23 (5.56, 6.9)	
RT	t_0	5.63 (4.37, 6.88)	0.17	5.45 (5.08, 5.82)	−0.12	5.45 (4.48, 6.43)	**−0.34**
	t_1	6 (5.18, 6.82)		5.18 (4.81, 5.55)		4.68 (3.74, 5.62)	
OP	t_0	3.44 (2.41, 4.46)	**−0.22**	4.11 (3.78, 4.43)	0.13	3.59 (2.94, 4.24)	**0.49**
	t_1	3 (2.12, 3.88)		4.36 (4.01, 4.71)		4.41 (3.67, 5.15)	
IR	t_0	5.63 (3.98, 6.14)	−0.17	4.8 (4.43, 5.17)	0.12	4.41 (3.48, 5.34)	**0.35**
	t_1	4.69 (3.66, 5.71)		5.05 (4.72, 5.39)		5.14 (4.32, 5.95)	
EE	t_0	4.38 (3.3, 5.45)	**−0.28**	4.93 (4.59, 5.28)	0.05	5.32 (4.54, 6.1)	**0.34**
	t_1	3.69 (2.34, 5.04)		5.02 (4.70, 5.35)		5.95 (5.15, 6.75)	
LZ	t_0	4.69 (3.5, 5.87)	0.13	4.81 (4.44, 5.18)	0.17	4.36 (3.47, 5.25)	**0.79**
	t_1	5 (3.8, 6.2)		5.20 (4.81, 5.60)		6.14 (5.14, 7.13)	
SU	t_0	5.75 (4.83, 6.67)	**−0.6**	4.45 (4.09, 4.81)	0.02	3.86 (3.25, 4.47)	**0.22**
	t_1	4.56 (3.55, 5.57)		4.5 (4.12, 4.89)		4.23 (3.49, 4.97)	

dTSE, pre-/post-change in teacher self-efficacy. AVEM features are given as stanine values (range = 1–9, M = 5, SD = 2). BA, subjective importance of work; BE, professional ambition; VB, willingness to work to exhaustion; PS, perfectionism; DF, distance ability; RT, tendency toward failure; OP, proactive problem-solving; IR, inner calm and balance; EE, experience of success at work; LZ, life satisfaction; SU, experience of social support; total N = 171; bold type values highlight medium effect sizes (Cohen's d, |0.2| = small effect, |0.5| = medium effect, |0.8| = large effect).

The correlation between teachers' self-efficacy and their mental health status affirms teacher self-efficacy as a personal resource (37) along with its health benefits (38, 46, 47). Ancillary analyses revealed which work-related attitudes and behavior patterns were affected when teacher self-efficacy was high vs. when it was low. Differences among groups on the AVEM subscales were marked on those features that represent the resources psychological resistance and emotions: Regarding psychological resistance, teachers with (very) low self-efficacy have a lower distancing ability, lower proactive problem-solving, and lower inner calm and balance, as well as a higher tendency for resignation in the face of failure than teachers with (very) high teacher self-efficacy. On the component emotions, teachers with (very) low teacher self-efficacy reported a lower experience of success at work, lower life satisfaction, and lower social support than teachers with (very) high teacher self-efficacy. These results suggest how high teacher self-efficacy functions as a personal resource, namely by going hand in hand with high psychological resistance and overall positive emotions. If teacher self-efficacy is low, teachers are prone to experience higher levels of stress and seem to be unable to cope accordingly.

On the AVEM features that represent work commitment, teachers with low, medium, or high self-efficacy did not differ in their subjective importance of work, professional ambition, willingness to work to exhaustion, and striving for perfection. Although teacher self-efficacy should contribute to motivational processes through operative cognitions (38), teacher self-efficacy seems to matter less in performance-based motivation but more in the emotional attitude toward teaching, especially emotional stability and the experience of strain.

Teacher self-efficacy generally improved from pre- to post-intervention. Thereby, teachers whose teacher self-efficacy was the lowest at the beginning of the intervention showed the highest improvements in teacher self-efficacy. Additionally, participating teachers whose teacher self-efficacy was already high at the beginning of the intervention remained constant. The investigations using the AVEM features showed that as teacher self-efficacy improved, the teachers increased their distancing ability and their overall life satisfaction. Thus, teachers strengthened their ability to recover from work and gained confidence not only in topics related to teaching, but also in topics that indicate a stable and healthy personal background, like high psychological resistance factors and positive emotions. By

contrast, teachers whose self-efficacy decreased post-intervention predominantly showed a reduction in experience of social support. The literature hails the experience of social support as an important, psychologically protective factor from adversity as well as an expression of well-being [cf. (60, 61)]. Skaalvik and Skaalvik (36) concluded that, within teaching as a profession, social support is a central resource that reduces negative influences of school-related stressors and the emotional response toward stress and directly enables teacher self-efficacy.

One could argue that the change in teacher self-efficacy resulted due to regression to the mean and, therefore, is estimated wrongly [cf. (62)]. In that case, it would have been more likely to observe that high teacher-self efficacy decreased pre- and post-intervention, instead of remaining constant. Moreover, the investigation in the AVEM subscales or features revealed that teachers whose self-efficacy improved post-intervention also improved resistance factors such as distancing ability. We have found earlier a similar improvement in resistance factors that went along with an improvement in mental health (30). Furthermore, the sample under investigation consisted of two independent subsamples from two consecutive school years. Identical analyses of the subsamples showed equal results as the joined sample. Thus, we conclude that regression to the mean did not relevantly influence our outcome.

Interestingly, teachers' self-efficacy increased regardless of how their general mental health status changed pre- and post-intervention. Although the MBPGPT is not designed to promote teacher self-efficacy specifically, it has shown to especially promote the experience of social support (60, in preparation), which is an important resource of self-efficacy in general (32). By focusing on promoting social support, the intervention may also indirectly promote self-efficacy. Moreover, the independence of teacher self-efficacy from changes in mental health can exclude cognitive biases of the intervention: For example, the interventions effect is not due to a "halo effect," meaning that participants see improvements in every aspect. The independence could also indicate that once high teacher self-efficacy is achieved, it appears rather stable and may not be affected by taxing circumstances as easy as the current status of mental health. As teacher self-efficacy was already high at baseline, possibly, the respective cognitions influence how situations and experiences are appraised [cf. (63)]: Difficult situations may be rather evaluated as challenging than threatening. In this respect, mastering challenging situations may reinforce teacher self-efficacy and self-efficacy may stabilize over time. Therefore, it seems likely that if teacher self-efficacy is high, teachers can retain overall positive emotions and strong psychological resistance although their current mental health status may not be great.

Our results are based on a teachers' sample of the German state Baden-Wuerttemberg, which we characterize as a school system which is highly structured. State regulations may impose additional constraints on those teachers, besides classroom management and maintaining good personal relationships to students. So, it might be even more difficult for this sample to develop and maintain a high level of self-efficacy than other teachers from different school systems. Nevertheless, we think that our results can be generalized and we hypothesize the same linkage between self-efficacy and mental health for teachers in other school systems. It would be of interest to prove this hypothesis in a multicenter study.

Limitations

First, the intervention was designed as a preventive measure: therefore, scientific research rather accompanied the integrated federal intervention than being its central focus. A control group was not planned in this context. So, the outcomes can only be interpreted cautiously as a result of the intervention. Moreover, the data reduction due to strict selection criteria from 742 registrations to 172 participants with both pre- and post-values was quite high. They likely resulted from the voluntary completion of the post-questionnaire, mistakes made within the personal code, or ending the intervention due to lack of time and change of address or workplace (28). Nevertheless, the conservative inclusion criteria were necessary to generate a valid pre-/post-sample. Despite the data reduction, the remaining sample was reliably high. Moreover, there were no significant differences between included and excluded participants regarding the key variables of interest, teacher self-efficacy, and mental health. The health benefits for true participants, as considered in the pre-/post-sample, have been proven (27, 28). Thus, although a control group was missing, it is likely that teacher self-efficacy improved through the intervention.

Second, the sample was possibly not representative for the general population of teachers, because only those who showed interest in the preventive measure could be assessed. The teachers who registered and participated at the intervention were probably in need of help and sought support. The interest in a preventive intervention may interfere with teacher self-efficacy: On the one hand, it is possible that their teacher self-efficacy was generally lower, yet norms for interpreting teacher self-efficacy scores are missing. On the other hand, the registration alone may have already stimulated the participants' teacher self-efficacy, because they took the first step for seeking help.

Outlook and Practical Implications

For further research, it would be interesting to investigate if teacher self-efficacy and mental health change independently, as our results suggest. There may be variables which moderate or mediate the relationship and postpone a direct effect, such as dispositional differences, e.g., how intensely people generally perceive work-related stress. Focusing on cognitive influences on behavior such as the participants' attitude toward certain work-related objects [cf. (64)] may be a promising approach to better understand the psychological processes involved in changes in behavior and experience patterns which enhance mental health. Exploring the attitude–behavior link in the context of coaching and preventive interventions may lead to the identification of maladaptive attitudes. These could then be changed to adaptive attitudes through intervention, which consequently results in health-orientated and stress-reducing behavior [cf. (65)]. Perhaps, teacher self-efficacy—as an important construct within motivational processes (38)—can be identified as an adaptive attitude which fosters such behavior.

In addition, to further understand which dimensions of teacher self-efficacy are most closely related to mental health and change in preventive interventions, it would be interesting to examine specific dimensions of teacher self-efficacy by means of reliable subscales [e.g., Teacher Sense of Efficacy Scale (66, 67); Multidimensional Scale of Teacher Self-Efficacy, German: Multidimensionale Skala der Lehrer-Selbstwirksamkeit (68)]. Also, more specific measures for mental health such as physical parameters would be helpful in achieving more valid results than with subjective measures alone.

Of course, other aspects such as outcome dependent on school type or health care outcomes on students level would be also interesting and will be pursued in future research.

Despite the limitations mentioned above, important practical implications can be derived to encourage qualitative preventive measures. First, this study confirms teacher self-efficacy to be an important resource which correlates with good overall mental health and several work-related behavior and experience patterns, which mostly indicate strong psychological resistance abilities and general positivity. Therefore, fostering self-efficacy seems beneficial not only for teachers but likely also within other work-related contexts. Focusing on the client's work-related self-efficacy may be a promising and effective tool for coaches and counselors, especially when self-efficacy is distinctly low. By enhancing work-related self-efficacy, clients may strengthen their personal resources and improve their handling of work-related stress to prevent burnout in the long run.

Second, the AVEM features showed that, in order to establish and sustain a strong work-related self-efficacy, interventions should focus on promoting social support. This seems important in preventing a decrease in self-efficacy. Several studies support this conclusion by showing that social support and positive relationships constitute strong protective factors (19, 61, 69–73). Preventive interventions may also promote the client's ability to distance him- or herself from work-related content. This way teachers can regenerate, recover, and boost their overall life satisfaction. The next research steps include exploring the nature of the relation between teacher self-efficacy and mental health to identify any valid causal relation. In order to adapt preventive measures, it would be important to investigate to what extent preventive interventions should focus on teacher self-efficacy to foster health-related and work-related behavior patterns and emotions.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The ethics committee of Albert-Ludwigs-University Freiburg has reviewed the submitted document and has no ethical or legal objections regarding the project and publications derived thereof.

AUTHOR CONTRIBUTIONS

MB, RP, and JB developed the treatment plan, research concept, and invited the participants. SM developed the scientific hypotheses and performed data analysis and drafted the initial version of the manuscript. MB, RP, AW, and CL directed the intervention and collected the data. RP and SM configured and matched the data. MB designed the figures. MB, RP, AG, and AW provided revisions and overall supervision. AG provided valuable improvements to the final draft of the manuscript. All authors approved the final version of the manuscript for submission.

FUNDING

Funds were received for open access publication fees by the Albert-Ludwig-Universität Freiburg, Open Access Publication Fund, University Library.

ACKNOWLEDGMENTS

We acknowledge the support and financial foundation of the Manual-Based Psychological Group Program for Teachers (MBPGP) by the State Ministry of Culture of Baden-Württemberg (Ministerium für Kultur, Jugend und Sport Baden-Württemberg). Furthermore, we would like to thank Marieluise Bethke for facilitating. Finally, we thank the teachers of Baden-Württemberg who participated in the intervention.

REFERENCES

1. Schaarschmidt U. (editor). *Halbtagsjobber? Psychische Gesunheit im Lehrerberuf - Analyse eines veränderungsbedürftigen Zustands*. 2nd ed. Weinheim: Beltz (2005).
2. Scheuch K, Seibt R, Rehm U, Riedel R, Melzer W. Lehrer. In: Letzel S, Nowak D, editors. *Handbuch der Arbeitsmedizin*. Fulda: Fuldaer Verlagsanstalt (2010). p. 1–2.
3. Bauer J, Stamm A, Virnich K, Wissing K, Müller U, Wirsching M, et al. Correlation between burnout syndrome and psychological and psychosomatic symptoms among teachers. *Int Arch Occup Environ Health*. (2006) 79:199–204. doi: 10.1007/s00420-005-0050-y
4. Seibt R, Galle M, Dutschke D. Psychische gesundheit im lehrerberuf. *Präv Gesundheitsförderung*. (2007) 2:228–34. doi: 10.1007/s11553-007-0082-0
5. Weber A, Weltle D, Lederer P. Frühinvalidität im Lehrerberuf. *Soz Arbeitsmed Aspekte. Deutsches Ärzteblatt*. (2004) 101:851–9.
6. Bermejo-Toro L, Prieto-Ursúa M, Hernández V. Towards a model of teacher well-being. Personal and job resources involved in teacher burnout and engagement. *Educ Psychol*. (2015) 36:481–501. doi: 10.1080/01443410.2015.1005006
7. Schaarschmidt U, Kieschke U. Beanspruchungsmuster im Lehrerberuf: Ergebnisse und Schlussfolgerungen aus der Potsdamer Lehrerstudie. In: Rothland M, editor. *Belastung und Beanspruchung im Lehrerberuf: Modelle, Befunde, Interventionen*. Wiesbaden: Springer (2013). p. 81–97.
8. Bauer J. Die Freiburger Schulstudie. *Z Schulverwaltung Z Schulleistung*. (2004) 13:259–64.
9. Hillert A, Marwitz M. *Die Burnout-Epidemie oder brennt die Leistungsgesellschaft aus*? München: Beck (2006).

10. Körner SC. *Das Phänomen Burnout am Arbeitsplatz: Ein empirischer Beitrag zur Beschreibung des Burnout-Syndroms und seiner Verbreitung sowie zur Analyse von Zusammenhängen und potentiellen Einflußfaktoren auf das Ausbrennen von Gymnasiallehrern*. Dissertation, Erziehungswissenschaftliche Fakultät, Universität Erfurt (2002). Available online at: https://d-nb.info/966450779/34 (accessed December 9, 2018).
11. Schaarschmidt U, Kieschke U. (editors). *Gerüstet für den Schulalltag: Psychologische Unterstützungsangebote für Lehrerinnen und Lehrer*. Weinheim; Basel: Beltz (2007).
12. Statistisches Bundesamt. Dritter *Versorgungsbericht der Bundesregierung*. (2005). Available online at: http://www.vbenrw.de/vbe_download/versorgbericht3.pdf (accessed December 8, 2018).
13. Schmidt J. *Ruhestand von Lehrkräften: Antrag der Abg*. Andreas Deuschle u. a. CDU und Stellungnahme des Ministeriums für Kultur, Jugend und Sport (2015).
14. Skaalvik EM, Skaalvik S. Dimensions of teacher burnout. *Relations with potential stressors at school. Soc Psychol Educ.* (2017) 20:775–90. doi: 10.1007/s11218-017-9391-0
15. Bauer J, Unterbrink T, Hack A, Pfeifer R, Buhl-Griesshaber V, Müller U, et al. Working conditions, adverse events and mental health problems in a sample of 949 German teachers. *Int Arch Occup Environ health.* (2007) 80:442–9. doi: 10.1007/s00420-007-0170-7
16. Sass DA, Seal AK, Martin NK. Predicting teacher retention using stress and support variables. *J Educ Admin.* (2011) 49:200–15. doi: 10.1108/09578231111116734
17. Unterbrink T, Zimmermann L, Pfeifer R, Wirsching M, Brähler E, Bauer J. Parameters influencing health variables in a sample of 949 German teachers. *Int Arch Occup Environ Health.* (2008) 82:117–23. doi: 10.1007/s00420-008-0336-y
18. Aloe AM, Shisler SM, Norris BD, Nickerson AB, Rinker TW. A multivariate meta-analysis of student misbehavior and teacher burnout. *Educ Res Rev.* (2014) 12:30–44. doi: 10.1016/j.edurev.2014.05.003
19. Beltman S, Mansfield C, Price A. Thriving not just surviving. A review of research on teacher resilience. *Educ Res Rev.* (2011) 6:185–207. doi: 10.1016/j.edurev.2011.09.001
20. Ksienzyk B, Schaarschmidt U. Beanspruchung und schulische Arbeitsbedingungen. In: Schaarschmidt U. *Halbtagsjobber? Psychische Gesunheit im Lehrerberuf - Analyse eines veränderungsbedürftigen Zustands.*, 2nd edn. Weinheim: Beltz (2005) p. 72–87.
21. Aldrup K, Klusmann U, Lüdtke O, Göllner R, Trautwein U. Student misbehavior and teacher well-being. Testing the mediating role of the teacher-student relationship. *Learn Instruct.* (2018) 58:126–36. doi: 10.1016/j.learninstruc.2018.05.006
22. Hattie J. Überweiterte Auflage mit Index und Glossar. In: *Lernen sichtbar machen*. Beywl W, Zierer K, editors. Baltmannsweiler: Schneider Verlag Hohengehren (2015).
23. Bauer J, Unterbrink T, Zimmermann L. *Gesundheitsprophylaxe für Lehrkräfte: Manual für Lehrer-Coachinggruppen nach dem Freiburger Modell*. Dresden: Technische Universität Dresden (2007).
24. Bauer J. *Gesundheit der Lehrkräfte bewahren: Belastungsfaktoren und Schutzmaßnahmen*. (2016). Available online at: https://lehrer-coachinggruppen.de/files/lehrer-coachinggruppen/downloads/Bauer2016_Gesundheit_der_Lehrkr%C3%A4fte_bewahren.pdf. (accessed January 24, 2019).
25. Otten H. Die Entwicklung der Balintarbeit. In: Otten H, editor. *Professionelle Beziehungen*. Berlin; Heidelberg: Springer Berlin Heidelberg (2012). p. 29–36.
26. König W. *Die Leitung von Balintgruppen: Ein Leitfaden*. Dt. Ärzte-Verlag (2004).
27. Unterbrink T, Pfeifer R, Krippeit L, Zimmermann L, Rose U, Joos A, et al. Burnout and effort-reward imbalance improvement for teachers by a manual-based group program. *Int Arch Occup Environ Health.* (2012) 85:667–74. doi: 10.1007/s00420-011-0712-x
28. Unterbrink T, Zimmermann L, Pfeifer R, Rose U, Joos A, Hartmann A, et al. Improvement in school teachers' mental health by a manual-based psychological group program. *Psychother Psychosom.* (2010) 79:262–4. doi: 10.1159/000315133
29. Unterbrink T, Pfeifer R, Krippeit L, Zimmermann L, Rose U, Joos A, et al. A manual-based group program to improve mental health. What kind of teachers are interested and who stands to benefit from this program? *Int Arch Occup Environ Health.* (2014) 87:21–8. doi: 10.1007/s00420-012-0832-y
30. Braeunig M, Pfeifer R, Schaarschmidt U, Lahmann C, Bauer J. Factors influencing mental health improvements in school teachers. *PLoS One.* (2018) 13:e0206412. doi: 10.1371/journal.pone.0206412
31. Schaarschmidt U, Fischer AW. *Arbeitsbezogenes Verhaltens- und Erlebensmuster AVEM (Standardform) andand AVEM-44 (Kurzform)*. Frankfurt am Main: Pearson (2008).
32. Bandura A. *Self-efficacy: The Exercise of Control*. New York, NY: Freeman (1997).
33. Schwarzer R, Jerusalem M. Das Konzept der Selbstwirksamkeit. In: Jerusalem M, Hopf D, editors. *Selbstwirksamkeit und Motivationsprozesse in Bildungsinstitutionen*. Weinheim: Beltz (2002). p. 28–53.
34. Klassen RM, Tze VMC, Betts SM, Gordon KA. Teacher efficacy research 1998-2009. Signs of progress or unfulfilled promise? *Educ Psychol Rev.* (2011) 23:21–43. doi: 10.1007/s10648-010-9141-8
35. Klassen RM, Chiu MM. Effects on teachers' self-efficacy and job satisfaction. Teacher gender, years of experience, job stress. *J Educ Psychol.* (2010) 102:741–56. doi: 10.1037/a0019237
36. Skaalvik EM, Skaalvik S. Teacher stress and teacher-efficacy: realtions and Consequences. In: McIntyre TM, McIntyre SE, Francis JD, editors. Educator Stress: *Aligning Perspectives on Health, Safety and Well-Being*. Cham: Springer International Publishing (2017). p. 101–25.
37. Cramer C, Friedrich A, Merk S. *Belastung und Beanspruchung im Lehrerinnen- und Lehrerberuf: Übersicht zu Theorien, Variablen und Ergebnissen in einem integrativen Rahmenmodell*. Bildungsforschung (2018). p. 1–23.
38. Schwarzer R, Hallum S. Perceived teacher self-efficacy as a predictor of job stress and burnout. Mediation analyses. *Appl Psychol.* (2008) 57:152–71. doi: 10.1111/j.1464-0597.2008.00359.x
39. Schwarzer R, Warner LM. Forschung zur Selbstwirksamkeit bei Lehrerinnen und Lehrern. In: Terhart E, Bennewitz H, Rothland M, editors. *Handbuch der Forschung zum Lehrerberuf*. Münster; New York, NY: Waxmann (2014). p. 662–78.
40. Schwerdtfeger A, Konermann L, Schönhofen K. Self-efficacy as a health-protective resource in teachers? A biopsychological approach. *Health Psychol.* (2008) 27:358–68. doi: 10.1037/0278-6133.27.3.358
41. Collie RJ, Shapka JD, Perry NE. School climate and social-emotional learning. Predicting teacher stress, job satisfaction, teaching efficacy. *J Educ Psychol.* (2012) 104:1189–204. doi: 10.1037/a0029356
42. Emin Türkoglu M, Cansoy R, Parlar H. Examining relationship between teachers' self-efficacy and job satisfaction. *UJER.* (2017) 5:765–72. doi: 10.13189/ujer.2017.050509
43. Skaalvik EM, Skaalvik S. Teacher stress and teacher self-efficacy as predictors of engagement, emotional exhaustion, and motivation to leave the teaching profession. *CE.* (2016) 07:1785–99. doi: 10.4236/ce.2016.713182
44. Chesnut SR, Burley H. Self-efficacy as a predictor of commitment to the teaching profession. A meta-analysis. *Educ Res Rev.* (2015) 15:1–16. doi: 10.1016/j.edurev.2015.02.001
45. Gilbert RB, Adesope OO, Schroeder NL. Efficacy beliefs, job satisfaction, stress and their influence on the occupational commitment of English-medium content teachers in the Dominican Republic. *Educ Psychol.* (2013) 34:876–99. doi: 10.1080/01443410.2013.814193
46. Schmitz GS, Schwarzer R. Selbstwirksamkeitserwartung von Lehrern. Längsschnittbefunde mit einem neuen Instrument. *Z Pädagogische Psychol.* (2000) 14:12–25. doi: 10.1024//1010-0652.14.1.12
47. Shoji K, Cieslak R, Smoktunowicz E, Rogala A, Benight CC, Luszczynska A. Associations between job burnout and self-efficacy. A meta-analysis. *Anxiety Stress Coping.* (2016) 29:367–86. doi: 10.1080/10615806.2015.1058369
48. Klassen RM, Tze VMC. Teachers' self-efficacy, personality, teaching effectiveness. A meta-analysis. *Educ Res Rev.* (2014) 12:59–76. doi: 10.1016/j.edurev.2014.06.001
49. Sehgal P, Nambudiri R, Mishra SK. Teacher effectiveness through self-efficacy, collaboration and principal leadership. *Intl J Educ Manag.* (2017) 31:505–17. doi: 10.1108/IJEM-05-2016-0090
50. Kim KR, Seo EH. The relationship between teacher efficacy and students' academic achievement. A meta-analysis. *Soc Behav Pers.* (2018) 46:529–40. doi: 10.2224/sbp.6554

51. Haigh MA, Anthony GJ. Induction and Efficacy. *A case study of new zealand newly qualified secondary science teachers. J Sci Teach Educ.* (2012) 23:651–71. doi: 10.1007/s10972-012-9285-0
52. Pfeifer R, Matthiessen J, Braeunig M, Lahmann C, Bauer J, Göritz AS, et al. Erfolgreiches Coaching für Lehrer/innen zur Förderung der Beziehungskompetenz - das. In: *Freiburger Modell unter der Lupe*. Lehren, Lernen, editors. Villingen-Schwenningen: Neckar Verlag (2020). p. 39–47.
53. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*., 2nd edn. New York, NY; London: The Guilford Press (2018).
54. Schwarzer R, Schmitz G. *Dokumentation der Skala Lehrer-Selbstwirksamkeit*. (1999). Available online at: https://psycharchives.org/bitstream/20.500.12034/363/1/PT_9004398_WirkLehr_Autorenbeschreibung.pdf (accessed November 14, 2018).
55. Goldberg D, Williams P. *A User's Guide to the General Health Questionnaire*. Windsor: NFER-NELSON (1988).
56. Romppel M, Braehler E, Roth M, Glaesmer H. What is the General Health Questionnaire-12 assessing? Dimensionality and psychometric properties of the General Health Questionnaire-12 in a large scale German population sample. *Compr Psychiatry.* (2013) 54:406–13. doi: 10.1016/j.comppsych.2012.10.010
57. Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O, et al. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med.* (1997) 27:191–7. doi: 10.1017/S0033291796004242
58. Field A. *Discovering Statistics Using SPSS: (and Sex and Drugs and Rock 'n' Roll).*, 3rd. edn. Los Angeles, CA: Sage (2011).
59. Cohen J. A power primer. *Psychol Bull.* (1992) 155–9. doi: 10.1037/0033-2909.112.1.155
60. Schwarzer R, Leppin A. *Sozialer Rückhalt und Gesundheit*. Göttingen: Hogrefe (1989).
61. Rothland M. Soziale Unterstützung: Bedeutung und Bedingungen im Lehrerberuf. In: Rothland M, editor. *Belastung und Beanspruchung im Lehrerberuf: Modelle, Befunde, Interventionen.* Wiesbaden: Springer (2013). p. 231–50.
62. Zwingmann C, Wirtz M. Regression zur Mitte [Regression to the mean]. *Die Rehabil.* (2005) 44:244–51. doi: 10.1055/s-2005-866924
63. Bengel J, Strittmatter R, Willmann H. *What Keeps People Healthy: The Current State of Discussion and the Relevance of Antonovsky's Salutogenetic Model of Health*. Cologne: Federal Centre for Health Education (FCHE) (2009).
64. Guyer JJ, Fabrigar LR. Attitudes and behavior. In: Wright JD, editor. *International Encyclopedia of the Social and Behavioral Sciences.* (Elsevier) (2015). p. 183–9.
65. Petty RE, Brinol P. Attitude change. In: Baumeister RF, Finkel JE. *Advanced Social Psychology: The State of the Science.* Oxford; New York, NY: Oxford University Press (2010). p. 217–59.
66. Tschannen-Moran M, Woolfolk Hoy. A. Teacher efficacy. Capturing an elusive construct. *Teach Teach Educ.* (2001) 17:783–805. doi: 10.1016/S0742-051X(01)00036-1
67. Pfitzner-Eden F. *STSE - Scale for Teacher Self-Efficacy: Deutsche adaptierte Fassung*. PSYNDEX Tests Review (2016). Available online at: https://www.zpid.de/retrieval/PSYNDEXTests.php?id=9007043
68. Schulte K. *Selbstwirksamkeitserwartungen in der Lehrerbildung: Zur Struktur und dem Zusammenhang von LehrerSelbstwirksamkeitserwartungen, Pädagogischem Professionswissen und Persönlichkeitseigenschaften bei Lehramtsstudierenden und Lehrkräften*. Dissertation, Georg-August-Universität (2008).
69. Hakanen JJ, Bakker AB, Schaufeli WB. Burnout and work engagement among teachers. *J School Psychol.* (2006) 43:495–513. doi: 10.1016/j.jsp.2005.11.001
70. Leung DYP, Lee WWS. Predicting intention to quit among Chinese teachers: differential predictability of the components of burnout. *Anxiety Stress Coping.* (2006) 19:129–41. doi: 10.1080/10615800600565476
71. Schaufeli WB, Bakker AB. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *J Organ Behav.* (2004) 25:293–315. doi: 10.1002/job.248
72. Skaalvik EM, Skaalvik S. Teacher self-efficacy and teacher burnout: a study of relations. *Teach Teach Educ.* (2010) 26:1059–69. doi: 10.1016/j.tate.2009.11.001
73. Skaalvik EM, Skaalvik S. Teacher job satisfaction and motivation to leave the teaching profession: Relations with school context, feeling of belonging, emotional exhaustion. *Teach Teach Educ.* (2011) 27:1029–38. doi: 10.1016/j.tate.2011.04.001

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Advantages of publishing in Frontiers

OPEN ACCESS
Articles are free to read for greatest visibility and readership

FAST PUBLICATION
Around 90 days from submission to decision

HIGH QUALITY PEER-REVIEW
Rigorous, collaborative, and constructive peer-review

TRANSPARENT PEER-REVIEW
Editors and reviewers acknowledged by name on published articles

Frontiers
Avenue du Tribunal-Fédéral 34
1005 Lausanne | Switzerland

Visit us: www.frontiersin.org
Contact us: frontiersin.org/about/contact

REPRODUCIBILITY OF RESEARCH
Support open data and methods to enhance research reproducibility

DIGITAL PUBLISHING
Articles designed for optimal readership across devices

FOLLOW US
@frontiersin

IMPACT METRICS
Advanced article metrics track visibility across digital media

EXTENSIVE PROMOTION
Marketing and promotion of impactful research

LOOP RESEARCH NETWORK
Our network increases your article's readership