# WORKPLACE HEALTH PROMOTION, 2nd Edition

EDITED BY: Leah Okenwa-Emegwa and Danijela Gasevic
PUBLISHED IN: Frontiers in Public Health and Frontiers in Psychiatry

frontiers Research Topics

ISSN 1664-8714
ISBN 978-2-83251-146-6
DOI 10.3389/978-2-83251-146-6

## 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

# WORKPLACE HEALTH PROMOTION, 2nd Edition

Topic Editors:
**Leah Okenwa-Emegwa,** Swedish Red Cross University College, Sweden
**Danijela Gasevic,** Monash University, Australia

**Publisher's note:** In this 2nd edition, the following article has been updated: the Editorial has been added to this ebook (10.3389/fpubh.2022.1090333).

**Citation:** Okenwa-Emegwa, L., Gasevic, D., eds. (2022). Workplace Health Promotion, 2nd Edition. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-83251-146-6

# Table of Contents


05 ***Editorial: Workplace health promotion***
Leah Okenwa Emegwa and Danijela Gasevic

08 ***Exploring and Developing the Workplace Health Culture Scale in Taiwan***
Yao-Tsung Chang, Feng-Jen Tsai, Chien-Chih Kuo, Ching-Ying Yeh and Ruey-Yu Chen

17 ***The Mediating Role of Psychological Capital in the Relationship Between Occupational Stress and Fatigue: A Cross-Sectional Study Among 1,104 Chinese Physicians***
Fangqiong Tian, Qianyi Shu, Qi Cui, Lulu Wang, Chunli Liu and Hui Wu

26 ***Managers' Perceptions of Factors Affecting Employees' Uptake of Workplace Health Promotion (WHP) Offers***
Fanny Sigblad, Maria Savela and Leah Okenwa Emegwa

35 ***Psychological Capital Mediates the Association Between Perceived Organizational Support and Work Engagement Among Chinese Doctors***
Shihan Yang, Hao Huang, Tian Qiu, Fangqiong Tian, Zhihui Gu, Xuege Gao and Hui Wu

43 ***Taking a Stand for Office-Based Workers' Mental Health: The Return of the Microbreak***
Casey Peter Mainsbridge, Dean Cooley, Sarah Dawkins, Kristy de Salas, Jiajin Tong, Matthew Wade Schmidt and Scott J. Pedersen

52 ***The Utility of a Mental Health App in Apprentice Workers: A Pilot Study***
Mark Deady, Nicholas Glozier, Daniel Collins, Rochelle Einboden, Isobel Lavender, Alexis Wray, Aimee Gayed, Rafael A. Calvo, Helen Christensen, Samuel B. Harvey and Isabella Choi

62 ***Does Dialogue Improve the Sustainable Employability of Low-Educated Employees? A Study Protocol for an Effect and Process Evaluation of "Healthy HR"***
Emmelie Hazelzet, Hans Bosma, Angelique de Rijk and Inge Houkes

71 ***Protecting Healthcare Workers Amid the COVID-19 Crisis: A Safety Protocol in Wuhan***
Yunlu Liu, Shijun Yang, Man Hung, Wei Tong and Yong Liu

76 ***A Corporate Wellness Program and Nursing Home Employees' Health***
Gabriela Kernan, Manuel Cifuentes, Rebecca Gore, David Kriebel and Laura Punnett

85 ***Learning Processes as Key for Success in Workplace Health Promotion Interventions in Health Care***
Andrea Eriksson and Lotta Dellve

95 ***The Effect of Physical Exercise Training on Neck and Shoulder Muscle Function Among Military Helicopter Pilots and Crew: A Secondary Analysis of a Randomized Controlled Trial***
Mike Murray, Britt Lange, Karen Søgaard and Gisela Sjøgaard

106 ***Implementing Organizational WHP Into Practice: Obstructing Paradoxes in the Alignment and Distribution of Empowerment***
Katrin Skagert and Lotta Dellve

*117* ***Serious Workplace Violence Against Healthcare Providers in China Between 2004 and 2018***

Jing Ma, Xi Chen, Qiongjuan Zheng, Yun Zhang, Zhi Ming, Dongxin Wang, Hua Wu, Haisen Ye, Xiaoxuan Zhou, Yunxuan Xu, Renjiao Li, Xia Sheng, Fangxiu Fan, Zuiwen Yang, Ting Luo, Yajun Lu, Ye Deng, Fen Yang, Chuntao Liu, Chunyu Liu and Xiaosong Li

*125* ***Pilot Feasibility Study of Incorporating Whole Person Care Health Coaching Into an Employee Wellness Program***

Anna Nelson, Olivia Moses, Brenda Rea, Kelly Morton, Wendy Shih, Fatimah Alramadhan and Pramil N. Singh

*134* ***An Ecological Study of a Universal Employee Depression Awareness and Stigma Reduction Intervention: "Right Direction"***

Benjamin Doty, Adrienne Grzenda, Seungyoung Hwang, Sean Godar, Darcy Gruttadaro, Kimberly A. Hauge, Bruce Sherman and Diana E. Clarke

frontiers | Frontiers in Public Health

TYPE Editorial
PUBLISHED 06 December 2022
DOI 10.3389/fpubh.2022.1090333



OPEN ACCESS

EDITED AND REVIEWED BY
Susana Viegas,
New University of Lisbon, Portugal

*CORRESPONDENCE
Leah Okenwa Emegwa
leok@rkh.se

†These authors have contributed equally to this work

SPECIALTY SECTION
This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health

RECEIVED 05 November 2022
ACCEPTED 18 November 2022
PUBLISHED 06 December 2022

CITATION
Okenwa Emegwa L and Gasevic D (2022) Editorial: Workplace health promotion.
*Front. Public Health* 10:1090333.
doi: 10.3389/fpubh.2022.1090333



# Editorial: Workplace health promotion

Leah Okenwa Emegwa[1*†] and Danijela Gasevic[2†]

[1]Department of Health Sciences, Swedish Red Cross University, Stockholm, Sweden, [2]School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC, Australia

KEYWORDS

**wellbeing, wellness packages, uptake, managers, occupational health and safety**

Editorial on the Research Topic
Workplace health promotion

Due to the amount of time spent at the workplace and the impact of work on health and wellbeing over an individual's life course, a strategic position of the workplace as an important arena for population health promotion cannot be over emphasized (1, 2). Several risk factors within the physical and psychosocial working environment, as well as inadequate organizational support, result in work-related health problems, and have psychosocial and economic implications for the individual, the family, the organization and the society (3, 4).

There are numerous international policy documents regarding occupational health promotion, for example, the Luxembourg declaration for Workplace Health Promotion (WHP), which recommends that WHP should be strategic (5). A strategic approach implies that WHP should be conducted in a systematic and continuous process of needs analysis, priority setting, planning, implementation, and evaluation. In recognition of the importance of worker health and a healthy working life, but also in line with numerous occupational health goals, it is important to understand issues connected to population health from a workplace perspective. This Research Topic aims to highlight among others, barriers, enabling factors, best practices, emerging problems, and other issues important for WHP.

In this Research Topic, about 95 researchers from across the globe contributed to a total of 15 articles that examined WHP from diverse perspectives. Article summaries are presented below.

To develop and validate a Work Health Culture Scale (WHCS) more suitable for Taiwan's health culture assessment, Chang et al. used a three-stage method: (1) reviewing literature and defining domains (2) item generation, and (3) validation test. The newly developed instrument was found to have appropriate reliability and validity. The authors conclude by recommending further research on validity and reliability of WHCS in diverse sectors as well as the relationship between WHCS and other WHP indicators.

Tian et al. explored a cross-sectional association between occupational stress and fatigue, while also examining the mediating role of psychological capital (PsyCap) among Chinese physicians. They observed a high prevalence of fatigue among Chinese physicians, and that two important components of PsyCap, self-efficacy, and resilience,

play more important roles in the mediating effect. The study suggests that intervention strategies and measures to relieve fatigue should be focused on physicians' positive PsyCap improvement.

In the study by Sigblad et al. a total of 19 managers were interviewed to understand their perceptions of employees' WHP uptake as well as challenges encountered by managers in the execution of their WHP-related tasks. The results of the study indicate that factors at the individual level, nature of the WHP offered, and organizational level factors played a key role in WHP uptake. Furthermore, challenges encountered by managers in executing WHP were mostly at the organizational level. The authors conclude that addressing these modifiable factors may improve WHP uptake among employees.

Yang et al. investigated the mediating effect of psychological capital (PsyCap) on the association between perceived organizational support and work engagement among medical doctors in China's Liaoning Province. In this cross-sectional study, self-administered questionnaires were distributed to 1,009 medical doctors. Findings suggest that the participants had a low level of work engagement, but that perceived organizational support could indirectly improve vigor, dedication, and absorption, partially through mediator PsyCap.

Mainsbridge et al. conducted a randomized-controlled pilot study with repeated measures of self-reported job stress and mood states in which 43 police officers were exposed to movement microbreaks during work hours. Preliminary findings suggest that interrupting sedentary work with movement microbreaks may have beneficial effects on employees' mental health. The authors discuss the implications and future research of movement microbreaks for mitigating work-related stress among police and by extension, first responders.

Deady et al. explored the utility and evaluated the acceptability, feasibility, and preliminary efficacy of a modified version of the HeadGear Apprentice app designed to reduce depressive symptoms in an apprentice. Findings suggest that the app was an acceptable and well-received intervention when adapted to young apprentices, however, addressing issues related to improving engagement and adherence to the program would improve effectiveness.

The paper by Hazelzet et al. describes the protocol for a planned evaluation study regarding effectiveness and the implementation process of the intervention "Healthy Human Resources" (HHR) on the sustainable employability of low-educated employees. A protocol consists of intended methods for effect evaluation (including a budget impact analysis), and process evaluation. The authors hypothesize that by improving dialogue HHR will strengthen the sustainable employability of low-educated employees and that if proven effective for tackling the socioeconomic health gap, HHR can be recommended on a wider scale.

COVID-19 brought many challenges to health care systems, as many healthcare workers became infected due to lack of adequate protection. Liu et al. shared their protocol for ensuring the safety of healthcare workers, which successfully controlled COVID-19 infection in the orthopedic department.

Kernan et al. evaluated a company-sponsored WHP program in a sample of long-term care facilities (nursing homes). Data were collected *via* standardized, self-administered questionnaire completed by a total of 1,589 workers in five job categories from 18 facilities within a single company. Findings show that the average levels of psychological demands and social support at work were relatively high. Compared to centers with no programs, supervisor support was higher in centers with well-developed WHP programs. Workers in centers with well-developed programs had slightly lower average body mass index and slightly lower prevalence of non-smoking as well as regular aerobic exercise. The low-intensity, low-resourced workplace health promotion program used in this study benefited a few individuals but had only modest influence on average levels of the measured health indicators.

Eriksson and Dellve conducted a mixed-methods study to identify the outcomes of a Swedish system-based WPH education program for managers and investigate impact of the program on health-oriented leadership, improvement work, and employee wellbeing. They reported that health-oriented leadership, improvement work, work satisfaction, and vitality increased at workplaces that worked actively to implement WHP following the program. These were also associated with improved job satisfaction. Furthermore, work environment issues, developmental leadership, and social learning climate may be important process indicators to consider when developing comprehensive WHP interventions.

Murray et al. explored the effect of a physical exercise training intervention on neck and shoulder muscle function [i.e., maximal voluntary contraction (MVC) and rate of torque development (RTD)] among military helicopter pilots and crew-members who were randomized to either an exercise-training-group (ETG; $n = 35$) or a reference-group (REF; $n = 34$). While REF received no training, the ETG received 20 weeks of self-administered exercise training specifically tailored to target the neck and shoulder muscles. Findings suggest that physical exercise training improved MVC and RTD in the upper neck extensors. Adherence to training regularly was poor, so future studies should focus on the practical implementation of self-administered exercise training to improve adherence.

In their mixed-methods study, Skagert and Dellve critically analyzed and identified interacting mechanisms and obstacles behind failures of organizational WHP projects from system perspectives. Obstacles identified included governance by logics of distancing and detaching, no binding regulation of WHP, separated responsibility of results, narrow focus on delegated responsibilities, store-fronting a strategic model, keeping poor organizational preconditions, and support for developments

and isolating WHP from other organizational developments. The following should be considered when developing WHP programs: (1) the uncertainty a distributed empowerment to all system levels may create; (2) the distributed impact to define the target and allow broader areas to be included in WHP; and (3) the integration into other development processes and not reducing the organizational WHP to the form of a project.

Ma et al. presented the features, causes, and outcomes of serious workplace violence (WPV) against healthcare providers in China. The prevalence of serious WPV among healthcare providers is high, with doctors being the victims in most instances (81%). Death, severe injury and hospitalization were the major outcomes of serious WPV, which may arise from poor patient–doctor relationships, overly stressed health providers in highly demanding hospitals, poorly educated/informed patients, insufficient legal protection, and poor communication. Measures and policies are needed to prevent serious workplace violence and ensure safety of healthcare providers in China.

A mixed methods design was employed in the study by Nelson et al. to assess feasibility, acceptability, and preliminary efficacy of incorporating a whole-person care model of health coaching into an employee wellness program (i.e., weight loss, smoking cessation) that is made available by an employer-sponsored health plan. Thirty-nine employees and covered spouses from Loma Linda University Health were recruited into a 12-week whole person care intervention (a combination of health coaching and health education) and examined for outcomes, such as participants' experience and biometric data. For the qualitative study, key informant interviews were obtained from three health coaches and six intervention participants recruited *via* random sampling. Findings identify positive behavior change effects of an employee health intervention based on a whole person care model of health coaching with integrated health education, and identify the need for methods to maintain behavior change (i.e., mHealth, peer-support) post-intervention.

Doty et al. used pre-intervention, post- intervention design to explore changes in mental health utilization among Kent State University (KSU) employees before and after Right Direction (RD), a component of a universal employee wellness program implemented at KSU in 2014. Compared to the pre-intervention period, increased awareness of available resources resulted in an increased number of employees seeking assistance and engaging in care in the post-intervention period. Findings suggest that the effects of RD may be realized over the long-term with follow-up enhancements such as workshops/informational sessions on mindfulness, stress management, resiliency training, and self-acceptance.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## Acknowledgments

Authors wish to thank all participating authors for their invaluable contribution to the topic.

## 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.

## Publisher's note



## References

1. Aldana SG, Merrill RM, Price K, Hardy A, Hager RJPM. Financial impact of a comprehensive multisite workplace health promotion program. *Prev Med.* (2005) 40:131–7. doi: 10.1016/j.ypmed.2004.05.008

2. Andersen LL, Proper KI, Punnett L, Wynne R, Persson R, Wiezer N. Workplace health promotion and wellbeing. *Sci. World J.* (2015) 2015:606875. doi: 10.1155/2015/606875

3. Tullar JM, Brewer S, Amick BC, Irvin E, Mahood Q, Pompeii LA, et al. Occupational safety and health interventions to reduce musculoskeletal symptoms in the health care sector. *J Occup Rehabil.* (2010) 20:199–219. doi: 10.1007/s10926-010-9231-y

4. Schulte PA, Pandalai S, Wulsin V, Chun H. Interaction of occupational and personal risk factors in workforce health and safety. *Am J Public Health.* (2012) 102:434–48. doi: 10.2105/AJPH.2011.300249

5. Cox T, Griffiths A, Rial-González E. *Research on Work-Related Stress: European Agency for Safety and Health at Work*. Luxembourg: Office for Official Publications of the European communities (2000).

frontiers in Public Health

ORIGINAL RESEARCH
published: 10 January 2020
doi: 10.3389/fpubh.2019.00397

# Exploring and Developing the Workplace Health Culture Scale in Taiwan

*Yao-Tsung Chang*[1], *Feng-Jen Tsai*[2], *Chien-Chih Kuo*[3], *Ching-Ying Yeh*[1] *and Ruey-Yu Chen*[1]*

[1] School of Public Health, Taipei Medical University, Taipei, Taiwan, [2] PhD Program in Global Health and Health Security, and Master Program in Global Health and Development, College of Public Health, Taipei Medical University, Taipei, Taiwan, [3] Department of Psychology, National Cheng-Chi University, Taipei, Taiwan

**Background:** The aim of this study was to develop and validate the workplace health culture scale.

**Methods:** This paper collected and re-organized current definitions about health culture from literature and created the domains and items to develop a new tool. Six enterprises and 2,431 participants were recruited from northern Taiwan for validity test.

**Results:** We found the workplace health culture scale had appropriate reliability and validity, including a good model fit for the 25-item scale.

**Conclusions:** Workplace health culture might be an important domain to the work of WHP. More validity and reliability studies about WHCS in wider industries and the correlation between WHCS and other WHP indicators are needed.

**Keywords: workplace health culture, scale, factor analysis, workplace health promotion, health behavior**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic, Monash University, Australia*

***Reviewed by:***
*Enid Chung Roemer, Johns Hopkins University, United States*
*Siti Munira Yasin, Universiti Teknologi MARA, Malaysia*

***Correspondence:**
*Ruey-Yu Chen*
*rueyyu@tmu.edu.tw*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *26 August 2019*
***Accepted:*** *10 December 2019*
***Published:*** *10 January 2020*

***Citation:***
*Chang Y-T, Tsai F-J, Kuo C-C, Yeh C-Y and Chen R-Y (2020) Exploring and Developing the Workplace Health Culture Scale in Taiwan. Front. Public Health 7:397. doi: 10.3389/fpubh.2019.00397*

## BACKGROUND

Many chronic diseases like cardiovascular diseases and type 2 diabetes are associated with obesity. Most of these are caused by the increasing sedentary lifestyles, unhealthy diets, and many other facets of an unhealthy lifestyle (1, 2). Since most adults have over half of their waking time working in the workplaces, to promote people's healthy behaviors and their health conditions, worksite health promotion (WHP) has become necessary. Over the past three decades, many WHP studies have focused on how to implement effective intervention and measure the effectiveness of WHP and the cost-effectiveness of WHP programs. However, the overweight and obesity rates are still going up all over the world (3), and the evidence of the effectiveness of WHP program is also inconsistent. To clarify the factors which influence the successfulness of WHP program, more studies relating to the health behaviors, barriers, promoters, and supporting environment were created. In recent years, there is one issue having received attention gradually: Workplace health culture.

Culture is an abstract concept which describes employees' attitudes and behaviors, and norms that is very ethnically and geographically specific, and it will affect specific behaviors (4, 5). Organizational culture is an important element of business management and there are kinds of cultures in different dimensions, including safety culture and healthy culture. A related concept is the "worksite culture of health" which includes the gamut of organizational factors that work to encourage healthy lifestyle choices (6–9). Currently, safety culture is a mature dimension and has received attention earlier than health culture (10–13). Many companies have created their

safety culture to keep employees' safe, reduce the costs associated with work-related accident, and enhance their corporate image. As the comprehensive occupational safety program can benefit the work of preventing injury, successful workplace wellness programs must be tailored to employees' health needs and wishes as well as complementing each organization's unique culture (9, 14). For healthy behaviors, culture acts as an interpersonal force to increase or decrease motivation like self-determination and self-efficacy (15, 16). This means that just as the safety culture and employee safety are related and important, if we want to effectively promote the healthy lifestyle of employees, healthy culture is inevitably a very important issue of WHP intervention, and it is necessary creating workplace health culture for implementing more comprehensive and better effectiveness worksite health promotion in the future.

The health culture concept is understood to be a set of core attributes engendered by the interaction of social and organizational systems that reflect the values, assumptions, expectations, and definitions of workers that in turn affect the way workers think, feel, and behave with regard to personal and group health (17, 18). Until now, there are not many studies on health culture, and only a few tools are available to measure this construct; at the same time, all of them have different definitions of the components of health culture (7, 19–22). Although we are not sure whether the existing health culture measurement tools are applicable to Taiwan, some items related to local regulations or habits may reduce the applicability of these tools, and some questions do not apply to Taiwan's health culture assessment. Therefore, the development of a more extensive tool can not only help Taiwan's work of WHP, but also contribute to the promotion of this study issue. The purpose of this study was to develop and validate Workplace Health Culture Scale (WHCS) to improve the work of WHP in Taiwan.

## METHODS

This study focused on developing and validating the WHCS between August 2017 and June 2019, and it was approved by the Institutional Review Board (IRB) of Taipei Medical University and budget supplements were granted by the Ministry of Science and Technology Taiwan. In this study, three phases were carried out to develop WHCS: (1) reviewing literature and defining domain, (2) item generation, (3) validation test. Data were collected from six companies in Northern Taiwan between June 2018 and December 2018.

### Development of Workplace Health Scale and the Definition of Domains

First, we organized an expert group to integrate literature and define domains. The expert group consisted of seven health and psychology professionals, including one WHP and health behavior expert, one WHP and occupational safety and health (OHS) expert, one Occupational Safety and Health Administration supervisor, one workplace health productivity expert, one global health expert, one industrial and organizational psychologist, and one statistician who has experience in scale development. In addition, the industrial and organizational psychologist has a good experience in developing the safety culture scale (23–25). In the first session, we integrated the definition and framework of workplace health culture which was mainly collected from Allen (6), Aldana (26), and Kent's (18) study. **Table 1** contains a list of our domain definitions. According to the definition of culture, the expert group believed the WHCS items would need to focus on employees' cognition, attitudes, and feelings toward workplace health promotion. Therefore, we generated eight domains as follows: (1) Supporting Environment, (2) Health Policy, (3) Health Climate, (4) Peer Support, (5) Supervisor Support and Role Modeling, (6) Health Involvement, (7) Personal Value, and (8) Common Value.

Then we generated items to these domains with a total of 67 items. Every item began with the heading "I think…" or "My colleagues and I feel that…" to reflect the employees' attitudes and feelings. We recruited additional two WHP and OHS experts to join the expert group and to check the feasibility and content validity based on the five-point Likert scale and open-ended feedback. Items remained on the list were according to the four criteria: (1) fitness $\geqq$ 3.0 points, (2) importance $\geqq$ 3.0 points, (3) description clarity $\geqq$ 3.0 points, and (4) experts' specific amendments.

Finally, there were 65 items remaining on the list with descriptions on some items being corrected. The supporting environment contained six items, including the physical activity/healthy diet/psychological health/health risk assessment/health management system environment or service that made employees feel health was valued by the employer; the health policy contained 10 items, including the attitude of whether the health policies could be effectively implemented and carried out; the health climate contained 10 items, including five

**TABLE 1** | Definitions of the workplace health culture scale (first edition).

| Domains | Definition |
|---|---|
| Supporting environment | The feelings and attitudes about the physical environment of sports, diets, and psychological health, and the importance of the company's emphasis on the employees' health promotion issues |
| Health policy | Employees' attitudes toward company policies on health promotion, including physical activities, healthy diets, psychological health, and work-life balance |
| Health climate | Employees' attitudes and feelings toward health promotion within the company |
| Peer support | Employees' feelings and attitudes about encouraging each other to have a healthy lifestyle and even forming groups to promote health |
| Supervisor support and role modeling | Employees' feelings about supervisors' attitudes toward health promotion, and the extent to which the supervisors play the role models |
| Health involvement | Employees' attitudes, behaviors, and responsibilities on the WHP activities they participate in |
| Personal value | Individual's beliefs, attitudes, and cognition toward health promotion |
| Common value | The common beliefs and attitudes toward health promotion |

items on which the employees felt about a specific health climate in the company (e.g., physical activity climate), and five items on which the employees felt about the supervisor's attitudes of a specific healthy lifestyle and health behavior; the peer support contained eight items which looked at the employees' feelings and attitudes about encouraging each other to have a healthy lifestyle; the supervisor support and role modeling contained nine items, including two items about the CEO's healthy lifestyle role modeling, two items about the direct supervisors' role modeling, and five items about the direct supervisors' support on healthy lifestyle; the health involvement contained eight items which looked at the employees' attitudes on the healthy activities they participated in; the personal value contained five items which examined employees' personal beliefs and attitudes toward WHP; and the common value contained 10 items which looked into the employees' common beliefs and attitudes toward health promotion. Considering the original survey items are constructed in Chinese language with the rigor of translation in the context, for more detailed information about specific items, please contact the author(s).

After the completion of the WHCS first edition, we started inviting companies for validity test. Considering the need of representative and diversified samples, we recruited six companies from three different industries and company sizes. Construct validity and composite reliability were assessed to verify our health culture framework and to determine the appropriateness of items by both exploratory factor analysis and confirmatory factor analysis. We also tested the discriminant validity among companies and the internal consistency of the WHCS's final version.

## Samples

Six companies were recruited from Northern Taiwan, including the large-sized bank A, the small-sized bank B, the large-sized manufacturers C and D, the large-sized technology company E, and the medium-sized retail and wholesale company F. Engagement in WHP varied among the companies (e.g., in terms of the issues they address, level of comprehensiveness, and maturity of program). Three companies were awarded the 2018 Health Promotion Administration Ministry of Health and Welfare's WHP prize (Companies C, E, and F), which is the highest official certification and honorary award a company can earn for workplace health promotion in Taiwan, and it has been in operation for 12 years. In this study, the participating enterprises were recruited from a pool of the certified companies. We invited and collected samples from each of the small and medium-sized enterprises, aiming for at least 50% participating rate. Considering a greater number of employees in the technology company E (∼6,000 employees) than other companies in this study, we collected 1,000 samples from the company E to ensure an adequate representation. Between June and December 2018, we sent online questionnaire to the target companies and had the assistance from the health promotion leaders of these companies in the promotion and recruitment, and participants were rewarded 50 New Taiwan dollars for each questionnaire. Out of the 2,575 total survey respondents, 2,431 completed the questionnaire. This represented ∼16.4–97.8% of the eligible employee population, with small-size company (B) having relatively higher participation rates and the large-size company (E) the lowest. We did not separate domains in this survey but combined all the 65 items into one questionnaire.

## Statistical Analysis

The validation test included exploratory factor analysis and confirmatory factor analysis. Before the factor analysis, we adjusted our sample size. Considering the recommendations of sample size for conducting factor analysis (27), we decided to use 10 times the number of questions for exploratory factor analysis and confirmatory factor analysis. We randomly extracted 300 samples from company E and combined with other samples, and then we randomly extracted 650 samples from this large sample pool ($n = 2{,}431$) for analysis. We confirmed that the randomly extracted samples were not significantly different from the original sample demographic characteristics.

The exploratory factor analysis was used for reducing the number of items. We used the principal component factor analysis with the varimax rotation and eigenvalue criterion >1.0 to detect the latent variable. Before analysis, we confirmed the feasibility of factor analysis by Kaiser-Meyer-Olkin test (KMO) and Bartlett's test of sphericity. Then, items with factor loading $< 0.50$, cross-loading $> 0.40$, or communalities $< 0.30$ were eliminated (28, 29). In addition, every latent variable had to have at least three factors. The exploratory factor analysis was analyzed at a 95% significance level and conducted using PASW 22.0 software for Windows (SPSS, Chicago, IL).

After the factor analysis, we performed the confirmatory factor analysis to build the conceptual model and compared it with the original model (as **Table 1** list) to establish construct validity and reliability of WHCS. Before full model building, every latent variable collected from confirmatory factor analysis was tested separately for the model fitness to detect any unsuitable item. The following criteria of model fitness were used: root mean square error of approximation (RMSEA) $< 0.08$ (and 0.05 or lower should be better), $\chi^2/df < 5$, standardized root mean square residual (SRMR) $< 0.08$, comparative fit index (CFI) $> 0.90$, Tucker-Lewis index (TLI) $> 0.90$ (30–33). In addition, the composite reliability (CR) needed to be >0.7 for appropriate construct reliability (34), and average variance extracted (AVE) had to be >0.5 for appropriate convergent validity (35). We used AMOS 20.0 software to conduct confirmatory factor analysis (Chicago, IL).

Finally, we conducted ANOVA test for the six companies with the final version of WHSC to detect the discriminant validity of different degrees of WHP and the companies. The Cronbach's α was also tested for appropriate content reliability (36), and the threshold was 0.70 or greater. The test was analyzed at a 95% significance level ($P < 0.05$).

# RESULTS

## Demographics

The demographic characteristics of the study samples ($N = 2{,}431$) are listed in **Table 2**. The total number of workers of these six companies ranged from 188 to 6,270. The two

**TABLE 2 |** Demographic characteristics of samples.

| | Companies *N* (%) | | | | | |
|---|---|---|---|---|---|---|
| | **Bank A (*n* = 267)** | **Bank B (*n* = 139)** | **Manufactory C (*n* = 264)** | **Manufactory D (*n* = 328)** | **Technology company E (*n* = 1,029)** | **Wholesale retailer F (*n* =322)** |
| **Gender** | | | | | | |
| Male | 128 (47.9) | 47 (33.8) | 206 (78.0) | 166 (50.6) | 637 (61.9) | 207 (64.3) |
| Female | 139 (52.1) | 92 (66.2) | 58 (22.0) | 162 (49.4) | 392 (38.1) | 115 (35.7) |
| **Educational level** | | | | | | |
| Lower than junior high school | 0 (0.0) | 3 (2.2) | 1 (0.3) | 10 (3.1) | 2 (0.2) | 0 (0.0) |
| Senior high school | 11 (4.2) | 15 (10.9) | 53 (20.2) | 40 (12.2) | 6 (0.6) | 35 (11.0) |
| University | 194 (74.3) | 68 (49.7) | 174 (66.2) | 210 (64.2) | 407 (39.6) | 222 (70.1) |
| Master's degree or higher | 56 (21.5) | 51 (37.2) | 35 (13.3) | 67 (20.5) | 614 (59.6) | 60 (18.9) |
| **Age, years** | | | | | | |
| 18–29 | 43 (16.4) | 14 (10.5) | 23 (8.7) | 30 (9.2) | 368 (35.7) | 30 (9.5) |
| 30–39 | 93 (35.5) | 49 (36.8) | 65 (24.7) | 110 (33.8) | 489 (47.5) | 136 (43.0) |
| 40–49 | 83 (31.7) | 21 (15.8) | 86 (32.8) | 96 (29.4) | 159 (15.5) | 105 (33.3) |
| 50–64 | 40 (15.3) | 48 (36.1) | 89 (33.8) | 89 (27.3) | 13 (1.3) | 45 (14.2) |
| 65 or higher | 3 (1.1) | 1 (0.8) | 0 (0.0) | 1 (0.3) | 0 (0.0) | 0 (0.0) |
| Age, years (Mean ± SD) | 39.6 ± 10.13 | 42.5 ± 12.49 | 43.6 ± 9.64 | 42.6 ± 10.19 | 37.7 ± 9.68 | 39.8 ± 8.45 |
| Seniority, years (Mean ± SD) | 13.2 ± 10.14 | 13.1 ± 11.82 | 18.1 ± 9.81 | 15.2 ± 11.48 | 5.5 ± 4.55 | 8.9 ± 7.15 |
| Total number of workers | 923 | 188 | 3,229 | 1,204 | 6,270 | 323 |

*SD, standard deviation.*

banks had significantly higher proportion of female workers. The technology company had the highest proportion of employees with a master's degree or higher education level (59.7%), the lowest average age (37.7 ± 9.68 years), and the lowest average seniority (5.5 ± 4.55 years). In general, most of the samples had an educational level with at least a bachelor's degree.

## Exploratory Factor Analysis

The first exploratory factor analysis produced 11 latent variables, accounting for 68.57% total variance. The KMO test of sampling adequacy was 0.967 and Bartlett's test for sphericity was highly significant ($p < 0.001$). The original 65 items were gradually eliminated according to their factor loading and cross-loading criteria, and eventually 38 items remained. There were 27 items eliminated as follows: 11 items had factor loading lower than 0.50, 12 items had cross-factor loading higher than 0.40, and two latent variables had only two items of each (and only <2% total explained variance). The two eliminated latent variables were separated from the "Supporting Environment" domain and the "Peer Support" domain. The factor analysis of the rest of the 38 items produced seven latent variables, accounting for 63.19% total variance. Most of the items remained in the original domains except Q15, which was classified as "Health climate" from "Health policy." Therefore, we did not change any domain's label.

## Confirmatory Factor Analysis

The confirmatory factor analysis tested each of the seven domains after the exploratory factor analysis test. However, only four domains could be analyzed since the other three domains had only three items each (just-identified). The first domain—"Health Climate"—which had the highest total explained variance in exploratory factor analysis had 11 items. We eliminated Q15, Q17, Q19, and Q24 since they had higher modification index (M.I.) value and high significant correlation with other items. The second domain—"Common Value"—had seven items. We eliminated Q58 for the same reason. The third domain—"Supervisor Support and Role Modeling"—had five items, and we eliminated Q35 since it significant correlated to Q37 and Q39, and it had a high M.I. value. The fourth domain—"Supporting Environment"—had four items, and it was the only domain that was eliminated because Q1 and Q3, Q2 and Q4 had very high significant correlation with each other that lacked enough model fit. The fifth domain—"Health Policy"—had five items. We eliminated Q9 due to its high M.I. value.

Six domains were constructed from the remaining 25 items, and the total explained variance was 69.64% (**Table 3**). All of the domains could meet the criteria of CR and AVE, and the Cronbach's α was 0.804–0.919. **Table 4** showed the model fit and the correlations among the domains. The two domains—"Health Climate" and "Supervisor Support and Role Modeling"—had worse model fit than others since each item within the domains had a certain degree of correlation (Health Climate had RMSEA = 0.075, $\chi^2/df = 4.879$, Supervisor Support and Role Modeling

**TABLE 3 |** Factor loadings for 25-items workplace health culture scale ($N = 650$).

| Domain | Original item code | Cronbach's α | Corrected item-to-total correlation | Factor loadings | | | | | | CR | AVE | Total explained variance (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Health climate | Q16 | 0.919 | 0.687 | 0.698 | | | | | | 0.92 | 0.63 | 18.94 |
| | Q18 | | 0.724 | 0.693 | | | | | | | | |
| | Q20 | | 0.795 | 0.756 | | | | | | | | |
| | Q21 | | 0.770 | 0.775 | | | | | | | | |
| | Q22 | | 0.809 | 0.758 | | | | | | | | |
| | Q23 | | 0.739 | 0.667 | | | | | | | | |
| | Q25 | | 0.733 | 0.682 | | | | | | | | |
| Common value | Q57 | 0.880 | 0.701 | | 0.711 | | | | | 0.88 | 0.60 | 14.32 |
| | Q59 | | 0.789 | | 0.827 | | | | | | | |
| | Q60 | | 0.763 | | 0.810 | | | | | | | |
| | Q61 | | 0.639 | | 0.727 | | | | | | | |
| | Q64 | | 0.677 | | 0.765 | | | | | | | |
| Supervisor support and role modeling | Q37 | 0.899 | 0.707 | | | 0.688 | | | | 0.91 | 0.71 | 12.31 |
| | Q38 | | 0.842 | | | 0.838 | | | | | | |
| | Q39 | | 0.830 | | | 0.818 | | | | | | |
| | Q42 | | 0.728 | | | 0.728 | | | | | | |
| Personal value | Q51 | 0.918 | 0.831 | | | | 0.814 | | | 0.92 | 0.79 | 10.46 |
| | Q52 | | 0.872 | | | | 0.869 | | | | | |
| | Q53 | | 0.801 | | | | 0.836 | | | | | |
| Health policy | Q6 | 0.809 | 0.607 | | | | | 0.635 | | 0.82 | 0.61 | 8.97 |
| | Q7 | | 0.748 | | | | | 0.825 | | | | |
| | Q8 | | 0.627 | | | | | 0.797 | | | | |
| Peer support | Q26 | 0.804 | 0.571 | | | | | | 0.612 | 0.82 | 0.60 | 8.58 |
| | Q32 | | 0.688 | | | | | | 0.800 | | | |
| | Q33 | | 0.706 | | | | | | 0.774 | | | |

*CR, composite reliability; AVE, average variance extracted.*

**TABLE 4 |** Corrections among constructs.

| Domain | Model fit | | | | Correlations | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RMSEA | $\chi^2$/df | SRMR | CFI | | | | | | |
| Health climate | 0.075 | 4.879 | 0.023 | 0.982 | – | | | | | |
| Common value | 0.048 | 2.611 | 0.014 | 0.995 | 0.458** | – | | | | |
| Supervisor support and role modeling | 0.079 | 5.275 | 0.016 | 0.995 | 0.637** | 0.474** | – | | | |
| Personal value | – | – | – | – | 0.499** | 0.479** | 0.514** | – | | |
| Health policy | – | – | – | – | 0.641** | 0.306** | 0.403** | 0.347** | – | |
| Peer support | – | – | – | – | 0.585** | 0.512** | 0.552** | 0.433** | 0.431** | – |
| Full model | 0.059 | 3.412 | 0.060 | | | | | | | |

*RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; CFI, comparative fit index.*
***$p < 0.01$.*

had RMSEA = 0.079, $\chi^2$/df = 5.275). The full model exhibited enough fit statistics (RMSEA = 0.059, $\chi^2$/df = 3.412, SRMR = 0.060, CFI = 0.952, GFI = 0.917, TLI = 0.938). The model fit did not have significant improvement when we eliminated some items with a relatively high M.I. value in the full model (e.g., Q16 and Q42); therefore, Q16 and Q42 were retained. Comparing to our original domain definition, two domains were eliminated (Supporting Environment and Health Involvement), but most items could be correctly classified under the original domain, hence we believe that this scale has sufficient construct validity. All of the domains' Cronbach's alpha were above 0.90.

The final model had good discriminant validity (**Table 5**). All of the domains and the total score had significant differences among the 6 companies. In general, those companies which won the WHP prize in 2018 (Company C, E, and F) had significant higher points than others, but the small bank B had the highest

**TABLE 5 |** The result of discriminant validity test.

| | Companies (Mean ± SD) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Bank A ($n$ = 262)** | **Bank B ($n$ = 134)** | **Manufactory C ($n$ = 263)** | **Manufactory D ($n$ = 326)** | **Technology company E ($n$ = 1029)** | **Wholesale retailer F ($n$ = 316)** | ***p* value** |
| Health climate | 21.3 ± 5.70 | 24.8 ± 4.69 | 24.9 ± 4.79 | 23.2 ± 4.76 | 24.3 ± 4.49 | 27.2 ± 4.16 | <0.001** |
| Common value | 19.9 ± 2.61 | 21.1 ± 2.54 | 21.0 ± 2.19 | 20.5 ± 2.36 | 20.5 ± 2.59 | 20.8 ± 2.56 | <0.001** |
| Supervisor support and role modeling | 13.3 ± 3.22 | 14.5 ± 3.04 | 14.6 ± 2.53 | 14.4 ± 2.64 | 14.8 ± 2.74 | 15.3 ± 2.68 | <0.001** |
| Personal value | 10.4 ± 2.23 | 10.9 ± 2.16 | 11.3 ± 1.93 | 10.7 ± 1.88 | 10.9 ± 2.08 | 11.2 ± 2.05 | <0.001** |
| Health policy | 8.1 ± 4.03 | 8.9 ± 3.66 | 10.0 ± 3.24 | 8.2 ± 4.12 | 9.3 ± 3.22 | 11.0 ± 2.92 | <0.001** |
| Peer support | 10.5 ± 2.07 | 12.1 ± 1.51 | 11.2 ± 1.86 | 11.0 ± 1.91 | 11.2 ± 1.99 | 11.3 ± 1.78 | <0.001** |
| Total score | 83.5 ± 14.6 | 92.4 ± 13.4 | 93.1 ± 12.90 | 88.1 ± 12.67 | 91.1 ± 12.68 | 96.7 ± 12.49 | <0.001** |

*SD, standard deviation.*
***p < 0.01.*

peer support point. Therefore, the final version of WHCS has six domains–Health Climate, Common Value, Supervisor Support and Role Modeling, Peer Support, Personal Value and Common Value–and 25 items in total.

## DISCUSSION

This is the first Chinese workplace health culture audit with appropriate development and validation work. In this study, we developed and validated the WHCS, and it had appropriate construct validity, content validity, discriminant validity, composite reliability, and internal consistency. This scale was developed based on several current workplace health culture and audit literature, and we believe it can appropriately reflect the workplace health culture and can be used for the improvement of WHP.

Considering our goal was to measure the workplace health culture and none of the existing tools could truly meet our needs in addressing the construct of interest, we saw the need of creating a new tool which is the frame and design of the "culture" definition from our point of view and the quality of the existing tools. Before we developed WHCS, we compared all the current health culture measurement tools (6, 7, 18, 20, 21) and took all the current health culture frame and theory into consideration (17, 22, 26, 37, 38). Health culture is a collective cognition and attitude, which is built on the individual's subjective and abstractive attitude, values, and beliefs to health. However, some of current health tools do not meet our definition, e.g., Jia's Chinese workplace health culture scale (21) and Kent's Culture of health scale (38). Jia's Chinese Workplace Health Culture scale had a lot of items related to direct supervisor's health behaviors (e.g., smoking, drinking, exercise) and the support and encouragement from the direct supervisor and family to lead a healthy lifestyle; it was not about the workplace health culture but the employees' cognition and attitude. Kent's Culture of health scale consisted of two parts: internal and external culture of health, and this scale was more likely a culture checklist rather than a personal questionnaire. For example, it asked the number of employees who were given health education in the past 12 months, whether the organization had a health promotion strategic plan, and it contained some open-ended questions to explore the organizational commitment and volunteerism. Aldana's review study pointed out that several health culture measurement tools developed before 2012 had some shortcomings, which were verified to be less relevant to health (19) or lacked evidence of reliability and validity (39). In addition, we also excluded those scales related to "health climate" since it was not the same as culture. Organizational culture and climate are not the same thing (40), climate has narrower concept than culture; however, both of them focus on the shared perception, values, and beliefs rather than the actual environment evaluation. It means the health culture measurement is not the evaluation of the degree of the accessibility or applicability in the health policy and physical and psychological environment, nor is it about the feeling of employees toward them. Finally, after checking the LHCA and Kwon's Culture of Health scale (COH) and considering that the translation and modification of the questionnaire would result in subtle variation in the semantics and that some questions might be irrelevant to the regulations in Taiwan, we finally decided to develop a new scale.

In general, WHCS has six domains and 25 items. Comparing to our original domain definition, only two domains were eliminated, and most items could be classified under the original domain. It might mean that our item design was appropriate and close to the original definition. In WHCS, we put more emphasis on the concept of collective cognition and attitude, so we excluded the investigation about the physical normative and physical environment. Comparing to Allen's Lifegain framework and Lifegain Health Culture Audit (LHCA) (6, 7), WHCS does not include the "normative" domain, and the domain of values is divided into personal and common values. In addition, the supporting environment and health policy domain also focus on "whether these supporting material works" instead of "the availability of materials," and it is the most obvious difference from the LHCA. Comparing to COH (41), which separates the definition of the supporting environment into two parts—"environment components" and "culture components," our domains and items are closer to the "culture components" part. Considering the "organizational culture" was defined as a kind of "shared basic assumptions"

(37), the workplace health culture should have similar definitions and characteristics. In general, since the definitions of health culture are inconsistent until now, the criterion validity might not be appropriate to the development of workplace health culture tools.

The exclusion of the domain about support environment may be quite reasonable, and it's not just because the model fits problem. In addition to the environment evaluation might not close to the culture definition, there might be another explanation. Until now, there have been many intervention studies in WHP that adopted supporting environment interventions alone or combined with other intervention, but the evidence of effectiveness is still inconsistent. Some studies have found that adopting environmental interventions alone is completely ineffective in improving employees' health behaviors and health status (42–45). However, combined with other behavioral interventions, environmental intervention can help to promote the effectiveness of WHP (46, 47). Therefore, most countries now encourage comprehensive WHP as much as possible. Such research evidence may represent that the supporting environment's influence on changing health attitudes or behaviors is more indirect than other domain of health culture or direct work of behavioral intervention, and this might explain why this domain was excluded in this study.

Another domain excluded in this study is "Health Involvement." Health involvement was related to employees' attitudes, behaviors, and responsibilities they had participating in the WHP activities, and we assumed it might be affected by the quality and comprehensiveness of WHP, which were different among the six workplaces. It might cause the cyclical interference of health involvement and its impact factor. For example, there were more companies believing that employees' health was entirely their own responsibility, especially for the small and medium-sized enterprises (48, 49), and it would affect employees' attitudes and health involvement in participation (50, 51). Although it was more complicated than other domains and was excluded from the WHCS, we believe that it is still very important and there should be more in-depth research with regard to worksite health culture.

Although we excluded the investigation of physical environment of WHCS, it might be an interesting issue to be studied in the future. In this study, we noticed the health culture might not directly associate with the business size (**Table 5**). The small and midsized business might have lower resources to WHP program; however, recent studies have shown that the effectiveness of WHP does not entirely depend on the size of the company (52). For example, small businesses might be more likely to shape the peer support in health. On the contrary, large enterprises might not necessarily create a better health culture even if they have the ability to invest more physical materials and resources in the WHP. The question "What kind of WHP investment might shape the health culture more effectively?," or "Which work of WHP might evoke a positive attitude and cognition to health and build supporting climate for each other?" (e.g., how long, to whom, and to what degree the comprehensiveness of the WHP intervention is suitable to change the culture?) might be the most important field to the WHP in the future.

Our study has several strengths. First, we conducted a complete review of the definition and related literature on organizational culture and health culture and compared existing measurement tools. It seems that not all of the health culture measurement tools are in compliance with our definition of culture nor can they provide us with suitable measurement. Our second strength was that we filled in the gap that only few tools had enough comprehensive structure. This strength might increase the applicability of the tool outside of Taiwan since most of the items focus on the subjective attitudes and employees' cognition and less on objective policies and environment at the substantive level, but we still believe that this requires rigorous verification and testing. In addition, though the final version of WHC consists of only 25 items, it is still good model fit that we believe it yielded sound response in this study.

The limitations of this study could be used to build future research. First, an effective, validated representation of WHCS should incorporate wider varieties of industries across different sizes of enterprises, and it should also include confirmatory factor analysis and model fit tests. Second, we would take into consideration of assigning different weight to each domain of WHCS in the future since it has an unbalanced number of items in each domain. Therefore, our next study will focus on the extensive validation of this tool and its relevance to the environment, employees' health behaviors, demographic characteristics and other factors that may influence health culture, and the association to the health risk.

## CONCLUSIONS

In this study, we developed and validated the WHCS, and the results of this study indicated the WHCS has appropriate reliability and validity. WHCS is suitable for measuring employees' attitudes, cognition, and feelings of a healthy workplace for improving the WHP in Taiwan. Based on the limitations and strengths of this study, we suggest that more studies about reliability and validity of WHCS and the correlation between WHCS and other WHP measuring indicators (e.g., personal health behavior and physical and psychological environment) are needed.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

Taipei Medical University- Joint Institutional Review Board Committee waived the requirement for written informed consent for participants in this study due to the questionnaire for this study was completely anonymous

and de-linked, and the written informed consent was the only source that could link to the respondent's individual. In addition, the questionnaire is distributed by the research team, or the online questionnaire is used, and the content of the questionnaire has the minimum personal risk, in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

Y-TC, R-YC, F-JT, C-CK, and C-YY participated in the conception, design of the study, and scale development. Y-TC participated in acquisition of data. Y-TC, R-YC, and C-YY performed the statistical analysis and drafted the manuscript. All authors read and approved the final manuscript.

## FUNDING

This study was funded by the Ministry of Science and Technology (MOST) of Taiwan (MOST 106-2314-B-038-041).

## ACKNOWLEDGMENTS

The authors would like to thank the participants in this study for their time and efforts.

## REFERENCES


1. Baicker K, Cutler D, Song ZR. Workplace wellness programs can generate savings. *Health Aff.* (2010) 29:304–11. doi: 10.1377/hlthaff.2009.0626
2. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health - Updated recommendation for adults from the American college of sports medicine and the American heart association. *Circulation.* (2007) 116:1081–93. doi: 10.1161/CIRCULATIONAHA.107.185649
3. Organization, WHO. *Obesity and Overweight factsheet from the WHO*. Health (2017). Available online at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
4. Kroeber AL, Kluckhohn C. *Culture: A Critical Review of Concepts and Definitions*. Wiley for Wesleyan University (1964).
5. Schein EH. *Organizational Culture*, Vol. 45. American Psychological Association (1990).
6. Allen RF, Linde S. *Lifegain: The Exciting New Program That Will Change Your Health-and Your Life*. New York, NY: Appleton-Century-Crofts (1981).
7. Golaszewski T, Hoebbel C, Crossley J, Foley G, Dorn J. The reliability and validity of an organizational health culture audit. *Am J Health Stud.* (2008) 23:116–23.
8. Berry LL, Mirabito AM, Baun WB, What's the hard return on employee wellness programs? *Harv Bus Rev.* (2010) 88:104–12, 142.
9. Terry PE, Seaverson EL, Grossmeier J, Anderson DR. Association between nine quality components and superior worksite health management program results. *J Occup Environ Med.* (2008) 50:633–41. doi: 10.1097/JOM.0b013e31817e7c1c
10. Cox SJ, Cheyne AJT. Assessing safety culture in offshore environments. *Saf Sci.* (2000) 34:111–29. doi: 10.1016/S0925-7535(00)00009-6
11. Short JF. The challenger launch decision: risky technology, culture, and deviance at NASA - Vaughan, D. *Contemp Sociol J Rev.* (1996) 25:727–9. doi: 10.2307/2077251
12. Pidgeon N. Safety culture: key theoretical issues. *Work Stress.* (1998) 12:202–16. doi: 10.1080/02678379808256862
13. Cooper MD. Towards a model of safety culture. *Saf Sci.* (2000) 36:111–36. doi: 10.1016/S0925-7535(00)00035-7
14. Goetzel RZ, Henke RM, Benevent R, Tabrizi MJ, Kent KB, Smith KJ, et al. The predictive validity of the HERO Scorecard in determining future health care cost and risk trends. *J Occup Environ Med.* (2014) 56:136–44. doi: 10.1097/JOM.0000000000000081
15. Deci EL. Self-determination theory and education. *Cesk Psychol.* (1994) 38:420–6.
16. Deci EL, Ryan RM. The theory of self-determination of motivation and its relevance to pedagogics. *Z Padagogik.* (1993) 39:223–38.
17. Allen J. Building supportive cultural environments. In: O'Donnell MP, eds. *Health Promotion in the Workplace*. Albany, NY: Delmar Publishers, Inc. (2002).
18. Kent K, Goetzel RZ, Roemer EC, Prasad A, Freundlich N. Promoting healthy workplaces by building cultures of health and applying strategic communications. *J Occup Environ Med.* (2016) 58:114–22. doi: 10.1097/JOM.0000000000000629
19. Basen-Engquist K, Hudmon KS, Tripp M, Chamberlain R. Worksite health and safety climate: scale development and effects of a health promotion intervention. *Prev Med.* (1998) 27:111–9. doi: 10.1006/pmed.1997.0253
20. Smith DR, Guidotti TL, Kwon Y, Marzec ML. Does worksite culture of health (CoH) matter to employees? Empirical evidence using job-related metrics. *J Occup Environ Med.* (2016) 58:448–54. doi: 10.1097/JOM.0000000000000724
21. Jia Y, Gao J, Dai J, Zheng P, Fu H. Associations between health culture, health behaviors, and health-related outcomes: a cross-sectional study. *PLoS ONE.* (2017) 12:e0178644. doi: 10.1371/journal.pone.0178644
22. Crimmins TJ, Halberg J. Measuring success in creating a "culture of health". *J Occup Environ Med.* (2009) 51:351–5. doi: 10.1097/JOM.0b013e318196a8e6
23. Tsay C-YJ, Kuo C-C, Chao C-J, Drury CG, Hsiao Y-L. Safety culture evaluation in China Airlines: a preliminary study. In: *International Conference on Engineering Psychology and Cognitive Ergonomics*. Taoyuan: Springer (2014).
24. Kuo C-C, Tsaur C-C, Kao F-H. Perceived control and work safety: the mediating role of safety culture. *J Occup Saf Health.* (2010) 18:95–110. doi: 10.7005/JOSH.201003.0095
25. Kuo C-C, Tsaur C-C, Chang Y-Y. The study of norm of safety culture questionary in construction industry of Taiwan. *J Occup Saf Health.* (2006) 15:91–103.
26. Aldana SG, Anderson DR, Adams TB, Whitmer RW, Merrill RM, George V, et al. A review of the knowledge base on healthy worksite culture. *J Occup Environ Med.* (2012) 54:414–9. doi: 10.1097/JOM.0b013e31824be25f
27. Howe GR, Anderson TW, Rubin H. Statistical inference in factor analysis. In: *Proceedings of the Third Berkeley Symposium on Mathematical Statistics and Probability* (1956) Okland, CL: University of California.
28. DeVellis RF. *Scale Development: Theory and Applications*, Vol. 26. Thousand Oaks, CA Sage Publications (2016).
29. Fabrigar RL, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. *Psychol Methods*. (1999) 4:272–99. doi: 10.1037//1082-989X.4.3.272
30. Bentler PM. Comparative fit indexes in structural models. *Psychol Bull.* (1990) 107:238–46. doi: 10.1037//0033-2909.107.2.238
31. McDonald RP, Marsh HW. Choosing a multivariate model: noncentrality and goodness of fit. *Psychol Bull.* (1990) 107:247. doi: 10.1037/0033-2909.107.2.247
32. Mulaik SA, James LR, Van Alstine J, Bennett N, Lind S, Stilwell CD. Evaluation of goodness-of-fit indices for structural equation models. *Psychol bulletin.* (1989) 105:430. doi: 10.1037/0033-2909.105.3.430
33. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Eq Model Multidiscipl J.* (1999) 6:1–55. doi: 10.1080/10705519909540118
34. Hair JF, Black B, Babin B, Anderson RE, Tatham RL. *Multivariate Data Analysis*, Vol. 6. Upper Saddle River, NJ: Pearson Prentice Hall (2006).
35. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Mark Res.* (1981) 18:39–50. doi: 10.1177/002224378101800104

36. Nunnally JC, Bernstein I. *Psychometric Theory (McGraw-Hill Series in Psychology)*, Vol. 3. New York, NY: McGraw-Hill (1994).
37. Schein EH. *Organizational Culture and Leadership*, Vol. 2. San Francisco, CL: John Wiley & Sons (2010).
38. Kent KB, Goetzel RZ, Roemer EC, McCleary K, Henke RM, Head MA, et al. Developing two culture of health measurement tools: examining employers' efforts to influence population health inside and outside company walls. *J Occup Environ Med.* (2018) 60:1087–97. doi: 10.1097/JOM.0000000000001438
39. Ribisl KM, Reischl TM, Ribisl KM, Reischl TM. Measuring the climate for health at organizations. Development of the worksite health climate scales. *J Occup Med.* (1993) 35:812–24. doi: 10.1097/00043764-199308000-00019
40. Schneider B, Ehrhart MG, Macey WH. Organizational climate and culture. *Ann Rev Psychol.* (2013) 64:361–88. doi: 10.1146/annurev-psych-113011-143809
41. Kwon Y, Marzec ML, Edington DW. Development and validity of a scale to measure workplace culture of health. *J Occup Environ Med.* (2015) 57:571–7. doi: 10.1097/JOM.0000000000000409
42. Brehm BJ, Gates DM, Singler M, Succop PA, D'Alessio DA, Brehm BJ, et al. Environmental changes to control obesity: a randomized controlled trial in manufacturing companies. *Am J Health Promot.* (2011) 25:334–40. doi: 10.4278/ajhp.090128-QUAN-37
43. Linde JA, Nygaard KE, MacLehose RF, Mitchell NR, Harnack LJ, Cousins JM, et al. HealthWorks: results of a multi-component group-randomized worksite environmental intervention trial for weight gain prevention. *Int J Behav Nutr Phys Act.* (2012) 9:14. doi: 10.1186/1479-5868-9-14
44. Kushida O, Murayama N. Effects of environmental intervention in workplace cafeterias on vegetable consumption by male workers. *J Nutr Educ Behav.* (2014) 46:350–8. doi: 10.1016/j.jneb.2014.05.001
45. Kahn-Marshall JL, Gallant MP. Making healthy behaviors the easy choice for employees: a review of the literature on environmental and policy changes in worksite health promotion. *Health Educ Behav.* (2012) 39:752–76. doi: 10.1177/1090198111434153
46. Verweij LM, Coffeng J, van Mechelen W, Proper KI. Meta-analyses of workplace physical activity and dietary behaviour interventions on weight outcomes. *Obes Rev.* (2011) 12:406–29. doi: 10.1111/j.1467-789X.2010.00765.x
47. Flynn JP, Gascon G, Doyle S, Matson Koffman DM, Saringer C, Grossmeier J, et al. Supporting a culture of health in the workplace: a review of evidence-based elements. *Am J Health Promot.* (2018) 32:1755–88. doi: 10.1177/0890117118761887
48. Taylor AW, Pilkington R, Montgomerie A, Feist H. The role of business size in assessing the uptake of health promoting workplace initiatives in Australia. *BMC public health.* (2016) 16:353. doi: 10.1186/s12889-016-3011-3
49. Pescud M, Teal R, Shilton T, Slevin T, Ledger M, Waterworth P, et al. Employers' views on the promotion of workplace health and wellbeing: a qualitative study. *BMC Public Health.* (2015) 15:642. doi: 10.1186/s12889-015-2029-2
50. Linnan L, Bowling M, Childress J, Lindsay G, Blakey C, Pronk S, et al. Results of the 2004 National Worksite Health Promotion Survey. *Am J Public Health.* (2008) 98:1503–9. doi: 10.2105/AJPH.2006.100313
51. Schult TM, Galway AM, Awosika ER, Schmunk SK, Hodgson M. Management support, worksite culture, and local resources for healthier employees the veterans affairs experience. *J Occup Environ Med.* (2013) 55:310–7. doi: 10.1097/JOM.0b013e31827dba1e
52. McLellan DL, Cabán-Martinez AJ, Nelson CC, Pronk NP, Katz JN, Allen JD, et al. Organizational characteristics influence implementation of worksite health protection and promotion programs: evidence from smaller businesses. *J Occup Environ Med.* (2015) 57:1009. doi: 10.1097/JOM.0000000000000517


**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 Public Health

ORIGINAL RESEARCH
published: 28 February 2020
doi: 10.3389/fpubh.2020.00012

# The Mediating Role of Psychological Capital in the Relationship Between Occupational Stress and Fatigue: A Cross-Sectional Study Among 1,104 Chinese Physicians

*Fangqiong Tian*[1], *Qianyi Shu*[2], *Qi Cui*[1], *Lulu Wang*[1], *Chunli Liu*[3] *and Hui Wu*[1]*

[1] Department of Social Medicine, School of Public Health, China Medical University, Shenyang, China, [2] Party Committee Office, Shengjing Hospital of China Medical University, Shenyang, China, [3] Library of China Medical University, Shenyang, China

OPEN ACCESS

**Edited by:**
Leah Okenwa Emegwa,
Swedish Red Cross University College, Sweden

**Reviewed by:**
Anselm Ting Su,
Universiti Malaysia Sarawak, Malaysia
Siti Munira Yasin,
Universiti Teknologi MARA, Malaysia

***Correspondence:**
Hui Wu
hwu@cmu.edu.cn

**Specialty section:**
This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health

**Received:** 04 October 2019
**Accepted:** 14 January 2020
**Published:** 28 February 2020

**Citation:**
Tian F, Shu Q, Cui Q, Wang L, Liu C and Wu H (2020) The Mediating Role of Psychological Capital in the Relationship Between Occupational Stress and Fatigue: A Cross-Sectional Study Among 1,104 Chinese Physicians. Front. Public Health 8:12. doi: 10.3389/fpubh.2020.00012

**Purpose:** This study aimed to explore the association of occupational stress with fatigue and to examine the mediating role of psychological capital (PsyCap) among Chinese physicians.

**Materials and Methods:** A cross-sectional study was conducted in Liaoning province, China, in 2018. Using a multistage stratified sampling method, a total of 1,500 physicians participated and 1,104 (73.6%) physicians responded effectively. The study used a self-administered questionnaire consisting of the 14-item Fatigue Scale (FS-14), the Effort-reward Imbalance questionnaire (ERI), the Psychological Capital Questionnaire (PCQ) and items about demographic and working characteristics. Hierarchical multiple regression analyses were performed to explore the association of occupational stress, PsyCap, and fatigue among physicians. Asymptotic and resampling strategies were used to examine the mediating effect.

**Results:** The incidence of fatigue among Chinese physicians was 83.70%. The average level of fatigue was 7.96 ± 3.95 (mean ± SD). Occupational stress and PsyCap were significantly associated with fatigue. PsyCap significantly mediated the association of ERR ($a \times b = 0.106$, bias-corrected and accelerated 95% confidence interval [BCa 95% CI]: 0.078, 0.138) and overcommitment ($a \times b = 0.068$, BCa 95% CI: 0.044, 0.092) with fatigue. Two important components of PsyCap, self-efficacy and resilience, play more important roles in the mediating effect.

**Conclusions:** The level of fatigue among Chinese physicians was high, which should be taken seriously by management. PsyCap could mediate the association between occupational stress and fatigue. The intervention strategies and measures to relieve fatigue could be focused on physicians' positive PsyCap improvement.

**Keywords: fatigue, occupational stress, psychological capital, mediating effect, physician**

## INTRODUCTION

Fatigue is expressed as a condition characterized by physical or mental exhaustion after prolonged periods of exertion without adequate rest and recovery (1). According to a survey among general working population in 2018, the rates of fatigue for sedentary workers and physical workers were 17.0 and 38.9%, respectively (2). In reality, fatigue is a longstanding problem within the health-care occupations in many countries, such as China, the United States, the United Kingdom, and Australia, and especially among physicians (3–7). O'Donnell's research suggested that nearly half of physicians (45.4%) are extremely fatigued (6). Physicians are more vulnerable to fatigue than are those in other occupational groups (8). Long-term fatigue of physicians could lead to adverse health consequences, like musculoskeletal disorders, poor mental health status, and increased error and accident at work (9, 10). It means fatigue has a major impact not only on physicians' life quality and work efficiency but also on patients' safety and satisfaction with health-care services. Therefore, more attention should be paid on the influencing factors and the formation mechanism of fatigue in order to develop targeted preventive measures against fatigue among physicians.

Demographics and working characteristics are two considerable factors affecting fatigue (11). It is reported that fatigue could be influenced by age, marital status, and educational level (3). Another study found the relation between fatigue and poorly designed shift rotas among junior physicians. Particularly, shift work and night duty predispose physicians to a high level of fatigue (12). In addition, fatigue is a multifactorial phenomenon that can be influenced by psychosocial factors. For instance, it is reported that fatigue was related with occupational stress and psychological distress among bus drivers and industrial workers (13, 14). Fatigue and occupational stress also showed a significantly positive correlation among nurses (15, 16).

Occupational stress usually refers to the physical and mental health pressures of employees, as well as physical disturbances caused by imbalances between employee's capabilities and objective needs (17). As two of the leading occupational stress models, effort–reward imbalance (ERI) model and job demand–control–support (DCS) model are extensively applied, but the ERI model appeared to be more predictive than the DCS model in Chinese workers (18). Siegrist's ERI model measures the balance of exertions and gains at work, which includes items on reward and intrinsic and extrinsic effort (19). One of the most important factors in ERI is effort–reward ratio (ERR), which evaluates whether the rewards are equal to the extrinsic effort. Overcommitment is the other component of ERI model, which is the individual's internal drive to achieve the goal, including the degree of physical and mental investment (20). Excessive commitment or imbalance between efforts and rewards would lead to occupational stress, which could trigger psychosomatic reaction and cause or exacerbate fatigue (21, 22). Therefore, occupational stress might significantly have an impact on fatigue among Chinese physicians.

Owing to the emergence of positive psychology in recent decades, scholars began to explore solutions to undesirable employee attitudes (fatigue, anxiety, and depression) from the perspective of psychological resources (23, 24). It is noticeable that internal psychological constructs, like self-efficacy, resilience, hope, and optimism, have played positive roles in relieving fatigue symptoms (25). Psychological capital (PsyCap) is an important positive psychological resource of individuals, defined by Luthans as "a positive psychological state that an individual performs in the process of growth and development" (26). PsyCap consists of four components of mental resource—self-efficacy, resilience, hope, and optimism—all of which can be measured and developed (27). PsyCap and its four components may be key to better understand the variation in stress, as well as intentions to negative behaviors (28). Previous studies have showed the a negative relation between PsyCap and fatigue in a variety of professions (27, 29). Analogously, Kim and Jang reported that seafarers' self-efficacy will have a negative effect on fatigue (30). Resilience also showed significant effects on fatigue among hospital employees (31). Therefore, PsyCap might be one of the keys to effectively prevent and relieve fatigue of Chinese physicians.

What is more, studies have indicated that occupational stress can directly affect psychological well-being and also can indirectly affect employee's attitude and health (32, 33). When occupational stress arises, PsyCap could psychologically buffer the effect of occupational stress on adverse outcomes (34) and bring more energy physically to the individual (35). It is well established that PsyCap can significantly affect the association between occupational stress with job burnout, depression, turnover intention, and job satisfaction among various occupational groups (36–39). For example, previous studies reported that PsyCap mediated the association of occupational stress (ERI) and burnout among bank employees and manufacturing workers (33, 36). However, whether PsyCap mediates the association between occupational stress and fatigue among physicians has not yet been determined. Therefore, it is necessary to find out the association between occupational stress, PsyCap, and fatigue among Chinese physicians.

On the basis of the above, we made the following three assumptions among Chinese physicians: (1) demographic and working characteristics such as age, gender, educational level, marital status, job rank, shift patterns, and night duty may be significantly associated with fatigue among physicians; (2) after demographic working characteristics were adjusted for, occupational stress would still be an important factor affecting fatigue; and (3) PsyCap could mediate the association between occupational stress and fatigue.

## MATERIALS AND METHODS

### Study Design and Data Collection

A cross-sectional survey was conducted in Liaoning province, China, in 2018. With the use of a multistage stratified sampling method, a total of 10 public tertiary hospitals and 1,500 physicians were randomly selected. Liaoning province consists of

14 prefecture-level cities, which can be divided into five regions by geographical location: eastern, western, southern, northern, and central. In each geographic region, one city was randomly selected. In the second sampling stage, we sampled according to the proportion of hospitals in each city. Three tertiary public hospitals were randomly selected if the sampling city was a capital city; two tertiary public hospitals were randomly selected from the smaller cities. Particularly, one hospital was selected if the selected city only has one tertiary public hospital. In this study, 10 tertiary public hospitals were selected from five cities. In each selected hospital, 150 physicians were randomly selected by the random number table. There was no incentive for participating in this study. The self-administered questionnaires were distributed to 1,500 physicians after obtaining written informed consent. For each physician, it took 8–10 min to complete the questionnaire. Of all subjects, 1,104 physicians answered all items and scales completely, with an effective response rate of 73.6% eventually.

## Demographic Variables and Working Characteristics

We used a self-designed questionnaire to collect demographics and working characteristics including gender, age (years), educational level, marital status, job rank, shift patterns, and night duty. Age was categorized as "<30," "30–40," and ">40." Educational level was categorized as "junior college or lower," "college," and "graduate or higher." Marital status was categorized as "single/widowed/divorced/separated" and "married/cohabiting." Job rank was divided into "staff" and "director or deputy director." Shift patterns were divided into "shift" and "fixed." Night duty was defined as "yes" or "no." All items were self-evaluated.

## Measurement of Fatigue

Fatigue was measured by the 14-item Fatigue Scale (FS-14), developed in 1992 by Chalder et al., which has been used to assess fatigue severity in China (40, 41). The score for each item is measured by a fatigue-related problem scored with two responses: 0 (no fatigue-related problem) and 1 (have fatigue-related problem). The total fatigue score was calculated ranging from 0 to 14. The Chinese version of the FS-14 has been used in physician groups in China, and it has adequate reliability and validity (42, 43). In our study, the Cronbach alpha coefficient of the FS-14 was 0.844.

## Measurement of Occupational Stress

Occupational stress was assessed using Siegrist's Effort–reward Imbalance questionnaire (ERI) (44). The Chinese version of the ERI scale was translated and provided by Li et al. (45). The questionnaire comprises 23 items and three subscales: extrinsic effort (6 items), reward (11 items), and overcommitment (6 items). For the ERI scale, occupational stress can be expressed by the ERR and overcommitment. The score of each response for extrinsic effort and reward is from 1 (not stressful) to 5 (very stressful). The ERR score was calculated by the following equation: ERR = 11 × effort/6 × reward. Responses for overcommitment are scored from 1 (strong disagreement) to 4 (strong agreement). The Chinese version of the ERI has been widely used in Chinese occupational groups and has been found to have good reliability and validity (32, 33). In our study, the Cronbach alphas for the extrinsic effort, reward, and overcommitment subscales and the total scale were 0.894, 0.955, and 0.877 and 0.776, respectively.

## Measurement of Psychological Capital

The 24-item Psychological Capital Questionnaire (PCQ) was used to measure PsyCap (46). The score for each of the four components of PsyCap (self-efficacy, hope, resilience, and optimism) is measured by six items scored from 1 (indicates strong disagreement) to 6 (indicates strong agreement). Higher values indicate a higher level of PsyCap and its components. The Chinese version of the PCQ has been proved to have satisfactory reliability and validity (47, 48). In our study, the Cronbach alpha coefficients for self-efficacy, hope, resilience, and optimism subscales and the total scale were 0.943, 0.952, 0.937, and 0.921 and 0.977, respectively.

## Statistical Analysis

All statistical analyses were carried out using IBM SPSS Statistics 21.0 (IBM, Asia Analytics Shanghai), with two-tailed probability value of $<0.05$ considered to be statistically significant. Descriptive statistics for demographic and working characteristics of the physicians were showed with mean, standard deviation (SD), number ($n$), and percentage. The independent samples $t$-test and one-way (ANOVA) analysis were carried out to compare the difference of fatigue according to demographic and working characteristics of the participants. Pearson's correlation analysis was used for the correlation between fatigue, PsyCap, and occupational stress. Hierarchical multiple regression analyses were applied to investigate the factors in relation to fatigue. In hierarchical multiple regression analyses, variance inflation factor (VIF) values of all predictive variables <10, which indicated that collinearity was a negligible problem in the study. The variables in the models were centralized before regression analysis. In block 1 of the analysis, demographics and working characteristics were associated with fatigue in the univariate analysis ($P < 0.05$), and age and gender were entered as control variables. Occupational stress and PsyCap were entered into block 2 and block 3 as an independent variable and a mediating variable, respectively. The conceptual framework of this study is shown in **Figure 1**; in step 1, the aim was to verify the direct effect of occupational stress on fatigue (the $c$ path) after adjusting covariates; in step 2, the aim was to verify the mediating effect of PsyCap. The asymptotic and resampling strategies developed by Preacher and Hayes were carried out to verify PsyCap as a potential mediator on the association between occupational stress and fatigue (49). The bootstrap estimate was based on 5,000 bootstrap samples. A bias-corrected and accelerated 95% confidence interval (BCa 95% CI) was calculated for each $a \times b$ product, and a BCa 95% CI excluding 0 significantly manifested mediation.

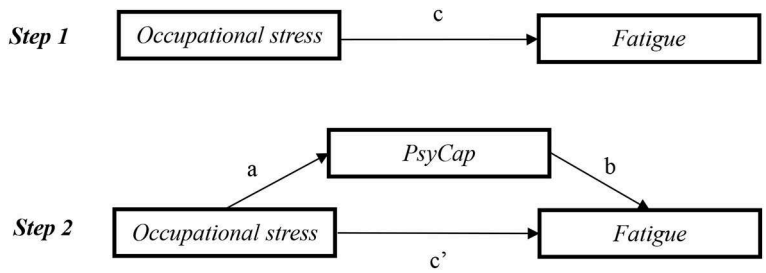


**FIGURE 1 |** Mediating role of PsyCap in the association between occupational stress and fatigue. c, association of occupational stress with fatigue; a, association of occupational stress with PsyCap; b, association between PsyCap and fatigue after controlling for the covariates; c′, association of occupational stress with fatigue after adding PsyCap as a mediator. PsyCap, psychological capital.

# RESULTS

## Demographic and Working Characteristics of Subjects

The prevalence of fatigue among Chinese physicians was 83.70% (924). Demographic and working characteristics among physicians and group comparisons on fatigue are displayed in **Table 1**. The participants were in the average age of 37.92 ± 9.19, and the average fatigue score of the participants was 7.96 ± 3.95. There was a significant difference in the level of fatigue on age, educational level, and marital status. The score of fatigue in the age group of >40 years was significantly higher than that of other age groups ($P < 0.05$). In comparison with the high educational level physicians, low educational level physicians had significantly higher levels of fatigue ($P < 0.01$). The score of fatigue with a married or cohabiting status was significantly higher than that of participants who are single, divorced, widowed, or separated ($P < 0.01$). However, no significant differences in fatigue were observed among male and female physicians. In terms of working characteristics, physicians on shift reported a higher fatigue score than did those on fixed work ($P < 0.01$). Nevertheless, job rank and night duty were not significantly related to the fatigue of physicians.

**TABLE 1 |** Demographic and working characteristics of subjects ($N = 1,104$) and comparisons on fatigues.

| Variables | *n* (%) | Mean ± *SD* | *t*/*F* value | *P*-value |
|---|---|---|---|---|
| Age (years) | | | 4.318 | 0.014 |
| <30 | 268 (24.3%) | 7.46 ± 3.55 | | |
| 30–40 | 390 (35.3%) | 7.88 ± 4.13 | | |
| >40 | 446 (40.4%) | 8.34 ± 4.00 | | |
| Gender | | | 0.605 | 0.437 |
| Male | 578 (52.4%) | 8.05 ± 4.04 | | |
| Female | 526 (47.6%) | 7.86 ± 3.86 | | |
| Educational level | | | 4.980 | 0.007 |
| Junior college or lower | 140 (12.7%) | 8.67 ± 4.56 | | |
| College | 605 (54.8%) | 8.07 ± 3.74 | | |
| Graduate or higher | 359 (32.5%) | 7.50 ± 4.00 | | |
| Marital status | | | 6.915 | 0.009 |
| Single/widowed/ divorced/separated | 388 (35.1%) | 8.38 ± 4.13 | | |
| Married/cohabiting | 716 (64.9%) | 7.73 ± 3.84 | | |
| Job rank | | | 0.403 | 0.526 |
| Staff | 905 (82.0%) | 8.00 ± 3.92 | | |
| Director or deputy director | 199 (18.0%) | 7.80 ± 4.10 | | |
| Shift patterns | | | 9.121 | 0.003 |
| Shift | 717 (64.9%) | 8.22 ± 3.70 | | |
| Fixed | 387 (35.1%) | 7.47 ± 4.34 | | |
| Night duty | | | 3.203 | 0.074 |
| Yes | 844 (76.4%) | 8.08 ± 3.93 | | |
| No | 260 (23.6%) | 7.58 ± 4.02 | | |

## Correlations Among Occupational Stress, Psychological Capital, and Fatigue

The results of the correlation analysis among occupational stress, PsyCap, and fatigue are shown in **Table 2**. Age, occupational stress (ERR and overcommitment), PsyCap, and the four components of PsyCap were all significantly correlated with fatigue. ERR and overcommitment were positively correlated with fatigue and negatively correlated with PsyCap. Self-efficacy, resilience, hope, optimism, and PsyCap were negatively correlated with fatigue.

## Mediating Role of Psychological Capital in the Association Between Occupational Stress and Fatigue

As shown in **Table 3**, the hierarchical multiple regression analyses were conducted to explore the contributing and mediating factors associated with fatigue. First of all, the VIFs of all independent variables were less than 10, which means that collinearity did not mislead in the estimate. After age, gender, educational level, marital status, and shift patterns were adjusted for, the EER was positively associated with fatigue ($\beta = 0.368$, $P < 0.01$), and overcommitment was positively associated with fatigue ($\beta = 0.144$, $P < 0.01$). Two components of occupational stress accounted for 17.7% of the variance in block 2. In block 3, PsyCap ($\beta = -0.379$, $P < 0.01$), self-efficacy ($\beta = -0.203$, $P < 0.01$), and resilience ($\beta = -0.120$, $P < 0.05$) were negatively associated

**TABLE 2 |** Pearson's correlation coefficients between study variables.

| Variables | Mean ± SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 37.92 ± 9.19 | 1 | | | | | | | |
| 2. ERR | 1.24 ± 0.70 | 0.125** | 1 | | | | | | |
| 3. Overcommitment | 15.37 ± 3.69 | −0.034 | 0.219** | 1 | | | | | |
| 4. Self-efficacy | 22.46 ± 6.80 | −0.101** | −0.282** | −0.171** | 1 | | | | |
| 5. Resilience | 21.22 ± 7.04 | −0.049 | −0.335** | −0.236** | 0.790** | 1 | | | |
| 6. Hope | 21.18 ± 7.12 | −0.083** | −0.297** | −0.186** | 0.837** | 0.800** | 1 | | |
| 7. Optimism | 21.58 ± 6.31 | −0.055 | −0.341** | −0.231** | 0.785** | 0.883** | 0.793** | 1 | |
| 8. PsyCap | 87.21 ± 28.05 | −0.086** | −0.340** | −0.236** | 0.885** | 0.931** | 0.895** | 0.918** | 1 |
| 9. Fatigue | 7.96 ± 3.95 | 0.067* | 0.416** | 0.201** | −0.465** | −0.460** | −0.450** | −0.447** | −0.410** |

*$P < 0.05$, **$P < 0.01$ (two-tailed).
*ERR, effort–reward ratio; PsyCap, psychological capital.*

with fatigue, whereas hope and optimism were not significantly associated with fatigue. The four components of PsyCap accounted for an additional 12.6% of the variance in model 2 of block 3. In block 3, the standardized regression coefficient ($\beta$) of ERR and overcommitment was both reduced. Thus, PsyCap, self-efficacy, and resilience could probably become mediators in the association between occupational stress and fatigue.

After PsyCap's mediating effect was tentatively explored by hierarchical regression analysis, asymptotic and resampling strategies were used to examine the mediating roles of PsyCap. As shown in **Table 4**, PsyCap ($a \times b = 0.106$, BCa 95% CI: 0.078, 0.138), self-efficacy ($a \times b = 0.046$, BCa 95% CI: 0.016, 0.011), and resilience ($a \times b = 0.034$, BCa 95% CI: 0.009, 0.070) significantly mediated the association between EER and fatigue, and the mediating effect of self-efficacy and resilience accounted for 17.20% and 12.71%, respectively. PsyCap ($a \times b = 0.068$, BCa 95% CI: 0.044, 0.092), self-efficacy ($a \times b = 0.030$, BCa 95% CI: 0.009, 0.052), and resilience ($a \times b = 0.022$, BCa 95% CI: 0.001, 0.045) also significantly mediated the association between overcommitment and fatigue, respectively, and the mediating effect of self-efficacy and resilience accounted for 37.69 and 27.64%, respectively.

## DISCUSSION

This cross-sectional research investigated the level of fatigue among 1,104 physicians in Liaoning province, China. The result of the fatigue assessment in this study was 7.96 ± 3.95 (mean ± SD), and it was slightly higher than the score from medical personnel in Zhuhai (mean ± SD: 7.29 ± 3.24), a big city in China (3). Physicians in the study denoted higher levels of fatigue than did the scientific and technical personnel (mean ± SD: 7.28 ± 3.37) (50). And there was a significant difference in the level of fatigue on demographic characteristics such as age, educational level, and marital status. The level of fatigue among older physicians as well as the physicians with low levels of education needs to be taken seriously. The married and living together status seems to be positive factors in relieving fatigue, which possibly connected with family and friends support (25). In terms of working characteristics, physicians on shift reported a higher fatigue score than did physicians on fixed work. It is compatible with the result among nurses (11). Therefore, it can be recognized that rationalizing work pattern is an impactful measure for preventing fatigue.

After demographic and working characteristics were controlled for, occupational stress was significantly associated with fatigue. The correlation analysis indicated occupational stress was positively correlated with physicians' fatigue level, which means fatigue level rises as the imbalance between effort and reward becomes aggravated. Similarly, previous studies also showed that perceived stress was positively associated with fatigue (51, 52). One possible explanation for these findings is that physicians require comprehensive professional medical ability and sense of responsibility for patients, which makes them undertake a large number of learning tasks and work pressure even during nonworking hours. And high overcommitment leads to the high level of fatigue among physicians. The career promotion of Chinese physicians requires much scientific research outputs, which increases the difficulty and task in physicians' career advancement (53). They have spent too much time and energy on work, study, and scientific research; however, salaries and benefits of physicians still need to be improved (54). Finally, ERI resulted in fatigue among physicians. Therefore, hospital managers could establish a scientific performance appraisal and salary distribution system to balance the efforts and rewards, so as to reduce the occupational stress level and alleviate fatigue of physicians.

In addition, PsyCap was negatively correlated with Chinese physicians' fatigue, and it could mediate the association of occupational stress with fatigue. Similar to other studies, as a kind of positive psychological resource possessed by individuals, PsyCap is a protective factor to avoid or reduce turnover intentions, job dissatisfaction, and job burnout (23, 27). From previous studies, PsyCap has been considered as a mediator or moderator in some psychological, physical, and organizational relationships (48, 55, 56). Two components of PsyCap, self-efficacy and resilience, were both negatively associated with fatigue and could mediate the association between occupational stress and fatigue. It is worth noting that the proportion of the mediating effect of self-efficacy for

**TABLE 3 |** Hierarchical multiple regression analysis of the association of occupational stress and PsyCap with fatigue.

| Variables | Block 1 ($\beta$) | | Block 2 ($\beta$) | | Block 3 ($\beta$) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Model 1 | | Model 2 | |
| | $\beta$ | VIF | $\beta$ | VIF | $\beta$ | VIF | $\beta$ | VIF |
| Age | 0.078* | 1.076 | 0.037 | 1.102 | 0.017 | 1.105 | 0.014 | 1.111 |
| Gender | −0.001 | 1.039 | 0.013 | 1.044 | 0.024 | 1.045 | 0.024 | 1.047 |
| Educational level | −0.072* | 1.051 | −0.057* | 1.064 | −0.028 | 1.071 | −0.021 | 1.087 |
| Marital status | −0.073* | 1.127 | −0.068* | 1.149 | −0.050 | 1.152 | −0.055* | 1.159 |
| Shift patterns | 0.072* | 1.057 | 0.071* | 1.070 | 0.069** | 1.070 | 0.064* | 1.077 |
| EER | | | 0.368** | 1.103 | 0.262** | 1.196 | 0.267** | 1.208 |
| Overcommitment | | | 0.144** | 1.110 | 0.077** | 1.147 | 0.080** | 1.152 |
| PsyCap | | | | | −0.379** | 1.175 | | |
| Self-efficacy | | | | | | | −0.203** | 4.095 |
| Resilience | | | | | | | −0.120* | 5.406 |
| Hope | | | | | | | −0.081 | 4.187 |
| Optimism | | | | | | | −0.004 | 5.248 |
| *F* | 5.445** | | 121.629** | | 197.741** | | 50.993** | |
| Adjusted $R^2$ | 0.020 | | 0.196 | | 0.319 | | 0.320 | |
| $\Delta R^2$ | 0.024 | | 0.177 | | 0.122 | | 0.126 | |

*$P < 0.05$, **$P < 0.01$ (two-tailed). Age was handled as a continuous variable. Gender, male vs. female. Marital status, single/widowed/divorced/separated vs. married/cohabiting. Shift patterns, shift vs. fixed.
EER, effort–reward ratio; PsyCap, psychological capital; VIF, variance inflation factor.

**TABLE 4 |** Mediating roles of PsyCap's components.

| Mediators | EER | | | Overcommitment | | |
|---|---|---|---|---|---|---|
| | $a_1$ | $b_1$ | $a_1 \times b_1$ (BCa 95% CI) | $a_2$ | $b_2$ | $a_2 \times b_2$ (BCa 95% CI) |
| PsyCap | −0.280** | −0.379** | 0.106 (0.078, 0.138) | −0.179** | −0.379** | 0.068 (0.044, 0.092) |
| Self-efficacy | −0.225** | −0.203** | 0.046 (0.016, 0.011) | −0.145** | −0.203** | 0.030 (0.009, 0.052) |
| Resilience | −0.285** | −0.120** | 0.034 (0.009, 0.070) | 0.185** | −0.120* | 0.022 (0.001, 0.045) |
| Hope | −0.243** | −0.080* | 0.020 (−0.008, 0.050) | −0.152** | −0.080* | 0.012 (−0.056, 0.033) |
| Optimism | −0.289** | −0.004 | 0.001 (−0.032, 0.034) | −0.182** | −0.004 | 0.001 (−0.020, 0.022) |

*$P < 0.05$, **$P < 0.01$ (two-tailed). Age, gender, educational level, marital status, and shift patterns were adjusted. $a_1$, association of EER with PsyCap's components; $b_1$, association of PsyCap's components with fatigue; $a_1 \times b_1$, the product of $a_1$ and $b_1$; BCa 95% CI, the bias-corrected and accelerated 95% confidence interval; $a_2$, association of overcommitment with PsyCap's components; $b_2$, association of PsyCap's components with fatigue; $a_2 \times b_2$, the product of $a_2$ and $b_2$; BCa 95% CI, bias-corrected and accelerated 95% confidence interval.
EER, effort–reward ratio; PsyCap, psychological capital.

ERR (17.20%) and overcommitment (37.69%) was respectively higher than the mediation rates of resilience for ERR (12.71%) and overcommitment (27.64%). A likely explanation is that self-efficacy represents an individual's confidence in ability to fulfill a task successfully (57). When physicians are faced with ERI and psychological and physical burden, low self-efficacy physicians may not perceive enough personal capabilities to perform successfully in complex undertakings (58). In other words, physicians with low occupational stress are more confident to do a good job and experience low levels of fatigue. Therefore, self-efficacy played a more important role in assuaging occupational stress and its effect on fatigue than resilience did. In terms of resilience, it can enable individuals to play a positive response to stressful environment and maintain physical and mental health (59). Chaukos found that building resilience can enhance concentration and coping skills and decline or prevent the aggravation of fatigue (60). Hence, a high level of resilience makes people able to recover from stressful experiences (like occupational stress) and buffers the effects of occupational stress on fatigue. Under the situation of ERI, it is feasible and effective to develop self-efficacy and resilience in the professional population like physicians for alleviating fatigue (61, 62).

Because PsyCap is developable, we suggest that the hospital administration can evaluate the PsyCap of physicians and implement targeted intervention. It is worth mentioning that Luthans et al. proposed PsyCap intervention (PCI) model (63), which provided guidelines in developing self-efficacy, resilience, hope, and optimism. In PCI training, we might develop self-efficacy by allowing physicians to experience success and accomplish their personal goals through peer encouragement;

also, we could improve resilience by encouraging physicians to practice anticipating and addressing setbacks associated with the personal goals setting or with other events in work. Furthermore, bibliotherapy is a simple and inexpensive method that might be applicable to Chinese physicians, by organizing bibliotherapy workshops held in appropriate time in order to improve the PsyCap and relieve occupational stress and fatigue (64).

The Chinese version of the FS-14 has been used in our investigation, although Jing's paper indicated that the 11-item Chalder Fatigue Scale was superior than the FS-14 among the general population (65). But in our sampling population, the reliability tests showed that the internal consistency reliability of FS-14 was better than FS-11, and the confirmatory factor analysis confirmed that the validity of FS-14 is more satisfactory than that of FS-11. The possible explanation for these discrepant findings is that the fatigue performance of physicians is different from that of the general population.

There are several limitations in this research that must be revealed. Firstly, the cross-sectional design limited us to derive causal conclusions between variables studied. Further longitudinal studies are needed for extrapolating the causality. Secondly, participations were limited to the public tertiary hospitals in Liaoning, which did not represent all clinical workers in China; thus, extrapolating our results to physicians who work in other hospitals should be taken with caution.

## CONCLUSION

Chinese physicians have high levels of fatigue. Age, educational level, marital status, and shift patterns were significant indicators of fatigue, and occupational stress was positively associated with fatigue. Self-efficacy and resilience, two components of PsyCap, were negatively associated with fatigue and could mediate the association between occupational stress and fatigue. This finding offers the recommendation that individual positive psychological resources should be utilized and developed in physicians to reduce the high level of fatigue. Under a high level of occupational stress, development of PsyCap, self-efficacy, and resilience should be included in intervention strategies for minimizing fatigue targeted at Chinese physicians.

## 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 survey was approved by the Provincial Department of Health and the Research Ethics Committee of the China Medical University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

FT carried out investigation, data analysis and wrote the paper. QS provided help with the investigation and data collection. QC provided guidance in result interpretation. CL provided assistance in reviewing the paper. LW contributed toward investigation and data collection. HW provided guidance in study design, organized the investigation, and is the corresponding author. All authors approved the final manuscript.

## FUNDING

The investigation and study were fully supported by a grant from the National Natural Science Foundation of China (no. 71673300).

## ACKNOWLEDGMENTS

The authors want to thank all the physicians who participated and all the teachers and students who assisted in distributing questionnaires to the subjects and in undertaking data collection for the survey.

## REFERENCES

1. Aaronson LS, Teel CS, Cassmeyer V, Neuberger GB, Pallikkathayil L, Pierce J. Defining and measuring fatigue. *J Nurs Scholars.* (1999) 31:45–50. doi: 10.1111/j.1547-5069.1999.tb00420.x
2. Blafoss R, Micheletti JK, Sundstrup E, Jakobsen MD, Bay H, Andersen LL. Is fatigue after work a barrier for leisure-time physical activity? Cross-sectional study among 10,000 adults from the general working population. *Scand J Public Health.* (2019) 47:383–91. doi: 10.1177/1403494818765894
3. Cai S, Lin H, Hu X, Cai YX, Chen K, Cai WZ. High fatigue and its associations with health and work related factors among female medical personnel at 54 hospitals in Zhuhai, China. *Psychol Health Med.* (2018) 23:304–16. doi: 10.1080/13548506.2017.1361038
4. Cullen W, Kearney Y, Bury G. Prevalence of fatigue in general practice. *Irish J Med Sci.* (2002) 171:10–2. doi: 10.1007/BF03168931
5. McClellL, HollJ, Lomas JP, Redfern N, Plunkett E. A national survey of the effects of fatigue on trainees in anaesthesia in the UK. *Anaesthesia.* (2017) 72:1069–77. doi: 10.1111/anae.13965
6. O'Donnell EP, Humeniuk KM, West CP, Tilburt JC. The effects of fatigue and dissatisfaction on how physicians perceive their social responsibilities. *Mayo Clin Proc.* (2015) 90:194–201. doi: 10.1016/j.mayocp.2014.12.011
7. Stuetzle KV, Pavlin BI, Smith NA, Weston KM. Survey of occupational fatigue in anaesthetists in australia and new zealand. *Anaesth Intensive Care.* (2018) 46:414–23. doi: 10.1177/0310057X1804600411
8. Van Cutsem J, Marcora S, De Pauw K, Bailey S, Meeusen R, Roelands B. The effects of mental fatigue on physical performance: a systematic review. *Sports Med.* (2017) 47:1569–88. doi: 10.1007/s40279-016-0672-0
9. Abdulrahman H, Abdul-Mumin K, Naing L. Psychosocial factors, musculoskeletal disorders and work-related fatigue amongst nurses in Brunei: structural equation model approach. *Int Emerg Nurs.* (2017) 34:17–22. doi: 10.1016/j.ienj.2017.04.001
10. Westbrook JI, Raban MZ, Walter SR, Douglas H. Task errors by emergency physicians are associated with interruptions, multitasking, fatigue and working memory capacity: a prospective, direct observation study. *BMJ Qual Saf.* (2018) 27:655–63. doi: 10.1136/bmjqs-2017-007333

11. Jones G, Hocine M, Salomon J, Dab W, Temime L. Demographic and occupational predictors of stress and fatigue in French intensive-care registered nurses and nurses' aides: a cross-sectional study. *Int J Nurs Stud.* (2015) 52:250–9. doi: 10.1016/j.ijnurstu.2014.07.015
12. Brown M, Tucker P, Rapport F, Hutchings H, Dahlgren A, Davies G, et al. The impact of shift patterns on junior doctors' perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf Health Care.* (2010) 19:e36. doi: 10.1136/qshc.2008.030734
13. Tang FC, Li RH, Huang SL. The association between job-related psychosocial factors and prolonged fatigue among industrial employees in Taiwan. *PLoS ONE.* (2016) 11:e0150429. doi: 10.1371/journal.pone.0150429
14. Useche SA, Ortiz VG, Cendales BE. Stress-related psychosocial factors at work, fatigue, and risky driving behavior in bus rapid transport (BRT) drivers. *Accid Anal Prev.* (2017) 104:106–14. doi: 10.1016/j.aap.2017.04.023
15. Milutinovic D, Golubovic B, Brkic N, Prokes B. Professional stress and health among critical care nurses in Serbia. *Arh Hig Rada Toksikol.* (2012) 63:171–80. doi: 10.2478/10004-1254-63-2012-2140
16. Shi CJ, Lin K, Wang MJ. Correlation research of occupational stress and occupational fatigue in nurses. *Chin Gen Pract Nurs.* (2017) 15:385–8. doi: 10.3969/j.issn.1674-4748.2017.04.001
17. Härmä M, Kompier MAJ, Vahtera J. Work-related stress and health—risks, mechanisms and countermeasures. *Scand J Work Environ Health.* (2006) 32:413–9. doi: 10.5271/sjweh.1047
18. Yu S, Lu ML, Gu G, Zhou W, He L, Wang S. Association between psychosocial job characteristics and sickness absence due to low back symptoms using combined DCS and ERI models. *Work.* (2015) 51:411–21. doi: 10.3233/WOR-141881
19. 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
20. Fang YY, Qi XL, Ji S, Gu FF, Deng HH. Association of effort,reward and overcommitment with work burnout among chinese nurses under new effort-reward imbalance model. *J Psychol Sci.* (2018) 41:441–6. doi: 10.16719/j.cnki.1671-6981.20180229
21. Lidwall U. Effort-reward imbalance, overcommitment and their associations with all-cause and mental disorder long-term sick leave - A case-control study of the Swedish working population. *Int J Occup Med Environ Health.* (2016) 29:973–89. doi: 10.13075/ijomeh.1896.00712
22. Rose DM, Seidler A, Nubling M, Latza U, Brahler E, Klein EM, et al. Associations of fatigue to work-related stress, mental and physical health in an employed community sample. *BMC Psychiatry.* (2017) 17:167. doi: 10.1186/s12888-017-1237-y
23. Avey JB, Reichard RJ, Luthans F, Mhatre KH. Meta-analysis of the impact of positive psychological capital on employee attitudes, behaviors, and performance. *Hum Resour Dev Q.* (2011) 22:127–52. doi: 10.1002/hrdq.20070
24. Sven G, Semmer NK, Meier LL, Wolfgang KL, Nicola J, Franziska T. The effect of positive events at work on after-work fatigue: they matter most in face of adversity. *J Appl Psychol.* (2011) 96:654–64. doi: 10.1037/a0022992
25. Xu N, Zhao S, Xue H, Fu W, Liu L, Zhang T, et al. Associations of perceived social support and positive psychological resources with fatigue symptom in patients with rheumatoid arthritis. *PLoS ONE.* (2017) 12:e0173293. doi: 10.1371/journal.pone.0173293
26. Luthans F, Avolio BJ, Walumbwa FO, Li W. The psychological capital of chinese workers: exploring the relationship with performance. *Manag Organ Rev.* (2005) 1:249–71. doi: 10.1111/j.1740-8784.2005.00011.x
27. Frey R, Robinson J, Wong C, Gott M. Burnout, compassion fatigue and psychological capital: findings from a survey of nurses delivering palliative care. *Appl Nurs Res.* (2018) 43:1–9. doi: 10.1016/j.apnr.2018.06.003
28. Avey JB, Luthans F, Jensen SM. Psychological capital: a positive resource for combating employee stress and turnover. *Hum Resour Manage.* (2009) 48:677–93. doi: 10.1002/hrm.20294
29. Hystad SW, Eid J. Sleep and fatigue among seafarers: the role of environmental stressors, duration at sea and psychological capital. *Saf Health Work.* (2016) 7:363–71. doi: 10.1016/j.shaw.2016.05.006
30. Kim JH, Jang SN. Seafarers' quality of life: organizational culture, self-efficacy, and perceived fatigue. *Int J Environ Res Public Health.* (2018) 15:E2150. doi: 10.3390/ijerph15102150
31. Jeon HJ, Bang YR, Park HY, Kim SA, Yoon IY. Differential effects of circadian typology on sleep-related symptoms, physical fatigue and psychological well-being in relation to resilience. *Chronobiol Int.* (2017) 34:677–86. doi: 10.1080/07420528.2017.1309425
32. Liu L, Chang Y, Fu JL, Wang JN, Wang L. The mediating role of psychological capital on the association between occupational stress and depressive symptoms among Chinese physicians: a cross-sectional study. *BMC Public Health.* (2012) 12:219. doi: 10.1186/1471-2458-12-219
33. Wang Z, Liu H, Yu H, Wu Y, Chang S, Wang L. Associations between occupational stress, burnout and well-being among manufacturing workers: mediating roles of psychological capital and self-esteem. *BMC Psychiatry.* (2017) 17:364. doi: 10.1186/s12888-017-1533-6
34. Roberts SJ, Scherer LL, Bowyer CJ. Job stress and incivility: what role does psychological capital play? *J Leaders Organ Stud.* (2011) 18:449–58. doi: 10.1177/1548051811409044
35. Moreno-Jiménez B, Garrosa E, Corso S, Boada M, Rodríguez-Carvajal B. Hardy personality and psychological capital: the positive personal variables and the processes of exhaustion and vigor. *Psicothema.* (2012) 24:79–86. doi: 10.1177/0146167211424418
36. Li X, Kan D, Liu L, Shi M, Wang Y, Yang X, et al. The mediating role of psychological capital on the association between occupational stress and job burnout among bank employees in China. *Int J Environ Res Public Health.* (2015) 12:2984–3001. doi: 10.3390/ijerph120302984
37. Shang Guan CY, Li Y, Ma HL. The mediating role of psychological capital on the association between occupational stress and job satisfaction among township cadres in a specific province of China: a cross-sectional study. *Int J Environ Res Public Health.* (2017) 14:E972. doi: 10.3390/ijerph14090972
38. Shen X, Yang YL, Wang Y, Liu L, Wang S, Wang L. The association between occupational stress and depressive symptoms and the mediating role of psychological capital among chinese university teachers: a cross-sectional study. *BMC Psychiatry.* (2014) 14:329. doi: 10.1186/s12888-014-0329-1
39. Yim HY, Seo HJ, Cho Y, Kim J. Mediating role of psychological capital in relationship between occupational stress and turnover intention among nurses at veterans administration hospitals in Korea. *Asian Nurs Res.* (2017) 11:6–12. doi: 10.1016/j.anr.2017.01.002
40. Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wallace EP. Development of a fatigue scale. *J Psychosom Res.* (1993) 37:147–53. doi: 10.1016/0022-3999(93)90081-P
41. Wong WS, Fielding R. Construct validity of the Chinese version of the chalder fatigue scale in a Chinese community sample. *J Psychosom Res.* (2010) 68:89–93. doi: 10.1016/j.jpsychores.2009.05.008
42. Gao YS, Wang XD. The investigation of fatigue of female medical staff from 3a-hospitals in Hainan province. *Clin Med Eng.* (2011) 18:1964–65.
43. Liu L, Xu P, Zhou K, Xue J, Wu H. Mediating role of emotional labor in the association between emotional intelligence and fatigue among Chinese doctors: a cross-sectional study. *BMC Public Health.* (2018) 18:881. doi: 10.1186/s12889-018-5817-7
44. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I. 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
45. Li J, Yang W, Cheng Y, Siegrist J, Cho SI. Effort-reward imbalance at work and job dissatisfaction in Chinese healthcare workers: a validation study. *Int Arch Occup Environ Health.* (2005) 78:198–204. doi: 10.1007/s00420-004-0581-7
46. Luthans F, Avolio BJ, Avey JB, Norman SM. Positive psychological capital: measurement and relationship with performance and satisfaction. *Pers Psychol.* (2007) 60:541–72. doi: 10.1111/j.1744-6570.2007.00083.x
47. Wen L, Qi SS, Zhang YZ. A preliminary revision of luthans psychological capital questionnaire. *Chin J Clin Psychol.* (2009) 17:148–50.
48. Zhou J, Yang Y, Qiu X, Yang X, Pan H, Ban B, et al. Serial multiple mediation of organizational commitment and job burnout in the relationship between psychological capital and anxiety in Chinese female nurses: a cross-sectional questionnaire survey. *Int J Nurs Stud.* (2018) 83:75–82. doi: 10.1016/j.ijnurstu.2018.03.016
49. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods.* (2008) 40:879–91. doi: 10.3758/BRM.40.3.879
50. Yang T, Zhou DL, Song MY, Lan YJ. Analysis of work-related fatigue characteristics and its influencing factors in scientific and technical personnel. *Chin J Indust Hyg Occupat Dis.* (2015) 33:100–3.

51. Kizhakkeveettil A, Vosko AM, Brash M, Ph D, Philips MA. Perceived stress and fatigue among students in a doctor of chiropractic training program. *J Chiropr Educ.* (2017) 31:8–13. doi: 10.7899/JCE-15-27
52. Wu S, Zhu W, Li H, Wang Z, Wang M. Relationship between job burnout and occupational stress among doctors in China. *Stress Health.* (2008) 24:143–9. doi: 10.1002/smi.1169
53. Emery SE, Gregory C. Physician incentives for academic productivity: an analysis of orthopaedic department compensation strategies. *J Bone Joint Surg.* (2006) 88-A:2049–56. doi: 10.2106/00004623-200609000-00020
54. Ran LM, Luo KJ, Wu YC, Yao L, Feng YM. An analysis of China's physician salary payment system. *J Huazhong Univ Sci Technol Med Sci.* (2013) 33:309–14. doi: 10.1007/s11596-013-1116-9
55. Hao J, Wu D, Liu L, Li X, Wu H. Association between work-family conflict and depressive symptoms among chinese female nurses: the mediating and moderating role of psychological capital. *Int J Environ Res Public Health.* (2015) 12:6682–99. doi: 10.3390/ijerph120606682
56. Yin H, Wang W, Huang S, Li H. Psychological capital, emotional labor and exhaustion: examining mediating and moderating models. *Curr Psychol.* (2016) 37:343–56. doi: 10.1007/s12144-016-9518-z
57. Stajkovic AD, Luthans F. Self-efficacy and work-related performance: a meta-analysis. *Psychol Bull.* (1998) 124:240–61. doi: 10.1037/0033-2909.124.2.240
58. Zamani-Alavijeh F, Araban M, Harandy TF, Bastami F, Almasian M. Sources of Health care providers' Self-efficacy to deliver Health Education: a qualitative study. *BMC Med Educ.* (2019) 19:16. doi: 10.1186/s12909-018-1448-z
59. Li CN, Dong Z, Jiao S, Zou H. The effect of psychological resilience on attachment among college students: the mediating role of emotion regulation strategies and meta-emotion. *J Psychol Sci.* (2016) 39:83–9. doi: 10.16719/j.cnki.1671-6981.20160113
60. Chaukos D, Chad-Friedman E, Mehta DH, Byerly L, Celik A, McCoy TH Jr, et al. Risk and resilience factors associated with resident burnout. *Acad Psychiatry.* (2017) 41:189–94. doi: 10.1007/s40596-016-0628-6
61. Back AL, Steinhauser KE, Kamal AH, Jackson VA. Building resilience for palliative care clinicians: an approach to burnout prevention based on individual skills and workplace factors. *J Pain Symptom Manage.* (2016) 52:284–91. doi: 10.1016/j.jpainsymman.2016.02.002
62. Findley JC, Kerns R, Weinberg LD, Rosenberg R. Self-efficacy as a psychological moderator of chronic fatigue syndrome. *J Behav Med.* (1998) 21:351–62. doi: 10.1023/A:1018726713470
63. Luthans F, Avey JB, Avolio BJ, Norman SM, Combs GM. Psychological capital development: toward a micro-intervention. *J Organ Behav.* (2006) 27:387–93. doi: 10.1002/job.373
64. Papi A, Mosharraf Z, Farashbandi FZ, Samouei R, Hassanzadeh A. The effect of bibliotherapy on the psychological capital of the staff of the School of Management and Medical Informatics of Isfahan University of Medical Science. *J Educ Health Promot.* (2017) 6:31. doi: 10.4103/jehp.jehp_138_14
65. Jing MJ, Lin WQ, Wang Q. Reliability and construct validity of two versions of chalder fatigue scale among the general population in Mainland China. *Int J Environ Res Public Health.* (2016) 13:147. doi: 10.3390/ijerph13010147


**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 Public Health

ORIGINAL RESEARCH
published: 05 May 2020
doi: 10.3389/fpubh.2020.00145

# Managers' Perceptions of Factors Affecting Employees' Uptake of Workplace Health Promotion (WHP) Offers

*Fanny Sigblad*[1], *Maria Savela*[2] *and Leah Okenwa Emegwa*[2,3]*

[1] The Swedish Work Environment Authority, Stockholm, Sweden, [2] Department of Public Health and Sport Science, Faculty of Health and Occupational Science, University of Gävle, Gävle, Sweden, [3] Swedish Red Cross University College, Huddinge, Sweden

OPEN ACCESS

**Edited by:**
Daniel P. Bailey,
Brunel University London,
United Kingdom

**Reviewed by:**
Ron Z. Goetzel,
Johns Hopkins University,
United States
Siti Munira Yasin,
MARA University of
Technology, Malaysia

***Correspondence:**
Leah Okenwa Emegwa
leok@rkh.se

**Specialty section:**
This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health

**Received:** 31 October 2019
**Accepted:** 07 April 2020
**Published:** 05 May 2020

**Citation:**
Sigblad F, Savela M and Okenwa Emegwa L (2020) Managers' Perceptions of Factors Affecting Employees' Uptake of Workplace Health Promotion (WHP) Offers. Front. Public Health 8:145. doi: 10.3389/fpubh.2020.00145

Managers are often charged with the responsibility of overseeing Workplace health promotion (WHP) for which significant amounts of resources are laid aside yearly. While there is increasing interest by employers to include WHP policies, studies show that WHP implementation and uptake by employees still need to be improved upon. Given that managers are part of organizational decision-making and implementation of new policies, they serve as the bridge between workers and management. The aim of this study is to investigate managers' perceptions of employees' WHP uptake as well as challenges encountered by managers in the execution of their WHP-related tasks.

**Method:** This study is based on a qualitative method using semi-structured interviews. Participants in the study were managers at medium and large-scale private companies in Northcentral Sweden. To ensure that participating companies are comparable in terms of structure and policy, only companies within the private sector were eligible to participate. Furthermore, only one manager per company was interviewed. A total of nineteen managers participated and the data generated were analyzed using content analysis.

**Results:** A total of three themes and nine subthemes emerged. The first theme deals with factors at the individual level, subthemes include awareness of WHP, work-life balance, and attitudes. The second theme comprises of factors related to the WHP offer, subthemes were design of the WHP, supportive collaborators and financing of WHP. The third theme deals with organizational factors, subthemes were the nature of the organization's operations, management as role models and resources and support for managers. Results show that most of the challenges encountered by managers in executing WHP were mostly at the organizational level.

**Conclusion:** Addressing modifiable factors at the individual and organizational levels and those related to the WHP may improve WHP uptake among employees.

**Keywords: workplace health promotion, managers, organization, employee, work-life balance**

## BACKGROUND

The workplace is an important priority setting for population health promotion due to the significant amount of time spent at work (1, 2). Studies have shown the relationship between health, sickness absence, productivity and the economic growth of organizations including the importance of employee well-being for the individual, the organizations and society at large (2–4). These findings, coupled with various occupational health policies (5), have contributed to increasing awareness among employers regarding the implications of employee health (2). There are thus diverse policies and significant financial resources annually set aside for WHP (2, 6–8). Although most companies have policies and resources in place for WHP, they may be experiencing constraints in terms of implementation (6).

The Center for Disease Control and Prevention (CDC) describes WHP as coordinated and comprehensive efforts to enhance workers' health and safety (9). WHP strategies take the form of programs and policies for improving the physical work environment, minimizing risks at the workplace (9) as well as policies and benefits to create a "culture of health" (10, 11). Creating a culture of health often implies encouraging behavioral change and the adoption of healthy lifestyles such as smoking cessation, alcohol reduction, and increased physical activity, (10, 11). However, despite employers' positive disposition to WHP and the provision of wellness offers (12, 13), employees' uptake of WHP offers remains minimal (14, 15).

In Sweden, individual and group-based wellness offers aimed at promoting healthy lifestyles (e.g., increased physical activity) have been in workplaces since the 1970s (16). Depending on the worksite, common WHP strategies may include an in-house gym, monetary allowance (known as "friskvårdsbidrag") for individual employees to engage in health promoting-activities outside of the workplace. Another popular WHP offer in Sweden is the "wellness hour" (i.e., employees may take 1 h off work per week to engage in health-promoting activities). Many of the offers are aimed at encouraging increased physical activity among workers. Physical activity is associated with general improvements in health behaviors and lifestyles, improved productivity, improved morale among employees, reduced absenteeism and economic gains for employers (17–21). A common practice among Swedish companies is the provision of monetary allowances to their employees (22). The monetary allowance is non-taxable and can be used for a range of specific activities e.g., membership at a gym (23). Swedish employment laws stipulate that WHP benefits should be provided to workers (23) however the amount and type of what is offered may vary across companies. Some stakeholders argue that non-uniform practices across sectors and professions may result in inequalities in access and utilization of WHP (24).

Managers are often charged with the responsibility of WHP in many organizations (25). They have a dual role as they are part of organizational decision-making but also responsible for the implementation of new policies (26) including WHP. Managers have closer contact with employees and serve as the link between workers and management. They play a vital role in policy implementation and in achieving desired changes (27). Unlike other forms of organizational policies, WHP involves an effort to encourage healthy lifestyle behaviors among employees (9). WHP is therefore sometimes perceived as an incursion into employees' private life and space, some stakeholders have expressed ethical and moral concerns about WHP (28). Given managers' role, known constraints to WHP implementation (6) and low levels of WHP participation among employees (14, 15), this study aims to examine managers' perceptions of factors affecting employees' WHP uptake. The study also intends to identify possible challenges that managers encounter in their WHP-related roles.

## METHODS

### Study Design and Participants

The study is based on semi-structured interviews to understand managers' perceptions of employees' uptake of WHP offers and possible challenges related to WHP implementation encountered by managers. Companies were selected based on size and geographical location, i.e., only medium and large-scale companies operating within the Northcentral region of Sweden were eligible to participate. Small-scale companies, defined as those having <50 employees (29), were excluded. To ensure homogeneity in terms of policy and administration, only companies in the private sector were eligible to participate. Over 50 companies that met the criteria for size and geographical location were identified and initially contacted via email with a detailed description of the project and objectives. A follow up to the emails was later done through telephone calls, a total of nineteen companies indicated interest to participate.

Only one manager (per company) responsible for WHP and who has occupied that position for at least 6 months preceding the interviews were eligible to participate.

Data collection was conducted between November 2016 and January 2017 by an experienced research assistant with additional training specifically for this project. All interviews were conducted at a convenient location in each manager's workplace. The average length of an interview was about 33 min, the longest interview was 55 min. All interviews were recorded and later transcribed verbatim.

### Ethical Approval and Consent to Participate

Ethical approval for the study was granted by the regional ethical review board in Uppsala, Sweden. Before commencing each interview, participating managers were provided with information about the project and ethical aspects, including their right to withdraw participation at any time during the interview. Written consent was thereafter obtained, and interviews conducted.

### Data Analysis

The analysis method was inductive using content analysis. The transcribed interview material was studied and interpreted to identify patterns and themes and to have a deeper understanding of different phenomena (30). Content analysis is useful for

**TABLE 1 |** Example of the content analysis process from meaning units to themes, inspired by Graneheim & Lundman (31).

| Meaning units | Condensed meaning units (Description close to the text) | Condensed meaning units (Interpretation of the underlying meaning) | Code | Sub theme | Theme |
|---|---|---|---|---|---|
| "…time constraint is a problem, people are of course at different stages of life. We have many employees who are parents of young children, these tend to not use this type of WHP offer because it is more difficult for them to find the time." | Lack of time to utilize WHP due to having young children | Difficulty finding time for WHP after work due to having children to care for after work | Lack of time due to having younger children | Work-life balance | Individual factors |
| "…it is, of course, the amount of the monetary allowance that can be a hindrance…when you must add your own (money)…" | Out-of-pocket additional payments depending on amount offered | Likely low WHP uptake if employees must augment WHP offers with significant amount of money | Amount of Monetary allowance provided | Financing of WHP | Factors related to the WHP offer |
| "The most important factor is time. We are already experiencing quite a lot of time constraints and there is so much else to do, but at the same time we must think about (WHP)and employee well-being." | Time constraints for WHP amid other responsibilities | Managers view WHP as additional responsibility to their primary roles. Adequate resources for executing WHP tasks (e.g., time) may therefore be lacking. | Managers lack time for WHP tasks | Resources and support for managers | Organizational factors |

investigating similarities and differences and for presenting results in a systematic and relevant manner (31).

The analysis was done in stages according to recommendations by Graneheim och Lundman (31). The first stage involved getting a holistic perspective of the data material, followed by the identification of meaning units related to the aim and objectives of the study. The text was then condensed to capture keywords and concepts that could systematically be marked as codes. To separate the content in the individual codes, they were compared for similarities and differences, similar codes were grouped and sorted into subthemes. Subthemes with similar contents were used to create main themes that reflected the meaning units (31).

# RESULTS

A total of 20 managers, consisting of ten women and nine men aged between 36 and 66 years, were interviewed. They were mostly from construction, health care, food, and retail sectors. One of the interviews had to be excluded due to non-conformity to inclusion criteria. The results are therefore based on nineteen interviews, fourteen of these were from large scale companies and five from medium-sized companies. The participants had various job titles and roles such as Human resources (HR) manager, HR- specialist, HR- partner, personnel manager, and branch manager. Results from the interviews showed that participants generally believed that a good WHP plan contributes to a company's attractiveness. Various factors were however identified as affecting employees' uptake of WHP offers. Three themes and nine subthemes were identified. The main themes were individual-level factors, factors related to the WHP offer and factors at the organizational level. Managers encounter challenges in their WHP-related roles, but these were mostly at the organizational level. See **Tables 1**, **2** below for a summary of the data analysis process and themes, respectively.

**TABLE 2 |** Showing themes and sub-themes.

| Individual factors | WHP offers | Organizational factors |
|---|---|---|
| - Awareness of WHP<br>- Work-life balance<br>- Attitudes to WHP | - Design of the WHP<br>- Supportive collaborators<br>- Financing of the WHP | - Nature of the organization's operations<br>- Management as role models<br>- Resources and support for managers |

## Individual Factors

### Awareness of WHP

Lack of awareness, often observed by managers through frequent requests for information, is common among new employees and younger staff. Below is how one manager described it:

> *"…i believe that certain individuals are not aware of how much (monetary allowance) is available to staff and if wellness packages exist in the first place. We often notice this since we employ many people, many youths actually…"* (Respondent 20).

Regular and systematic information dissemination is important to counter uncertainty and lack of knowledge regarding the availability and administration of WHP offers. Some participants address the problem by "marketing" WHP offers during staff meetings, managers meeting, performance reviews, monthly newsletter, intranet and information brochures.

> *" We have made it a recurrent point of discussion at all our departmental meetings. We talk about the importance of utilizing it…think we market it fairly well…"* (Respondent 18).

Some managers actively worked toward increased uptake of WHP through coaching, reminders, encouragement and personally inviting employees to try.

> *"We can encourage them by visiting the worksites during staff meetings and talk about it… otherwise, I think that motivation and coaching in leadership are also about working more with health promotion and to get them to utilize WHP offers"* (Respondent 3).

### Work Life-Balance

Most of the managers interviewed believe that individual employee's uptake of WHP offers depends on their life situation. Time constraints and tiredness were named as likely barriers:

> *" … time constraint is a problem, people are of course at different stages of life. We have many employees who are parents of young children, these tend to not use this type of WHP offer because it is more difficult for them to find the time."* (Respondent 5).
> *" … for the wellness hour, it has been a case of me… skipping it if I have a lot to do. I do not use it because I have so much to do… "* (Respondent 15).

In companies where wellness hour is offered, employees have the option to close early from work, many managers allow flexibility to boost uptake.

### Attitudes to WHP

Employees' individual attitudes and disposition to WHP may also result in low uptake of WHP offers. Specific examples named by managers include negative mindset, excuses, laziness, low commitment, declining interest, lack of motivation for necessary behavioral changes, non-prioritization of own health, and WHP.

> *" … certain people are interested in this type of activity if I may say so. And some are less interested… it may, of course, be connected to the individual's lifestyle."* (Respondent 20).

Employees who are convinced that they get enough physical activity in their daily commute to work and other motion may question the need for utilizing WHP offers. As one manager puts it:

> *" … they (employees) think yes… , but do I still need to work out or use the exercise bicycle if I walk up 3 km a day? It's kind of not necessary, they say. They also think they get the needed physical activity from working"* (Respondent 17).

## Factors Related to the WHP Offer

### Design of the WHP

Several elements related to the design and administration of the WHP offer were identified. A participatory approach, i.e., management's positive attitude to and support for staff initiatives, is believed to increase participation and foster improved relations between managers and staff. Management's sensitivity and responsiveness to individual employees' needs is important. They can, for example, conduct a survey to find out the types of wellness packages that are of interest to employees.

> *" … One must, first and föremost, listen to the employee, what they want, what they think or feel. Decisions should be based on these. It is after all the employees that should be in focus since they are the ones who will eventually utilize the wellness offers… "* (Respondent 18).

It appears that WHP packages designed as group activities among coworkers often facilitate uptake because coworkers inspire and motivate one another. Examples of group activities are steps-count competition, team activities, recreational activities as well health-themed retreat away from the work environment.

> *" … this type of step-count competition where all our 24 000 employees participate… it has shown effects just from last year till this year… just this wellbeing and people losing weight, feeling better and so on… "* (Respondent 17).
> *" So, a combination of one being able to use their wellness allowance individually … and additional group activities just like the company does, makes more people start. And it has, from an organizational point of view, felt like an incredible success on our part… it has been a combination of (WHP offers at) the individual level… and group level, it has increased uptake" …* (Respondent 18).

Some managers stressed the need for inclusiveness i.e., WHP should be available to all workers irrespective of their employment status

> *" … we do not differentiate, every worker gets their WHP monetary allowance, irrespective of whether I am part-time or permanent staff, I get the same WHP allowance"* (Respondent 14).

### Supportive Collaborators

Enlisting the help of external and internal supportive collaborators were judged as positive for improving uptake of WHP offers. Examples of external collaborators are wellness and fitness centers, health coaches, personal trainers, occupational health consulting firms. These partnerships become relevant for wellness-themed organizational meetings and activities, on-site fitness training and lectures on health and wellness.

> *" … (we) have a gym chain that is connected to wellness allowance… we have had that in a project. Personal trainers and fitness experts from the gym chain were at our worksite to inspire and speak about what one can do… "* (Respondent 10).
> *"… we had a wellness intervention in which we got an occupational health consulting firm to come to our worksite and conduct this kind of tests, fitness test as it is called… the result is that we have 2–3 additional employees who now train and engage in physical activities more regularly"* (Respondent 9).

For best results, external collaborators should not be located too far away and should offer a wide range of alternatives for employees to choose from. Unfortunately, employees in smaller cities are often unable to access WHP offered by collaborators whose facilities are concentrated in large cities. Moreover, the routine for companies who offer a fixed monetary allowance is that employees make out-of-pocket payment, but get a refund up to the amount offered by the company. To avoid the extra

financial burden of out-of-pocket payments, managers suggest delivering WHP offers through systems and portals that are easy to access, especially those connected to wellness centers.

Internal collaborators were in the form of "Health Peer Educators." These are employees in the same organization who volunteer to disseminate information about WHP offers. They plan activities aimed at getting colleagues interested in WHP and keeping them motivated to utilize WHP offers.

> *" . . . we have about 30–35 health peer educators who are also part of our health council. Their role is to spread information regarding what activities we have, spread information about wellness allowances. . . initiate and participate in activities. . . "* (Respondent 16).

Some managers were critical of the lack of systematic evaluation and follow-up of WHP interventions:

> *" . . . We have no follow-up whatsoever, we simply get a receipt that (the employee) has paid. But the question is: does he really go for these activities or are we simply giving money to the gym? Has it added any value to us as a company? So, it is a bit questionable that we do not have any follow up whatsoever"* (Respondent 16).

### Financing of WHP

According to managers, low uptake was common for WHP offers for which employees must make an additional out-of-pocket payment. Managers reported getting regular requests from staff for an increase in the fixed-rate monetary allowance offered, uptake seem to improve when the amount was increased.

> *" . . . it is, of course, the amount of the monetary allowance that can be a hindrance. . . when you must add your own (money). . . "* (Respondent 15).

An increase in the subvention offered to employees led to increased WHP uptake at one of the participating worksites:

> *" . . . the amount was increased by 300% so that we have a fairly large amount of money, one can then appreciate the benefit of utilizing the allowance. It covers yearly membership at a fitness center, and it covers quite a lot, therefore there has been an increase in employees' interest to utilize it, I think"* (Respondent 14).
>
> *" . . . we created better economic conditions for employees to be able to purchase membership at fitness centers or swimming centers or whatever else. This is because I think financial constraint is often the problem . . . "* (Respondent 15).

On the contrary, one manager believed that it is a positive approach to offer only subsidized WHP offer, that way employees can complete with own funds:

> *" . . . I always believe in people having to pay a little (for WHP). It means they will be more committed to the services purchased (e.g., gym membership)"* (Respondent 18).

## Organizational Factors

### Nature of the Organization's Operations

Factors such as irregular working hours, strenuous tasks, job description and non-uniform organizational structures across branches may limit employees' uptake of WHP offers:

> *"Actually, it is the nature of the company's operations that demand that I have such and such role or such position. . . makes it difficult for me to choose the wellness hour. . . it is clear that your role or position can be a limitation"* (Respondent 6).
>
> *" . . . one of the biggest barriers is that we are mobile, we never work within four walls, it keeps changing. . . "* (Respondent 9).

Suggestions to address barriers include the provision of on-site gym and duty rosters that accommodate participation in WHP even during working hours:

> *" . . . this might sound stupid, but I think the only way out is to incorporate wellness into working hours. . . i doubt we can make this work if it is not within working hours"* (Respondent 16).
>
> *" concerning that, if every company should own a gym or a treadmill or exercise bikes at the work site. . . it would be easier to engage in physical activity. Or having a fitness center very close by to the company"* (Respondent 18).

### Management as Role Models

Managers believed that top management's uptake of WHP offers would set a good example and encourage employees to utilize theirs. By utilizing WHP offers, top management staff would reinforce the importance of health promotion and show their readiness to influence the entire organization in the right direction.

> *". . . a lot has to do with being a role model, to be an ambassador for what is available. . . because if I, as boss, utilize and speak well of available wellness offers then the information will spread through the entire organization and the wellness offers will be viewed as good. . . "* (Respondent 15).
>
> *" . . . so, I think that top management has to view it (WHP) as important and there must be follow up too. . . more resources will be put in place if top management considers it as important"* (Respondent 16).

### Resources and Support for Managers

Time constraint, the responsibility to convince top management and the constant need to provide proof that investing in WHP can result in measurable economic gains for the company are major barriers encountered by managers.

> *" The most important factor is time. We are already experiencing quite a lot of time constraints and there is so much else to do, but at the same time we must think about (WHP)and employee well-being"* (Respondent 7).
>
> *" In fact, one must calculate and show in figures the whole time, it is always the economy first. We must always show them the costs and long-term benefits in clear detail...they must understand that it is better to invest in health promotion rather than rehabilitation. We must show the top management these things in figures"* (Respondent 3).

Respondents raised the need for companies to have a managerial position that deals mainly with WHP. A manager with such a role must possess a holistic view and understanding of WHP, must have adequate time for WHP and support function for management in their decision-making.

> *"…I think it has a lot to do with the fact that one has never before had a human resource function with a holistic view of the organization …It is important to have an overall health coordinator who deals with health and health promotion issues…"* (Respondent 3).

Some respondents spoke about the need for sending managers on training courses so that they may improve their knowledge of occupational health promotion. Training will ensure that managers have enough skills for motivating and supporting all categories of employees, including those with diverse needs.

> *" The most important thing is training for managers so that they are well-equipped to get out the best in their workers…and how to improve as leaders…"* (Respondent 3).

## DISCUSSION

This study investigated managers' perceptions of factors affecting employees' uptake of WHP offers. Three themes and nine sub-themes were identified, i.e., factors related to the individual (with sub-themes: awareness of WHP, work-life balance and attitudes); those related to the WHP (sub-themes: design and implementation of WHP, supportive collaborators, and financing of WHP) and factors at the organizational level (sub-themes: nature of the organization's operations, management as role models and resources, and support for managers).

Although an individual's autonomy in decision making is an important ethical principle in health promotion (32), identifying individual-level barriers and addressing them are important for improving WHP uptake. Lack of awareness and negative attitudes are modifiable factors that may improve uptake without infringing on employee's autonomy. Issues of work-life balance, such as the time constraints experienced by employees with diverse life situations, are crucial for uptake. Work-life balance is used to describe the impact of work and family life on working individuals. The concept has its history in policy efforts to reduce the effects of gender inequalities and low female labor participation due to caring for young children (33). The concept is now used more commonly in recognition of the various meaning of family challenges beyond caring for children. According to Kossek et al. (34), employers can work toward a sustainable workforce by taking into cognizance the relationship between employees' well-being and work-life balance. To address individual-level factors, managers in this study adopted various strategies such as flexible "wellness hour," targeted information dissemination, site visitations, individual coaching and creating opportunities for employees to ask questions during staff meetings. These are laudable strategies as research has shown that employees' engagement in WHP improves when they perceive strong organizational support and involvement (35).

Factors related to the WHP offer were WHP design, supportive collaborators and financing. A participatory approach, that encourages and supports employees' WHP initiatives, was viewed as a key factor for improving WHP uptake. A possible explanation is that employees' initiatives may reflect their actual needs rather than what management perceives as important. According to the Centers for Disease Control and Prevention (36), effective WHP is built on a continuous process of needs analysis, priority setting, planning, implementation, and evaluation. Our finding is in line with those of Kilpatrick, Blizzard, Sanderson et al. (37), who found that participation in WHP was higher among workers who felt consulted and those who perceived other colleagues as engaged and interested in WHP.

The success of WHP was perceived to be partly related to external and internal collaborators and optimal administrative systems for WHP. Supportive external collaborators are, for example, employee assistance program providers (EAP), fitness chains, wellness companies, among others. Many of these external collaborators have portals that offer employees easy access and a variety of activities to choose from. However, although engaging external collaborators was generally viewed as an enabling factor, managers believed that the success rate is dependent on the type of collaborator, the range of activities provided and the location of the WHP. Many of the managers reported that their company's current external collaborators mostly had facilities in larger cities. This is problematic for employees residing in or working in branches located in smaller towns, they may find it difficult to access or participate in activities located far away. A recommendation is that large corporations with branches in both large and small cities, but who operate a centralized WHP policy may have to decentralize certain aspects of their WHP policies and structure. Without proper evaluation, it is difficult to judge the efficiency of external collaborators. Managers were critical about the continued engagement of external collaborators without regularly evaluating outcome or impact. In a study by Compton & McManus (38), it was found that the non-evaluation of external collaborators is a general problem and must be addressed.

The effectiveness of strategies to create a culture of health and good communication at workplaces (39) was further confirmed in the present study. Apart from managers strategies to spread information, some companies have employees who volunteer to be on the organization's health council as "health motivators." They help to raise awareness about health and WHP by spreading information to their colleagues. Although information may be available on company websites and WHP portals, employees are less likely to seek out such specific information. The creation of a health motivator role is, therefore, an innovative way to ensure adequate information dissemination and keeping employees motivated to achieve the organization's WHP goals.

Findings from the interviews showed that how WHP is financed is important for uptake. According to Swedish employment laws, WHP benefits should be provided to workers (23) but the amount and type of what is offered vary across companies. A common practice among employers is the provision of monetary allowance for individual employees to

engage in a health promotion activity of their choice. The tax agency provides a list of a wide range of activities on its website. Managers had opposing views about the role of partly financed WHP offers requiring out-of-pocket payment by employees. While some managers viewed this as a barrier (i.e., financial constraints will result in low uptake), others considered it as an enabling factor (i.e., out-of-pocket payment by employees will lead to increased uptake and commitment to WHP). It is unclear whether these contrasting views are as a result of individual differences between managers or due to contextual differences in the workplaces they represent. Contextual differences such as the size of the monetary allowance and therefore, the amount of out-of-pocket-payment to be made, may be responsible for the differences in opinion among managers.

Unfortunately, the above variation may create possible inequalities in WHP offers and consequently uptake among employees in different organizations, sectors, and professions. Such inequalities may be larger when comparing larger organizations with smaller organizations (6). Although the size and financial capacity of individual companies must be taken into consideration, the importance of a systematic and continuous process of needs assessment, priority setting, planning, implementation, and evaluation cannot be ignored (36). The assumption that out-of-pocket payment to complement monetary allowance is positive for uptake may reflect a general approach to WHP. Employers probably design WHP based on an assumption that they know employees' needs and without consulting the employees. A participatory approach when designing WHP is useful for focusing on areas identified by employees, which is likely to improve uptake.

Although individual factors and factors related to the WHP were identified, it appears that organizational factors were crucial to what happens at the individual and WHP levels. For example, the finding that many managers still struggle to convince top management about investing in WHP probably suggests a lack of understanding of the importance of WHP among top management in some organizations. It also appears that despite growing awareness and interest for WHP among employers, they are probably hesitant to invest in WHP beyond a certain basic level. It is also likely that some employers do not view WHP to include life outside of the workplace or as encompassing psychosocial health and well-being. Likely reasons could be due to a narrow perception of WHP to only mean on-site strategies like accident reduction, a notion that has been observed especially in rural settings (40). Similarly, some managers lack adequate organizational support and resources for WHP (e.g., time and training). Challenges faced by managers may be better addressed if management is interested in developing a well-structured and goal-driven WHP policy. Many of the managers have come to understand the importance and intricacies of WHP to the extent that they suggest the creation of managerial positions with a specific focus on WHP.

Managers need adequate training and skills for the successful execution of WHP related tasks. Other organizational level challenges faced by employees include irregular working hours, strenuous and limiting job tasks, jobs that involved high mobility, non-uniform organizational structure in many large corporations. Strategies suggested to address such barriers include permitting wellness activities during working hours and flexible work scheduling among others. The above suggestions from managers can only be considered if top management has the right perspective concerning WHP i.e., what it is and how it works. The concept of health-promoting leadership is thus an emerging term that describes leadership behaviors for health-oriented organizations (41). According to Erikson (41), health-promoting leadership includes the systematic health-oriented development of the physical and psychosocial work environment. Some previous studies have shown that the success of WHP intervention depends, not only on the structure of the intervention provided but also on organizational involvement (19, 42).

Although WHP offers are common in Sweden, this study is one of the few that have explored factors related to employees' uptake of WHP from managers' perspectives, as well as challenges encountered by managers responsible for WHP. Some methodological issues are worth highlighting. The study is based on interviews of a convenient sample of managers from organizations willing to participate in the study, results are therefore not generalizable. As only private organizations were included in the study, it is likely that WHP in the public sector works differently compared to the private sector. Moreover, considering that managers had differing opinions regarding certain issues, an analysis of factors likely to explain this difference would have been appropriate. For example, it would be relevant to see if the differences in opinion were associated with gender, age, years of experience, the size of their company, the type of WHP offered, just to name a few. Overall, this study provides an insight into WHP uptake among employees in private medium and large-scale companies, challenges faced by managers and modifiable factors to address challenges and improve uptake.

## CONCLUSIONS

Findings from this study show that employees' uptake of WHP offers can be improved by addressing certain factors. To address factors at the individual level, organizations should regularly inform employees about WHP offers. This will increase awareness, generate interest and keep employees motivated. The wellness-hour and increased flexibility around it may be a good strategy to address constraints related to work-life balance. Further research is however needed to investigate its effectiveness and impact. The design and delivery of WHP can be improved by adopting a participatory approach and regular evaluation of WHP practices. A regular evaluation will ensure that organizations are able to measure outcomes, identify areas of unmet need and improve where necessary. To prevent exclusion and inequality in access to WHP, there should be alternatives for small-town dwellers who may be unable to access city-based WHP facilities. Another example is to determine the implications of WHP financing and employees' out-of-pocket payments and how they affect WHP uptake. At the organizational level, the role of providing adequate training and support in terms of resources and time for managers can not be overstated. WHP should not be treated as a side responsibility in addition to managers' primary role. For effective implementation, enough

time and resources should be allocated to managers. Management should show interest by also utilizing WHP and ensuring that WHP designs match the nature of the company's operations. For example, "a one-size fits all" kind of approach will be ineffective in organizations with many workers whose job tasks involve high mobility outside of the office.

In conclusion, WHP is a common feature of many Swedish workplaces. Given the amount of resources annually spent on WHP, the need for establishing evidence (or lack of it) for WHP's effectiveness and impact can not be overemphasized. Further research that uses other methods and includes diverse participant categories e.g., the public sector is warranetd if results are to be generalized to the rest of the population.

## 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 regional ethical review board in Uppsala, Sweden. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

LO and MS conceived of the project idea, designed the study, and coordinated data collection. FS and LO were involved in data analysis and manuscript drafting. LO finalized the manuscript.

## FUNDING

This study was funded by the University of Gävle.

## REFERENCES


1. Aldana SG, Merrill RM, Price K, Hardy A, Hager R. Financial impact of a comprehensive multisite workplace health promotion program. *Prev Med*. (2005) 40:131–7. doi: 10.1016/j.ypmed.2004.05.008
2. World Health Organisation. *Workplace Health Promotion: The Workplace: A Priority Setting for Health Promotion*. (2010). Available online at: https://www.who.int/occupational_health/topics/workplace/en/ (accessed october 24, 2019).
3. Kuoppala J, Lamminpää A, Husman P. Work health promotion, job well-being, and sickness absences—a systematic review and meta-analysis. *J Occup Environ Med*. (2008) 50:1216–27. doi: 10.1097/JOM.0b013e31818dbf92
4. Kaspin LC, Gorman KM, Miller RM. Systematic review of employer-sponsored wellness strategies and their economic and health-related outcomes. *Popul Health Manag*. (2013) 16:14–21. doi: 10.1089/pop.2012.0006
5. International Labour Organization. *Policy Documents*. (2020). Available online at: https://www.ilo.org/safework/info/policy-documents/lang--en/index.htm (accessed February 11, 2020).
6. Beck D, Lenhardt U, Schmitt B, Sommer S. Patterns and predictors of workplace health promotion: cross-sectional findings from a company survey in Germany. *BMC Public Health*. (2015) 15:343. doi: 10.1186/s12889-015-1647-z
7. Froneberg B, Timm S. *Country Profile of Occupational Health System in Germany*. Copenhagen: WHO Regional Office for Europe (2012).
8. Burton J. *WHO Healthy Workplace Framework and Model: Background and Supporting Literature and Practices*. Geneva: World Health Organization (2010).
9. The Center for Disease Control. *Workplace Health Program Definition and Description*. (2016). Available online at: https://www.cdc.gov/workplacehealthpromotion/pdf/Workplace-Health-Program-Definition-and-Description.pdf (accessed October 24, 2019).
10. Shareck M, Frohlich KL, Poland B. Reducing social inequities in health through settings-related interventions—A conceptual framework. *Glob Health Promot*. (2013) 20:39–52. doi: 10.1177/1757975913486686
11. World Health Organisation. *Global Status Report on Noncommunicable Diseases*. 2010 (2010). Available online at: https://www.who.int/nmh/publications/ncd_report_full_en.pdf (accessed June 28, 2019).
12. Lassen A, Bruselius-Jensen M, Sommer HM, Thorsen AV, Trolle E. Factors influencing participation rates and employees' attitudes toward promoting healthy eating at blue-collar worksites. *Health Educ Res*. (2006) 22:727–36. doi: 10.1093/her/cyl153
13. Robroek SJ, van de Vathorst S, Hilhorst MT, Burdorf AJ. Moral issues in workplace health promotion. *Int Arch Occup Environ Health*. (2012) 85:327–31. doi: 10.1007/s00420-011-0675-y
14. Rongen A, Robroek SJ, van Lenthe FJ, Burdorf A. Workplace health promotion: a meta-analysis of effectiveness. *Am J Prevent Med*. (2013) 44:406–15. doi: 10.1016/j.amepre.2012.12.007
15. Robroek SJ, Van Lenthe FJ, Van Empelen P, Burdorf AJ, Activity P. Determinants of participation in worksite health promotion programmes: a systematic review. *Int J Behav Nutr Phys Act*. (2009) 6:26. doi: 10.1186/1479-5868-6-26
16. Hanson A. *Hälsopromotion i Arbetslivet (Occupational Health Promotion)*. Lund: Studentlitteratur (2004).
17. Grawitch MJ, Gottschalk M, Munz DC. The path to a healthy workplace: a critical review linking healthy workplace practices, employee well-being, and organizational improvements. *Consult Psychol J Pract Res*. (2006) 58:129–47. doi: 10.1037/1065-9293.58.3.129
18. Dallat MAT, Hunter RF, Tully MA, Cairns KJ, Kee F. A lesson in business: cost-effectiveness analysis of a novel financial incentive intervention for increasing physical activity in the workplace. *BMC Public Health*. (2013) 13:953. doi: 10.1186/1471-2458-13-953
19. Vingård E, Blomkvist V, Rosenblad A, Lindberg P, Voss M, Alfredsson L, et al. A physical fitness programme during paid working hours–impact on health and work ability among women working in the social service sector: a three year follow up study. *Work*. (2009) 34:339–44. doi: 10.3233/WOR-2009-0932
20. Pronk NP. Physical activity promotion in business and industry: evidence, context, and recommendations for a national plan. *J Phys Act Health*. (2009) 6(Suppl. 2):S220–35. doi: 10.1123/jpah.6.s2.s220
21. Gånedahl H, Viklund PZ, Carlén K, Kylberg E, Ekberg J. Work-site wellness programmes in Sweden: a cross-sectional study of physical activity, self-efficacy, and health. *Public Health*. (2015) 129:525–30. doi: 10.1016/j.puhe.2015.01.023
22. Hanson A. *Workplace Health Promotion: A Salutogenic Approach*. Bloomington, IN: AuthorHouse. (2007). p. 1-351.
23. The Swedish Tax Agency. *Personalvårdsförmån, Motion och Friskvård*. (2019). Available online at: https://www.skatteverket.se/privat/skatter/arbeteochinkomst/formaner/personalvardmotionoch%20friskvard.4.7459477810df5bccdd4800014540.html (accessed June 28, 2019).
24. Hennel L. *Ojämlikt Stöd Till Friskvård*. (2016). Available online at: https://arbetet.se/2016/05/20/ojamlikt-stod-till-friskvard/ (accessed June 28, 2019).
25. Downey AM, Sharp DJ. Why do managers allocate resources to workplace health promotion programmes in countries with national health coverage? *Health Promot Int*. (2007) 22:102–11. doi: 10.1093/heapro/dam002

26. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st century workplace. *J Occ Org Psychol*. (2001) 74:489–509.
27. Bryant M, Stensaker I. The competing roles of middle management: negotiated order in the context of change. *J Change Manage*. (2011) 11:353–73. doi: 10.1080/14697017.2011.586951
28. Rothstein MA, Harrell HLJJoo, Occupational emACo, Medicine E. Health risk reduction programs in employer-sponsored health plans: Part II—Law and ethics. *J Occup Environ Med*. (2009) 51:951–7. doi: 10.1097/JOM.0b013e3181b05435
29. European Commision. *What is an SME?* (2020). Available online at: https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_sv (accessed February 11, 2020).
30. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. (2005) 15:1277–88. doi: 10.1177/1049732305276687
31. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today*. (2004) 24:105–12. doi: 10.1016/j.nedt.2003.10.001
32. Holmqvist M, Maravelias C. *Managing Healthy Organizations: Worksite Health Promotion and the New Self-Management Paradigm*. New York, NY: Routledge (2010). doi: 10.4324/9780203845806
33. Kossek EE, Baltes BB, Matthews RA. How work–family research can finally have an impact in organizations. *Ind Organ Psychol*. (2011) 4:352–69. doi: 10.1111/j.1754-9434.2011.01353.x
34. Kossek EE, Valcour M, Lirio P. *The Sustainable Workforce: Organizational Strategies for Promoting Work-Life Balance and Wellbeing*. Work and Wellbeing. John Wiley & Sons (2014). p. 1–24. doi: 10.1002/9781118539415.wbwell030
35. Hoert J, Herd AM, Hambrick M. The role of leadership support for health promotion in employee wellness program participation, perceived job stress, and health behaviors. *Am J Health Promot*. (2018) 32:1054–61. doi: 10.1177/0890117116677798
36. Centers for Disease Control and Prevention. *Workplace Health Model*. (2016). Available online at: https://www.cdc.gov/workplacehealthpromotion/model/index.html (accessed June 28, 2019).
37. Kilpatrick M, Blizzard L, Sanderson K, Teale B, Jose K, Venn A. Barriers and facilitators to participation in workplace health promotion (WHP) activities: results from a cross-sectional survey of public-sector employees in Tasmania, Australia. *Health Promot J Austr*. (2018) 28:225–32. doi: 10.1071/HE16052
38. Compton RL, McManus JG. Employee assistance programs in Australia: Evaluating success. *J Workplace Behav Health*. (2015) 30:32–45. doi: 10.1080/15555240.2015.998971
39. Kent K, Goetzel RZ, Roemer EC, Prasad A, Freundlich N. Promoting healthy workplaces by building cultures of health and applying strategic communications. *J Occup Environ Med*. (2016) 58:114–22. doi: 10.1097/JOM.0000000000000629
40. Pescud M, Teal R, Shilton T, Slevin T, Ledger M, Waterworth P, et al. Employers' views on the promotion of workplace health and wellbeing: a qualitative study. *BMC Public Health*. (2015) 15:642. doi: 10.1186/s12889-015-2029-2
41. Eriksson A. *Health-Promoting Leadership: A Study of the Concept and Critical Conditions forImplementation and Evaluatio*. Gothenburg: Nordic School of Public Health NHV Gothenburg (2011).
42. Jørgensen MB, Faber A, Jespersen T, Hansen K, Ektor-Andersen J, Hansen JV, et al. Implementation of physical coordination training and cognitive behavioural training interventions at cleaning workplaces–secondary analyses of a randomised controlled trial. *Ergonomics*. (2012) 55:762–72. doi: 10.1080/00140139.2012.665946


**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 Public Health

ORIGINAL RESEARCH
published: 22 May 2020
doi: 10.3389/fpubh.2020.00149

# Psychological Capital Mediates the Association Between Perceived Organizational Support and Work Engagement Among Chinese Doctors

*Shihan Yang[1], Hao Huang[1], Tian Qiu[1], Fangqiong Tian[1], Zhihui Gu[1], Xuege Gao[2] and Hui Wu[1]**

[1] Department of Social Medicine, School of Public Health, China Medical University, Shenyang, China, [2] Department of Mathematics, University of California, San Diego, CA, United States

**Background:** As experts studying occupational health psychology know, low level of work engagement leads to higher turnover intentions. Some researchers have put a focus on the association between organizational support and work engagement. However, little has been done concerning the mediating effect of psychological capital (PsyCap) on the association between perceived organizational support (POS) and work engagement (vigor, dedication, absorption) among Chinese doctors.

**Methods:** A cross-sectional study has been carried out from November to December in 2017, in Liaoning Province, China. The questionnaire consists of Survey of Perceived Organizational Support, the Utrecht Work Engagement Scale, Psychological Capital Questionnaire, and demographic and working variables. The self-administered questionnaires were distributed to 1,009 doctors. Effective responses were collected from 836 participants (82.85%). Hierarchical multiple regression and the asymptotic and resampling strategies were used to examine the association between POS and work engagement mediated by PsyCap.

**Results:** After controlling the demographic and working variables, POS was positively related to vigor ($\beta = 0.402$, $P < 0.01$), dedication ($\beta = 0.413$, $P < 0.01$), and absorption ($\beta = 0.373$, $P < 0.01$). Psychological capital was positively associated with vigor ($\beta = 0.442$, $P < 0.001$), dedication ($\beta = 0.413$, $P < 0.001$), and absorption ($\beta = 0.395$, $P < 0.001$). Thus, PsyCap [$a \times b = 0.1895$, bias-corrected and accelerated 95% confidence interval (BCa 95% CI) = 0.1524, 0.2290]; $a \times b = 0.1517$, BCa 95% CI = 0.1180, 0.1875; $a \times b = 0.1693$, BCa 95% CI = 0.1299, 0.2099] significantly mediated the association between POS and vigor, dedication, and absorption, respectively.

**Conclusion:** There was a low level of work engagement among Chinese doctors. Perceived organizational support could indirectly improve vigor, dedication, and absorption, partially through mediator PsyCap. Perceived organizational support intervention, education, and training in PsyCap should be carried out to cope with work engagement.

**Keywords: Chinese doctors, work engagement, perceived organizational support, psychological capital, mediating effect**

OPEN ACCESS

***Edited by:***
*Leah Okenwa Emegwa, Swedish Red Cross University College, Sweden*

***Reviewed by:***
*Siti Munira Yasin, MARA University of Technology, Malaysia*
*Sok King Ong, Ministry of Health, Brunei*

***Correspondence:**
*Hui Wu*
*hwu@cmu.edu.cn*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *30 October 2019*
***Accepted:*** *09 April 2020*
***Published:*** *22 May 2020*

***Citation:***
*Yang S, Huang H, Qiu T, Tian F, Gu Z, Gao X and Wu H (2020) Psychological Capital Mediates the Association Between Perceived Organizational Support and Work Engagement Among Chinese Doctors. Front. Public Health 8:149. doi: 10.3389/fpubh.2020.00149*

## INTRODUCTION

Work engagement is defined as an active, substantial, and job-relevant status of spirit (1). It consists of three subscales: vigor (i.e., always keep energetic work), dedication (i.e., actively and enthusiastically involved in the work), and absorption (i.e., totally focus on one's work) (2). Low work engagement among a large proportion of practitioners could generate a negative attitude toward their work (3). Around the world, low work engagement is a serious problem among all types of occupational groups, especially to the doctors (4–6). In China, shortage of doctors is a common phenomenon in the hospitals, which probably leads to overfatigue (7) and even low level of work engagement. The number of doctors was 2.83 million in 2017 in China, indicating the doctor–patient ratio is 2.44 doctors for 1,000 patients (8). This ratio is immensely lower than the ratio of 9.8 in high-income or the ratio of 4.45 in middle-income countries (9). More seriously, doctors in China complain about being in highly intensive work and in enormously stressful environment. Approximately 94% doctors work more than 8 h per day in China. One-quarter of doctors work more than 12 h per day without corresponding recompense. Most doctors must work on national holidays, who have not received contractually required income (10). In addition, doctors are often overworked. They have frequent night shifts, lots of daily consultations, and even hundreds of patients 1 day. This undoubtedly increases their occupational prevalence and undermines their work engagement compared with nurses and other occupations (4, 5, 11–13). Even worse, low work engagement may damage the job motivation and job enthusiasm of doctors and then exacerbate job burnout and turnover intentions (6, 14–16). Ultimately, a low level of work engagement has a negative impact on doctors' mental health and medical service quality (2). On the contrary, a high level of work engagement could promote doctors' working performance, contentment, and psychological health (17–19). Loerbroks et al. (2) research demonstrates that improving doctors' work engagement, particularly vigor and dedication, are related to better patient care. Therefore, work engagement of doctors in China needs further research.

A low level of work engagement dramatically impacts physical and psychological health, the quality of life, and the health service of the doctors. It is essential to find positive psychological resources to manage this adverse effect. Doctors are usually rewarded for providing excellent medical services. In the work, perceived organizational support (POS) could be maintaining an employee's feelings. Perceived organizational support relates to the degree that the organization treasures his/her contribution and concerns with his/her well-being (20). It appears through encountering benefits to employees taken by the organization. Perceived organizational support is also a vital element of the social interaction. It means employees trust that the organization will provide encouragements and value their achievements, and the organization trusts that employees will perform excellently at work (21). Empirical studies have shown that low POS leads to negative work attitude and performance. Low POS also negatively influences mental health and employee engagement (20, 22–24). Especially in hospitals, low POS results to bad consequences in doctors, such as frequent absenteeism, reduced productivity, and separation (20, 25, 26). Furthermore, it may have a negative impact on the quality of medical services. Perceived organizational support was found to be a positive factor relating with work engagement in professional managers and nurses before (11, 27, 28). Hence, improving POS may be a kind of means for promoting the doctors' professional performance (20).

Psychological science is becoming increasingly important at all aspects of society. Because POS has been explored at the organizational aspect, it is also an interesting topic to enhance the doctors' work engagement at the personal aspect. The psychological factors at the personal perspective can enrich interventions in the future. Based on the results of many previous studies, a vital notion derived from organizational psychological behavior is psychological capital (PsyCap). It is a positive resource and psychological force against "doctor pressure and resignation" (29–33). As an exploitable human resource, PsyCap can be suitably developed through training and intervention programs (34). As people become increasingly aware of the significance of positive psychological resources, organizations seek to promote physical and mental health of doctors via reinforcing psychological resources (35). In recent years, some studies have shown that PsyCap relates to POS and work engagement in nurse and staff (11, 29), while PsyCap is connected with professional identity among Chinese doctors (33). For instance, raising PsyCap has positively to do with POS and work engagement (11, 36). Additionally, a previous review presents that POS could influence work engagement through PsyCap but lacks empirical research (34). Nevertheless, to the best of our knowledge, PsyCap has not been entirely certified as a mediator between POS and working engagement, particularly among doctors in the Asian countries. Therefore, we want to add psychological resources to the model of doctors' work engagement and to explore the mediating role of PsyCap in "organization" and "individual."

## PURPOSE OF THE STUDY

Based on the research presented above, this study explored the potential mediating role of PsyCap on the association between organizational care and employee mentality. We try to explore the role of PsyCap on the relationships between POS and work engagement (vigor, dedication, and absorption) among Chinese doctors (**Figure 1**). Four hypotheses were proposed:

Hypothesis 1: Perceived organizational support is positively associated with work engagement (vigor, dedication, absorption) (path c).

Hypotheses 2 and 3: Psychological capital is positively related to POS (path a) and work engagement (vigor, dedication, absorption) (path b).

Hypothesis 4: The effects of POS on work engagement (vigor, dedication, absorption) are partially mediated by PsyCap (path c′).

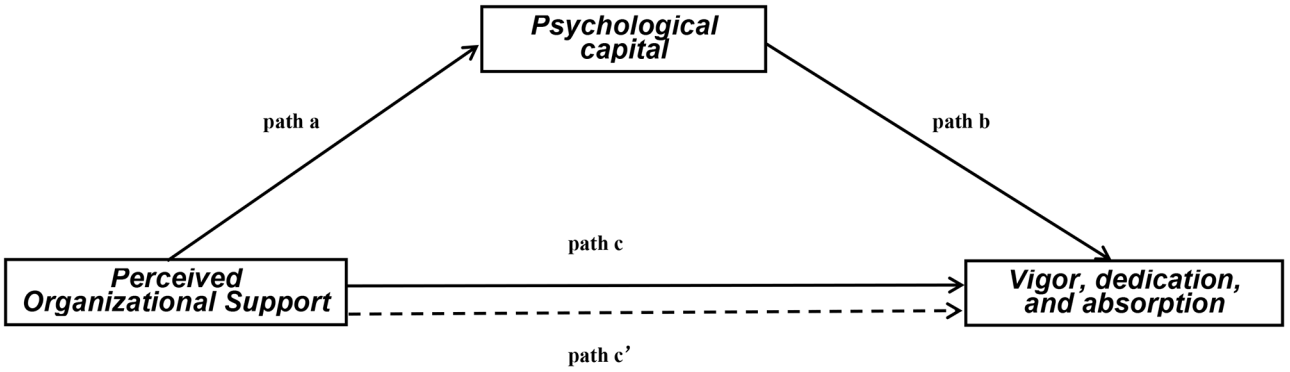


**FIGURE 1 |** Theoretical model of the mediating role of PsyCap on the association between POS and work engagement. c: association of POS with vigor, dedication and absorption; a: association of POS with PsyCap; b: association between PsyCap and vigor, dedication, and absorption after controlling for the covariates; c′: association of POS with vigor, dedication, and absorption after adding PsyCap as a mediator; c = c′ + ab. POS, perceived organizational support; PsyCap, psychological capital.

# MATERIALS AND METHODS

## Ethics Statement

All participants filled in the informed written consent voluntary and anonymous. The study was performed in accordance with the Declaration of Helsinki, and the protocol was approved by the Committee on Human Experimentation of China Medical University.

## Study Design and Sample

This cross-sectional study was conducted from November to December in 2017, in Liaoning Province, China. Liaoning province has 14 cities, 57 tertiary hospitals, and 98,985 doctors in 2017 (8). Tertiary hospitals need more than 500 beds in China (37). Based on geographic division, we selected doctors from five cities and randomly chose one tertiary hospital in each city. Then, we randomly selected ∼200 doctors from each hospital. With acquiring informed consent written by participants, the self-administered questionnaires were distributed to 1,009 doctors. Eight hundred thirty-six doctors provided effective answers (effective response rate, 82.85%).

## Demographic Characteristics and Working Characteristics

Demographic characteristics included gender, age (years), marital status, and educational level. "Age (years)" was classified as ≤30, 31–40, and ≥41; "Marital status" was classified as single/widow/divorced/separated and marriage/cohabitation; "Educational level" was classified as junior college or lower, college, and postgraduate or higher. Working characteristics included professional title and monthly income (RMB, yuan); "Professional title" was classified as junior, intermediate, and senior; "Monthly income (RMB, yuan)" was classified as <4,000 yuan, 4,000 to 8,000 yuan, and >8,000 yuan.

## Measurement of Work Engagement

The Utrecht Work Engagement Scale (UWES) was used to assess work engagement. It has three subscales and 17 items, which are vigor (6 items), dedication (5 items), and absorption (6 items) (11). All items range from 0 (never) to 6 (always), and the total score of each dimension was valued by summing scores of each dimension (38). Higher scores indicate high-level work engagement. The Chinese version of UWES is practiced in many Chinese occupational groups. It has satisfactory reliability and validity (39, 40). In this study, Cronbach α coefficients for vigor, dedication, absorption, and the UWES scales were 0.848, 0.867, 0.835, and 0.943, respectively. The confirmatory factor analyses for the UWES were RMSEA (root mean square error of approximation) = 0.052, CFI (comparative fit index) = 0.979, GFI (goodness-of-fit index) = 0.962, AGFI (adjusted goodness-of-fit index) = 0.931, TLI (Tucker–Lewis index) = 0.966, and NFI (normed fit index) = 0.970.

## Measurement of POS

A 9-item scale of the Survey of Perceived Organizational Support (SPOS) was used to evaluate POS (20). All items were scored from 1 (strongly disagree) to 7 (strongly agree). Higher POS needs higher scores. The short-version SPOS is practiced in many Chinese occupational groups. It has satisfactory reliability and validity (23, 24). In this study, Cronbach α coefficient for the SPOS scale was 0.883. The confirmatory factor analysis for SPOS were RMSEA = 0.045, CFI = 0.991, GFI = 0.982, AGFI = 0.968, TLI = 0.987, and NFI = 0.985.

## Measurement of PsyCap

Psychological Capital Questionnaire (PCQ) was used to examine PsyCap, which has 24 items (41). All items were scored from 1 (strongly disagree) to 6 (strongly agree). Higher PsyCap needs higher scores. Numerous Chinese researches have used the Chinese version of the PCQ and have excellent reliability and validity (42–44). In this study, Cronbach α coefficient for PsyCap scale was 0.934. The confirmatory factor analyses for PCQ were RMSEA = 0.049, CFI = 0.962, GFI = 0.940, AGFI = 0.917, TLI = 0.951, and NFI = 0.945.

## Statistical Analyses

The demographic and working variables were described with mean ± SD. Differences of the mean value of work engagement

in different groups were tested by *t* test or one-way analysis of variance. Pearson correlation analysis was used to assess correlations among continuous variables. The validity of the scales was tested by confirmatory factor analysis. In this study, multicollinearity was not an issue in the estimate because of variance inflation factor values <10. Hierarchical multiple regression was applied to explore the mediating effect of PsyCap in the association between POS and work engagement. All variables in univariate analysis ($P < 0.05$) were entered: Step 1, adding covariates demographic and working variables (gender, age, and professional title); Step 2, adding independent variable POS; Step 3, adding mediation PsyCap. As shown in **Figure 1**, in Steps 1 and 2 after adjusting for covariates, the purpose was to test whether POS has an effect on work engagement (the c path). In Step 3, the purpose was to explore the mediation of PsyCap. If the effect of POS on work engagement (c′ path coefficient) in Step 3 was smaller than the c path coefficient in Step 2, PsyCap was likely to be considered to have a partial mediating role (45, 46). Asymptotic and resampling strategies were used to examine PsyCap as potential mediator in the association between POS and work engagement (vigor, dedication, and absorption) based on 5,000 bootstrap samples. The bias-corrected and accelerated 95% confidence interval (BCa 95% CI) was estimated for mediation, and a BCa 95% CI excluding 0 indicated a significant mediating role (37). All the above analyses were conducted using IBM SPSS Statistics 21.0 (IBM, Asia Analytics Shanghai, China) and IBM AMOS 21.0 (IBM, Asia Analytics Shanghai, China) statistical software for Windows. Two-tailed $P < 0.05$ was viewed as statistically significant in this study.

# RESULTS

## Demographic and Working Characteristics of Subjects of Work Engagement

Demographic and wok characteristics of participants and comparisons on vigor, dedication, and absorption are shown in **Table 1**. The score of absorption in women's group was significantly higher than that in men's group ($P < 0.01$). The scores of vigor, dedication, and absorption in the senior professional title group were significantly higher than those in junior and intermediate groups, respectively ($P < 0.001$).

## Correlations Among Study Variables

Correlations among study variables are shown in **Table 2**. The mean age of our sample was 36.55 (SD = 7.31) years, and the mean scores of vigor, dedication, and absorption were 23.82 (SD = 8.00), 21.74 (SD = 6.86), 24.85 (SD = 8.00), respectively. Age was positively correlated with PsyCap. Perceived organizational support was positively connected with PsyCap. Perceived organizational support and PsyCap were positively connected with vigor, dedication, and absorption among Chinese doctors.

**TABLE 1 |** Demographic and working characteristics of subjects and comparisons on vigor, dedication, and absorption.

| Variables | *n* (%) | Vigor Mean ± SD | *F/t* | *P* | Dedication Mean ± SD | *F/t* | *P* | Absorption Mean ± SD | *F/t* | *P* |
|---|---|---|---|---|---|---|---|---|---|---|
| Gender | | | 0.472 | 0.637 | | 1.856 | 0.064 | | 2.752 | 0.006 |
| Men | 285 (34.1) | 23.64 ± 8.32 | | | 21.13 ± 7.12 | | | 23.74 ± 8.79 | | |
| Women | 551 (65.9) | 23.92 ± 7.84 | | | 22.06 ± 6.70 | | | 25.42 ± 7.50 | | |
| Age (years) | | | 1.637 | 0.195 | | 1.175 | 0.309 | | 1.948 | 0.143 |
| ≤30 | 162 (19.4) | 24.01 ± 7.44 | | | 21.72 ± 5.99 | | | 24.30 ± 7.48 | | |
| 31–40 | 467 (55.9) | 23.41 ± 8.09 | | | 21.48 ± 7.09 | | | 24.63 ± 7.92 | | |
| ≥41 | 207 (24.8) | 24.60 ± 8.19 | | | 22.35 ± 6.94 | | | 25.77 ± 8.52 | | |
| Marital status | | | 0.507 | 0.613 | | 0.021 | 0.983 | | 0.224 | 0.823 |
| Single/widow/divorced/separated | 148 (17.7) | 24.13 ± 8.16 | | | 21.75 ± 6.78 | | | 24.98 ± 7.58 | | |
| Marriage/cohabitation | 688 (82.3) | 23.76 ± 7.97 | | | 21.74 ± 6.88 | | | 24.82 ± 8.09 | | |
| Educational level | | | 1.715 | 0.181 | | 2.743 | 0.065 | | 1.980 | 0.139 |
| Junior college or lower | 60 (7.2) | 25.26 ± 8.59 | | | 23.03 ± 7.30 | | | 25.56 ± 9.19 | | |
| College | 138 (16.5) | 22.99 ± 7.34 | | | 20.70 ± 7.12 | | | 23.65 ± 8.11 | | |
| Postgraduate or higher | 638 (76.3) | 23.87 ± 7.99 | | | 21.84 ± 6.74 | | | 25.04 ± 7.84 | | |
| Professional title | | | 9.755 | 0.000 | | 9.120 | 0.000 | | 7.688 | 0.000 |
| Junior | 300 (35.9) | 24.27 ± 7.56[b] | | | 22.21 ± 6.40[b] | | | 24.68 ± 7.46[b] | | |
| Intermediate | 401 (48.0) | 22.73 ± 8.12 | | | 20.80 ± 7.11 | | | 24.17 ± 8.30 | | |
| Senior | 135 (16.1) | 26.08 ± 8.10[a] | | | 23.50 ± 6.68[a] | | | 27.24 ± 7.83[a] | | |
| Monthly income (RMB, yuan) | | | 0.393 | 0.675 | | 0.578 | 0.556 | | 0.857 | 0.425 |
| <4,000 | 80 (9.6) | 24.17 ± 7.82 | | | 21.75 ± 6.21 | | | 24.94 ± 7.65 | | |
| 4,000–8,000 | 286 (34.2) | 23.49 ± ± 8.02 | | | 21.39 ± 7.04 | | | 24.35 ± 7.68 | | |
| >8,000 | 470 (56.2) | 23.97 ± 8.03 | | | 21.95 ± 6.83 | | | 25.13 ± 8.25 | | |

[a,b]*Significantly higher compared with intermediate group, P < 0.001.*
*SD, standard deviation.*

**TABLE 2 |** Correlations among study variables.

| Variable | Mean ± SD | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 1. Age | 36.55 ± 7.31 | 1 | | | | | |
| 2. POS | 44.18 ± 7.96 | 0.000 | 1 | | | | |
| 3. PsyCap | 104.83 ± 13.5 | 0.803* | 0.424*** | 1 | | | |
| 4. Vigor | 23.82 ± 8.00 | 0.705* | 0.403*** | 0.535*** | 1 | | |
| 5. Dedication | 21.74 ± 6.86 | 0.602 | 0.416*** | 0.514*** | 0.862*** | 1 | |
| 6. Absorption | 24.85 ± 8.00 | 0.105** | 0.376*** | 0.485*** | 0.846*** | 0.820*** | 1 |

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$ (two-tailed).
*SD, standard deviation; POS, perceived organizational support; PsyCap, psychological capital.*

**TABLE 3 |** Associations of POS and PsyCap with vigor, dedication, and absorption.

| Variables | Vigor | | | Dedication | | | Absorption | | |
|---|---|---|---|---|---|---|---|---|---|
| | Block 1 ($\beta$) | Block 2 ($\beta$) | Block 3 ($\beta$) | Block 1 ($\beta$) | Block 2 ($\beta$) | Block 3 ($\beta$) | Block 1 ($\beta$) | Block 2 ($\beta$) | Block 3 ($\beta$) |
| Gender | 0.021 | 0.002 | 0.021 | 0.068 | 0.048 | 0.066* | 0.108** | 0.090** | 0.108*** |
| Age (years) | 0.102* | 0.091* | 0.068 | 0.095 | 0.083 | 0.062 | 0.100* | 0.089 | 0.068 |
| Professional title | −0.035 | −0.022 | −0.038 | −0.039 | −0.025 | −0.041 | 0.017 | 0.030 | 0.015 |
| POS | | 0.402*** | 0.214*** | | 0.413*** | 0.237*** | | 0.373*** | 0.204*** |
| PsyCap | | | 0.442*** | | | 0.413*** | | | 0.395*** |
| *F* | 1.886 | 41.959*** | 80.525*** | 2.593 | 45.464*** | 77.344*** | 6.388*** | 39.862*** | 67.016*** |
| Adjusted $R^2$ | 0.003 | 0.164 | 0.323 | 0.006 | 0.176 | 0.314 | 0.019 | 0.157 | 0.283 |
| $\Delta R^2$ | 0.007 | 0.161*** | 0.159*** | 0.009 | 0.170*** | 0.138*** | 0.023*** | 0.138*** | 0.127*** |

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$ (two-tailed). Gender, men vs. women. Age was controlled in the model as a continuous variable.
*POS, perceived organizational support; PsyCap, psychological capital.*

## Associations of POS and PsyCap With Work Engagement

In **Table 3**, the hierarchical regression analysis was performed to investigate the contribution and mediation associated with work engagement (vigor, dedication, and absorption). In Step 1, we found that gender and professional title were associated with work engagement. In Step 2, after controlling for gender, age, and professional title, POS was positively related to work engagement [vigor ($\beta = 0.402$; $P < 0.001$), dedication ($\beta = 0.413$; $P < 0.001$), and absorption ($\beta = 0.373$; $P < 0.001$)], explaining 16.1, 17.0, and 13.8% of the variance of vigor, dedication, and absorption, respectively. In Step 3, PsyCap was positively associated with work engagement [vigor ($\beta = 0.442$, $P < 0.001$), dedication ($\beta = 0.413$, $P < 0.001$), and absorption ($\beta = 0.395$, $P < 0.001$)], explaining 15.9, 13.8, and 12.7% of the variance of vigor, dedication, and absorption, respectively. Moreover, the positive effect of POS on work engagement (0.214, 0.237, 0.204) in Step 3 was smaller than that (0.402, 0.413, 0.373) in Step 2, indicating the probable mediation of PsyCap in the relationship between POS and work engagement (vigor, dedication, and absorption).

## MEDIATING ROLE OF PsyCap

Based on the results of hierarchical linear regression analysis in **Table 3**, asymptotic and resampling strategies were used to examine the mediating role of PsyCap. In **Table 4**, POS was positively associated with PsyCap ($a = 0.7231$, $P < 0.001$). Thus, PsyCap ($a \times b = 0.1895$, BCa 95% CI = 0.1524, 0.2290) significantly mediated the association between POS and vigor; PsyCap ($a \times b = 0.1517$, BCa 95% CI = 0.1180, 0.1875) significantly mediated the association between POS and dedication; PsyCap ($a \times b = 0.1693$, BCa 95% CI = 0.1299, 0.2099) significantly mediated the association between POS and absorption.

## DISCUSSION

In this research, we probed the relationships of POS and PsyCap with work engagement (vigor, dedication, absorption). Likewise, we examined the partially mediating role of PsyCap in the association between POS and work engagement (vigor, dedication, absorption) among Chinese doctors.

The present research results have theoretical and practical significance for work engagement. Perceived organizational support was discovered to be positively connected with work engagement (vigor, dedication, absorption). It is consistent with previous studies (11, 24). One of the proper explanations is: POS not only improves work attitude, but also promotes many positive organizational behaviors (11). The doctors who have been recognized by the organizations generally hold an organized identity themselves, which increases emotional bond with the organization (47). Positive and satisfactory work experience of

**TABLE 4 |** Mediating role of PsyCap.

| Dependent variables | Mediators | a | b | a × b (BCa 95% CI) |
|---|---|---|---|---|
| Vigor | PsyCap | 0.7231*** | 0.2621*** | 0.1895 (0.1524, 0.2290) |
| Dedication | PsyCap | 0.7231*** | 0.2097*** | 0.1517 (0.1180, 0.1875) |
| Absorption | PsyCap | 0.7231*** | 0.2341*** | 0.1693 (0.1299, 0.2099) |

****P < 0.001 (two-tailed). Gender, age and professional title were adjusted. a: the association of POS with PsyCap; b: the association of PsyCap with vigor, dedication, and absorption after controlling for the covariates; a × b: the product of a and b; BCa 95% CI: the bias-corrected and accelerated 95% confidence interval.*
*PsyCap, psychological capital.*

doctors can promote their work actively. It can also improve their emotional response and attitude toward treatment (48), such as high work engagement. In this study, POS was positively connected with work engagement (vigor, dedication, absorption), which support our hypothesis. Therefore, hospital administrators should take some targeted interventions immediately to improve the organizational support of doctors, for example, creating a better working environment for doctors (49).

In particular, previous studies viewed PsyCap as a positive resource for countering negative health outcomes, such as "workplace pressure, lassitude, and work–family conflict" (35, 42–44, 50, 51). Luthans et al. (32) reported that high-level PsyCap can strengthen self-confidence, so that employees make their efforts to succeed. Bonner et al. (31) thought PsyCap as an antecedent to work engagement. Psychological capital can maintain one's ambition to accomplish goals and boost the positive psychological ability to deal with difficult problems (52, 53). Other researchers are also concerned about the potential role of PsyCap among doctors (33, 54, 55). Qiu et al. (33) showed workplace violence will reduce doctors' PsyCap level, as well as result in low-level professional identity. Another study showed that workplace bullying can lead to emotional exhaustion. It is exacerbated when psychological distress is too high (56). Once you have a psychological breakdown, you are failing to resist workplace bullying, and your work engagement is worse. Psychological capital, as a positive psychological resource, may play a positive role in resisting workplace violence and bullying and improving work engagement. Therefore, it is particularly important to strengthen PsyCap in Chinese doctors. In our study, the result explains the positive relationship between PsyCap and vigor, dedication, absorption among Chinese doctors. So, we have reason to think that PsyCap is a positive resource for improving work engagement (vigor, dedication, absorption).

Our research also found that PsyCap partially mediated the relationship between POS and work engagement (vigor, dedication, absorption) among Chinese doctors. This proposed that POS might be good for PsyCap (11) and increase doctors' PsyCap, in order to improve doctors' work engagement (vigor, dedication, absorption). The conceivable explanation is that with high level of PsyCap doctors could resist heavier psychological burden. Therefore, they can improve their POS and balance work–family schedule (34). This suggests hospital administrators improve the access to organizational support to improve the doctors' POS. As work demands increase and work resources decrease, the medical environment is increasingly deteriorating. At this point, it is critical to provide an active work environment for employees (57). Establishing a supportive work environment can effectively improve the psychological health and work attitude of doctors, as well as improve organizational performance.

Our findings provide empirical support for positive psychology about work engagement in Chinese doctors. Above all, our results have implications for intervening low level of work engagement in Chinese doctors. It is essential to enhance work engagement by proposing targeted measures in Chinese doctors. First, the impact of organizational encouragement on personal PsyCap is important. Hospital administrators should create a supportive organizational climate to improve the POS and increase the professional happiness of doctors (58). Our findings can also help hospital managers to comprehend doctors' dedication (58). Second, doctors need positive psychological intervention to improve their work engagement, especially boost their PsyCap by valid methods (59). For instance, we can develop a PsyCap intervention (PCI) training model (60). Measures from both working environment and personal resources can improve the doctor's performance, efficiency, and physical and mental quality (5, 50, 59).

In addition, our previous researches focus on the positive psychological resources to improve the mental health of doctors. By strengthening PsyCap, it reduces the physical and mental fatigue of doctors. The emphasis of this study lies in organizational benefits; it further studies the positive psychological resources to promote the organizational behavioral health of doctors. On the basis of insufficient organizational support, strengthening PsyCap can accelerate the improvement of physical and mental health of doctors; promote healthy workplace behaviors, such as high levels of work engagement; and ultimately increase organizational benefits and improve medical care. This article integrates positive psychology and organizational behavior and uses positive psychological resources to mediate the relationship between organizational support and doctors' organizational behavior. It could be beneficial to the intervention for low-level work engagement and the promotion for workplace health in Chinese doctors.

Nevertheless, this article has several limitations that need to be explained. First, the cross-sectional study design is unable to prove temporal relationship, which requires a longitudinal study to improve. Second, the study was limited to hospitals and not others such as general practice. Later, we would like to extend the study areas in the research. Third, the sample appears to be skewed toward younger doctors; we will pay more attention to the work engagement of older doctors in future research. Fourth, self-reporting is commonly assumed to cause inaccuracy; it should be minimized by using some effective measures.

## CONCLUSION

The findings of this study demonstrate that work engagement (vigor, dedication, absorption) of doctors in China was comparatively low, particularly in the dedication subscale. First,

this study links POS with work engagement in the doctor field in the context of Chinese hospitals. Second, on the organizational psychology perspective, our findings help to identify that PsyCap really fosters work engagement as well as mediates the relationship between POS and work engagement among Chinese doctors. Our findings also pave the way for interventions that aim to increase doctors' well-being and performance. Third, our results can be used to study further on how to make the interventions more targeted in Asian countries, such as China, by providing practice guidelines for hospital leaders. We consider boosting the doctors' work engagement by improving salary rewards, providing a safe and comfortable working environment, carrying out PCI activities, and increasing the PsyCap levels of doctors.

## DATA AVAILABILITY STATEMENT

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

## AUTHOR CONTRIBUTIONS

HW and SY designed the research and organized the investigation. SY and HH carried out data analysis. SY wrote the paper. TQ, FT, ZG, and XG provided assistance in interpreting and paper writing. All authors read and approved the final manuscript.

## FUNDING

The study was supported by the National Natural Science Foundation of China (No. 71673300).

## ACKNOWLEDGMENTS

We would like to thank all the teachers and teammates who assisted in obtaining written informed consent for the survey and in distributing questionnaires to the subjects.

## REFERENCES

1. Schaufeli WB, Salanova M, González-Romá V, Bakker AB. The measurement of engagement and burnout: a two sample confirmatory factor analytic approach. *J Happiness Studies*. (2002) 3:71–92. doi: 10.1023/A:1015630930326
2. Loerbroks A, Glaser J, Vu-Eickmann P, Angerer P. Physician burnout, work engagement and the quality of patient care. *Occup Med*. (2017) 67:356–62. doi: 10.1093/occmed/kqx051
3. Denton DA, Newton JT, Bower EJ. Occupational burnout and work engagement: a national survey of dentists in the United Kingdom. *Br Dent J*. (2008) 205:382–3. doi: 10.1038/sj.bdj.2008.654
4. Inoue A, Kawakami N, Ishizaki M, et al. Organisational justice, psychological distress, and work engagement in Japanese workers. *Int Arch Occup Environ Health*. (2010) 83:29–38. doi: 10.1007/s00420-009-0485-7
5. Viseu J, Neves de Jesus S, Rus C, Canavarro JM. Teacher motivation, work satisfaction, and positive psychological capital: a literature review. *Electr J Res Educ Psychol*. (2016) 14:439–61. doi: 10.14204/ejrep.39.15102
6. Calvo JM, Kwatra J, Yansane A, Tokede O, Gorter RC, Kalenderian E. Burnout and Work Engagement Among US Dentists. *J Patient Saf*. (2017). doi: 10.1097/PTS.0000000000000355. [Epub ahead of print].
7. Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. *J Appl Psychol*. (2001) 86:499–512. doi: 10.1037/0021-9010.86.3.499
8. National Bureau of Statistics of China. *China Statistical Yearbook 2017*. Beijing: China Statistics Press (2017). Available online at: http://www.stats.gov.cn/tjsj/ndsj/2017/indexeh.htm
9. Wan Q, Zhou W, Li Z, Shang S, Yu F. Work engagement and its predictors in registered nurses: a cross-sectional design. *Nurs Health Sci*. (2018) 20:415–21. doi: 10.1111/nhs.12424
10. Ma ZS, Wang L, Du GS, Wang L, Chen XJ. What is the work environment of orthopedic surgeons in China? *Clin Orthop Relat Res*. (2014) 472:3576–80. doi: 10.1007/s11999-014-3859-4
11. Wang X, Liu L, Zou F, Hao J, Wu H. Associations of Occupational Stressors, Perceived organizational support, and Psychological Capital with Work Engagement among Chinese Female Nurses. *Biomed Res Int*. (2017) 72:2–11. doi: 10.1155/2017/5284628
12. Keyko K, Cummings GG, Yonge O, Wong CA. Work engagement in professional nursing practice: a systematic review. *Int J Nurs Stud*. (2016) 61:142–64. doi: 10.1016/j.ijnurstu.2016.06.003
13. Vander Elst T, Cavents C, Daneels K, Johannik K, Baillien E, Van den Broeck A, et al. Job demands-resources predicting burnout and work engagement among Belgian home health care nurses: a cross-sectional study. *Nurs Outlook*. (2016) 64:542–56. doi: 10.1016/j.outlook.2016.06.004
14. Halbesleben JR, Wheeler AR. The relative roles of engagement and embeddedness in predicting job performance and intention to leave. *Work Stress*. (2008) 22:242–56. doi: 10.1080/02678370802383962
15. Filho POV, Souza MR, Elias PEM, Viana ALD. Physicians' job satisfaction and motivation in a public academic hospital. *Hum Resour Health*. (2016) 14:1–11. doi: 10.1186/s12960-016-0169-9
16. Li F, Wang G, Li Y, Zhou R. Job demands and driving anger: the roles of emotional exhaustion and work engagement. *Accid Anal Prev*. (2017) 98:198–205. doi: 10.1016/j.aap.2016.10.013
17. Mache S, Vitzthum K, Klapp BF, Danzer G. *Surgeons*' work engagement: influencing factors and relations to job and life satisfaction. *Surgeon*. (2014) 12:181–90. doi: 10.1016/j.surge.2013.11.015
18. Imamura K, Kawakami N, Inoue A, Shimazu A, Tsutsumi A, Takahash M, et al. Correction: work engagement as a predictor of onset of major depressive episode (MDE) among workers, independent of psychological distress: a 3-year prospective cohort study. *PLoS ONE*. (2016) 11:e0167862. doi: 10.1371/journal.pone.0167862
19. Laguna M, Mielniczuk E, Zalinski A, Walachowska K. Organizational commitment and work engagement-theoretical conceptions and terminological problems. *Med Pr*. (2015) 66:277–84. doi: 10.13075/mp.5893.00169
20. Rhoades L, Eisenberger R. Perceived organizational support: a review of the literature. *J Appl Psychol*. (2002) 87:698–714. doi: 10.1037/0021-9010.87.4.698
21. Battistelli A, Galletta M, Vandenberghe C, Odoardi C. Perceived organizational support, organizational commitment and self-competence among nurses: a study in two Italian hospitals. *J Nurs Manage*. (2016) 24:E44–53. doi: 10.1111/jonm.12287
22. Puah LN, Ong LD, Chong WY. The effects of perceived organizational support, perceived supervisor support and perceived co-worker support on safety and health compliance. *Int J Occup Saf Ergon*. (2016) 22:333–9. doi: 10.1080/10803548.2016.1159390
23. Hao J, Wang J, Liu L, Wu W, Wu H. Perceived organizational support impacts on the associations of work-family conflict or family-work conflict with depressive symptoms among chinese doctors. *Int J Environ Res Public Health*. (2016) 13:326. doi: 10.3390/ijerph13030326
24. Mahon EG, Taylor SN, Boyatzis RE. Antecedents of organizational engagement: exploring vision, mood and perceived organizational support with emotional intelligence as a moderator. *Front Psychol*. (2014) 5:1322. doi: 10.3389/fpsyg.2014.01322
25. Lachish S, Goldacre MJ, Lambert T. Associations between perceived institutional support, job enjoyment, and intentions to work in the United Kingdom: national questionnaire survey of first year doctors. *BMC Med Educ*. (2016) 16:151. doi: 10.1186/s12909-016-0673-6

26. Liu J, Liu YH. Perceived organizational support and intention to remain: The mediating roles of career success and self-esteem. *Int J Nurs Pract*. (2016) 22:205–14. doi: 10.1111/ijn.12416
27. Li X, Gao J. An empirical study based on middle professional manager: the relations among work-family conflict, perceived supervisory support and job satisfaction. *Sci Sci Manag.(in Chinese)*. Available online at: http://en.cnki.com.cn/Article_en/CJFDTOTAL-KXXG201102023.htm. (accessed February, 2011).
28. Spence Laschinger HK, Nosko A, Wilk P, Finegan J. Effects of unit empowerment and perceived support for professional nursing practice on unit effectiveness and individual nurse well-being: a time-lagged study. *Int J Nurs Stud*. (2014) 51:1615–23. doi: 10.1016/j.ijnurstu.2014.04.010
29. Avey JB, Luthans F, Jensen SM. Psychological capital: a positive resource for combating employee stress and turnover. *Hum Resour Manage*. (2009) 48:677–93. doi: 10.1002/hrm.20294
30. Luthans F, Youssef CM. Human, social, and now positive psychological capital management: Investing in people for competitive advantage. *Organiz Dyn*. (2004) 33:143–60. doi: 10.1016/j.orgdyn.2004.01.003
31. Bonner L. A survey of work engagement and psychological capital levels. *Br J Nurs*. (2016) 25:865–71. doi: 10.12968/bjon.2016.25.15.865
32. Luthans, F., Youssef, C. M., Avolio, B. J. *Psychological capital: Developing the human competitive edge*. Oxford University Press. (2007). doi: 10.1037/t06483-000
33. Qiu T, Liu C, Huang H, Yang S, Gu Z, Tian F, et al. The mediating role of psychological capital on the association between workplace violence and professional identity among Chinese doctors: a cross-sectional study. *Psychol Res Behav Manage*. (2019) 12:209–17. doi: 10.2147/PRBM.S198443
34. Nikhil, Seena and Arthi, J, Perceived Organisational Support and Work Engagement: Mediation of Psychological Capital - A Research Agenda (February 1, 2018). *J Strat Hum Res Manage (JSHRM)*. Vol. 7. Available online at: https://ssrn.com/abstract=3174118
35. Wang Y, Chang Y, Fu J, Wang L. Work-family conflict and burnout among Chinese female nurses: the mediating effect of psychological capital. *BMC Public Health*. (2012) 12:915. doi: 10.1186/1471-2458-12-915
36. Sweetman D, Luthans F. The power of positive psychology: Psychological capital and work engagement. *Work Engag*. (2010) 54–68. doi: 10.4324/9780203853047
37. Liu L, Xu P, Zhou K, Xue J, Wu H. Mediating role of emotional labor in the association between emotional intelligence and fatigue among Chinese doctors: a cross-sectional study. *BMC Public Health*. (2018) 18:881. doi: 10.1186/s12889-018-5817-7
38. Roelen CA, van Hoffen MF, Groothoff JW, de Bruin J, Schaufeli WB, van Rhenen W. Can the Maslach Burnout Inventory and Utrecht Work Engagement Scale be used to screen for risk of long-term sickness absence? *Int Arch Occup Environ Health*. (2015) 88:467–75. doi: 10.1007/s00420-014-0981-2
39. Zhu Y, Liu C, Guo B, Zhao L, Lou F. The impact of emotional intelligence on work engagement of registered nurses: the mediating role of organisational justice. *J Clin Nurs*. (2015) 24:2115–24. doi: 10.1111/jocn.12807
40. Fong TC, Ng SM. Measuring engagement at work: validation of the Chinese version of the Utrecht Work Engagement Scale. *Int J Behav Med*. (2012) 19:391–7. doi: 10.1007/s12529-011-9173-6
41. Luthans F, Avolio BJ, Avey JB, Norman SM. Positive psychological capital: measurement and relationship with performance and satisfaction. *Pers Psychol*. (2007) 60:541–72. doi: 10.1111/j.1744-6570.2007.00083.x
42. Ding Y, Yang Y, Yang X, Zhang T, Qiu X, He X, et al. The mediating role of coping style in the relationship between psychological capital and burnout among Chinese nurses. *PLoS ONE*. (2015) 10:e0122128. doi: 10.1371/journal.pone.0122128
43. Peng J, Jiang X, Zhang J, Xiao R, Song Y, Zhanag Z, et al. The impact of psychological capital on job burnout of Chinese nurses: the mediator role of organizational commitment. *PLoS ONE*. (2013) 8:e84193. doi: 10.1371/journal.pone.0084193
44. Kan D, Yu X. Occupational stress, work-family conflict and depressive symptoms among chinese bank employees: the role of psychological capital. *Int J Environ Res Public Health*. (2016) 13:134. doi: 10.3390/ijerph13010134
45. Yang L, Li P, Mao H, Wang H, Shu C, Bliksted V. Theory of mind deficits partly mediate impaired social decision-making in schizophrenia. *BMC Psychiatry*. (2017) 17:168. doi: 10.1186/s12888-017-1313-3
46. Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Methods Instru Comp*. (2004)36:717–31. doi: 10.3758/BF03206553
47. Fuller JB, Marler LE, Hester K. Promoting felt responsibility for constructive change and proactive behavior: exploring aspects of an elaborated model of work design. *J Organiz Behav*. (2006) 27:1089–120. doi: 10.1002/job.408
48. Zhao H, Wayne SJ, Glibkowski BC, Bravo J. The impact of psychological contract breach on work-related outcomes: a meta-analysis. *Personnel Psychol*. (2007) 60:647–80. doi: 10.1111/j.1744-6570.2007.00087.x
49. Kinnunen U, Feldt T, Makikangas A. Testing the effort-reward imbalance model among Finnish managers: the role of perceived organizational support. *J Occup Health Psychol*. (2008) 13:114–27. doi: 10.1037/1076-8998.13.2.114
50. Zhong X, Li X, Liu T, Chen Y. The mediator role of psychological capital: A study among authentic leadership, work engagement, and psychological capital. In: *Paper presented at: 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. (2016). Avaialble online at: https://ieeexplore.ieee.org/abstract/document/7798200)
51. Hao J, Wu D, Liu L, Li X, Wu H. Association between work-family conflict and depressive symptoms among chinese female nurses: the mediating and moderating role of psychological capital. *Int J Environ Res Public Health*. (2015) 12:6682–99. doi: 10.3390/ijerph120606682
52. Luthans KW, Luthans BC, Chaffin TD. Refining grit in academic performance: the mediational role of psychological capital. *J Manage Educ*. (2019) 43:35–61. doi: 10.1177/1052562918804282
53. Fu J, Sun W, Wang Y, Yang X, Wang L. Improving job satisfaction of Chinese doctors: the positive effects of perceived organizational support and psychological capital. *Public Health*. (2013) 127:946–51. doi: 10.1016/j.puhe.2012.12.017
54. Guan J. Origin and prevention of workplace violence in health care in China: legal and ethical considerations. *Chin Med J*. (2017) 130:1731–6. doi: 10.4103/0366-6999.209888
55. Wang Y, Yao L, Liu L, et al. The mediating role of self-efficacy in the relationship between Big five personality and depressive symptoms among Chinese unemployed population: a cross-sectional study. *BMC Psychiatry*. (2014) 14:61. doi: 10.1186/1471-244X-14-61
56. Anasori E, Bayighomog SW, Tanova C. Workplace bullying, psychological distress, resilience, mindfulness, and emotional exhaustion. *Serv Industries J*. (2020) 40:65–89. doi: 10.1080/02642069.2019.1589456
57. Abdelhadi N, Drach-Zahavy A. Promoting patient care: work engagement as a mediator between ward service climate and patient-centred care. *J Adv Nurs*. (2012) 68:1276–87. doi: 10.1111/j.1365-2648.2011.05834.x
58. Bobbio A, Bellan M, Manganelli AM. Empowering leadership, perceived organizational support, trust, and job burnout for nurses: a study in an Italian general hospital. *Health Care Manage Rev*. (2012) 37:77–87. doi: 10.1097/HMR.0b013e31822242b2
59. Mache S, Vitzthum K, Wanke E, David A, Klapp BF, Danzer G. Exploring the impact of resilience, self-efficacy, optimism and organizational resources on work engagement. *Work*. (2014) 47:491–500. doi: 10.3233/WOR-131617
60. Dello Russo S, Stoykova P. Psychological capital intervention (PCI): A replication and extension. *Hum Resour Dev Q*. (2015) 26:329–47. doi: 10.1002/hrdq.21212


**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 Public Health

ORIGINAL RESEARCH
published: 11 June 2020
doi: 10.3389/fpubh.2020.00215

# Taking a Stand for Office-Based Workers' Mental Health: The Return of the Microbreak

*Casey Peter Mainsbridge[1]*, Dean Cooley[2], Sarah Dawkins[3], Kristy de Salas[4], Jiajin Tong[5]*, Matthew Wade Schmidt[6] and Scott J. Pedersen[1]*

[1] School of Education, Launceston, TAS, Australia, [2] School of Education, Ballarat, VIC, Australia, [3] Tasmanian School of Business and Economics, Hobart, TAS, Australia, [4] School of Technology, Environments, and Design, Hobart, TAS, Australia, [5] School of Psychological and Cognitive Sciences, Beijing Key Laboratory of Behavior and Mental Health, Beijing, China, [6] School of Health Sciences, Hobart, TAS, Australia

There is evidence that movement-based microbreaks can improve the cardiovascular health of desk-based employees, but their effect on mood states is yet to be investigated. As daily work tasks can potentially result in the loss of physical and psychological resources, the objective of this study was to measure the effect of movement microbreaks during formal work time on mood states. In a randomized-controlled pilot study with repeated measures (baseline, post-test, washout) of self-reported job stress and mood states (fatigue and vigor), police officers ($N = 43$) were exposed to movement microbreaks during work hours. A multivariate significant difference between groups was noted after the intervention period. Further analysis revealed that the experimental group reported a latent reduction in job-related stress after the 3-months washout period. Although the study was conducted with a small sample, our preliminary findings suggest that interrupting sedentary work with movement microbreaks may have beneficial effects on employee mental health. The implications of movement microbreaks for mitigating work-related stress of first responders, including police, is discussed, along with directives for future research.

**Keywords: occupational health, mental health, microbreaks, stress, fatigue, vigor, prolonged sitting**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic, Monash University, Australia*

***Reviewed by:***
*Yuke Tien Fong, Singapore General Hospital, Singapore*
*Sok King Ong, Ministry of Health, Brunei*

****Correspondence:***
*Casey Peter Mainsbridge*
*casey.mainsbridge@utas.edu.au*
*Jiajin Tong*
*tongttong@163.com*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *01 April 2020*
***Accepted:*** *11 May 2020*
***Published:*** *11 June 2020*

***Citation:***
*Mainsbridge CP, Cooley D, Dawkins S, de Salas K, Tong J, Schmidt MW and Pedersen SJ (2020) Taking a Stand for Office-Based Workers' Mental Health: The Return of the Microbreak. Front. Public Health 8:215. doi: 10.3389/fpubh.2020.00215*

## INTRODUCTION

Technology in the workplace has altered the pace, intensity, efficiency, and duration of office-based work. The advent of internet and devices such as smart phones (1) has led to changes in working practices such as 24-h access, teleworking, hot desking, and flexitime (2, 3). One unintended outcome of these changes is reduced opportunity for physical movement at work, which has resulted in prolonged periods of sitting at work, particularly in desk-based roles. The flow on effect is a concomitant rise in cumulative trauma disorders (CTD) (4). CTD are a range of health complaints such as stress, pain, mood swings, and fatigue that underpin more serious diseases. Research indicates that CTD have negative long-term effects on health status (5–8). Moreover, the changes in workflow due to technology advances has seen the loss of the microbreak (9). The microbreak is a short, informal break which can occur spontaneously throughout the workday (10, 11). Microbreaks are associated with reducing the incidences of CTD (4) because the break is taken in response to a perceived loss of a resource, such as an inability to maintain attention or change in mood state (12). Microbreaks therefore provide an opportunity to improve perceptions of stress and mood state in desk-based workers. The aim of this study was to reintroduce the microbreak back into desk-based work to determine its effect on workers' affective states.

Employees can experience job-related stress due to a range of stressors such as excessive or undue work demands, management of their own work responsibilities, tasks of their own, and pressure to meet objectives (13). Subsequently, employees can suffer from personal difficulty, strain, anxiety, and worry in attempts to countering such stressors. In a study (14) composed of government, private, and non-government organizations, employees reported high work demands, low-control over work situations, effort-reward imbalance related to working conditions, and management style were the primary causes of work-related stress (15). Stress emanating from work can contribute to psychological distress, physical, and mental illness (16–18). It is generally acknowledged by employers and employees that stressful work environments at times can be unavoidable. Consequently, organizations implement a range of therapeutic interventions to aid employees to recover from work demands and creating healthy work-life balance. A strategy from such programs is the use of work breaks as a key to combatting work stress (15).

Apart from CTD, work stress can also be manifested through physical and emotional responses, which negatively impact upon psychological factors such as mood. Mood can be measured using five negative states; "tension-anxiety," "depression-dejection," "anger-hostility," "fatigue-inertia," "confusion-bewilderment," and one positive state, "vigor-activity" (19). Each state has a bi-directional relationship or hedonic flexibility principle, indicating employees can change their mood by engaging in a range of activities or by changing their environments (20). For example, sunshine and higher temperatures made travel mood more positive and relaxed for vehicle and public transport users but led to negative mood for cycling and walking commuters in three different Swedish cities (21). Conversely, an inability to maintain the ideal mood state has been associated with stress (22, 23) and adverse health symptomology (24, 25).

Following the hedonic flexibility principle, mood states impact on employees' choices of activities. Specifically, employees use their mood as a resource (26, 27). When employees feel good, they can endure tasks which they find tedious, such as completing repetitive work tasks. When employees find themselves feeling mentally fatigued, they can swap and engage in different activities which can alter their mood. Low energy-based activities that incorporate movement and physical action are associated with a range of mood alterations. For example, interrupting occupational sitting by standing and walking within the workplace to talk to a colleague is associated with a corresponding elevation in positive moods (12, 28–30). Similarly, a brief session of yoga in the workplace resulted in a reduction in the negative mood state of fatigue, and a concurrent increase in employee's positive mood state of vigor (31). Increasing energy expenditure activities also reflect the hedonic flexibility principle with one daily 15-min session of aerobic exercise resulting in attenuated mood states for anger and hostility, as well as depressive symptomology (32). A more comprehensive Bosster Break intervention (including aerobic exercises, strengthening exercises, and flexibility exercises) resulted in reports of reduced stress, increases in enjoyment and health awareness, facilitated behavior change, and enhanced workplace social interaction (33). Comparably, changes of the work environment also are associated with mood alterations. For instance, university students who physically moved to view a flowery meadow roof scene, compared to a concrete scene, reported improved attention, attention control, and vigor (11). These findings provide evidence to suggest that a change to the environment by including some form of movement has a positive effect on employees' mood states, specifically reversing negative mood states to be more positive.

Despite these positive associations, there are shortcomings when applied to workplace settings. Primarily interventions and approaches to date have incorporated movement breaks into the workday by means of a single break and for a continuous period of time (such as 15 min). In some cases, this might not be possible in all workplaces, such as in call centers, with emergency contact response employees, reception and first point of contact employees, information technology employees, air traffic control employees, and occupations that are performed primarily through a computer. Moreover, the use of traditional forms of physical activity exclude non-leisure time exercisers. There is some evidence that non-leisure time exercisers are willing to engage in non-exercise physical activity (NEPA). In a series of studies (34–39) of Tasmanian government employees classified as non-leisure time exercisers, elected to incorporate into hourly prompted microbreaks throughout a normal workday. In these studies, employees engaged in movement microbreaks were operationally defined as low-intensity, short-duration, NEPA. NEPA were comprised of movements that allowed incorporation into the normal daily work routine. For example, standing up from a seated position to take a telephone call; or taking the stairs, rather than taking the elevator, to attend a meeting. Although participation was voluntary, once in the study, employees had hourly prompted software installed on their work computers to take a micro-movement break. Employees were able to self-select the type of movement, the duration, and repetitions. Results revealed high adherence and compliance rates over 13 weeks (37, 39). Moreover, the samples self-reported increases in daily energy expenditure (36), and perceptions of quality of life (38); with associated reductions in blood pressure (34, 35). These results suggest that NEPA might also be associated with changes in mood state, especially in a population that rejects traditional forms of leisure time exercise.

The focus of this study was to investigate if microbreaks comprised of regular, low-dose NEPA, would alter desk-based employees' mood states and perceptions of job-related stress. In particular, we were interested in the mood states of vigor and fatigue as there is evidence that participation in physical activity is associated with increases and decreases, respectively (34–39). We were also interested to explore if the movement microbreaks would ameliorate perceptions of stress associated with work tasks. Based on a lack of literature related to the impact of low-dose, movement microbreaks on measures of mental health status, in this pilot study we tested the null hypothesis that regular movement microbreaks would not significantly change desk-based employees' mood states and perceptions of organizational stress.

# METHOD

## Research Design

We conducted a pilot quasi-experimental, field-based, repeated measures (pre-intervention, post-intervention, washout) research design with random assignment with replacement to an experimental or control group. The experimental group received the movement microbreak software (39) on their work computers for 13 weeks during the intervention period. Both groups were followed for an additional 13 weeks after the intervention was removed from the experimental group (washout period).

## Participants

The participants of this study were identified within the Tasmanian Department of Police and Emergency Management (TDPEM). Policing environments are diverse, with stressors emanating from a combination of danger, ambiguity, human misery, and death, yet also involve stressors such as ineffective workplace organizational structures and operational processes such as shift work, excessive overtime and poor communication (40, 41). Unsurprisingly, police employees disproportionally experience poorer mental and physical health than the general population (41, 42). With a mission to deliver policing services to build a safe, secure, and resilient Tasmania, the TDPEM understood that many of their employees spend a considerable amount of their time sitting isolated in front of desktop computers and sought an opportunity to engage them in improving their workplace mental health.

Participants for this field-based, randomized-control pilot study were selected from a state-wide population of TDPEM employees. The structure of this organization included 70 Police stations spread across the state, each varying in size and infrastructure. All police employees were contacted by the TDPEM occupational health and safety officer through email. The email contained health information about prolonged bouts of sitting and an invitation to use the intervention designed by the research team to prompt seated employees to stand up every hour to engage in a self-selected movement microbreak. The researchers received a 25 per cent positive return ($N$ = 91). To adequately power the study, we selected a stratified sample with equal representation from the employment regions of the organization based on the percentage of desk-based employees specific to that region. We deemed that a medium effect size would be meaningful for each dependent variable. *A priori* calculations for adequate participant numbers were set with power at 0.80, and $\alpha$ at 0.05, for a planned medium effect ($d$ = 0.25), which indicated a total sample size of 76 was deemed sufficient.

From the initial number ($N$ = 91) pool, the research team applied selection criteria; (1) full-time employee with primarily desk-based job responsibilities being available to complete the study requirements; (2) used a personal computer with internet access to perform work; (3) classified as a non-exerciser (<30 min of exercise per week for a period of 3 months), were prepared to engage in behavior change (43); (4) were deemed medically healthy via a PAR-Questionnaire (44) to perform the self-selected, movement microbreaks suggested by the software; and (5) available for a 6-months study including baseline, post-test (after 13 weeks) and washout (after 26 weeks) data collection points. This screening excluded 48 employees because of their inability to meet all the selection criteria (ethics #H0010875).

**TABLE 1** | Participant demographic data.

| Gender ($N$ = 43) | Age (years) | Weight (kg) | Height (cm) | BMI |
|---|---|---|---|---|
| Female ($n$ = 32) | 41.69 (12.07) | 72.69 (13.82) | 164.09 (6.68) | 26.98 (4.71) |
| Male ($n$ = 11) | 44.27 (6.84) | 98.27 (17.73) | 178.45 (3.64) | 30.80 (5.01) |

*Values are means (standard deviations).*

After the application of selection criteria, 43 employees (32 females and 11 males; *mean age* = 42.52 ± 10.89) were included in the study and subjected to randomization software to select the experimental groups. All excluded participants were informed of the reasons for non-selection into the study and were provided with the intervention at the conclusion of the study. Types of occupations included in this investigation were receptionist, administrative support, call center, forensic analysis, community liaison, media liaison, transcription, and tech support. Demographic data were all electronically self-reported during work hours (**Table 1**), as were the data collected on the scales for the dependent variables described below. A flow diagram for invitation to participate, group, allocation, and follow up is presented in **Figure 1**.

## Measures

To assess the impact of the workplace intervention on participants' mood states and self-reported job stress, two measures were employed electronically: a Police Stress Questionnaire (45) and the Profile of Mood States (POMS) inventory (19).

## Police Stress Questionnaire

Stress was measured using the Police Stress Questionnaire (45). This 40-item self-report questionnaire contains two subscales: operational stressors relating to job content, such as field work; and organizational stressors relating to job context, such as clerical work. The Police Stress Questionnaire is scored as a cumulative sum for each subscale, with higher scores reflecting greater perceived stress during work. In this pilot study only the organizational stress subscale (PSQ-Org) was employed, as the population of interest were administrative and not involved in police operational duties (i.e., arrests, foot and traffic patrols, special operations teams). To measure perceived organizational stress derived from environmental sources, participants responded to 20 items regarding their experience of stress at work over the past 3 months on a 7-point Likert scale anchored from (1) "no stress at all" to (7) "a lot of stress." Individual items were summed for the PSQ-Org and reported as mean and standard deviation. Example items included "too much computer work" and "If you are sick or injured your co-workers seem to look down on you." The original authors reported acceptable coefficients for validity ($r^2$ values ranging from 7 to 22%) and internal reliability ($\alpha$ = 0.92) for the PSQ-Org (45). In the

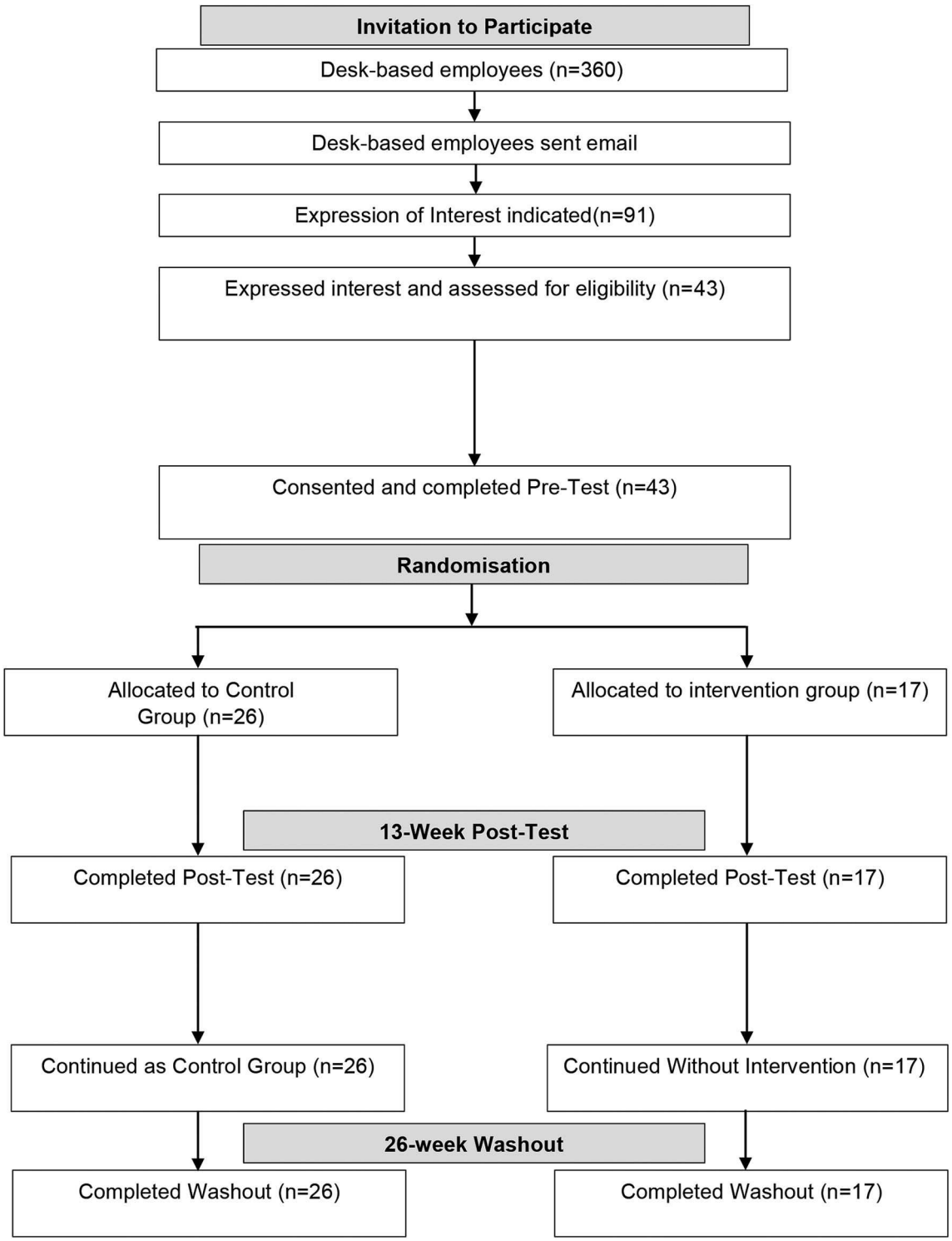


**FIGURE 1 |** Consort flow diagram of invitation to participate, group, allocation and follow-up.

present study, the internal consistencies for perceived stress were 0.93, 0.92, and 0.94 for the three data collection time points, respectively.

## Profile of Mood States (POMS) Inventory

Two of the subscales of the POMS inventory are related to changes in mood or feelings of energy: the energy-specific

vigor-activity (POMS-Vigor: $n = 8$ items) subscale for positive mood, and the fatigue-inertia (POMS-Fatigue: $n = 7$ items) subscale to measure negative mood (24, 46, 47). Participants completed these two subscales presented individually on 5-point Likert-type scales (0 = "Not at all" to 5 = "Extremely,"). Items were summed separately for each subscale and reported as means and standard deviations. Higher scores indicate higher levels of the mood states (e.g., energy-specific vigor-activity and fatigue-inertia) that participants experienced during work hours over the past week. We selected the stem, "In the last 7 days" rather than a shorter time period because we were interested in assessing if the intervention had a sustainable effect on mood states rather than transient effects. Suitable measures of internal consistency reliability ($\alpha > 0.80$) and concurrent validity ($\alpha > 0.74$) have been previously reported for these POMS subscales (46, 47). In the present study, the internal consistencies for both subscales were acceptable (POMS-Fatigue = 0.96 for both baseline and post-test, and 0.97 for the washout test; and POMS-Vigor = 0.94 for baseline and 0.95 for both post-test and washout test).

# PROCEDURES

## Pre-intervention Phase

The research team conducted an orientation session with all participants. The purpose of this session was to discuss using the movement microbreak intervention during work hours. Baseline data collection and experimental group allocation for our field-based trial were also accomplished during this session. During the orientation session participants were informed of possible health effects associated with prolonged sitting at work and provided strategies for interrupting sitting during the workday. The last portion of the session was dedicated to trialing the movement microbreak software. Some participants asked questions about being away from their computer, or what to do during meetings and video conferences. These participants were reassured that movement microbreak prompts were just prompts and engaging in the healthy behavior suggestions during work was an individual discretion. There were no restrictions placed on frequency or intensity during the prompted hourly microbreaks. Once all questions were answered, baseline data were collected through a digital web-based survey tool. Average time to complete the online survey was $12 \pm 2.34$ min.

After baseline data were collected participants were randomly assigned with replacement to either an experimental group ($n = 17$; 82% Female; $Mean_{Age} = 40.18 \pm 12.94$ years) who had the intervention installed on their work computers, with next day implementation; or a control group ($n = 26$; 70% Female; $Mean_{Age} = 43.77 \pm 9.44$ years) who continued to work as normal. All participants were asked not to make any changes to other aspects of their lifestyle during the 26-weeks experimental period such as starting any other new exercise programs, well-being strategies, or fad diets. Those participants randomly assigned to the control group were informed that they would receive the intervention once the six-month study period was over.

## Intervention Phase

The intervention involved a prompting sequence to encourage participants to rethink their decision to remain seated after 60 min of computer work. The prompt was a small window that appeared in the lower right hand of the computer screen indicating that 60 min of continual computer work had elapsed, and the microbreak screen was going to initiate. At this point, participants could choose to engage the microbreak selection sequence immediately; or postpone the sequence once for 15 min. At the end of this 15-min interval, the microbreak selection sequence screens covers the employee's entire computer screen preventing the continuance of computer work. This screen displays until participants complete a movement microbreak of their choice (e.g., chair squats) and record their progress. At this point, the hostage screen disengages, and participants can access their working screen(s). The decision for an hourly prompt time was based on national guidelines for office employees (48).

The microbreak selection screen contained 65 different NEPA choices (e.g., stair climb, stork stand, walking), with digital video coaching. All participants were informed during the orientation session that the decision on type of activity, duration, and intensity was an individual choice. However, the prompt was passive in delivery during the first 3 months (in that participants did not need to engage in responding to the system), thereby forcing participants to engage with the intervention on an hourly basis. During the 13-weeks intervention period, each movement microbreak was date/time stamped by the software once employees recorded their progress (activity specific—either in terms of the number of repetitions or duration in seconds). This daily progress could be optionally viewed by participants as bar graphs, measured in caloric expenditure and non-sedentary time, at the end of each movement microbreak sequence. On average, aggregate daily use of the software self-reported by the experimental group was $7.21 \pm 2.56$ times per workday.

## Post Intervention Phase

After the 13-week intervention period baseline measures were repeated and reported as post-test data. At this time, the movement microbreak software was removed from all computers. After a second 13-weeks period (washout) the baseline measures were repeated once more.

## Data Analysis

To examine if there were significant differences in predicting the three dependent variables (vigor, fatigue, & organizational stress) between experimental and control groups at post-test and after the washout period, we conducted a one-way multivariate analysis of variance (MANOVA) after controlling for baseline scores, age, and gender. Significant multivariate findings were followed up with univariate ANOVA procedures including simple main effects and independent sample *t*-tests for *post hoc* analysis. *A priori* alpha levels were set at 0.05 for all inferential tests of significance. Due to the pilot nature of this investigation and the underpowered sample size, to control against type 2 error effect sizes ($\eta 2$ and Cohen's *d* statistic) were reported for the appropriate statistical analyses. All data were analyzed using PASW version 18.0 (49).

**TABLE 2 |** Descriptive statistics for the control and experimental groups across time.

| Variable | Group | Baseline | Post-test | Washout |
|---|---|---|---|---|
| | Experimental | 2.23 (1.11) | 2.40 (1.08) | 2.12 (1.06)* |
| Perceived stress | | | | |
| | Control | 2.66 (1.13) | 2.59 (1.10) | 3.03 (1.23) |
| | Experimental | 3.17 (0.88) | 3.62 (0.61) | 3.38 (0.70) |
| Vigor | | | | |
| | Control | 2.81 (0.86) | 2.89 (0.93) | 2.89 (0.91) |
| | Experimental | 1.93 (0.70) | 1.67 (0.47) | 1.85 (0.66) |
| Fatigue | | | | |
| | Control | 2.32 (1.06) | 2.35 (1.08) | 2.40 (1.17) |

*Values are Likert scale means (standard deviations). Group mean difference (*$p < 0.05$).*

## RESULTS

The multivariate, mixed design analysis suggested a significant between-group difference at post-test (Wilk's? = 0.79, multivariate $F_{(3,34)} = 3.09$, $p = 0.04$, $\eta^2 = 0.21$), but not at washout (Wilk's?=0.85, multivariate $F_{(3,34)} = 2.08$, $p = 0.12$, $\eta^2 = 0.16$). To examine the function of the movement microbreak intervention, we further compared group differences at each time point on each outcome variable. We proceeded with three separate univariate ANOVA using a 2 (group: experimental, control) X 3 (time: baseline, post-test, washout) mixed design ANOVA separately for the three dependent variables (PSQ-Org, POMS-Fatigue, and POMS-Vigor).

In predicting perceived stress (PSQ-Org), the ANOVA results showed a significant interaction between group and time after controlling for age and gender, $F_{(2,78)} = 4.21$, $p = 0.02$, $\eta^2 = 0.10$. Follow-up analysis revealed no significant differences between the groups for baseline and the post-test ($d = 0.36 \pm 0.36$ & $0.21 \pm 0.35$, $t = 1.02$ & $0.60$, $p > 0.10$), but a significant difference between groups during the washout test ($d = 0.85 \pm 0.38$, $t = 2.23$, $p = 0.03$), with a medium effect size (*Cohen's* $d = 0.77$, 95% $CI = 0.14 \sim 1.40$). Thus, we rejected our null hypothesis that police officers allocated to desk-based duties who interrupted their occupational sitting would not experience a reduction in self-reported stress stemming from their organizational environment, compared to their colleagues who maintained their normal desk-based occupational patterns.

Univariate analyses for mood profile changes revealed no significant interactions between group and time for fatigue (POMS-Fatigue), $F_{(2,78)} = 1.39$, $p = 0.25$, $\eta^2 = 0.04$, or for vigor (POMS-Vigor), $F_{(2,78)} = 1.92$, $p = 0.15$, $\eta^2 = 0.05$, after controlling for baseline, age, and gender. Group mean differences for the three dependent variables are indicated in **Table 2**.

## DISCUSSION

Our pilot study findings indicated that desk-based employees engaged in desk-based work who were exposed to sustained and regular prompts to complete low dose NEPA (i.e., microbreaks) demonstrated a significant interaction between job-related stress and the mood states of vigor and fatigue. The directional movement of these three combined dependent variables in the experimental group over time indicates that perceptions of stress and mood states can be positively affected by using targeted movement microbreaks designed to instigate interruptions to sitting posture, and then have employees engage in some form of physical activity. This multivariate analysis suggested that both stress and mood variables have a possible influence on the other. Despite being pilot in nature and being low in power, this novel finding requires further exploration. With no previous literature to refer to within this experimental design it is difficult to speculate on the meaning of this multivariate finding. Nonetheless, previous research in the workplace has acknowledged the inter-relationship between stress, depression, and anxiety, and the various effects these variables can have on health broadly (15). Thus, we followed this analysis with separate univariate analysis.

Our novel finding has implications for the health of desk-based workers who suffer from stress and negative mood states (50). Workplace stress can adversely impact components of mood states such as anxiety, fatigue, and depression, thus decreasing stress in the workplace may improve mood over the long-term possibly leading to employees feeling positive (50). Cautiously, it would appear that our microbreak strategy significantly decreased job-related stress compared to their counterparts who maintained their regular occupational sitting habits. Notwithstanding, changes in perceptions of stress are not easily realized through short-term, non-therapeutic interventions (51–53). Thus, our intervention strategy offers the first evidence that organizational stress can possibly be attenuated by having desk-based workers take a break from their tasks to engage in some self-determined movement activity. Second, despite the evidence that employees' probability of signing up and adhering to workplace programs is related to prior exercise habits, time costs, taste for fitness, confidence, and positive attitude toward fitness (54, 55) our intervention realized a positive outcome for adherence and compliance in a non-exercising population. We argue that this result was achieved by having movement break activities that were self-determined, office-appropriate, did not require specialized equipment or a change of clothing, and were short in duration. This finding has potential implications for the design of future workplace health and wellbeing studies, especially those which target individuals who are most likely to experience the largest effect as a result of initiating a movement-based program (56, 57).

There are some notes of caution for the stress-related results reported in this study. The use of a self-report to determine perceptions of stress rather than a biological measure is open to subjective error (58). For example, some individual Likert scale items had standard deviations >2. Moreover, the stem for each item on the inventory directed participants to think about stress in the previous 3 months (45). There are memory and positivity-bias issues with using self-recall data (59). Although different in regard to time (immediate vs. recall) a biological measure taken at the time of the microbreak would have provided an instantaneous

measure of how participating in NEPA microbreaks not only aided in offsetting the physical effects of prolonged sitting but also had a concomitant effect of stress. We would suggest that future designs use a measure of salivary cortisol to determine a more precise interpretation of effect. Such evidence would reduce the subjectivity of our findings and allow for the generalization of our data toward the development of targeted workplace policies and practices.

Despite the multivariate interaction of the three dependent variables, when measured independently both mood state variables did not exhibit significant differences between groups across time points. A possible explanation for the non-interaction is the high reactivity of mood to environmental and personal experiences and the possible latency associated with change in mood (20, 59). For example, mood state is influenced by many different factors (i.e., time of day, presence of others, hunger) and hence a single measure of mood profile on any given day or time might have been confounded by an immediate reaction present in the environment not measured in this study. Moreover, during the washout period, the change to environment (e.g., prompted microbreaks) initiated by the software had ceased for participants, so it could be somewhat expected that once the prompt had ceased, any benefit to mood would also stop. The use of a mood diary (60, 61) in combination with the current study design could potentially counter this limitation for future research.

Similarly, there is debate about the various methods used to measure mood (62, 63). It is acknowledged that from both a physiological and cognitive standpoint that accurately and consistently capturing valid and reliable data can be biased toward emotionally salient information that reflects one's emotional state at that present moment (61). Whilst arguments that self-report instruments are acceptable for measuring certain psychological states such as mood and stress (64), objective measures (e.g., biomarkers such as cortisol) might provide a more immediate temporal link to participation in microbreaks and changes in mood states.

Overall, our pilot study provides preliminary evidence for the consideration of 'old wine in a new bottle' policy, the return of microbreaks to workflow (65). Moreover, designing microbreaks to include regular, low-dose, movement-based activities to help improve or sustain employees' health. Such a policy would be advantageous in that it would be inclusive of more technology into the workplace, increased changes to work, while providing a mechanism to maintain good mental health. In this study, the advent of regular movement-based microbreaks during work hours resulted in a self-reported latent decrease in job-related stress. We suggest to further evaluate this finding that future field-based work include a washout period and be conducted for longer duration (e.g., >6 months). Finally, a comment on the use of persuasive technology driven behavior change. Future field-based research should be mindful that persuasive technologies can suffer from a lack of adoption (66, 67), particularly during work hours. One reason for this can be attributed to a lack of theoretical understanding of human behavior change that these technologies are being developed to impact upon. If technologists engage with theory, for example the Behavior Change Wheel (BCW) (68) to inform the content and process within their technology, this would improve its suitability for the target behaviors. The BCW describes a methodology by which intervention designers can systematically examine the behaviors the intervention aims to target. BCW then has recommendations for target audiences to enhance engagement, efficacy, opportunity and motivation (68). Our method, while not informed by the BCW, reflects this approach. If technical developers incorporate some of the elements of our method into their technology designed to change target behaviors, they are likely to increase the robustness of the technology and its capacity to achieve its goal of behavior change.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Tasmania Social Sciences Human Research Ethics Committee, reference number H0018075. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

SP, DC, and CM conceived the presented idea, carried out the experiment, collected the data for this study, and took the lead in writing the manuscript. SP, DC, CM, SD, KS, and JT developed the theory and performed the calculations and analysis of the data. SP, DC, CM, and JT verified the statistical and analytical methods. SD, KS, MS, JT, SP, DC, and CM contributed to the interpretation of the results. SP, DC, and CM wrote the manuscript with support from SD, KS, and MS. SP, DC, CM, and SD contributed to the final version of the manuscript. All authors discussed the results and commented on the manuscript design and presentation, provided critical feedback and helped shape the research, analysis, and manuscript.

## FUNDING

This research submitted was partially funded by a Tasmanian Government Healthy at Work grant.

## ACKNOWLEDGMENTS

The authors of this manuscript acknowledge The Tasmanian Department of Police and Emergency Services organisation for allowing access to various worksites and employees.

## REFERENCES


1. Jayantha W, Oladinrin O. Evaluating the effect of new working practices on office space usage in Hong Kong. *J Corp Real Estate*. (2019) 21:346–66. doi: 10.1108/JCRE-06-2019-0030
2. Clemes SA, O'connell SE, Edwardson CL. Office workers' objectively measured sedentary behaviour and physical activity during and outside working hours. *J Occup Environ Med*. (2014) 56:298–303. doi: 10.1097/Jom.0000000000000101
3. Haynes BP, Fawcett W, Rigby D. The interaction of activity, space and cost variables in office workstation sharing. *J Corp Real Estate*. (2009) 11:38–51. doi: 10.1108/14630010910940543
4. McLean L, Tingley M, Scott RN, Rickards J. Computer terminal work and the benefit of microbreaks. *Appl Ergon*. (2001) 32:225–37. doi: 10.1016/S0003-6870(00)00071-5
5. Biddle S, Bennie J, Bauman A, Chau J, Dunstan D, Owen N, et al. Too much sitting and all -cause mortality: is there a causal link? *BMC Public Health*. (2016) 16:635. doi: 10.1186/s12889-016-3307-3
6. Chandola T, Brunner E, Marmot M. Chronic stress at work and the metabolic syndrome: prospective study. *BMJ*. (2006) 332:521–5. doi: 10.1136/bmj.38693.435301.80
7. Mcdonald B, Janssen X, Kirk A, Patience M, Gibson Am. An integrative, systematic review exploring the research, effectiveness, adoption, implementation, and maintenance of interventions to reduce sedentary behaviour in office workers. *Int J Environ Res Public Health*. (2018) 15:E2876. doi: 10.3390/Ijerph15122876
8. Ren X, Yu B, Lu Y, Zhang B, Hu J, Brombacher A. LightSit: an unobtrusive health-promoting system for relaxation and fitness microbreaks at work. *Sensors*. (2019) 19:2162. doi: 10.3390/s19092162
9. Ajunwa I, Crawford K, Schultz J. Limitless work surveillance. *Calif L Review*. (2017) 105:735. doi: 10.15779/Z38BR8MF94
10. Henning R, Sauter SL, Salvendy G, Krieg EF Jr. Microbreak length, performance, and stress in a data entry task. *Ergonomics*. (1989) 32:855–64. doi: 10.1080/00140138908966848
11. Lee KE, Williams KJ, Sargent LD, Williams NS, Johnson KA. 40-second green roof views sustain attention: the role of micro breaks in attention restoration. *J Environ Psychol*. (2015) 42:182–9. doi: 10.1016/j.jenvp.2015.04.003
12. Jett QR, George JM. Work interrupted: a closer look at the role of interruptions in organisational life. *Acad Manage Rev*. (2003) 28:494–507. doi: 10.5465/amr.2003.10196791
13. Stranks J. *Stress at Work: Management and Prevention*. Massachusetts, MA: Elsevier Butterworth-Heinemann. (2015).
14. Fritz C, Ellis AM, Demsky CA, Lin B, Guros F. Embracing work breaks: recovering from work stress. *Organ Dyn*. (2013) 42:274–80. doi: 10.1016/j.orgdyn.2013.07.005
15. Bhui K, Dinos S, Galant-Miecznikowska M, de Jongh B, Stansfeld S. Perceptions of work stress causes and effective interventions in employees working in public, private and non-governmental organisations: a qualitative study. *BJPsych Bull*. (2016) 40:318–25. doi: 10.1192/pb.bp.115.050823
16. Chandola T, Heraclides A, Kumari M. Psychobiological biomarkers of workplace stressors. *Neurosci Biobehav Rev*. (2010) 35:51–7. doi: 10.1016/j.neubiorev.2009.11.005
17. Eskelinen L, Toikkanen J, Tuomi K, Mauno I, Nygard CH, Ilmarinen J. Symptoms of mental and physical stress in different categories of municipal work. *Scand J Work Environ Health*. (1991) 17:82–6.
18. Nieuwenhuijsen K, Bruinvels D, Frings-Dresen M. Psychosocial work environments and stress-related disorders, a systematic review. *Occup Med*. (2010) 60:277–86. doi: 10.1093/occmed/kqq081
19. Ekman P, Davidson RJ. (eds.). *Series in Affective Science. The Nature of Emotion: Fundamental Questions*. Oxford University Press (1994).
20. Ettema D, Friman M, Olssen LE, Garling T. Season and weather effects on travel-related mood and travel satisfaction. *Front Psychol*. (2017) 8:140. doi: 10.3389/fpsyg.2017.00140
21. Chennaoui M, Arnal PJ, Sauvet F, Leger D. Sleep and exercise: a reciprocal issue. *Sleep Med Rev*. (2015) 20:59–72. doi: 10.1016/j.smrv.2014.06.008
22. Evangelista AL, Santos EMM, do Socorro Maciel M, Bocalini DS, Rica RL, Costa EF, et al. Associations of quality of life, physical activity and mood states in women with breast cancer treated with curative intent. *Appl Res Qual Life*. (2016) 11:445–59. doi: 10.1007/s11482-014-9373-8
23. Barbosa-Leiker C, Kostick M, Lei M, McPherson S, Roper V, Hoekstra T, et al. Measurement invariance of the perceived stress scale and latent mean differences across gender and time. *Stress Health*. (2013) 29:253–60. doi: 10.1002/smi.2463
24. Bergouignan A, Legget KT, De Jong N, Kealey EH, Groppel J, Chris J, et al. Effect of frequent interruptions of prolonged sitting on self-perceived levels of energy, mood, food cravings and cognitive function. *Int J Behav Nutr Phys Act*. (2016) 13:113. doi: 10.1186/s12966-016-0437-z
25. Riley KE, Park CL. How does yoga reduce stress? A systematic review of mechanisms of change and guide to future inquiry. *Health Psychol Rev*. (2015) 9:379–96. doi: 10.1080/17437199.2014.981778
26. Taquet M, Quoidbach YA, Desseilles M, Gross JJ. Hedonism and the choice of everyday activities. *Proc Natl Acad Sci USA*. (2016) 113:201519998. doi: 10.1073/pnas.1519998113
27. Jaffery A, Edwards MK, Loprinzi PD. Randomised control intervention evaluating the effects of acute exercise on depression and mood profile: solomon experimental design. *Mayo Clinic Proc*. (2017) 92:480–1. doi: 10.1016/j.mayocp.2016.12.017
28. Hobfoll SE. Conservation of resources. A new attempt at conceptualising stress. *Am Psychol*. (1989) 44:513–24. doi: 10.1037/0003-066X.44.3.513
29. Hobfoll SE. The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Appl Psychol*. (2001) 50:337–421. doi: 10.1111/1464-0597.00062
30. Sonnentag S, Binnewies C, Mojza EJ. Staying well and engaged when demands are high: the role of psychological detachment. *J Appl Psychol*. (2010) 95:965–76. doi: 10.1037/a0020032
31. Yoshihara K, Hiramoto T, Oka T, Sudo C, Kubo N. Effect of 12 weeks of yoga on the somatisaion, psychological symptoms, and stress-related biomarkers of healthy women. *Biopsychosoc Med*. (2014) 8:1. doi: 10.1186/1751-0759-8-1
32. Taylor WC, King, KE, Shegog R, Paxton RJ, Evans-Hudnall GL, Rempel DM, et al. Booster break in the workplace: participants' perspectives on health-promoting work breaks. *Health Educ Res*. (2013) 28:414–25. doi: 10.1093/her/cyt001
33. Mainsbridge CP, Ahuja K, Williams A, Bird M-L, Cooley D, Pedersen SJ. Blood pressure response to interrupting workplace sitting time with non-exercise physical activity. *J Occup Environ Med*. (2018) 60:769–74. doi: 10.1097/JOM.0000000000001377
34. Mainsbridge CP, Cooley D, Pedersen SJ. The effect of an e-health intervention designed to reduce prolonged occupational sitting on mean arterial pressure. *J Occup Environ Med*. (2014) 56:1189–94. doi: 10.1097/JOM.0000000000000243
35. Pedersen SJ, Cooley D, Mainsbridge CP. An e-health intervention designed to increase energy expenditure by reducing prolonged occupational sitting habits. *Work*. (2014) 49:289–95. doi: 10.3233/WOR-131644
36. Cooley D, Pedersen SJ, Mainsbridge CP. Assessment of a workplace intervention to reduce prolonged occupational sitting time. *Qual Health Res*. (2013) 24:90–101. doi: 10.1177/1049732313513503
37. Mainsbridge CP, Cooley D, Fraser SP, Pedersen SJ. A workplace intervention designed to interrupt prolonged occupational sitting: self-reported perceptions of health from a cohort of desk-based employees over 26 weeks. *Int J Workplace Health Manage*. (2016) 9:221–37. doi: 10.1108/IJWHM-01-2015-0005
38. Cooley D, Pedersen SJ. A pilot study of increasing nonpurposeful movement breaks at works as a means of reducing prolonged sitting. *J Environ Public Health*. (2013) 2013:128376. doi: 10.1155/2013/128376
39. Lagestad P, van den Tillaar R. A comparison of training and physical performance of police students at the start and at the end of a three-year police education. *J Strength Cond Res*. (2014) 28:1394–400. doi: 10.1519/JSC.0000000000000273
40. Tang TL, Hammontree ML. The effects of hardiness, stress, and life stress on police officers' illness and absenteeism. *Public Pers Manage*. (1992) 21:493–510. doi: 10.1177/009102609202100406
41. MacMillan F, Karamacoska D, El Masri A, McBride KA, Steiner GZ, Cook A, et al. A systematic review of health promotion intervention studies in the police force: study characteristics, intervention design and impacts on

health. *J Occup Environ Med*. (2017) 4:913–23. doi: 10.1136/oemed-2017-104430
42. Marcus B, Rakowski W, Rossi J. Assessing motivational readiness and decision making for exercise. *Health Psychol*. (1992) 11:257–61. doi: 10.1037/0278-6133.11.4.257
43. Shephard RJ. PAR-Q, canadian home fitness test and exercise alternatives. *J Sports Med*. (1988) 5:185–95. doi: 10.2165/00007256-198805030-00005
44. McCreary D, Thompson M. Development of two reliable and valid measures of stressors in policing: the operational and organisational police stress questionnaires. *Int J Stress Manage*. (2006) 13:494–518. doi: 10.1037/1072-5245.13.4.494
45. Fink A, Eckhardt M, Jones J, Kruse D, Ryan C, Zerwic J. Psychometric properties of three instruments to measure fatigue with myocardial infarction. *West J Nurs Res*. (2010) 32:967–83. doi: 10.1177/0193945910371320
46. Wood C, Magnello M, Jewell T. Measuring vitality. *J R Soc Med*. (1990). 80:486–9. doi: 10.1177/014107689008300803
47. Commonwealth Government of Australia. *Guidance Note for the Prevention of Occupational Overuse Syndrome in Keyboard Employment*. National Occupational Health and Safety Commission.1996. Canberra, ACT: Australian Government Publishing Service.
48. Norusis M. *Statistical Package for Social Science*. Chicago, IL: SPSS Inc. (1986).
49. Toker S, Biron M. Job burnout and depression: unravelling their temporal relationship and considering the role of physical activity. *J Appl Psychol*. (2012) 97:699–710. doi: 10.1037/a0026914
50. van der Klink J, Blonk R, Schene A, Van Dijk F. The benefits of interventions for work-related stress. *Am J Public Health*. (2001) 91:270–7. doi: 10.2105/AJPH.91.2.270
51. McNair DM, Lorr M, Droppleman LF. *Profile of Mood States*. San Diego: Educational and Industrial Testing Service. (1981).
52. Abraham JM, Feldman R, Nyman JA, Barleen N. What factors influence participation in an exercise-focused, employer-based wellness program? *Inquiry*. (2011) 48:221–41. doi: 10.5034/inquiryjrnl_48.03.01
53. King AC, Taylor CB, Haskell WL, DeBusk RF. Identifying strategies for increasing employee physical activity levels: findings from the Stanford/Lockheed exercise survey. *Health Educ Q*. (1990) 17:269–85. doi: 10.1177/109019819001700304
54. Pringle A, Parnell D, Zwolinsky S, Hargreaves J, McKenna J. Effect of a health-improvement pilot programme for older adults delivered by a professional football club: the burton albion case study. *Soccer Soc*. (2014) 15:902–18. doi: 10.1080/14660970.2014.920625
55. Zwolinsky S, McKenna J, Pringle A, Widdop P, Griffiths C. Physical activity assessment for health: efficacious use of a single-measure item. *Public Health*. (2015) 129:1630–6. doi: 10.1016/j.puhe.2015.07.015
56. Ogden J, Mtandabari T. Examination of stress and changes in mood and health related behaviours. *Psychol Health*. (1997) 12:289–99. doi: 10.1080/08870449708407406
57. Lucas RE. Reevaluating the strengths and weaknesses of self-report measures of subjective wellbeing. In: Diener E, Oishi S, Tay L, editors. *Handbook of Well-being*. Salt Lake City, UT: DEF Publishers (2018). p. 1–12.
58. Horiuchi M, Endo J, Akatusuka S, Uno T, Hasegawa, T, et al. Influence of forest walking on blood pressure, profile of mood states and stress markers from the viewpoint of aging. *J Aging Gerontol*. (2013) 1:9–17. doi: 10.12974/2309-6128.2013.01.01.2
59. Caldeira C, Chen W, Chan L, Pham V, Chen Y, Zheng K. Mobile apps for mood tracking: an analysis of features and user reviews. *AMIA Annu Symp Proc*. (2017) 495–504.
60. Yetton BD, Revord J, Margolls S, Lyubomirsky S, Seitz AR. Cognitive and physiological measures in well-being science: limitations and lessons. *Front Psychol*. (2019) 10:1630. doi: 10.3389/fpsyg.2019.01630
61. Desment PMA, Vastenburg MH, Romero N. Mood measurement with pick-a-mood: review of current methods and design of a pictorial self-report scale. *J Des Res*. (2016) 14:241–79. doi: 10.1504/JDR.2016.079751
62. Lucas G. Gut thinking: the gut microbiome and mental health beyond the head. *Microb Ecol Health Dis*. (2018) 29:1548250. doi: 10.1080/16512235.2018.1548250
63. Spector PE. Method variance in organisational research: truth or urban legend. *Organ Res Methods*. (2006) 9:221–32. doi: 10.1177/1094428105284955
64. Synder CR, Smith TW. Symptoms as self-handicapping strategies: the virtues of old wine in a new bottle. In: Wery G, Mirels HL, editors. *Integrations of Clinical and Social Psychology*. New York: Oxford University Press (1982). p. 314–21.
65. Orji R, Moffatt K. Persuasive technology for health and wellness: state-of-the-art and emerging trends. *Health Informatics J*. (2018) 24:66–91. doi: 10.1177/1460458216650979
66. Fogg BJ. Creating persuasive technologies: an eight-step design process. In: *Proceedings of the 4th International Conference on Persuasive Technology*. Claremont, CA. (2009). p. 44. doi: 10.1145/1541948.1542005
67. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *BMC Implement Sci*. (2011) 6:42. doi: 10.1186/1748-5908-6-42
68. Michie S, Atkins L, West R. Book Review: The behaviour change wheel: a guide to designing interventions. *Canadian Physician Leadersh J*. (2015) 2:26–27.

**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 Public Health

ORIGINAL RESEARCH
published: 04 September 2020
doi: 10.3389/fpubh.2020.00389

# The Utility of a Mental Health App in Apprentice Workers: A Pilot Study

*Mark Deady[1]*, Nicholas Glozier[2], Daniel Collins[1], Rochelle Einboden[3], Isobel Lavender[1], Alexis Wray[4,5], Aimee Gayed[1], Rafael A. Calvo[6], Helen Christensen[1], Samuel B. Harvey[1] and Isabella Choi[2]*

[1] Faculty of Medicine, Black Dog Institute, UNSW, Sydney, NSW, Australia, [2] Faculty of Medicine and Health, Brain and Mind Centre, Central Clinical School, The University of Sydney, Sydney, NSW, Australia, [3] Faculty of Medicine and Health, Susan Wakil School of Nursing and Midwifery, The University of Sydney, Sydney, NSW, Australia, [4] SafeWork NSW, Sydney, NSW, Australia, [5] WorkSafe ACT, Canberra, ACT, Australia, [6] Dyson School of Design Engineering, Imperial College London, London, United Kingdom

**Background:** Young people are at heightened risk for mental health problems. Apprenticeships are common pathways into the workforce at a critical developmental period. However, in some cases the working conditions for apprentices present significant challenges to mental wellness. As apprentices are unlikely to utilize traditional services, eHealth and mHealth interventions are a useful means of delivering interventions to this group. The aim of the current paper is to: (1) qualitatively explore the utility of an existing mental health app within an apprentice population; and (2) evaluate the usability, acceptability, feasibility and preliminary efficacy of a modified version of the app (*HeadGear Apprentice*), designed to reduce depressive symptoms in an apprentice working population.

**Methods:** Study One: Twenty-six apprentices (aged 18–30) took part in one of eight (90-min) focus groups. Participants explored the *HeadGear* app, took part in group discussions, and completed uMARS questionnaires. Modifications were made to the app based on feedback. Study Two: In the follow-up pilot testing, 47 apprentices downloaded and used the modified app over 30 days. Assessment occurred online at baseline, 5-weeks, and 3-months post-baseline. Feasibility was evaluated using consent rates, adherence and attrition. Acceptability was assessed using questionnaires and a post-study interview. Depression, anxiety, well-being, and work performance scores were used to assess preliminary efficacy.

**Results:** Overall, the app was well-received in both studies, with high self-reported scores for acceptability and utility. However, engagement—both in terms of self-report and adherence—was an issue in both studies. In Study Two, users completed approximately one-third of the app's therapeutic content, with increased usage associated with improved outcomes. This had implications for the preliminary effectiveness of the app [depression as measured by the PHQ-9 *Cohen's d* = 0.27 (95%CI:-0.16–0.69)]. At follow-up users reported improvements in all outcomes, but overall only change in well-being reached statistical significance [*Cohen's d* = −0.29 (95%CI:-0.72–0.14)].

OPEN ACCESS

***Edited by:***
*Leah Okenwa Emegwa, Swedish Red Cross University College, Sweden*

***Reviewed by:***
*Yuke Tien Fong, Singapore General Hospital, Singapore*
*Sok King Ong, Ministry of Health, Brunei*

****Correspondence:***
*Mark Deady*
*m.deady@unsw.edu.au*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *04 May 2020*
***Accepted:*** *02 July 2020*
***Published:*** *04 September 2020*

***Citation:***
*Deady M, Glozier N, Collins D, Einboden R, Lavender I, Wray A, Gayed A, Calvo RA, Christensen H, Harvey SB and Choi I (2020) The Utility of a Mental Health App in Apprentice Workers: A Pilot Study. Front. Public Health 8:389. doi: 10.3389/fpubh.2020.00389*

**Conclusion:** Overall, findings from the two studies suggest that an eHealth tool, *HeadGear Apprentice*, was an acceptable and well-received intervention when adapted to young apprentices. However, questions remain regarding how to improve engagement and adherence to the program. These questions appear critical to effectiveness. The two studies also have implications for awareness raising in this population. Whilst preliminary results were encouraging, these improvements, along with a full-scale efficacy trial, are needed to better understand the utility of smartphone applications for mental health in this population.

**Trial registration**: ACTRN12618001475235 https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=375875&isReview=true.

**Keywords: mental health, apprentice, workplace, depression, eHealth, smartphone, feasibility, pilot**

## INTRODUCTION

Most mental health disorders emerge prior to the age of 25 years (1). The 2007 National Survey of Mental Health and Well-being found the prevalence of 12-months mental disorders was highest in young people aged 16–24 years, but service use was also the lowest (2). As such, there is a growing focus on prevention programs to reduce the incidence of new episodes of mental disorders by managing risk factors, enhancing resilience (3), and the relaying of personal risk information (4).

The transition from school to work is a unique developmental challenge that presents an opportunity for intervention. Some of the most well-described modifiable risk factors for common mental disorder are based in the workplace (5), yet relatively little attention has been devoted to young people as workers. Apprenticeships are a common pathway for young people making the transition from adolescence to adulthood and offer a prime opportunity for the delivery of mental health interventions. Furthermore, working conditions for some apprentices present significant challenges to mental wellness (6), and are implicated in heightened risk for anxiety, depression or stress disorder compared to older workers (7).

Mental health programs delivered online (eHealth) and via mobile technology (mHealth) can overcome barriers to young people receiving mental health information and support, as these modalities are provided in a practical, anonymous, and cost-effective manner (8). Our project team has developed a smartphone app (*HeadGear*) to help improve the mental health and well-being of workers in male-dominated industries (9). *HeadGear* involves a risk-profiling tool and a tailored 30-days mental health challenge to reduce risk, embodying evidence-based approaches, such as behavioral activation and mindfulness. In a large scale RCT, the app was found to reduce depression symptoms and prevent incident depression caseness (10). There was a specific dose-response effect present, with users, on average, completing one-third of the intervention content.

There is potential to adapt effective digital mental health interventions for specific populations to improve relevance and engagement (11). It is suggested that low engagement in mental health apps may be due to poor usability and lack of user-centric design (12). Meanwhile, there is support that tailored interventions, such as culturally adapted interventions, increase efficacy and reduce attrition (13). Yet there is little research to guide the adaptation of existing mental health interventions and subsequent evaluation for specific populations.

The aim of the current paper is to: (1) qualitatively evaluate the *HeadGear* app within an apprentice population; and (2) evaluate the usability, acceptability, feasibility, and preliminary efficacy of a modified version of the app (*HeadGear Apprentice*), designed to reduce depressive symptoms in an apprentice working population.

## METHOD

### Study 1: Focus Testing to Qualitatively Evaluate the *HeadGear* App

#### Participants and Recruitment

Registered group training organizations in Sydney and Newcastle, Australia, promoted the study to apprentices through their communication channels which included emails, flyers, and class announcement notices. The promotional material invited apprentices to take part in focus groups to explore how to support apprentice mental well-being. Interested participants registered with an onsite training group coordinator. To be included in the focus groups participants had to be enrolled in an apprenticeship program, fluent in English language, and a resident of Australia.

#### Procedure

This study formed part of a larger qualitative study of 54 apprentices (across eight activity-based focus groups), with a subset taking part in this component ($N = 26$) during September to November 2017. The overall sample for Study One was derived from a larger qualitative study ($N = 54$). These focus groups were randomly split (via block randomization) at each focus group occasion. This manuscript reports on those randomized to review the app, while the other half of the overall sample explored the concept of risk assessment and the reporting of risk. Participants gave written consent and completed demographic questionnaires at the beginning of all focus groups. In neither Study One nor

Study Two were participants were not asked to disclose their employers. Additionally, it was made clear to participants that no findings would be directly shared with employers, and all published data would be at a deidentified (aggregated) level.

Each session was conducted by two researchers and lasted for ∼90 min. A semi-structured discussion guide was used. The initial stage explored the challenges (6) and supports (14) used by apprentices; participants then spent the remainder of the group exploring the *HeadGear* app, discussing it, and completing questionnaires. All participants were reimbursed with a $40 gift card for their time.

This research was approved by the Human Research Ethics Committee at the University of Sydney (2017/648).

### Intervention

*HeadGear* is a smartphone application-based intervention centered on behavioral activation and mindfulness therapy. The main therapeutic component of the *HeadGear* app takes the form of a 30-days challenge in which users complete one "challenge" daily. These include psychoeducational videos; mindfulness exercises; value-driven activity planning, goal setting, and review; and coping skill development (problem solving, sleep, grounding, alcohol use, assertiveness, and training in adaptive forms of coping). Incorporated into the app was a risk calculator, which assessed and provided participants with personalized feedback regarding their risk for future mental health issues. The risk calculator was developed from the validated HILDA risk algorithm for future distress in working Australian adults (15). The risk factor items are based on participant self-report. Other components of the app include a mood monitoring widget, a toolbox of skills (which is built from the challenge as it is completed), and support service helplines. The app was developed following a model of user engagement involving workshops, focus testing, and surveys with a range of relevant end users and stakeholders (9, 16, 17).

### Measures

The self-report uMARS Scale (18) provides comprehensive ratings of user experience and impressions of the app by assessing app quality (objective and subjective) and perceived impact. Each item has customized wording appropriate to the aspect being assessed. Items employ a common 5-point rating scale from 1 (*Inadequate*) to 5 (*Excellent*), such that higher scores represent a stronger impact of the app on that aspect of user cognition and/or potential behavior. The subjective quality and perceived impact of particular app features were rated under each subscale of objective App Quality, assessed on an individual basis per item. Overall objective quality was measured using mean subscale scores.

### Data Analysis

Study one formed part of a larger qualitative study. The prevailing theory is that sample size is based on the concept of "saturation" (i.e., sufficiently describe the phenomenon of interest, and address the research question at hand). Recently the idea of "information power" (the more information the sample holds, relevant for the actual study, the lower amount of participants is needed) has been proposed to estimate saturation (19). Although a number of elements must be considered in this definition, our focus was on the gleaning of new information from this group broadly, which we determined to be achieved as the later groups failed to present significantly new information.

No formal inferential analysis was undertaken on this data, descriptive statistics are reported pertaining to the uMARS. User feedback is also reported and informed Study Two.

## Study 2: Pilot Trial to Evaluate the Adapted *HeadGear* Apprentice App

### Participants and Recruitment

Participants were recruited via three methods: (1) email circulation and snowball recruitment within industry partner organizations; (2) recruitment flyers, email, and site visits with education partner organizations; and (3) social media advertising. Eligible participants were required to be aged between 16 and 30 years, an Australian resident, fluent in English, enrolled in an apprenticeship program; and to have a valid email address and mobile number, and own an Apple- or Android-operating smartphone.

### Procedure

Trial promotion materials directed interested participants to the trial website, upon which screening took place and consent was obtained electronically, between March and May 2019. After completing the online questionnaire battery, participants were directed to their respective app store to download the app.

Participants were encouraged to use the *HeadGear* apprentice app for 30 days. Objective app usage data was collected in-app. At 5-weeks post-baseline, participants were directed via email and SMS to complete the follow-up survey online. Participants were also invited to complete a telephone interview regarding their use of the app, and a 3-month online follow-up survey using the same measures completed at the 5-weeks assessment. The flow of users through the trial is presented in **Figure 1**.

This research was approved by the Human Research Ethics Committee at the University of Sydney (2018/788).

### Intervention

Following on from the focus group testing (Study One), minor modifications were made to the *HeadGear* app including some changes to wording to increase accessibility, orientation video and improved navigation, specific apprentice support service guidance, the ability to skip through certain challenges and elements to enhance gamification (including badges for achievements). Personalization was also added to the risk assessment tool, directing users to the challenge days which were deemed to be most relevant based on their scores.

### Outcome Measures

Participants completed self-administered questionnaires online. Demographic information provided included age, sex, education, area of study, year of apprenticeship, current medication, and help-seeking. They also completed the questionnaires outlined below.

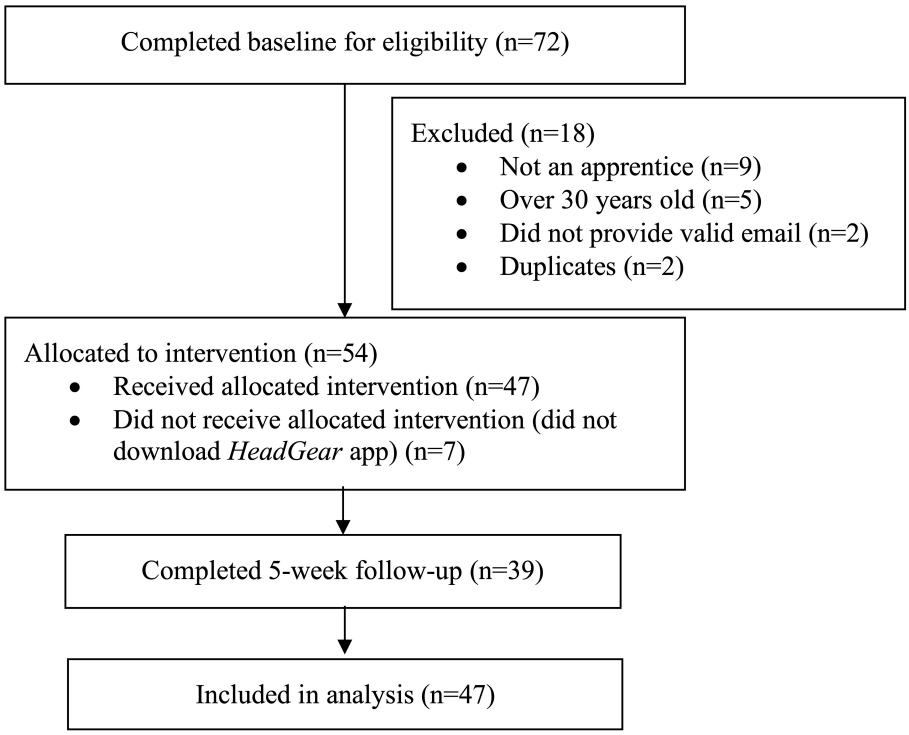


**FIGURE 1 |** Flow of users through the trial.

Patient Health Questionnaire (PHQ-9) (20): The PHQ-9 is a reliable and valid nine-item measure of depression severity over the past 2 weeks and is sensitive to change (21, 22). The PHQ-9 can be used either as a diagnostic algorithm to make a probable diagnosis of major depressive disorder (MDD) or as a continuous measure with scores ranging from 0 to 27 and cut-points of 5, 10, 15, and 20 representing mild, moderate, moderately severe and severe levels of depressive symptoms (Cronbach's $\alpha = 0.89$).

General Anxiety Disorder-7 item (GAD-7) (23): The GAD-7 is a reliable and valid seven-item measure of generalized anxiety symptoms, and it has also proved to have good sensitivity and specificity as a screening measure for panic, social anxiety, and post-traumatic stress disorder (24). GAD-7 scores can range from 0 to 27, with 5, 10, and 15 representing mild, moderate and severe levels of anxiety symptoms [Cronbach's $\alpha = 0.89$ (25)].

The 5-item World Health Organization Well-Being Index (WHO-5) (26): Scores on the WHO-5 range from 0 to 25 where 0 indicates the worst possible quality of life and a score of 25 represents the best possible quality of life. A score $\leq$13 or an answer of 0 or 1 on any of the five items shows poor well-being. The WHO-5 is a psychometrically sound measure of well-being with high internal consistency (Cronbach's $\alpha = 0.84$) and convergent associations with other measures of well-being (27).

Work performance was measured using three items from the Health and Work Performance Questionnaire (HPQ) (28) and an additional item pertaining to days absent in the last month. For the purposes of analysis, a composite measure for effective work days was constructed, by multiplying days present at work (absenteeism) by absolute work productivity score (presenteeism) as calculated by the HPQ, replicating previous work in the area (29).

The follow-up survey comprised of the same measures as in the initial battery with the addition of an adapted version of the Usefulness, Satisfaction, and Ease questionnaire (30), which has been used successfully in previous research (9). Participants were asked to rate their agreement with a series of statements about the intervention. Usage data was automatically collected by the app including time spent in app, number of logins, number of challenges completed, and specific responses to exercises.

## Data Analysis

In the previous study using the *HeadGear* app (9), a small to moderate within group effect size (28) was observed. Power calculations showed that 44 participants would be needed to achieve this effect size with 80% power at alpha = 0.05. To account for an expected 30% dropout rate, 63 participants were to be recruited.

All data was analyzed using SPSS version 23.0. Descriptive statistics regarding participant characteristics and smartphone use data were analyzed to characterize engagement and acceptability. Paired samples *t*-tests were used to test for differences between pre- and post-trial clinical outcomes (e.g., PHQ-9). No adjustments were made for missing data; however, a sensitivity analysis was carried out utilizing last observation carried forward, with no differences found. To explore impact of actual intervention component exposure on symptoms and the

**TABLE 1 |** Sample characteristics of focus group participants ($N = 26$).

| | *n* (%) |
|---|---|
| Mean age (SD) | 20.77 (3.0) |
| **GENDER** | |
| Male | 26 (100%) |
| **SMARTPHONE OWNED** | |
| Android | 10 (38.5) |
| iPhone | 15 (57.7) |
| Other (Google, Windows) | 1 (3.8) |
| **LENGTH OF TIME IN APPRENTICESHIP** | |
| <1 year | 8 (30.8) |
| 1–2 years | 13 (50.0) |
| 3–4 years | 4 (15.4) |
| **TYPE OF APPRENTICESHIP** | |
| Full-time | 24 (92.3) |
| Part-time | 1 (3.8) |
| School-based | 1 (3.8) |
| **AREA OF STUDY** | |
| Commercial cookery/hospitality | 2 (15.4) |
| Electronics | 9 (34.6) |
| Construction trade (plumbing, bricklaying, carpentry, electrician) | 11 (42.3) |
| Other | 1 (3.8) |
| **LOCATION OF APPRENTICESHIP** | |
| Metropolitan | 18 (69.2) |
| Regional | 8 (30.8) |

**TABLE 2 |** uMARS subscale ratings.

| Subscale | Score |
|---|---|
| App objective quality | *M* (*SD*); min–max |
| A. Engagement | 3.6 (0.47); 2.8–4.6 |
| B. Functionality | 3.9 (0.49); 3–4.8 |
| C. Aesthetics | 4.1 (0.66); 3–5 |
| D. Information | 4.1 (0.66); 3–5 |
| Overall objective quality | 3.8 Good (0.46); 3.1–4.8 |
| App Subjective Quality | Rating (score) |
| Recommend the app to others | Probably (4) |
| Predicted frequency of use of app in next year | 3–10 (3) |
| Willing to pay for the app | Probably not (2) |
| Overall star rating | • • • • (4/5 stars) |
| Perceived impact of app ($N = 26$) | *M* (*SD*); min–max |
| Awareness | 3.9 (0.72); 2–5 |
| Knowledge | 3.8 (0.90); 2–5 |
| Attitudes | 3.9 (0.93); 2–5 |
| Intention to change | 3.6 (0.90); 1–5 |
| Help-seeking | 3.9 (0.74); 2–5 |
| Behavior change | 4.0 (0.96); 1–5 |
| Mean perceived impact for all factors | Moderate impact (4) |

effect of engagement, usage was segmented in tertiles based on overall use. All *p*-values were two-sided (one-sided for the *t*-test), with significance set at 5%. Effect size (*Cohen's d*) was calculated using mean change/baseline SD (31).

A series of open-ended interviews were conducted, via telephone, to ascertain themes and/or patterns pertaining to participants' evaluation of the *HeadGear* app for apprentices. Consistent with methods for the analysis of generative participatory data (32), an inductive approach to thematic analysis was taken with the transcripts of audio interviews (33–35). Coding was conducted independently by a researcher not involved in initial interviews (IL). Independently, a second researcher reviewed the recordings. Researcher codes were compared, and consensus reached via comparison and discussion (where needed) (34).

# RESULTS

## Study One

### Sample Characteristics

Typical of this target group, apprentices were aged 18–30 years, male (100%), and all owned a smartphone with approximately half iPhone and half Android type. The majority (83%) were undertaking a full-time apprenticeship and were completing an electronics or construction-related trade (**Table 1**).

### App Quality

Overall, apprentices rated the *HeadGear* app positively, with an average of 4/5 stars (**Table 2**). Ratings for objective quality altogether indicated good objective quality (3.8) and were similar across all aspects indicating consistent degree of quality in terms of all features. Specifically, "customization" under Engagement was poorest (2.8) whilst "layout" in "Aesthetics" was rated highest, closely followed by credibility and quality of information. While most apprentices would widely recommend the app (all endorsing on average a "likely" recommendation to at least several individuals), on average users predicted their use would be infrequent (3–10 times) over the next 12 months, unlikely to allow the app to have sufficient therapeutic impact. Encouragingly though, around one-third expressed interest in more frequent use 10–50 times in the next year. Participants generally had no or neutral willingness to pay for the app, with 65.4% not at all. On average, apprentices reported that the *HeadGear* app had a consistent moderate degree of impact upon their awareness, knowledge, attitudes, intention to change, help-seeking, and behavior change around mental health and well-being.

### Feedback

The inability to skip challenges was raised as a negative point in terms of app engagement, highlighted by the low scores for customization. Participants sought the ability to pick and choose specific activities rather than progress through the challenge in linear succession. They also emphasized the importance of gamification and greater personalization within the app, for example through the inclusion of music. Participants also suggested minor changes to language used in the app.

## Study Two

Overall, 54 eligible participants consented to the study, of which 47 completed baseline assessment and downloaded the app. The characteristics of this sample are presented in **Table 3**.

**TABLE 3 |** Sample characteristics of pilot app evaluation participants ($N = 47$).

| | ***n* (%)** |
|---|---|
| Mean age (SD) | 21.68 (3.62) |
| **BASELINE MEAN SCORES** | |
| PHQ-9 (SD) | 7.06 (5.54) |
| GAD7 (SD) | 5.94 (5.03) |
| WHO5 (SD) | 13.55 (5.20) |
| **GENDER** | |
| Male | 45 (96.7) |
| **APPRENTICESHIP YEAR** | |
| 1st | 14 (29.8) |
| 2nd | 16 (34.0) |
| 3rd | 11 (23.4) |
| 4th | 6 (12.8) |
| **EMPLOYMENT** | |
| Full-time | 47 (100.0) |
| **AREA OF STUDY** | |
| Electrical and electronics | 16 (34.0) |
| Carpentry/joinery/cabinet making | 14 (29.8) |
| Engineering and machinery | 7 (14.9) |
| Hospitality and Cookery | 4 (8.5) |
| Plumbing | 3 (6.4) |
| Automotive trades and services | 2 (4.3) |
| **EDUCATION** | |
| Year 10 certificate | 9 (19.1) |
| Year 12 certificate | 29 (61.7) |
| Trade or other certificate | 5 (10.6) |
| University degree | 4 (8.5) |
| **GROUP TRAINING ORGANIZATION** | |
| TAFE | 32 (68.1) |
| Other provider | 15 (31.9) |
| Current mental health help | 7 (14.9) |
| Current medication | 2 (4.3) |

The sample was predominately male (96%), with a mean age of 21.7 years. Participants' apprenticeship experience was relatively evenly spread, with the majority working in the areas of building and construction, electronics, and engineering. On average participants scored in the mild range for depression and anxiety at baseline; however, 15% were currently seeking mental health support.

## App Usage and Feedback

On average users spent 77.4 ($SD = 59.30$) min in the app, over 21 (median) sessions. Users completed approximately a third of the app challenges ($M = 11.91$; $SD = 11.25$). The app was well-received by the participants, with 87.2% claiming it had at least moderately improved their mental fitness. The majority understood the app content (87.2% very/completely), while three-quarters (74.4%) claimed they would probably/definitely recommend the app to others. The appropriateness of app content had slightly lower appeal (66% very/completely), while app engagement was slightly lower again (59% very/completely). Overall, participants rated the app highly or very highly (74.4%).

## Interviews

While eleven participants agreed to be interviewed, only four could be reached (8.5% of participants overall). Of the emergent themes, there was a consensus as to the positive overall impact of the app on mental health, significance of tailoring the app to apprentices specifically, importance of reminders, and a failure to make use of the toolbox function. Nonetheless, the participants shared different viewpoints in relation to technical difficulties, general usage of the app, and value of daily challenges; specifically, the mindfulness, mood monitoring, and action-planning/goal setting activities. Two of these users completed the entire challenge, with the remaining interviewees completing 7 and 20 challenges, respectively.

Firstly, it was unanimously indicated that the *HeadGear* for apprentices app elicited positive effects on their mental health (e.g., *"the app in general is really good"* and helped the user *"to think about a lot of things [he] doesn't end up thinking about during the day"*). Consistently, reasons for participation were driven by the tailoring of the app to apprentices specifically (e.g., *"I think that it's good it's targeted to apprentices… they might not always seek out other mental health apps"*).

With respect to app usage, non-completion of challenges was mainly attributed to *"forgetting"* to do so and then choosing not to *"catch up"*. Participants consistently reported that the reminders were *"helpful"*; however, they also reported that these could be improved on by allowing the user to select the time of the reminder notification (this was possible within the app although participants were not aware of this function). Specifically, presenting reminders were "at lunch time or 4 p.m. when he finishes work" was suggested.

Several interviewees stated that they did not (or rarely) utilize the toolbox function, citing unawareness, forgetfulness, and laziness as reasons.

Although one respondent found the goal setting exercises to be the most helpful of the challenges ("the goal setting and tracking was very helpful... it helped me to stay on top of it and things I needed to do."), in general there was a reluctance to engage in action planning (e.g., *"mental exercises were better than the active exercises," [I disliked] activities associated with "list[s] and planning"*).

The mindfulness challenges were well-received (*"very helpful technique I learnt"*), as were the psychoeducational videos which were described as being *"helpful and fun to watch."* In both cases the inclusion of a transcript was considered important.

The interviewees expressed divergent opinions when discussing the efficacy of the mood monitoring function. Where it was not used, interviewees asserted that they felt as though their *"moods [don't] really change from being genuinely happy so [I] didn't think I needed to track it"*. Conversely, others found it incredibly useful, and continued to use it *"most days", "at the end of the day to see how I feel [about] the day as a whole"* claiming that it enabled them to *"look at it over a month and go… was it just a sh*tty month? Was it a sh*tty stuff up thing or has my outlook perhaps changed?"*

**TABLE 4 |** Change in outcome scores over time.

| | Pretrial mean (SD) | Post-trial mean (SD) | *F* (df) | Significance | Effect size (*Cohen's d*) |
|---|---|---|---|---|---|
| PHQ-9 | 6.74 (5.47) | 5.26 (4.35) | 3.777 (1.38) | 0.059 | 0.27 (−0.16–0.69) |
| WHO-5 | 13.36 (5.09) | 14.85 (5.70) | 4.204 (1.38) | 0.047 | −0.29 (−0.72–0.14) |
| GAD-7 | 6.08 (5.41) | 4.95 (3.69) | 2.633 (1.38) | 0.113 | 0.21 (−0.24–0.65) |
| Effective work days | 18.98 (3.99) | 19.55 (5.14) | 0.772 (1.38) | 0.385 | −0.14 (−0.59–0.30) |

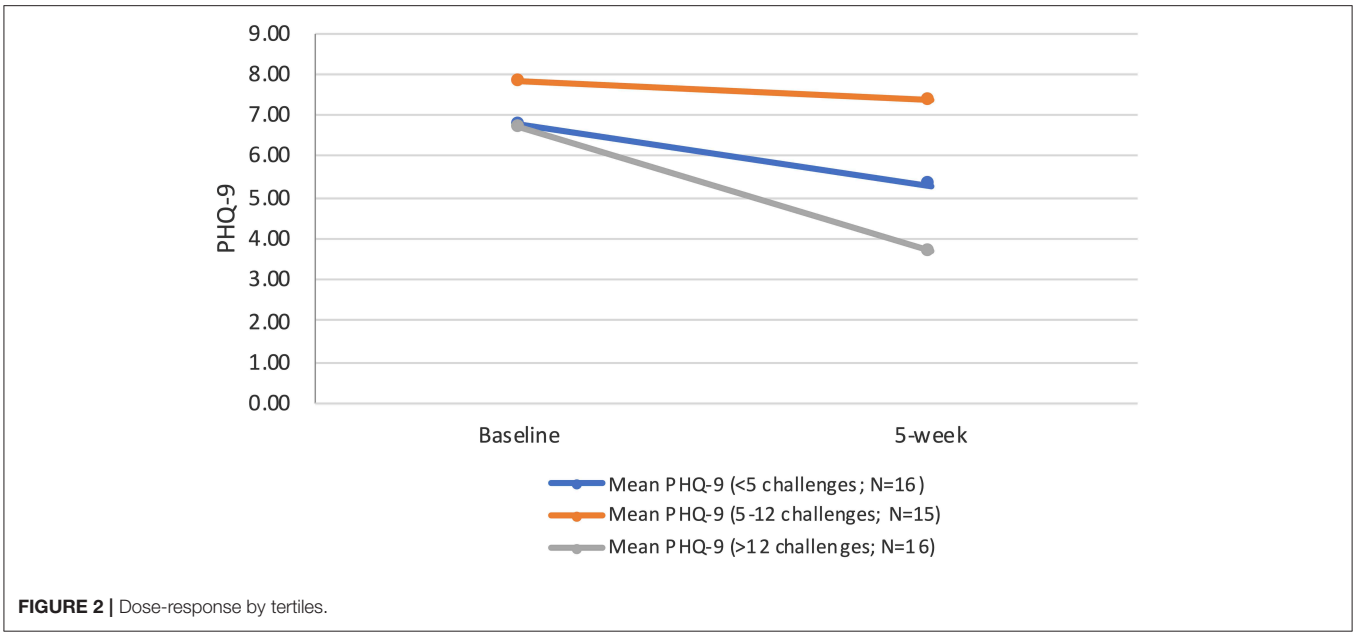


**FIGURE 2 |** Dose-response by tertiles.

### Symptom Levels and Productivity

Overall, 39 participants (82.9%) completed follow-up questionnaires. Symptom levels were generally in the mild range at follow-up. There was a positive trend across all the outcomes of interest over the 5-weeks follow-up; however, only well-being (WHO-5) reached statistical significance (**Table 4**).

When exploring the impact of actual intervention component exposure on the main outcome of interest (depression symptoms), one third completed fewer than five challenges, one-third completed 5–12 and the remaining third completed >12. Those completing more than 12 sessions had significantly reduced depressive symptoms at 5-weeks follow-up [$F_{(1,15)} = 11.25$; $p = 0.004$; mean difference: 3.00], whereas those who completed fewer than 5, or 5–12 sessions, showed no significant difference. Dose-response of the intervention by tertiles are presented in **Figure 2**.

### 3-Month Follow-Up

Of the 47 eligible participants, 19 (40%) completed 3-month follow-up. There were no significant differences between baseline and 3-month follow-up across outcomes of interest. Similarly, there were no significant differences between scores at the two follow-up time points. Low questionnaire completion precluded the exploration of app usage at this timepoint.

## DISCUSSION

This paper aimed to explore the utility of a mental health app, *HeadGear*, within an apprentice population. To the authors' knowledge, this is the first time a tailored eHealth program has been developed for this population. Overall, the app was well-received in both studies; however, engagement (measured through both self-report and intervention adherence) was an issue. This is unsurprising due to the difficulties in engaging this group in mental health interventions generally (36). Nevertheless, this had implications for the preliminary effectiveness of the app.

Previous trials of mental health apps with young people highlight the difficulties in achieving program adherence within this population (37). Despite minimal feedback on ways to improve the app at the conclusion of Study One, the incorporation of elements to improve engagement and completion rates are required, highlighted by the links

between completion and symptom change highlighted in Study Two. The results of this paper highlight the importance of engagement, and that simply relying on positive subjective reports of usability, satisfaction, acceptability, or feasibility is insufficient when determining actual engagement (38). Peter's et al. (39) suggest that the psychological needs of autonomy, competence and relatedness mediate positive user experience outcomes including engagement and may be critical factors in designing interventions. This is in-line with some of the qualitative feedback including seeking customization (autonomy), gamification (competence satisfaction), and language (relatedness).

Furthermore, the results suggest that engagement (in the form of intervention completion) is directly related to effect of an app-based intervention of this kind. Although it has been shown that completion of digital mental health interventions is not always directly correlated with outcomes (38), and the minimum level of engagement required for such interventions to achieve beneficial effects remains an open question (40, 41). Involving end-users in the conception, design, and implementation of any app is a critical component to successful design (18)—in the case of *HeadGear*, this was a core component of development (6, 14). Indeed many recommendations to enhance engagement in this young, predominately male population (36) were incorporated in the preliminary work completed as part of the app modifications. Other useful techniques to enhance engagement may include a means to better embed the technology within the systems and structures which users already operate within (e.g., clinical services) (18); in this case, given the low levels of traditional service use within the apprentice population, workplaces or training organizations may place a vital role. This may also be a means to provide supportive accountability, which is linked to enhanced engagement (42). However, there remains the question of how to create habit-forming technologies within this space by improving the intrinsic motivation to complete such programs, which requires intensive multidisciplinary development.

Symptom change is, indeed, only one element of importance in developing programs within this population. The apprenticeship experience and support given to mental health issues can vary greatly, especially in small employers (43). Importantly, the response to the app was positive in terms of perceived impact on awareness, help-seeking, and behavior, along with subjective mental fitness. Such elements are critical to adequately serving a population that has low levels of mental health literacy (44) and high rates of training incompletion, with factors related to poor mental health reported as the primary reasons for incompletion (45).

Although only well-being scores improved to a statistically significant degree, there was a consistent trend toward improvements across all health and behavioral outcomes. The true potentially beneficial impact of the app may be obscured in this study due to lack of power and low baseline symptom rates (10). Furthermore, the app was designed to prevent rather than treat depression and in a pilot trial of this kind exploring such an outcome was not feasible. This is a limitation of the current study, and requires much greater numbers to determine effectiveness (46). Nevertheless, baseline depression scores and app usage were comparable within this sample and the original *HeadGear* prevention trial (10). In the original trial users completed on average 9 challenges, using the app for 52 min. The within-group effect size in the current study was slightly smaller at post-intervention (0.8 vs. 1.2), but the mean difference was similar (1.80 vs. 1.94). Comparatively, well-being scores improved to a greater extent within the current trial (−0.41 vs. −0.62).

Other limitations of the study include the low rates of female participation in both studies; while this is reflective of the makeup of industries sampled, there remains a question around whether female apprentices would respond differently to this app than males. Similarly, the range of industries represented was limited, and findings may not be generalizable to all apprentices. Finally, as with any study of this kind there is the potential for self-report bias, nevertheless, evidence suggests self-report provides useful and accurate estimates when conditions are designed to maximize response accuracy (47, 48). To minimize bias in responding we intentionally recruited via non-workplace channels (e.g., training organizations and online). Overall, the findings from the two studies reported here suggest that an eHealth tool, the *HeadGear* application, was generally considered acceptable and well-received when adapted to young apprentices. However, questions remain regarding how to improve engagement and adherence to the program. These questions appear critical to effectiveness. Whilst preliminary results were encouraging, these improvements, along with a full-scale efficacy trial are needed to better understand the utility of smartphone applications for mental health in this population.

## DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because ethics approval states no individual participant results or identification will be published or accessed by anyone other than the research team. Requests to access the datasets should be directed to Mark Deady, m.deady@unsw.edu.au.

## ETHICS STATEMENT

The University of Sydney Human Research Ethics Committee approved these studies (2018/788, 2017/648). All participants gave written informed consent before data collection began.

## AUTHOR CONTRIBUTIONS

MD, DC, IL, IC, and SH had full access to all the data in the study and take responsibility for the integrity of the data. MD had a primary role in conceptualization and write up and editing of this manuscript. IC had a secondary role in conceptualization and write up and editing of this manuscript. NG and SH had a role in conceptualization and editing of this manuscript. DC, IL, AG, HC, and IC had a role in write up and editing of this

manuscript. AW and RE had a role data collection and editing. RC had a role in technical development of the intervention and editing of this manuscript. HC had a role in write up and editing of this manuscript. All authors have read and approved of the final manuscript.

## FUNDING

This study was funded by a UNSW-Sydney Mental Well-being Scheme, SafeWork NSW, and the AFFIRM Foundation. SH, AG, IL, and MD are supported by funding from the iCare Foundation and NSW Health.

## ACKNOWLEDGMENTS

We would like to acknowledge the support of industry partners, including Apprenticeship Support Australia, My Gateway, and Electro Group. SH, MD, and AG were supported by funding from the iCare Foundation and NSW Health. Special thanks to Ms. Rene Poulos for assisting recruitment.

## REFERENCES

1. McGorry PD, Purcell R, Goldstone S, Amminger GP. Age of onset and timing of treatment for mental and substance use disorders: implications for preventive intervention strategies and models of care. *Curr Opin Psychiatry*. (2011) 24:301–6. doi: 10.1097/YCO.0b013e3283477a09
2. Slade T, Johnston A, Oakley Browne MA, Andrews G, Whiteford H. 2007 National survey of mental health and wellbeing: methods and key findings. *Aust Nz J Psychiat*. (2009) 43:594–605. doi: 10.1080/00048670902970882
3. Cuijpers P, Van Straten A, Smit F. Preventing the incidence of new cases of mental disorders: a meta-analytic review. *J Nerv Ment Dis*. (2005) 193:119–25. doi: 10.1097/01.nmd.0000152810.76190.a6
4. Bellón JÁ, Conejo-Cerón S, Moreno-Peral P, King M, Nazareth I, Martín-Pérez C, et al. Intervention to prevent major depression in primary care: a cluster randomized trial preventing major depression in primary care. *Ann Intern Med*. (2016) 164:656–65. doi: 10.7326/M14-2653
5. Henderson M, Harvey SB, Øverland S, Mykletun A, Hotopf M. Work and common psychiatric disorders. *J R Soc Med*. (2011) 104:198–207. doi: 10.1258/jrsm.2011.100231
6. Einboden R, Choi I, Ryan R, Petrie K, Johnston DA, Wray A, et al. 'Having a thick skin is essential': mental health challenges for young apprentices in Australia. *J Youth Stud*. doi: 10.1080/13676261.2020.1728240. [Epub ahead of print].
7. Safe Work Australia. Work-related mental disorders profile. Canberra, ACT: Safe Work Australia (2015).
8. Ellis LA, McCabe KL, Rahilly KA, Nicholas MA, Davenport TA, Burns JM, et al. Encouraging young men's participation in mental health research and treatment: perspectives in our technological age. *Clin Invest*. (2014) 4:881–8. doi: 10.4155/cli.14.61
9. Deady M, Johnston D, Milne D, Glozier N, Peters D, Calvo R, et al. Feasibility, acceptability and preliminary effectiveness of a smartphone-app to reduce depressive symptoms in the workplace. *JMIR mHealth*. (2018) 3:e11661. doi: 10.2196/11661
10. Deady M, Glozier N, Calvo RA, Johnston DA, Mackinnon A, Milne D, et al. Preventing depression using a smartphone app: a randomised clinical trial. *Psychol Med*. doi: 10.1017/S0033291720002081. [Epub ahead of print].
11. Schueller SM, Hunter JF, Figueroa C, Aguilera A. Use of digital mental health for marginalized and underserved populations. *Curr Treat Opt Psychiatry*. (2019) 6:243–55. doi: 10.1007/s40501-019-00181-z
12. Torous J, Nicholas J, Larsen ME, Firth J, Christensen H. Clinical review of user engagement with mental health smartphone apps: evidence, theory and improvements. *Evid Based Mental Health*. (2018) 21:116–9. doi: 10.1136/eb-2018-102891
13. Harper Shehadeh M, Heim E, Chowdhary N, Maercker A, Albanese E. Cultural adaptation of minimally guided interventions for common mental disorders: a systematic review and meta-analysis. *JMIR Mental Health*. (2016) 3:e44. doi: 10.2196/mental.5776
14. Choi I, Petrie K, Einboden R, Collins D, Ryan R, Johnston D, et al. Exploring young male workers' healthy coping strategies and attitudes to using a smartphone app to support their mental health (in press).
15. Fernandez A, Salvador-Carulla L, Choi I, Calvo R, Harvey SB, Glozier N. Development and validation of a prediction algorithm for the onset of common mental disorders in a working population. *Aust N Z J Psychiatry*. 2017:0004867417704506. doi: 10.1177/0004867417704506
16. Deady M, Peters D, Lang H, Calvo R, Glozier N, Christensen H, et al. Designing smartphone mental health applications for emergency service workers. *Occup Med*. (2017) 67:425–8. doi: 10.1093/occmed/kqx056
17. Peters D, Deady M, Glozier N, Harvey S, Calvo RA. Worker preferences for a mental health app within male-dominated industries: participatory study. *JMIR Ment Health*. (2018) 5:e30. doi: 10.2196/mental.8999
18. Stoyanov SR, Hides L, Kavanagh DJ, Wilson H. Development and validation of the user version of the mobile application rating scale (uMARS). *JMIR Mhealth Uhealth*. (2016) 4:e72. doi: 10.2196/mhealth.5849
19. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res*. (2015) 26:1753–60. doi: 10.1177/1049732315617444
20. Kroenke KMD, Spitzer RLMD. The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric Ann*. (2002) 32:509–15. doi: 10.3928/0048-5713-20020901-06
21. Löwe B, Kroenke K, Herzog W, Gräfe K. Measuring depression outcome with a brief self-report instrument: sensitivity to change of the patient health questionnaire (PHQ-9). *J Aff Disord*. (2004) 81:61–6. doi: 10.1016/S0165-0327(03)00198-8
22. Martin A, Rief W, Klaiberg A, Braehler E. Validity of the brief patient health questionnaire mood scale (PHQ-9) in the general population. *Gen Hosp Psychiatry*. (2006) 28:71–7. doi: 10.1016/j.genhosppsych.2005.07.003
23. Spitzer RL, Kroenke K, Williams JBW, Löwe 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
24. Kroenke K, Spitzer RL, Williams JBW, Löwe B. The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *Gen Hosp Psychiatry*. (2010) 32:345–59. doi: 10.1016/j.genhosppsych.2010.03.006
25. Löwe B, Decker O, Müller S, Brähler E, Schellberg D, Herzog W, et al. Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. *Med Care*. (2008) 46:266–74. doi: 10.1097/MLR.0b013e318160d093
26. Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 well-being index: a systematic review of the literature. *Psychother Psychosom*. (2015) 84:167–76. doi: 10.1159/000376585
27. Bech P. Measuring the dimensions of psychological general well-being by the WHO-5. *QoL Newsletter*. (2004) 32:15–6.
28. Kessler RC, Barber C, Beck A, Berglund P, Cleary PD, McKenas D, et al. The world health organization health and work performance questionnaire (HPQ). *J Occup Environ Med*. (2003) 45:156–74. doi: 10.1097/01.jom.0000052967.43131.51
29. Wang PS, Simon GE, Avorn J, et al. Telephone screening, outreach, and care management for depressed workers and impact on clinical and work productivity outcomes: a randomized controlled trial. *JAMA*. (2007) 298:1401–11. doi: 10.1001/jama.298.12.1401
30. Lund A. Measuring usability with the USE questionnaire. *Usabil User Exp*. (2001) 8:8.
31. Morris SB, DeShon RP. Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychol Methods*. (2002) 7:105–25. doi: 10.1037/1082-989X.7.1.105

32. Sanders L, Stappers PJ. *Convivial Toolbox: Generative Research for the Front End of Design*. Amsterdam: BIS (2013).
33. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* (2006) 3:77–101. doi: 10.1191/1478088706qp063oa
34. Coffey A, Atkinson P. *Making Sense of Qualitative Data: Complementary Research Strategies*. Thousand Oaks, CA: Sage Publications (1996).
35. Saldaña J. *The Coding Manual for Qualitative Researchers*. London: Sage Publications Ltd. (2015).
36. Ellis LA, Collin P, Hurley PJ, Davenport TA, Burns JM, Hickie IB. Young men's attitudes and behaviour in relation to mental health and technology: implications for the development of online mental health services. *BMC Psychiatry.* (2013) 13:119. doi: 10.1186/1471-244X-13-119
37. Bohleber L, Crameri A, Eich-Stierli B, Telesko R, von Wyl A. Can we foster a culture of peer support and promote mental health in adolescence using a web-based app? A control group study. *JMIR Ment Health.* (2016) 3:e45. doi: 10.2196/mental.5597
38. Donkin L, Hickie IB, Christensen H, Naismith SL, Neal B, Cockayne NL, et al. Rethinking the dose-response relationship between usage and outcome in an online intervention for depression: randomized controlled trial. *JMIR.* (2013) 15:e231. doi: 10.2196/jmir.2771
39. Peters D, Calvo RA, Ryan RM. Designing for motivation, engagement and wellbeing in digital experience. *Front Psychol.* (2018) 9:797. doi: 10.3389/fpsyg.2018.00797
40. Donkin L, Christensen H, Naismith SL, Neal B, Hickie IB, Glozier N. A systematic review of the impact of adherence on the effectiveness of e-therapies. *J Med Internet Res.* (2011) 13:e52. doi: 10.2196/jmir.1772
41. Bakker D, Rickard N. Engagement in mobile phone app for self-monitoring of emotional wellbeing predicts changes in mental health: MoodPrism. *J Affect Disord.* (2018) 227:432–42. doi: 10.1016/j.jad.2017.11.016
42. Mohr DC, Cuijpers P, Lehman K. Supportive accountability: a model for providing human support to enhance adherence to ehealth interventions. *J Med Internet Res.* (2011) 13:e30. doi: 10.2196/jmir.1602
43. Buchanan J, Raffaele C, Glozier N, Kanagaratnam A. *Beyond Mentoring: Social Support Structures for Young Australian Carpentry Apprentices*. Adelaide, SA: NCVER (2016).
44. Jorm A. Mental health literacy. Empowering the community to take action for better mental health. *Am Psychol.* (2012) 67:231–43. doi: 10.1037/a0025957
45. Bednarz A. *Understanding the Non-Completion of Apprentices*. Adelaide, SA: National Centre for Vocational Education Research (NCVER) (2014).
46. Cuijpers P. Examining the effects of prevention programs on the incidence of new cases of mental disorders: the lack of statistical power. *Am J Psychiatry.* (2003) 160:1385–91. doi: 10.1176/appi.ajp.160.8.1385
47. Del Boca FK, Noll JA. Truth or consequences: the validity of self-report data in health services research on addictions. *Addiction.* (2000) 95:347–60. doi: 10.1046/j.1360-0443.95.11s3.5.x
48. Del Boca FK, Darkes J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction.* (2003) 98:1–12. doi: 10.1046/j.1359-6357.2003.00586.x


**Conflict of Interest:** MD, IC, NG, RC, and SH were involved in the development of the HeadGear application. The IP was jointly owned by MD, IC, NG, RC, and SH, however, the authors do not currently receive any financial gain from this IP.

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 Public Health

STUDY PROTOCOL
published: 08 September 2020
doi: 10.3389/fpubh.2020.00446

# Does Dialogue Improve the Sustainable Employability of Low-Educated Employees? A Study Protocol for an Effect and Process Evaluation of "Healthy HR"

*Emmelie Hazelzet*, Hans Bosma, Angelique de Rijk and Inge Houkes*

*Department of Social Medicine, Faculty of Health, Medicine and Life Sciences, CAPHRI Care and Public Health Research Institute, Maastricht University, Maastricht, Netherlands*

OPEN ACCESS

***Edited by:***
*Leah Okenwa Emegwa, Swedish Red Cross University College, Sweden*

***Reviewed by:***
*Victor C. W. Hoe, University of Malaya, Malaysia*
*Kaisa Törnroos, Finnish Institute of Occupational Health, Finland*

****Correspondence:***
*Emmelie Hazelzet*
*e.hazelzet@maastrichtuniversity.nl*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *17 April 2020*
***Accepted:*** *20 July 2020*
***Published:*** *08 September 2020*

***Citation:***
*Hazelzet E, Bosma H, de Rijk A and Houkes I (2020) Does Dialogue Improve the Sustainable Employability of Low-Educated Employees? A Study Protocol for an Effect and Process Evaluation of "Healthy HR". Front. Public Health 8:446. doi: 10.3389/fpubh.2020.00446*

**Background:** There is a need to develop sustainable employability (SE) interventions that are better aligned to the needs of low-educated employees. This group needs to get a voice in intervention development and implementation. In this study, a dialogue-based approach is proposed consisting of an online step-by-step support toolkit for employers, "Healthy Human Resources" (HHR). When intervening, this toolkit enables and stimulates employers to have a continuous dialogue with their low-educated employees. By improving the employees' job control, HHR is aimed at cost-beneficially improving SE. This paper describes the protocol of the evaluation study to evaluate the effectiveness and implementation process of HHR on the SE of low-educated employees.

**Methods:** The protocol of the evaluation study consists of: (1) an effect evaluation with a pretest-posttest design with a 1-year follow-up in five work organizations in the Netherlands deploying low-educated employees and with SE as the primary outcome and job control as the secondary outcome. The effect evaluation is expanded with a budget impact analysis; (2) a mixed-method process evaluation at 6 and 12 months after the start of HHR to evaluate the whole implementation process of HHR. This includes the experiences with HHR of various stakeholders, such as employees, human resource managers, and line managers.

**Discussion:** The effect evaluation will give insight into the effects of HHR on the SE of low-educated employees. The process evaluation will provide insight into the underlying mechanisms of the (in) effectiveness of HHR. By improving dialogue, we hypothesize that HHR, through enhancing job control, will strengthen the SE of low-educated employees. Also for helping with tackling the socioeconomic health gap, if proven effective, the implementation of HHR on a wider scale can be recommended.

**Keywords: low-educated employees, employer, dialogue, job control, sustainable employability, effect evaluation, process evaluation, protocol**

## INTRODUCTION

Despite many attempts to reduce socioeconomic health differences, such differences remain large and persistent (1, 2). As, in the work domain, low-educated employees much more often prematurely leave the labor force due to health-related problems than their higher-educated counterparts (2–4), it is worrying that lower-educated employees are often difficult to reach in research and intervention efforts aimed at improving their situation (5, 6). Through absenteeism, presenteeism, and high staff turnover, this has substantial financial implications for employers too (7). Low-educated employees constitute a group that needs extra effort in this regard. Employees' sustainable employability (SE) has become top priority for employers, as they aim to foster employees' health and productivity in a sustainable way (8). The concept of SE is not one individual aspect, but rather an interaction between the employee and the organizational context. The workplace therefore is a good starting point to reach low-educated employees and improve their SE (8–10). This group, however, hardly participates in workplace health interventions (9, 11), and when they do participate, they tend to benefit to a lesser extent (12). In practice, many SE interventions are being developed without taking the perspective of the target group into account. Employers tend to buy ready-made health programs from (commercial) third parties, in which implementation takes place via a non-participatory top-down approach (13). Employees are often passive receivers in these programs (14, 15). Consequently, a mismatch occurs between these health programs and the needs and the world of daily experience of most low-educated employees. Therefore, low-educated employees need a different and more intensive approach than their higher-educated counterparts (16).

There is thus an urgent need to better align SE interventions to the needs of low-educated employees. To increase the effectiveness of these interventions, this group needs to have a say and needs to be actively involved in intervention development and implementation (6, 17, 18). Active involvement and participation in decision-making processes is expected to empower employees by increasing job control and autonomy; these in turn are expected to improve the employees' (mental) health and SE (19–21). Job control is an important determinant of employee well-being, particularly for low-educated employees who generally work in low control situations (20, 22, 23). When intervening, we expect that a profound dialogue between employees and the employer is crucial in increasing job control and SE among low-educated employees (24–26). Dialogue stands for an explanatory way of having a conversation in which all involved stakeholders experience a shared responsibility for the outcome of the dialogue (27). Instead of one-sided monologs or directives from the top, during dialogue, employees and representatives of the employer can think together and share experiences from different perspectives (25). When employers engage employees in dialogue, employees feel that their opinions count and that they are given a voice (28, 29). Previous studies found positive effects of improved work conditions through dialogue groups among high-educated physicians (28) and feeling heard and valued has been found to increase the self-esteem and self-efficacy of employees (19).

We propose a dialogue-based approach to stimulate active employee participation in the development and implementation of tailored SE interventions. We assume that this will contribute to a higher job control and SE of low-educated employees. Due to the participatory approach, including the dialogue component, employees get the opportunity to obtain more self-direction, experience more job control, which eventually will improve their health and SE. By lowering sickness absence, our approach will also be cost-beneficial for employers (7). We have therefore developed a free online support toolkit named - Healthy Human Resources' (HHR) aimed at improving SE of the low-educated employees. With the toolkit, employers (e.g., HR managers; supervisors), in dialogue with the low-educated employees, can develop and implement tailored SE interventions. As long as these are the outcome of a shared dialogue, the tailored SE interventions can vary widely regarding size and content and may, e.g., include compliments cards, job crafting, lifestyle interventions, or leadership training. The online toolkit HHR has already been developed, also in dialogue with several stakeholders, such as HR-managers, supervisors, and low-educated employees.

This paper presents the study protocol of the evaluation study, evaluating the effect and the process of HHR. Particularly through increasing the low-educated employees' control at work, we hypothesize that the use of HHR in organizations, by integrating a dialogue-based approach, improves the SE of low-educated employees. We therefore also expect that employees who are more exposed to the dialogue integrated within HHR will experience more improvement in SE than employees who are less or not at all exposed to HHR (dose-response). The conceptual model of HHR is illustrated in **Figure 1**.

## METHODS

The evaluation framework consists of a quantitative effect evaluation and an extensive mixed-method process evaluation. The aim of the effect evaluation is to investigate the effect of HHR on the SE of low-educated employees. The aim of the process evaluation is to assess the implementation process, the underlying mechanisms of the HHR's effectiveness or lack thereof (the how, what, why), and the HHR experiences of key stakeholders, such as the employees, HR manager and supervisors. The effect and process evaluation supplement each other.

### Intervention: Healthy HR

HHR is a web-based step-by-step support toolkit for HR managers and/or supervisors aimed at improving SE of low-educated employees. It supports HR managers and supervisors by developing and implementing their own tailored SE interventions by – from the start – involving their low-educated employees via dialogue. This online toolkit is presented on the "Healthy Human Resources" website (www.gezondhr.nl) (in Dutch). It consists of different steps, tasks, and dialogue-based

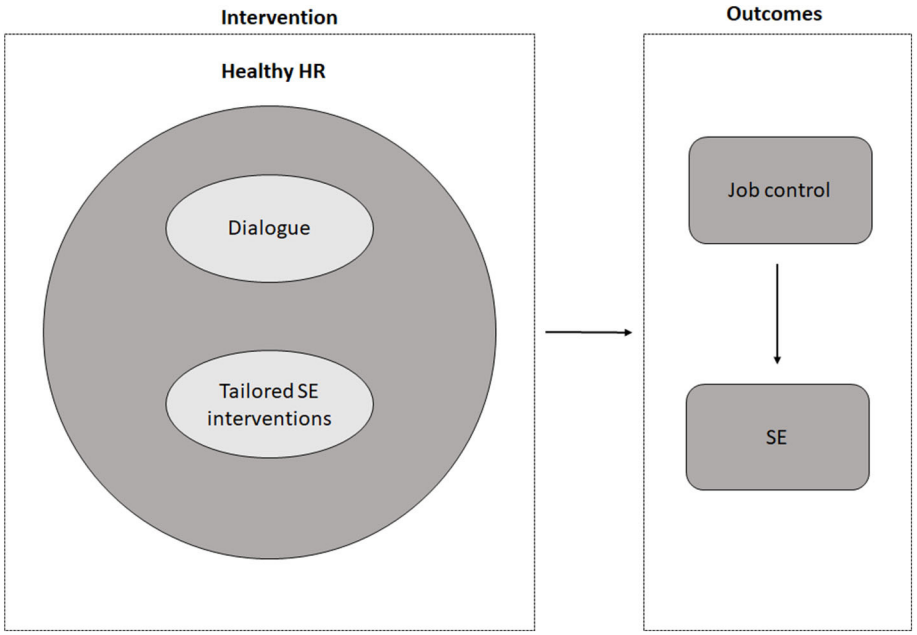


**FIGURE 1 |** Conceptual model of HHR and expected outcomes.

tools for use within a team or department of the participating organizations. Within HHR eight steps are presented: step (1) Prepare together; step (2) Measuring is knowing; step (3) Our problems; step (4) Our solutions; step (5) Action plan; step (6) Let's start; step (7) Evaluation, and step (8) Along the way: obstacles in the process. Each step, is represented by several underlying tasks (e.g., brainstorming; prioritizing; communicating) and every task contains one or more supportive tools. Tools can be questionnaires, working forms, checklists, communication tips and information, external links, or a library with simple solutions and evidence-based interventions. Every task and tool facilitates a certain degree of employee participation and dialogue. The main outline of the steps, tasks and tools are presented in **Appendix A**. Organizations can select the tools which best fit to their context and their employees' situation, thereby developing a tailor-made toolkit for the needs assessment (HHR step 1–4) and developing and implementing their own tailored SE interventions (HHR step 5–7). The development of HHR is based on the Intervention Mapping approach (IM) (30). As IM is a rather detailed and time-consuming approach (30, 31), we decided to use an adapted version of the IM within HHR as well; this will make HHR more feasible for employers to put into practice (32, 33). The HR manager and/or supervisor will facilitate HHR themselves, without any external consultancy. We developed HHR in such a way, that it is a self-led intervention. It will be delivered in the participating organization, likely during working hours. HR manager and supervisors are able to decide by themselves how much time they spend on HHR and how they are going to integrate HHR in the daily business. However, a rule of thumb is provided within the toolkit by the researchers. Nevertheless, we expect when using HHR more frequent and more intense, employees will be more exposed and will experience more improvement on SE as mentioned before. A detailed description about the development and content of HHR will be published elsewhere (34).

## Effect Evaluation

The effect evaluation will be a quantitative study with a pretest-posttest design with a 1-year follow-up within each participating organization (T2). The employees' SE will be compared between prior to and after the HHR intervention. We will also examine whether the SE improves more, if employees are more exposed to HHR. Additionally, a budget impact analysis (BIA) will be performed to gain more insight into whether HHR is financially affordable and beneficial for employers deploying low-educated employees. The primary aim of the effect evaluation is to investigate the effectiveness of HHR on the SE of low-educated employees. The main research question is:

- What is the effect of HHR on the SE of low-educated employees?

### Study Sample and Sample Size

Five Dutch work organizations (a manufacturing company, a meat processing company, a cleaning company, a warehouse and a governmental institution) participated in the development of HHR. These organizations will also implement HHR and participate in the effect evaluation. Employees with lower educational levels varying from no education to secondary vocational education [coded according to the 2011 International Standard Classification of Education (ISCED-11)] will be included in HHR and the effect evaluation. In this study, we will focus on employees with lower educational levels, particularly

those employees who perform low-skilled jobs within certain departments of an organization.

A power calculation was performed to determine the sample size. Based on the mean difference in SE of 0.25 (theoretical range 1 to 5) that was found between high and low-educated employees in a previous study (35), we expect SE differences between high and low-educated employees to decrease with 0.25. As the uptake and output of HHR is organization-specific, we aim to study the SE improvement in each organization separately, but we will also pool the data to examine the overall effect. With a power of 80% and a significance level of 5%, the required sample size is a minimum of 126 employees per organization (36), which implies an overall sample size of 630 employees. We expect a varied non-response and dropout rate per organization. The gross number of employees varies between 40 and 1,200 per organization. For participating organizations with insufficient power, data will be pooled.

## Data Collection

Data for the effect evaluation of HHR will rely upon quantitative data from similar questionnaires at two time points: baseline (T0) and follow up (T2, 12 months after the start of step 1) (**Figure 2**). The baseline questionnaire (T0) will also be used as the needs assessment instrument in step 2 of HHR. The questionnaire for the needs assessment and effect evaluation is adapted and based on the existing Maastricht Instrument of Sustainable Employability (MAISE) (35). The MAISE has been developed for measuring SE from an employees' perspective. The MAISE has been validated among employees with (on average) intermediate and higher educational levels. For use among a sample of low-educated employees and the purpose of serving as a needs assessment, the MAISE and other (self-developed) subscales, such as job control, self-efficacy and lifestyle have been adjusted, to better fit with the language and way of thinking of low-educated employees. It is our hope that this adaptation improves the reach and the validity and reliability of our questionnaires. For instance, the use of existing job control scales from existing questionnaires were still too difficult to understand by the employees when discussing these items together with them. For the effect evaluation, additional, well-validated measures were also used (e.g., vitality).

### *Primary outcomes*

Sustainable employability (SE) will be the primary outcome of the effect evaluation and can be considered as a distal outcome measure. The level of SE is measured by means of two scales, productivity and health, from the Maastricht Instrument of Sustainable Employability (MAISE) (35). SE measurement will be complemented by several proxies of SE:

Vitality will be measured by means of the subscale vitality of the Dutch version of the Utrecht Work Engagement Scale (UWES) (5 items) (37). The response scale ranged from 1 (never) to 7 (always/every day). A global measure of work engagement will be used as well, measured by means of the shortened Dutch version of the Utrecht Work Engagement Scale (UWES-3). This short version of UWES-9 is proven to be reliable and valid (38). Self-perceived health will be measured using a single item: "In general, what would you say about your health?" with five response options: excellent; very good; good; fair; and poor. For sickness absence, self-reported sickness absence will be measured by using a single item: "In the past 12 months, how many days were you sick-listed?" and registered sickness absence data will be drawn from the registers of the organizations. The sickness absence percentages will be obtained per participating department of each organization before the start at T0 and after 12 months (T2).

### *Secondary outcome*

Job control will be the secondary outcome of the study and will be measured by means of a self-developed scale consisting of 5 items. The items are inspired by existing lists, such as the Dutch Questionnaire on the Experience and Evaluation of Work and the Maastricht Autonomy questionnaire (39, 40). The formulation of the items was aligned to the linguistic usage and preferences of the low-educated employees. The response scale ranged from 1 (never) to 5 (always). An example item is: "I have a say in what happens on my job." Validity and reliability of this scale will be analyzed.

### *Other outcomes*

We included several additional proximal outcomes which can be used to measure potential effects of the tailored SE interventions per organization: self-efficacy, lifestyle, social climate, social support, organization of work, adapted work possibilities, and communication and collaboration. Self-efficacy will be measured by means of the general self-efficacy scale (GSES-12) using the subscale effort (5 items) (41). Lifestyle will be measured according to the five behaviors: physical activity, smoking, alcohol use, consumption of fruit or vegetables and quality of sleep (42–44). These five lifestyle behaviors provided a so-called "optimal lifestyle index." Each behavior scored "1" when the norm is met (and "0" when not met). A sum score will be computed of all five behaviors to create an optimal lifestyle index (43). The variables social climate (4 items), social support (3 items), organization of work (9 items), adapted work possibilities (4 items), and communication and collaboration (5 items) will be measured by means of self-developed scales. Validity and reliability of these scales will be analyzed.

Information on covariates (gender, age, type of contract (e.g., permanent or flex), level of education, ethnicity, shift work) will be also collected. Finally, to examine whether the SE improves more when employees are more intensely exposed to HHR (dose-response), the process indicator dose-received will be included in the follow-up questionnaire (T2). Dose-received will be measured by means of a self-developed continuous scale at employee and organizational level (see also process evaluation). Employees will be asked to what extent they actively aware and participated in HHR.

## Data Analysis

Descriptive statistics will be used to analyze background characteristics. Differences over time (T0-T2) on the primary and secondary outcomes will be analyzed by means of paired *t*-tests of mean differences, chi square tests and regression

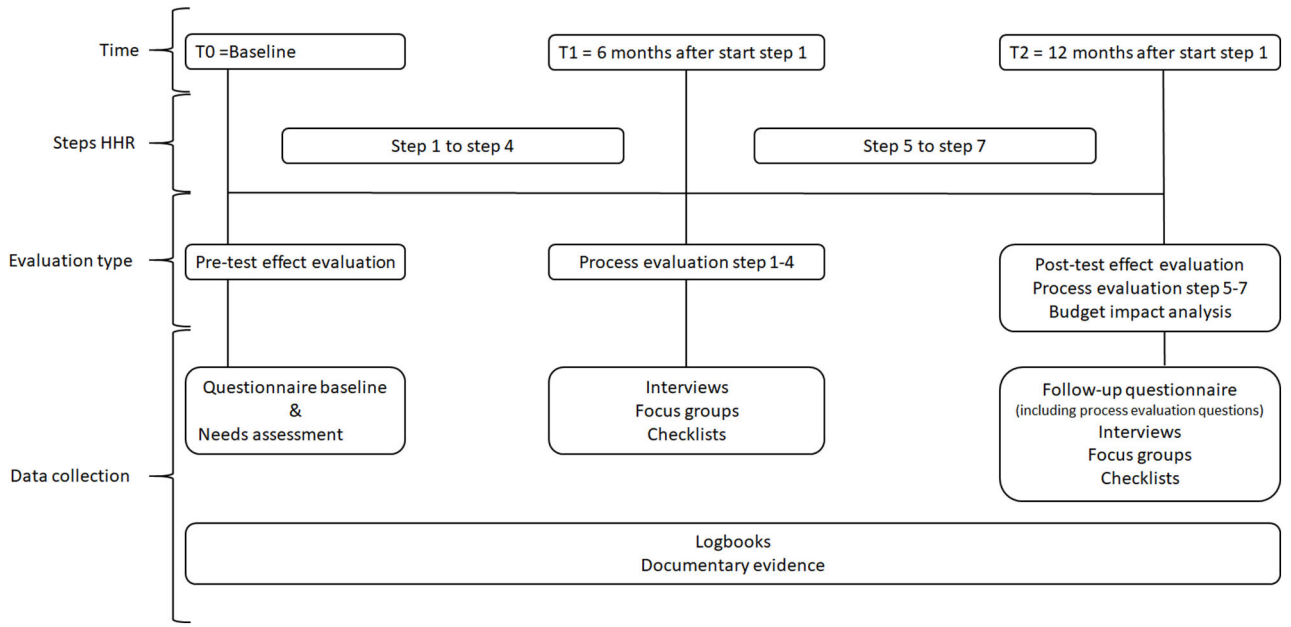


**FIGURE 2 |** Overview evaluation moments and data collection.

analyses. The dose-received variable will be used to test the correlation between the dose and change in the primary outcome SE. Subgroup analyses (e.g., gender; education; type of contract) will be performed to examine specifically heightened or lowered improvements in SE in subgroups. Multilevel analyses are used to examine the association between the level of HHR implementation on the company level (level 2) and the improvement in SE (level 1). If multilevel analyses appear not to be feasible, other ways of taking account of the nested design will be considered. Finally, when there is a need for pooling (one organization has only 40 employees in total), multilevel is similarly considered (when pooling). Analyses will be performed using SPSS version 26.

### Budget Impact Analysis

We will perform a budget impact analysis (BIA) from the employer perspective. The main aim of the BIA is to assess whether the implementation of HHR is financially affordable for the employer (e.g., time; implementation costs of HHR; additional cost for HHR) and show the budget impact of HHR. Generally, employers have interest in maintaining a healthy and productive workforce and, thus, they may be able to offset decreased sickness absence gains against the costs. Data will be collected on the direct costs of specific resources needed to implement HHR (e.g., staff, expertise, supplies, equipment, working time) by means of interviews. The estimation of the time spent gathered in interviews will be supplemented with data from the logbooks of the employers and researchers. The time spent will be translated to costs by multiplying number of hours with the average hour salary of for the group of employees involved in HHR. We ensure that the report on both costs and benefits will be simultaneously available for employers and HR managers.

## Process Evaluation

The aim of the process evaluation is to evaluate, in each participating organization, the implementation process and the underlying mechanisms of the HHR's effectiveness or lack thereof (the how, what, why), and the experiences of key stakeholders with HHR. These key stakeholders might influence the implementation throughout the process in various ways and therefore the outcomes. The process evaluation will have a mixed-method design (45) and will be utilized to interpret and understand the outcomes of the effect evaluation (46, 47). The study population of the quantitative process evaluation (follow-up questionnaire T2) equals that of the effect evaluation (the employees). The study population of the qualitative process evaluation includes various stakeholders (i.e., employees, supervisors, and HR managers) at different levels of the organizations. We will examine the key process indicators suggested by Linnan and Steckler presented in **Table 1** (48). Because the organizational context can hinder or facilitate the implementation process and outcomes, we will examine both omnibus context (e.g., general context) and discrete context (e.g., specific events during HHR) in this process evaluation (46, 47, 49). In the qualitative parts of the process evaluation, we will generally follow the principles of responsive evaluation, which is well in line with the participative and dialogue-based approach of this study (50). This participative evaluation method explicitly includes the intervention and

**TABLE 1 |** Process indicators, stakeholders' level, operationalization and data collection method.

| Process indicators and definition | Stakeholder level | Operationalization | Data collection method |
|---|---|---|---|
| *Context*<br>The contextual factors (omnibus; discrete) and history (i.e., barriers, facilitators) that affect HHR implementation or outcomes | Employer<br>Employees | Description of barriers<br>Description of facilitators | Documentary evidence (T0–T2)<br>Logbook (T0–T2)<br>Focus groups (T1; T2)<br>Semi-structured Interviews (T1;T2) |
| *Recruitment*<br>Procedures used to approach and attract employees | Employer<br>Employees | Description of approaches | Logbook (T0–T2)<br>Focus group (T1; T2) |
| *Reach*<br>Percentage of departments and employees participating in HHR | Employees | Characteristics of departments<br>Characteristics of employees<br>Percentage of employees, participated<br>Drop-out and reasons | Baseline questionnaire and follow-up questionnaire (T0; T2)<br>Logbook (T0–T2)<br>Focus groups (T1; T2)<br>Semi structured Interviews (T1; T2)<br>Checklist (T1; T2) |
| *Dose delivered*<br>The extent to which HHR or components actually was delivered according to the intervention plan | Employer<br>Employees | Dose delivered items (yes/no) | Logbook (T0–T2)<br>Questionnaire at follow-up (T2)<br>Focus groups (T1; T2)<br>Semi structured Interviews (T1; T2)<br>Checklist (T1; T2) |
| *Dose received*<br>The extent to which employees actively aware and participated in HHR | Employees | Dose-response<br>Participation rate HHR | Questionnaire at follow-up (T2)<br>Focus groups (T1;T2)<br>Semi structured Interviews (T1;T2) |
| *Fidelity*<br>The extent to which HHR was delivered as intended | Employer<br>Employees | Statements (yes/no)<br>Reasons | Logbook (T0–T2)<br>Questionnaire at follow-up (T2)<br>Focus groups (T1; T2)<br>Semi structured Interviews (T1; T2) |
| *Satisfaction*<br>Employees and employer satisfaction about HHR | Employer<br>Employees | Satisfaction rate (scale 0–10)<br>Experiences of employees and employers | Logbook (T0–T2)<br>Questionnaire at follow-up (T2)<br>Focus groups (T1; T2)<br>Semi structured Interviews (T1; T2) |

connects the different perspectives of stakeholders in order to obtain a more complete picture.

The research questions for the process evaluation are:

- How and to what extent has HHR been implemented in the participating organizations, taking into account the key process indicators?
- What are the experienced changes and the perspectives of the key stakeholders with HHR?

## Data Collection and Analysis

Data will be collected throughout the entire process (T0-T2), at 6 months (T1), and at 12 months (T2) after the start of step 1 of HHR (**Figure 2**). In order to gain multiple perspectives and assure data validity, data source triangulation will be applied (51). At T2, the follow-up questionnaire of the effect evaluation will be extended with quantitative process evaluations questions covering the key process indicators: Reach, dose delivered, dose received, fidelity and satisfaction. These quantitative data will be analyzed by means of descriptive statistics. Data on the process indicators will be collected by means of different methods and at different stakeholder's levels within the organization (**Table 1**). Throughout the process (T0-T2), employers have the opportunity to give feedback by means of a feedback function built within HHR. Employers will keep track of the progress, number of meetings, time investment, participants, special remarks and events by means of a logbook and will be called monthly by the researchers. The researchers will also keep a logbook to document events and to keep documentary evidence for each participating organization. At T1, we will collect qualitative data about the experiences of employees and employers with steps 1–4 of HHR. At T2, we will collect qualitative data about the experiences of employees and employers with steps 5–7 of HHR (**Figure 2**). For both T1 and T2, focus groups and individual semi-structured interviews with the key stakeholders and other third parties (e.g., policy makers; communication staff) involved in the process will be conducted. These individual interviews and focus groups are complementary to each other (52). The topic lists for the focus groups and individual semi-structured interviews will be based on the process indicators and will include open-ended questions about HHR, the dialogue-based approach, experiences of stakeholders with HHR, and experienced changes. All focus groups and individual interviews will be digitally recorded and qualitative data will be analyzed thematically via a qualitative data analysis software program (e.g., NVivo).

# DISCUSSION

This paper presents the protocol for the effect and process evaluation of the intervention HHR. HHR is a web-based support toolkit for employers based on dialogue and aimed at improving

the SE of low-educated employees. We hypothesize that - through increasing job control - employees who are more exposed to HHR will experience better SE than employees who are less or not exposed to HHR.

## Strengths of the Protocol

This evaluation study provides insight into the effect and implementation process of HHR, including the underlying mechanisms that shapes the outcomes. Data triangulation using different quantitative and qualitative methods and data sources will be applied to assure the validity of this research. We expect that HHR as a whole will show positive effects on the SE of low-educated employees, regardless which organization or the effects of the tailored SE interventions developed per organization and the way we organized the process evaluation supports finding explanations for possible lack of effects. Furthermore, an economic perspective from the employer is also taken into account in a form of a BIA. The BIA will address the affordability of HHR and, together with the report on the benefits and gains of the intervention, will help employers to decide whether they want to invest in HHR.

The extensive process evaluation, including different time points and data collection methods, will be a strength to better understand the underlying mechanisms of HHR, experienced changes and how dialogue and job control is experienced by different key stakeholders over time. Furthermore, the process evaluation at T2 allows to gain insight into the specific tailored SE interventions in each organization and their related perceived effectiveness next to the experience of HHR as a whole. Finally, we conduct the evaluation study in five different sectors and settings, which will increase the generalizability of our results.

## Methodological Challenges

Despite this extensive study design, several methodological challenges can be pointed out. First, HHR is a generic toolkit and organizations will work with the same steps, tasks and tools. However, the way HHR will be implemented, including the use of the tools will differ per organization. Employers are free to choose those tools which best fits their situation and their specific SE problems. This might lead to differences in effects and processes across the organizations. Therefore, it is important to perform subgroup analyses. Second, the participating organizations appeared to be unable to allocate a control group, because of time limits and other concerns within organizations. The lack of a control group is a well-known issue within research of organizations; this unfortunately leads to less robust evidence about what is effective in terms of SE interventions in the workplace (53). Hence, due to the lack of the control group it is important to study the uptake of HHR and profoundly assess whether there is a dose-response relationship. Third, the setting and context within participating organizations will be a challenge, due to constant changes (e.g., dismissing/attracting flex workers; changing role/attitude of key stakeholders). Fourth, it may vary per organization how much time the HR managers and the wider management will allow to spend by their employees, e.g., for filling in questionnaires (including the needs assessment) and to work with HHR. This is also related to the level of commitment and support of the higher management. These changes might affect the results and will therefore be well-documented throughout the process and assessed during the process evaluation moments (e.g., being dismissed clearly is a low control experience for the employee).

Despite these methodological challenges, it is important to conduct evaluation studies in natural settings of organizations and among low-educated employees in particular. Their voices need to be heard, also in research. If HHR is proven to be effective, HHR for and with this vulnerable group will be a valuable support toolkit, which can be applied on a wider scale. HHR is thereby expected to contribute to tackling the socioeconomic health gap.

# ETHICS STATEMENT

The Medical Ethical Committee (METC) of the academic hospital (MUMC) in Maastricht confirmed that the Medical Research Involving Human Subjects Act (WMO) does not apply to this study and that an official approval of this study by the committee is not required (METC 2017-0311). All participants in the effect and process evaluation will be asked to sign an informed consent form when they start their participation in the study.

# AUTHOR CONTRIBUTIONS

EH wrote the original draft. EH, AR, HB, and IH reviewed, revised, and edited several earlier versions of this paper. All authors read and approved the final version of the manuscript and contributed to finalizing the design and protocol for the study.

# FUNDING

This research was funded by ZonMw project: The MAISE-toolkit: a dialogue-based approach to improve the health of workers with a low socio-economic status (531001405), the Netherlands.

# SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2020.00446/full#supplementary-material

# REFERENCES

1. Mackenbach JP, Stirbu I, Roskam A-JR, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities in health in 22 European countries. *N Engl J Med.* (2008) 358:2468–81. doi: 10.1056/NEJMsa0707519
2. The Lancet Public H. Achieving health equity in the European region. *Lancet Pub Health.* (2019) 4:e482. doi: 10.1016/S2468-2667(19)30181-1
3. Sorensen G, Peters S, Nielsen K, Nagler E, Karapanos M, Wallace L, et al. Improving working conditions to promote worker safety, health, and

wellbeing for low-wage workers: the workplace organizational health study. *Int J Environ Res Public Health.* (2019) 16:1449. doi: 10.3390/ijerph16081449
4. Robroek SJ, Nieboer D, Järvholm B, Burdorf A. Educational differences in duration of working life and loss of paid employment: working life expectancy in the Netherlands. *Scand J Work, Environ Health.* (2020) 46:77–84. doi: 10.5271/sjweh.3843
5. Schaap R, de Wind A, Coenen P, Proper K, Boot C. The effects of exit from work on health across different socioeconomic groups: a systematic literature review. *Soc Sci Med.* (2018) 198:36–45. doi: 10.1016/j.socscimed.2017.12.015
6. van de Ven D, Robroek SJW, Burdorf A. Are workplace health promotion programmes effective for all socioeconomic groups? A systematic review. *Occupat Environ Med.* (2020) 26:oemed-2019-106311. doi: 10.1136/oemed-2019-106311
7. Noben C, Evers S, Nieuwenhuijsen K, Ketelaar S, Gärtner F, Sluiter J, et al. Protecting and promoting mental health of nurses in the hospital setting: is it cost-effective from an employer's perspective? *Int J Occup Med Environ Health.* (2015) 28:891–900. doi: 10.13075/ijomeh.1896.00465
8. van der Klink JJ, Bultmann U, Burdorf A, Schaufeli WB, Zijlstra FR, Abma FI, et al. Sustainable employability–definition, conceptualization, and implications: a perspective based on the capability approach. *Scand J Work Environ Health.* (2016) 42:71–9. doi: 10.5271/sjweh.3531
9. Williams N. Collaboration to improve health promotion in workplaces. *Occup Med.* (2019) 69:402. doi: 10.1093/occmed/kqz010
10. Robroek SJ, van Lenthe FJ, van Empelen P, Burdorf A. Determinants of participation in worksite health promotion programmes: a systematic review. *Int J Behav Nutr Phys Act.* (2009) 6:26. doi: 10.1186/1479-5868-6-26
11. Meershoek A, Bartholomée, Y, Aarden, E, Hoyweghen IV, Horstman K. Vitaal en bevlogen: vermarkting van gezondheid van werknemers. *WRR-Project Markt, Staat en Samenleving.* (2011).
12. Burdorf A. *Kennissynthese Werk(en) is Gezond [Knowledge Synthesis Work(ing) is Healthy]*. Den Haag: Een studie in opdracht van ZonMw. (2016) 53:1–68.
13. Magnavita N. Obstacles and future prospects: considerations on health promotion activities for older workers in Europe. *Int J Environ Res Public Health.* (2018) 15:1096. doi: 10.3390/ijerph15061096
14. Nielsen K, Taris TW, Cox T. The future of organizational interventions: addressing the challenges of today's organizations. *Work Stress.* (2010) 24:219–33. doi: 10.1080/02678373.2010.519176
15. Nielsen K. Review article: how can we make organizational interventions work? Employees and line managers as actively crafting interventions. *Hum Relations.* (2013) 66:1029–50. doi: 10.1177/0018726713477164
16. WRR. *Weten is Nog Geen Doen. Een Realistisch Perspectief of Zelfredzaamheid*. The Hague: Wetenschappelijk Raad voor het Regeringsbeleid (2017).
17. Tafvelin S, von Thiele Schwarz U, Nielsen K, Hasson H. Employees' and line managers' active involvement in participatory organizational interventions: examining direct, reversed, and reciprocal effects on well-being. *Stress Health.* (2019) 35:69–80. doi: 10.1002/smi.2841
18. Nielsen K, Randall R, Holten A-L, González ER. Conducting organizational-level occupational health interventions: what works? *Work Stress.* (2010) 24:234–59. doi: 10.1080/02678373.2010.515393
19. Knight C, Patterson M, Dawson J, Brown J. Building and sustaining work engagement—A participatory action intervention to increase work engagement in nursing staff. *Euro J Work Org Psychol.* (2017) 26:634–49. doi: 10.1080/1359432X.2017.1336999
20. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Admin Sci Quart.* (1979) 24:285–308. doi: 10.2307/2392498
21. Nielsen K, Randall R. The importance of employee participation and perceptions of changes in procedures in a teamworking intervention. *Work Stress.* (2012) 26:91–111. doi: 10.1080/02678373.2012.682721
22. Bosma H, Marmot MG, Hemingway H, Nicholson AC, Brunner E, Stansfeld SA. Low job control and risk of coronary heart disease in whitehall ii (prospective cohort) study. *BMJ.* (1997) 314:558. doi: 10.1136/bmj.314.7080.558
23. Orton LC, Pennington A, Nayak S, Sowden A, Petticrew M, White M, et al. What is the evidence that differences in 'control over destiny' lead to socioeconomic inequalities in health? A theory-led systematic review of high-quality longitudinal studies on pathways in the living environment. *J Epidemiol Commun Health.* (2019) 73:929–34. doi: 10.1136/jech-2019-212565
24. Francis HM, Ramdhony A, Reddington M, Staines H. Opening spaces for conversational practice: a conduit for effective engagement strategies and productive working arrangements. *Int J Hum Res Manage.* (2013) 24:2713–40. doi: 10.1080/09585192.2013.781530
25. Cabot S. Employees involvement can stem labor-related problems. *Hotel Motel Manage.* (2003) 171:22.
26. O'Brien AT, Alexander Haslam S, Jetten J, Humphrey L, O'Sullivan L, Postmes T, et al. Cynicism and disengagement among devalued employee groups: the need to ASPIRe. *Career Dev Int.* (2004) 9:28–44. doi: 10.1108/13620430410518129
27. Visse M, Abma TA. *Dialooggestuurde Zorg(Innovaties) [Dialogue-Based Healthcare(Innovations)]. Vernieuwende Zorgpraktijken, Verbindende Waarden*. Den Haag: Lemma (2008).
28. Bergman D, Arnetz B, Wahlström R, Sandahl C. Effects of dialogue groups on physicians' work environment. *J Health Org Manage.* (2007) 21:27–38. doi: 10.1108/14777260710732240
29. Senge PM. *The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization*. New York, NY: Currency (1994).
30. Bartholomew LK, Parcel GS, Kok G, Gottlieb NH. Planning health promotion programs. In: Schaalma H, Markham C, Tyrrell S, Shegog R, Fernández M, Mullen PD, et al., editors. *An Intervention Mapping Approach, 2nd ed*. San Francisco, CA: Jossey-Bass (2006), 1–704.
31. Ammendolia C, Côté P, Cancelliere C, Cassidy JD, Hartvigsen J, Boyle E, et al. Healthy and productive workers: using intervention mapping to design a workplace health promotion and wellness program to improve presenteeism. *BMC Public Health.* (2016) 16:1190. doi: 10.1186/s12889-016-3843-x
32. Meng A, Borg V, Clausen T. Enhancing the social capital in industrial workplaces: Developing workplace interventions using intervention mapping. *Eval Prog Plann.* (2019) 72:227–36. doi: 10.1016/j.evalprogplan.2018.11.007
33. Belansky ES, Cutforth N, Chavez R, Crane LA, Waters E, Marshall JA. Adapted intervention mapping: a strategic planning process for increasing physical activity and healthy eating opportunities in schools via environment and policy change. *J School Health.* (2013) 83:194–205. doi: 10.1111/josh.12015
34. Hazelzet E, Houkes, I, Bosma, H, De Rijk, et al. Using intervention mapping to develop "Healthy HR" aimed at improving sustainable employability of low-educated employees (unpublished manuscript).
35. Houkes I, Miglioretti M, Picco E, De Rijk AE. Tapping the employee perspective on the improvement of Sustainable Employability (SE): validation of the MAastricht Instrument for SE (MAISE-NL). *Int J Environ Res Public Health.* (2020) 17:2211. doi: 10.3390/ijerph17072211
36. Rosner B. *Fundamentals of Biostatistics. 4th Edn*. Belmont: Duxbury Press (1995).
37. Schaufeli WB, Bakker AB. Bevlogenheid: een begrip gemeten [work engagement: a concept measured]. *Gedrag Org.* (2004) 17:89–112.
38. Schaufeli WB, Shimazu A, Hakanen J, Salanova M, De Witte H. An ultra-short measure for work engagement: The UWES-3 validation across five countries. *Euro J Psychol Assessment.* (2017) 35:577–91. doi: 10.1027/1015-5759/a000430
39. Veldhoven M, Prins J, van der Laken P, Dijkstra L. *QEEW2.0: 42 Short Scales for Survey Research on Work, Well-Being and Performance* Amsterdam, SKB. (2015).
40. De Jonge J, Landeweerd JA, Van Breukelen GJP. De maastrichtse autonomielijst: achtergrond, constructie en validering' [The Maastricht Autonomy Questionnaire: background, construction and validation]. *Gedrag Org.* (1994) 7:27–41.
41. Bosscher RJ, Smit JH. Confirmatory factor analysis of the general self-efficacy scale. *Behav Res Therap.* (1998) 36:339–43. doi: 10.1016/S0005-7967(98)00025-4
42. Peters V, Houkes I, de Rijk AE, Bohle PL, Engels JA, Nijhuis FJN. Which resources moderate the effects of demanding work schedules on nurses working in residential elder care? A longitudinal study. *Int J Nursing Stud.* (2016) 58:31–46. doi: 10.1016/j.ijnurstu.2016.01.008
43. Pronk NP, Katz AS, Gallagher J, Austin E, Mullen D, Lowry M, et al. Adherence to optimal lifestyle behaviors is related to emotional health indicators among employees. *Population Health Manage.* (2011) 14:59–67. doi: 10.1089/pop.2010.0007

44. Pronk NP. An optimal lifestyle metric: four simple behaviors that affect health, cost, and productivity. *ACSM's Health Fitness J.* (2012) 16:39–43. doi: 10.1249/01.FIT.0000414748.25945.58
45. Abildgaard JS, Saksvik PØ, Nielsen K. How to measure the intervention process? An assessment of qualitative and quantitative approaches to data collection in the process evaluation of organizational interventions. *Front Psychol.* (2016) 7:1380. doi: 10.3389/fpsyg.2016.01380
46. Nielsen K, Randall R. Opening the black box: Presenting a model for evaluating organizational-level interventions. *Euro J Work Org Psychol.* (2013) 22:601–17. doi: 10.1080/1359432X.2012.690556
47. Nielsen K, Abildgaard JS. Organizational interventions: a research-based framework for the evaluation of both process and effects. *Work Stress.* (2013) 27:278–97. doi: 10.1080/02678373.2013.812358
48. Linnan L, Steckler A. *Process Evaluation for Public Health Interventions and Research*. San Francisco, CA: Jossey-Bass. (2002). p. 1–23.
49. Johns G. The essential impact of context on organizational behavior. *Acad Manage Rev.* (2006) 31:386–408. doi: 10.5465/amr.2006.20208687
50. Abma T. Responsive evaluation: the meaning and special contribution to public administration. *Pub Admin.* (2004) 82:993–1012. doi: 10.1111/j.0033-3298.2004.00428.x
51. Carter N, Bryant-Lukosius D, Dicenso A, Blythe J, Neville A. The use of triangulation in qualitative research. *Oncol Nursing Forum.* (2014) 41:545–7. doi: 10.1188/14.ONF.545-547
52. Kaplowitz MD, Hoehn JP. Do focus groups and individual interviews reveal the same information for natural resource valuation? *Ecol Econ.* (2001) 36:237–47. doi: 10.1016/S0921-8009(00)00226-3
53. Nielsen K, Miraglia M. What works for whom in which circumstances? On the need to move beyond the 'what works?' question in organizational intervention research. *Hum Relat.* (2017) 70:40–62. doi: 10.1177/0018726716670226


**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 Public Health

POLICY BRIEF
published: 08 October 2020
doi: 10.3389/fpubh.2020.577499

# Protecting Healthcare Workers Amid the COVID-19 Crisis: A Safety Protocol in Wuhan

*Yunlu Liu[1†], Shijun Yang[2†], Man Hung[3], Wei Tong[1*] and Yong Liu[1*]*

[1] Department of Orthopaedics, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [2] Department of Cardiology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [3] College of Dental Medicine, Roseman University of Health Sciences, South Jordan, UT, United States

Coronavirus disease 2019 (COVID-19), which is caused by a distinct coronavirus, is an acute infectious disease that spreads mainly via the respiratory route. During the COVID-19 outbreak, many healthcare systems faced a severe burden when a large number of healthcare workers (HCWs) became infected due to the lack of adequate protection. Consequently, it was apparent that it is important to ensure the health and safety of HCWs in order to control the outbreak throughout society. In this article, we share our successful protocol for protecting the safety of HCWs in the course of their daily work in an orthopedics department with the aim of eventually reducing the risk of nosocomial infection. None of our HCWs or their families contracted the infection during the COVID-19 pandemic.

**Keywords: COVID-19, SARS-CoV-2, Wuhan, healthcare workers, protocol**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic, Monash University, Australia*

***Reviewed by:***
*Luigi Vimercati, University of Bari Aldo Moro, Italy*
*Yuke Tien Fong, Singapore General Hospital, Singapore*

****Correspondence:***
*Wei Tong*
*tongwei312@126.com*
*Yong Liu*
*lw7812@126.com*

*† These authors have contributed equally to this work*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *29 June 2020*
***Accepted:*** *26 August 2020*
***Published:*** *08 October 2020*

***Citation:***
*Liu Y, Yang S, Hung M, Tong W and Liu Y (2020) Protecting Healthcare Workers Amid the COVID-19 Crisis: A Safety Protocol in Wuhan. Front. Public Health 8:577499. doi: 10.3389/fpubh.2020.577499*

## INTRODUCTION

In December 2019, an outbreak of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in Wuhan, China, and subsequently spread rapidly around the world (1). In order to control the COVID-19 spread, the Chinese government imposed a lockdown of Wuhan City on January 23, 2020 (2). The most common symptoms of SARS-COV-2 infection are fever, cough, shortness of breath, and myalgia or fatigue. SARS-CoV-2 is highly contagious and can be transmitted by droplets, via direct contact and possibly by aerosols (3). On March 11, 2020, the World Health Organization declared the disease a pandemic. As of August 5, 2020, there were 18,318,928 confirmed cases and 695,043 confirmed deaths reported globally (4).

During the early stage of the COVID-19 outbreak, many healthcare workers (HCWs) became infected due to lack of appropriate infection prevention and control protocols and implementation procedures. In Wuhan Union Hospital, 14 HCWs were infected by two index patients in the early days (5). In Italy, more than 3,300 HCWs had been infected, and at least 22 had died by early March, and by the end of March, COVID-19 had infected 20% of the frontline HCWs, and many had died (6). In the United States, by April 4, 2020 a total of 9,282 HCWs had been infected by COVID-19, including 27 deaths (7). However, in our hospital the infection became well-controlled once a strict safety protocol was implemented. Starting from January 25, 2020, our hospital was one of the designated hospitals for intensive care treatment of COVID-19 patients, yet none of the HCWs there was infected during the frontline medical care of COVID-19 patients following the implementation of the strict safety protocol.

At present, multiple countries are experiencing the COVID-19 pandemic, and HCWs are the most valuable resource in every country for saving patients' lives. Thus, it is imperative to protect the health and safety of HCWs during the COVID-19 pandemic so that they can treat patients. Fortunately, effective infection control measures have been put in place to protect the safety of HCWs in some countries (8–10). The aim of this article is to share our successful protocol, which ensured the safety of all of the HCWs in our orthopedics department and strengthened the overall COVID-19 epidemic control. This protocol covered five aspects: (1) safety protection classification, (2) reasonable working hours, (3) ward protection, (4) operating room protection, and (5) rest area protection. These aspects are presented individually in the following sections.

## SAFETY PROTECTION CLASSIFICATION

Beginning on January 20, 2020, infection control training was provided to all medical staff at our hospital. The infection control measures implemented in our hospital's orthopedic department were based on detailed risk assessments by both local orthopedic and infection control experts. These measures were classified into a four-level hierarchy of control and were used in different risk environments for recommendation of personal protective equipment (PPE) usage for HCWs (**Table 1**).

## REASONABLE WORKING HOURS

HCWs could have been infected due to the shortage of staff and lack of supplies resulting from the large influx of COVID-19 patients in the early stages (11, 12). Previous studies have demonstrated that severe fatigue can contribute to a higher probability of contracting COVID-19 in HCWs; thus, reducing workload could be a strategy for orthopedic surgeons to defend against becoming infected with COVID-19 (12). In our hospital, frontline medical staff were limited to work for 3 h in the quarantine ward and 8 h in the clean office area during a regular day. Ensuring that frontline medical staff have adequate rest time was a priority in the orthopedic department of our hospital.

## WARD PROTECTION

Our ward was divided into three areas, comprising the quarantine ward, buffer zone, and clean area (**Figure 1**). The COVID-19 patients' access to the ward was separate from that of the HCWs. The HCWs were obliged to wear appropriate PPE before entering the buffer zone. This procedure involved two HCWs working together to check for any damage to their PPE. After the HCWs entered buffer zone 1, they again helped each other to ensure that their PPE was properly secured in place. In the quarantine ward, the hands of the HCWs were disinfected with 75% alcohol before and after patient contact. Once their work in the quarantine ward was finished, the HCWs entered buffer zone 2 to remove their PPE. It was important that the PPE be removed following a given order (see **Figure 2** for details). The HCWs then disinfected the contaminated PPE in the buffer room. Subsequently, the HCWs put on a new surgical mask, left the buffer zone, and entered the clean office area. It was important to ensure that the door into the buffer zone and the door out of the buffer zone could not be opened at the same time.

HCWs working in the clean area (i.e., level 0) only needed to wear white coats and N95 respirators (or surgical masks). We used throat swabs to sample items in the clean area regularly and removed any items having positive SARS-CoV-2 nucleic acid test results. We also ensured that the HCWs refrained from touching their eyes, nose, or mouth before performing hand hygiene. In addition, we required the HCWs to put their cell phones in a clear plastic protective bag to minimize accidental contamination of their cell phones.

It was essential to follow the principles of social distancing and avoid face-to-face contact with colleagues during meal times to minimize potential disease transmission. In our hospital, no more than three HCWs were allowed to eat at the same time in the dining area, and everyone must keep a distance of more than 1 m.

When the HCWs left the office area, they entered the disinfection room to change into a new mask, disinfect their personal belongings, and perform hand hygiene.

## OPERATING ROOM PROTECTION

During the outbreak of COVID-19, elective surgeries had been suspended in many areas (13, 14). However, some patients affected by fracture and soft tissue injury required immediate assessment and emergency surgeries. In the department of orthopedics, we treated seven COVID-19 patients with fracture and one with lower limb ischemia and necrosis, of whom four

**TABLE 1 |** Infection control measures across protection levels.

| Protection level | Personal protective equipment | Recommended usage |
|---|---|---|
| Level 0 | White coats, surgical mask or N95 respirator, surgical cap | Clean area (office of healthcare worker) |
| Level I | Protective suits, surgical mask or N95 respirator, protective goggles, gloves, shoe covers, surgical cap | Ward rounds |
| Level II | Protective coveralls, N95 respirator, protective goggles, gloves (double), long shoe covers, surgical cap | Transferring patients, dressing change, stitches removed |
| Level III | Protective coveralls, N95 respirator and surgical mask, protective goggles, gloves (triple), long shoe covers, surgical cap, powered air purifying respirators | Contact with patients' blood, body fluids, and involvement in any aerosol-generating procedures |

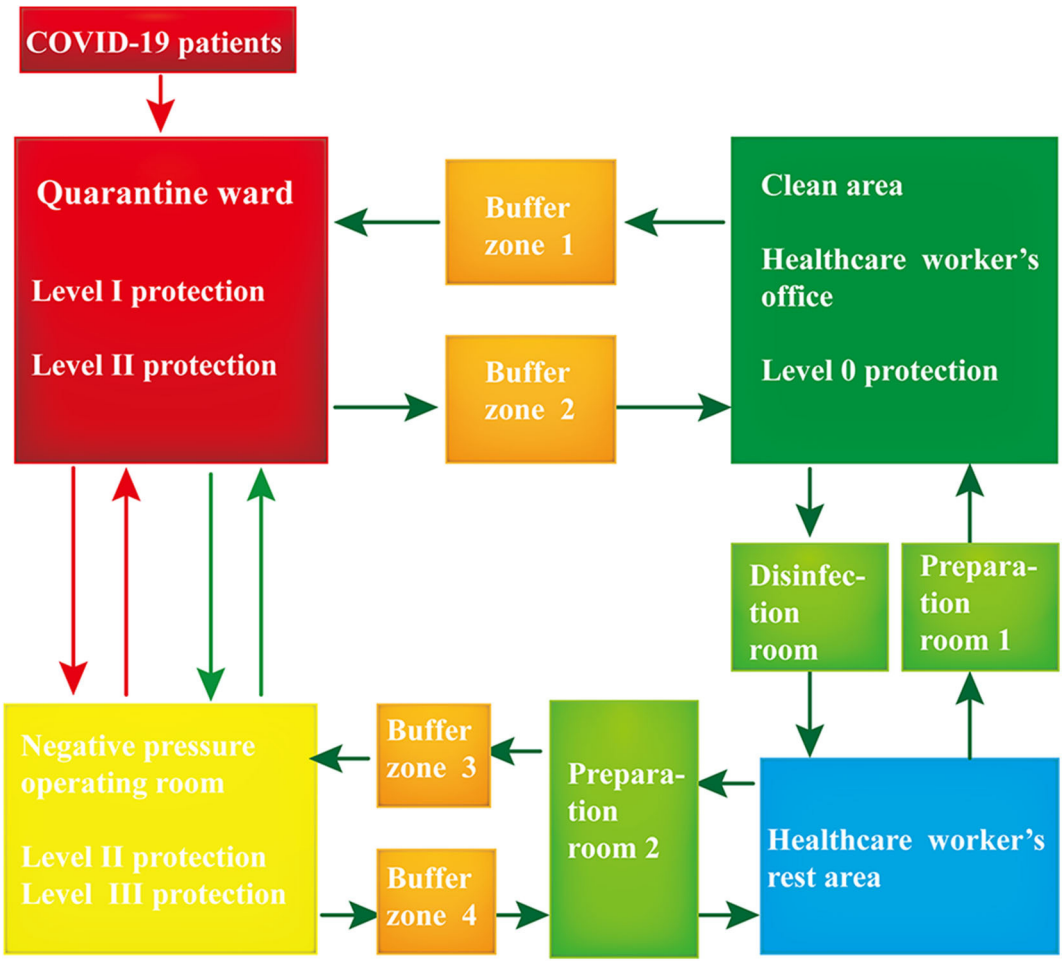


**FIGURE 1 |** Conceptual scheme of workplace protection for healthcare workers (HCWs). The green arrows show the direction of movement of the HCWs; the red arrows show the direction of movement of the coronavirus disease 2019 (COVID-19) patients. The entrances to all rooms were marked with specific signs warning the HCWs to move in the right direction. Patients testing positive for COVID-19 were directed to the quarantine ward where they were placed in individual isolation rooms for further treatment. The clean area comprised the office where the medical staff worked, and measures were taken to prevent the virus from entering this area. The disinfection room was the place where the HCWs disinfected their personal belongings (cell phone, watch, and so on) and performed hand hygiene. The preparation room was the place where the HCWs dressed in appropriate personal protective equipment (PPE). The negative pressure operating room was designated for the surgical treatment of COVID-19 patients, and it is an effective measure to control the source of infection and block the route of transmission.

| Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---|---|---|---|---|
| Remove protective coveralls and gloves; Peel off protective coveralls & gloves and roll inside-out | Perform hand hygiene | Remove cap; Remove protective goggles from behind | Remove mask from behind | Perform hand hygiene |

**FIGURE 2 |** The order of removing personal protective equipment.

patients underwent surgical treatment. None of the HCWs was infected as a result of caring for these COVID-19 patients.

The COVID-19 patients were transferred to a negative pressure operating room through a separate path and elevator by operative staff wearing PPE (level II). During the transfer, the patients wore a surgical mask. The surgeon entered preparation room 2, changed into an operating gown, performed surgical hand preparation, and dressed in the appropriate PPE (level III). After adequate safety examination and proper protection were secured in buffer zone 3, the surgeon entered the negative pressure operating room. The COVID-19 patient was anesthetized by an anesthesiologist wearing PPE (level II) in the negative pressure room. However, if the patient was under general anesthesia, which involved an open airway, the anesthesiologist must wear a full-face mask. The surgeon wore a full-face mask, disinfected his/her hands with 75% alcohol solution, and put on the first pair of sterile surgical gloves and sleeve protectors, followed by a sterile, disposable, surgical gown, and then a second pair of gloves. Subsequently, the surgeon placed the COVID-19 patient in an appropriate surgical position.

SARS-CoV-2 can be transmitted by droplets, direct contact, and possibly by aerosols. In orthopedic surgical procedures, the use of powered instruments, such as electrocautery, bone saws, reamers, and drills, releases aerosols (15). Therefore, in these high-risk procedures, it was necessary for us to minimize the number of surgical staff involved and to shorten the operation time as much as possible. Each operation room was equipped with skilled staff according to the operation type. The surgical staff were not allowed to leave the operating room, and the external staff could not enter the operating room until the operation was completed. All protective apparel and respirators were immediately discarded before leaving the operating room.

At the end of the surgical procedure, the surgeon would remove the outermost pair of gloves, the surgical gown, sleeve protectors, and full-face mask. His/her hands were disinfected with an alcohol solution, and then the surgical mask and the surgical cap were removed. Finally, the surgeon removed all his/her gloves and disinfected his/her hands before leaving the operating room. The PPE was removed in buffer zone 4, and hand hygiene was performed before entering preparation room 2 where the surgeon took a shower.

## REST AREA PROTECTION

The rest area for HCWs was a hotel next to the hospital, which was requisitioned by the hospital. The hospital also guaranteed the availability of adequate food and daily living supplies for everyone in the hotel. HCWs in the hotel could take shuttle buses to and from the hospital. In addition, if an HCW was accidentally exposed to COVID-19, they would be required to leave the frontline and remain under quarantine for 14 days in the hotel. All the staff were advised to measure their own body temperatures daily and promptly report any symptoms of upper respiratory tract infection, vomiting, or diarrhea. Medical staff would also be quarantined in the hotel for 14 days when they left the frontline before returning home. In addition, a physical examination including pulmonary computed tomography, COVID-19 nucleic acid, and antibody testing are also needed. This ensured that the colleagues and families of HCWs could also be properly protected.

## CONCLUSIONS

With the rapid spread of COVID-19, many healthcare systems faced severe burdens. In the early stage, a large number of medical staff were infected due to the lack of adequate protection. Currently, the COVID-19 pandemic is evolving into more of a marathon and less of a short-lived sprint (16). Some experts have warned of a possible second wave of COVID-19 (17). In the long run, proper protection from contracting COVID-19 in clinics and hospitals is necessary and will likely become the norm. The protection of HCWs and appropriate training are of paramount importance in the fight against COVID-19. We hope our protocol of measures, which successfully controlled COVID-19 infection in our orthopedics department, can help HCWs minimize the risks of infection in medical facilities around the world.

## AUTHOR CONTRIBUTIONS

YuL collected the data and drafted the manuscript. SY helped conceive the study and drafted the manuscript. MH contributed to language control and revised the manuscript. WT and YoL conceived the study, coordinated the study tasks, and helped draft the manuscript. All authors contributed to improvement of the manuscript and approved the submitted version.

## FUNDING

This work was supported by grants from the National Natural Science Foundation of China (Grant nos: 81702157 and 81900947).

## REFERENCES

1. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* (2020) 382:1708–20. doi: 10.1056/NEJMoa2002032
2. The State Council, China. *Wuhan Novel Coronavirus Prevention and Control Command Notice (no 1).* (2020). Available online: http://www.gov.cn/xinwen/2020-01/23/content_5471751.htm (accessed May 2, 2020).
3. Zhang LP, Wang M, Wang Y, Zhu J, Zhang N. Focus on a 2019-novel coronavirus (SARS-CoV-2). *Future Microbiol.* (2020) 15:905–18. doi: 10.2217/fmb-2020-0063
4. World Health Organization. *Coronavirus Disease (COVID-19)Pandemic.* (2020). Available online at: https://www.who.int/emergencies/diseases/novel-Coronavirus-2019 (accessed August 5, 2020).
5. Wei XS, Wang XR, Zhang JC, Yang WB, Ma WL, Yang BH, et al. A cluster of health care workers with COVID-19 pneumonia caused by SARS-CoV-2. *J Microbiol Immunol Infect.* (2020). doi: 10.1016/j.jmii.2020.04.013. [Epub ahead of print].

6. The Lancet. COVID-19: protecting health-care workers. *Lancet.* (2020) 395:922. doi: 10.1016/S0140-6736(20)30644-9
7. Team CC-R. Characteristics of health care personnel with COVID-19 - United States, february 12-April 9, 2020. *MMWR Morb Mortal Wkly Rep.* (2020) 69:477–81. doi: 10.15585/mmwr.mm6915e6
8. Vimercati L, Tafuri S, Chironna M, Loconsole D, Fucilli FIM, Migliore G, et al. The Covid-19 hotel for healthcare workers: an Italian best practice. *J Hosp Infect.* (2020) 105:387–8. doi: 10.1016/j.jhin.2020.05.018
9. Luigi V, Alessandro D, Giovanni M, Luigi M, Antonio C, Marco Q, et al. Prevention and protection measures of healthcare workers exposed in health settings to severe acute respiratory infections from Sars-Cov-2 in a university hospital in Bari, Apulia Region, Southern Italy. *J Hosp Infect.* (2020) 105:454–8. doi: 10.1016/j.jhin.2020.05.024
10. Rivett L, Sridhar S, Sparkes D, Routledge M, Jones NK, Forrest S, et al. Screening of healthcare workers for SARS-CoV-2 highlights the role of asymptomatic carriage in COVID-19 transmission. *Elife.* (2020) 9:e58728. doi: 10.7554/eLife.58728
11. Adalja AA, Toner E, Inglesby TV. Priorities for the US Health Community responding to COVID-19. *JAMA*. (2020) 323:1343–4. doi: 10.1001/jama.2020.3413
12. Guo X, Wang J, Hu D, Wu L, Gu L, Wang Y, et al. Survey of COVID-19 Disease Among Orthopaedic Surgeons in Wuhan, People's Republic of China. *J Bone Joint Surg Am.* (2020) 102:847–54. doi: 10.2106/JBJS.20.00417
13. Iacobucci G. Covid-19: all non-urgent elective surgery is suspended for at least three months in England. *BMJ.* (2020) 368:m1106. doi: 10.1136/bmj.m1106
14. Coimbra R, Edwards S, Kurihara H, Bass GA, Balogh ZJ, Tilsed J, et al. European Society of Trauma and Emergency Surgery (ESTES) recommendations for trauma and emergency surgery preparation during times of COVID-19 infection. *Eur J Trauma Emerg Surg.* (2020) 46:505–10. doi: 10.1007/s00068-020-01364-7
15. Yeh HC, Turner RS, Jones RK, Muggenburg BA, Lundgren DL, Smith JP. Characterization of aerosols produced during surgical procedures in Hospitals. *Aerosol Sci Technol.* (1995) 22:151–61. doi: 10.1080/02786829408959736
16. Lee Ting Soh T, Loong Ho SW, Quan Yap WM, Yoong-Leong Oh J. Spine surgery and COVID-19. *J Bone Joint Surg.* (2020) 102:e56. doi: 10.2106/JBJS.20.00503
17. Xu S, Li Y. Beware of the second wave of COVID-19. *Lancet.* (2020) 395:1321–2. doi: 10.1016/S0140-6736(20)30845-X


**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 Public Health

ORIGINAL RESEARCH
published: 30 October 2020
doi: 10.3389/fpubh.2020.531116

# A Corporate Wellness Program and Nursing Home Employees' Health

*Gabriela Kernan[1]*, Manuel Cifuentes[2], Rebecca Gore[3], David Kriebel[1] and Laura Punnett[3]*

*[1] Department of Public Health, University of Massachusetts Lowell, Lowell, MA, United States, [2] Department of Public Health, Regis College, Weston, MA, United States, [3] Department of Biomedical Engineering, University of Massachusetts Lowell, Lowell, MA, United States*

**Background:** Many employed Americans suffer from chronic conditions like obesity, diabetes, and cardiovascular diseases. Worksite wellness programs provide opportunities to introduce health promotion strategies. While there is evidence of the effectiveness of workplace health promotion, this is tempered by concern that benefits may be less available to low-wage workers with inflexible working conditions.

**Objective:** The aim was to evaluate a workplace health promotion (WHP) in the long-term care sector (skilled nursing facilities).

**Methods:** Nursing home employees from 18 facilities within a single company were surveyed by a standardized, self-administered questionnaire. A company-sponsored WHP program was offered to the facilities, which were free to take it up or not. We categorized the facilities by level of program adoption. Cross-sectional associations were estimated between program category and prevalence of individual-level worker health indicators, adjusting for center-level working conditions.

**Results:** A total of 1,589 workers in 5 job categories completed the survey. Average levels of psychological demands and social support at work were relatively high. Supervisor support stood out as higher in centers with well-developed WHP programs, compared to centers with no programs. There were no differences among program levels for most health outcomes. Workers in centers with well-developed programs had slightly lower average body mass index and (unexpectedly) slightly lower prevalence of non-smoking and regular aerobic exercise.

**Conclusions:** Only small health benefits were observed from well-developed programs and working conditions did not appear to confound the negative results. This low-intensity, low-resourced workplace health promotion program may have benefited a few individuals but seems to have had only modest influence on average levels of the measured health indicators. Many nursing home employees experience obstacles to health behaviors; approaches that provide more environmental and economic supports for healthy behaviors, such as *Total Worker Health*®, may yield larger health benefits.

**Keywords: body mass index, leisure-time exercise, health behaviors, work environment, healthcare workers, nursing homes, interventions**

OPEN ACCESS

***Edited by:***
*Leah Okenwa Emegwa, Swedish Red Cross University College, Sweden*

***Reviewed by:***
*Marzuki Isahak, University of Malaya, Malaysia*
*Siti Munira Yasin, MARA University of Technology, Malaysia*

****Correspondence:***
*Gabriela Kernan*
*Gabriela_Kernan@student.uml.edu;*
*Gabriela.Kernan@gmail.com*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *31 January 2020*
***Accepted:*** *21 September 2020*
***Published:*** *30 October 2020*

***Citation:***
*Kernan G, Cifuentes M, Gore R, Kriebel D and Punnett L (2020) A Corporate Wellness Program and Nursing Home Employees' Health. Front. Public Health 8:531116. doi: 10.3389/fpubh.2020.531116*

## INTRODUCTION

Most adults in the United States are employed and spend on average of 8.5 h per day in a work-related activity. Workplaces thus provide an environment to educate employees how to adopt healthy lifestyles (1). Worksite health promotion (WHP) has been recognized as a public health strategy (2) and a number of large US employers offer some type of wellness programming as a part of their employees' health benefits (3). At the same time, working conditions represent potential obstacles to health behaviors (4). The dilemma is under-studied in the literature.

WHP programs are typically intended to modify employee health behaviors in order to reduce risk for chronic health conditions. Typical components include some form of health assessment and education about smoking, alcohol consumption, healthy eating, sleep, and exercise (5–7). In the United States, the underlying premise of WHP is simple: A healthy workforce can be financially beneficial to the employer by lowering medical health care spending (8, 9). Employers who initiate such programs are typically motivated by goals such as decreasing absenteeism, increasing job satisfaction, and reducing the cost of group health care coverage (9–13). There is some evidence that healthier employees are more productive and are less likely to miss work (10, 14, 15). Over the past three decades, the popularity of WHP programs has increased notably (1, 15, 16).

However, there is no clear consensus with respect to empirical WHP program effectiveness and benefits (16–20). Rongen et al. (21) conducted a systematic review of randomized clinical trials of the effect of workplace health promotion programs on smoking cessation, physical activity, healthy nutrition, and/or obesity, self-perceived health, work absence due to sickness, work productivity, and concluded that overall effect of WHP programs are small. Studies that have reported positive WHP effectiveness are often not free of methodological issues (21–25). Some suffered from small sample size (19), while some larger, longitudinal studies found no or very little effect (5, 26).

Another important caveat concerns program setting and limits on generalizability. Many positive studies had participation mostly from better-off employees, with unequal proportions by race or ethnicity and barriers such as working conditions and low socioeconomic status unaccounted for (27, 28). Most published studies from the United States describe WHP programs that rely on group health insurance resources (16, 18, 29, 30). Low-wage workers often cannot afford health insurance offered by their employers and therefore do not have access to those programs (28). Many other countries organize their preventive health care and medical insurance differently, meaning that income is not a barrier to services; results from these studies would not necessarily apply to the U.S. context.

The lack of consistency in the research literature prompts us to a point where we must ask ourselves "Are WHPs working?" If so, is it true in all settings, or only in a few, highly selective ones? Moreover, are they equally effective for all workers? (31).

Worksite health promotion activities typically target health behavior choices by individuals but do not often consider the fact that behaviors tend to cluster in certain populations and are not randomly distributed among groups. For example, SES is negatively associated with BMI (32), which may reflect a wide range of mediating causal variables (4). Therefore, health promotion programs should consider the environmental and mediating factors that affect specific groups, whether defined by socioeconomic status, ethnicity, and/or occupation.

With the projection of the healthcare sector growing faster than others, this workforce's health is a necessity (33). Nursing aides employed in nursing homes are a vulnerable low-wage population; most of them are middle-aged, and many also are recent immigrants or single parents. They work long hours to make ends meet (32). Finding time and energy for exercise may be impossible after a physically or emotionally fatiguing workday; difficulty in balancing work with family demands, especially common for working women, may exacerbate this. Comfort eating, as well as other unhealthy behaviors, serves as coping strategies for many workers to better tolerate or relieve work-induced fatigue and/or stress (34). Shiftwork and excessively long work hours disrupt sleep and metabolism, in turn increasing the risk of obesity and metabolic syndrome. Night work also interferes with exercise through physiological as well as behavioral mechanisms (35, 36).

The overall objective of this study was to evaluate a workplace health promotion (WHP) program in a sample of long-term care facilities (nursing homes). We sought to compare facilities with different levels of WHP programming in terms of workers' health behaviors, and perceived working conditions. Specific research questions were: (1) Are there differences related to facility WHP programs with respect to employee health behaviors, health beliefs, or working conditions; and (2) does social support from coworkers and/or supervisors mediate the association between WHP and health outcomes.

## MATERIALS AND METHODS

This cross-sectional study is based on a larger project ["Promoting Caregivers' Physical & Mental Health via Transdisciplinary Intervention (ProCare)"] examining health of employees of long-term nursing facilities located in several states of the U.S. and managed by one company (37–40). Each center was provided with educational materials for employees and (at first) a small annual budget for health promotion activities, which was subsequently canceled. The centers had the freedom to use it or not and to design their own WHP strategies. No release time was authorized for employees to participate in any activities. To our knowledge, there were no professional wellness consultancies contracted, and no WHP professionals were employed directly by the company.

The independent variable was WHP programming level, classified at the facility level. Data were collected by multiple methods. Two rounds of a survey were distributed to management representatives (facility director, Director of Nursing, etc.) to gather information on type of activities, their length and frequency, and who sponsored them within the center. Activities were counted by category targeting specific health behaviors: eating habits, weight management, voluntary exercise, stress reduction, and other health promotion topics (**Table 1**).

**TABLE 1 |** Selected questions from corporate survey of center representatives about WHP activities offered.

| **For the past year, indicate which of these activities were done, number of participants, length of time that the activity was in place, and number of times that it was offered.** |
|---|
| **Healthy eating (examples)** |
| "Healthy" vending machine foods; Healthy "light" recipe swap; Healthy potluck/bag lunch group; Healthy food tasters contest |
| **Weight loss (examples)** |
| Biggest Loser; Weight Watchers; Weight loss program discount |
| **Exercise (examples)** |
| Tai Chi, Yoga, Aerobics; Competition for walking miles, lost inches, etc.; Exercise room on site; Bicycle rack to parking lot; Allow exercise during work time; Designated walking route around center grounds; Walking club; Use of center's equipment |
| **Stress reduction (examples)** |
| Traveling massage; Quiet room; Meditation class; Relaxation techniques class |
| **Health promotion (examples)** |
| Blood pressure clinics; Health fair with screenings; Smoking cessation program; Wellness bulletin board or newsletter |

This was supplemented by a brief survey distributed by the investigators, in an attempt to fill in gaps from non-respondents to the corporate surveys.

For each of the 18 centers, a wellness composite score was developed based on the sum of activities and program classification. Some centers had formal wellness programs in place, while some had only informal employee-based initiatives. WHP programming was categorized as: (1) "well developed," meaning there was a formal plan at the center with at least three different health activities, program champion, and/or committee; (2) "emerging," meaning employee-initiated only, with one or two activities offered; (3) no WHP; or (4) unknown status (no response to any survey).

Data from individual workers were collected by self-administered questionnaires. The population comprised of active direct-care employees: nursing aides (CNAs, GMAs, etc.), licensed practical nurses (LPNs), and registered nurses (RNs). Other occupations such as office, clerical, janitorial, food, and recreational services were defined as not eligible. The procedures of survey administration were described in details elsewhere (37–39). The study was approved by the University of Massachusetts Lowell Institutional Review Board (IRB #06-1403).

Outcome variables were measured using validated instruments, when possible. Health behaviors were assessed by questions about the frequency of weekly physical exercise, smoking habits, and sleep quality. Self-reported height and weight were used to calculate body mass index (BMI). Self-rated health (mental and physical) were measured by the SF-12 (41). Behavioral changes within the last 3 months were assessed by a set of items using the same question stem: "Have you changed during the last 3 months how often you do any of the following:" (1) Eat high fat food, (2) Eat a diet high in fiber, (3) Try to lose weight, (4) Exercise, (5) Have stress in my life, (6) Drink alcohol, and (7) Get a full night sleep. The ratings varied from 1 (much less often than the participant used to do) to (5 much more often than used to do).

Measured working conditions included perception of supervisory and coworker support (2 items each), job strain defined as the ratio of psychological demand (effort required to perform the job and time pressure; 2 items) to decision-making latitude (combination of job decision-making authority and the opportunity to use and develop skills on the job; 2 items), physical job exertion (42), workers' perception of control over their work schedule (2 items) (43), perception of safety at work (4 items; 2 from Griffin and Neal (44) and 2 developed by investigators, workplace assault in the past 3 months measured by a single item: "Have you been kicked, grabbed, pushed or scratched by a patient, patient's visitor, or family member?" Beliefs about health were measured by 9 behavior-specific self-efficacy items, which are considered amenable to change following positive or negative experiences (44), and internal health locus of control, which is considered stable throughout adulthood (45).

The SAS® 9.2 system was used for data management and analysis. Cross-tabulation and ANOVA (fitted via PROC GLM) were utilized to compare differences across WHP program levels. Chi-square statistics were employed to test the cross-tabulation results. Schaffe test was used in conjunction with ANOVA to find the mean differences between groups (46). Statistical significance was based on alpha of 0.05.

Separate multivariate models were fitted to examine whether working conditions or health behaviors were associated with program status, starting with variables that differed ($p < 0.05$) in bivariate analyses. Generalized linear models were constructed using the Genmod procedure with link log and identity function. Centers with no WHP were used as a comparison group. Covariates included in the regression models were gender (male or female), job category (nursing aide or other), age, and place of residence (New England or Maryland), as these demonstrated variability across programs. Decision about retention of covariates in the multivariate models was based on the change-in-estimate criterion, keeping the variable in the final model if adding it changed the effect estimates of program status on outcome by 10% or more (47).

## RESULTS

Two, four, and seven centers were classified as having well-developed, emerging, and no WHP programs, respectively. Five

**TABLE 2 |** Sociodemographic and occupational characteristics of nursing home employees ($n$ = 1,589) in 18 skilled nursing facilities classified by level of Worksite Health Promotion (WHP) programing.

| **Worksite health promotion programming status Mean ± SD or *n* (%)** | | | | |
|---|---|---|---|---|
| **Characteristic (range)** | **Well-developed (2 centers; $n$ = 226)[1]** | **Emerging (4 centers; $n$ = 313)[1]** | **No programs (7 centers; $n$ = 591)[1]** | **Unknown (5 centers; $n$ = 459)[1]** |
| **SOCIO-DEMOGRAPHICS** | | | | |
| **Gender*** | | | | |
| Female | 194 (89.0%) | 268 (88.2%) | 487 (87.1%) | 409 (92.3%) |
| Male | 24 (11.0%) | 36 (11.8%) | 72 (12.9%) | 34 (7.7%) |
| **Race/Ethnicity*** | | | | |
| White | 184 (81.4%) | 158 (50.5%) | 240 (41.1%) | 191 (41.6%) |
| Black | 15 (6.6%) | 73 (23.3%) | 262 (44.9%) | 229 (49.9%) |
| Other | 27 (11.9%) | 82 (26.2%) | 82 (14.0%) | 39 (8.5%) |
| **Marital status** | | | | |
| Married (yes) | 128 (57.4%) | 157 (50.8%) | 289 (49.6%) | 223 (49.6%) |
| **Residence**** | | | | |
| New England | 96 (42.5%) | 135 (43.1%) | 279 (7.2%) | 45 (9.8%) |
| Maryland | 130 (57.5%) | 178 (56.9%) | 312 (52.3%) | 414 (90.2%) |
| **Job category**** | | | | |
| Nursing aides | 127 (56.2%) | 170 (54.3%) | 229 (44.0%) | 301 (65.6%) |
| Others | 99 (43.8%) | 143 (45.7%) | 292 (56.0%) | 158 (34.4%) |
| Age (years) (18–78) | 42.3 ±12.3 | 40.2 ±13.0 | 42.1 ±12.6 | 42.5 ± 13.1 |
| Education (years) (8–17) | 13.4 ± 1.8 | 13.3 ± 1.9 | 13.4 ± 1.8 | 13.3 ± 1.7 |
| **WORKING CONDITIONS** | | | | |
| Supervisory support (2–8)* | 5.9 ± 1.3[a] | 5.5 ± 1.5 | 5.5 ± 1.6[ab] | 5.5 ± 1.5[b] |
| Coworker support (2–8)* | 6.0 ± 1.0 | 5.7 ± 1.3[a] | 5.8 ± 1.2[b] | 5.8 ± 1.2 |
| Decision latitude (2–8)* | 5.1 ± 1.1[ca] | 5.2 ± 1.3[b] | 5.6 ± 1.2[a] | 5.4 ± 1.3 |
| Psychological demand (2–8) | 5.7 ± 1.1 | 5.7 ± 1.0 | 5.6 ± 1.1 | 5.7 ± 1.0 |
| Job strain (0–4) | 1.2 ± 0.4 | 1.2 ± 0.5 | 1.1 ± 0.4 | 1.1 ± 0.4 |
| Physical exertion (5–20) | 12.0 ± 3.5 | 12.2 ± 3.7 | 11.6 ± 3.5 | 12.0 ± 3.5 |
| Safety climate (1–4) | 2.8 ± 0.5 | 2.8 ± 0.5 | 2.8 ± 0.5 | 2.8 ± 0.5 |
| Schedule control (2–8) | 5.6 ± 1.4 | 5.6 ± 1.4 | 5.5 ± 1.4 | 5.7 ± 1.3 |
| Recent assault at work (yes) | 78 (34.4%) | 142 (45.4%) | 268 (34.4%) | 203 (42.2%) |

*$p < 0.05$; **$p < 0.0001$.
*(1) Number of participants; N's (%) are based on valid responses to survey items. N's vary slightly among the rows, due to missing values.*
*(abc) Letters indicate the mean differences according to Scheffe method.*

centers did not respond and were designated as unknown. Examples of WHP activities reported by wellness team members addressed all target behaviors and ranged from discrete annual events to ongoing programs. Centers in New England were more likely to have well-developed programs likely because the regional employee health and safety nurse had initiated and championed these efforts. Centers in Maryland received no customized outreach and reported fewer WHP activities.

Survey response rate was about 72% of the complete workforce rosters of clinical staff members. Nursing aides comprised a majority of respondents (**Table 2**). Most participants in all facilities were married women aged between 40 and 43 years old. Body mass index (BMI) varied from 27 to 29, placing the average participant in the overweight category (BMI ≥25). This differed by geographic region, as participants in New England were lighter than those in the South, on average.

Bivariate analyses showed that working conditions were comparable across WHP groups, except for support from supervisors and coworkers as well as decision latitude. Both support constructs were slightly higher in centers with well-developed WHP programs, while decision latitude was lower (**Table 2**).

A majority of respondents had never smoked, and more than half reported to exercise regularly. The prevalence of not smoking and regular aerobic activity were both slightly lower in centers with well-developed programs (**Table 3**).

All but one of the health self-efficacy items were similar among programs. Confidence in ability to lose weight or maintain ideal body weight was lowest in centers with well-developed programs. Degree of change in health behavior within last 3 months was similar across program levels, except that participants in centers with well-developed programs reported having slightly more stress and getting slightly less sleep than they used to do (**Table 3**). Because there were such minimal differences in the health outcomes among groups, there was no power to examine supervisor support as a

**TABLE 3 |** Health behavior and beliefs outcome characteristics of nursing home employees ($n$ = 1,589) in 18 skilled nursing facilities classified by level of Worksite Health Promotion (WHP) programing'.

| **Worksite health promotion programming status Mean ± SD or Percentage (%)** | | | | |
|---|---|---|---|---|
| **Characteristic (range)** | **Well-developed (2 centers; $n$ = 226)[1]** | **Emerging (4 centers; $n$ = 313)[1]** | **No programs (7 centers; $n$ = 591)[1]** | **Unknown (5 centers; $n$ = 459)[1]** |
| **Health behavior** | | | | |
| Smoking (never) | 157 (44.6%) | 244 (58.0%) | 468 (60.7%) | 352 (62.3%) |
| Regular exercise (yes) | 118 (52.7%) | 177 (57.5%) | 333 (57.1%) | 272 (59.8%) |
| Body mass index (12–57)* | 27.8 ± 5.6 | 27.9 ± 6.1 | 29.0 ± 6.5 | 28.8 ± 6.3 |
| **During the last 3 months have you any of the following (1 = do much less to 5 = do much more often)** | | | | |
| Eat high fat | 2.3 ± 1.1 | 2.4 ± 1.3 | 2.4 ± 1.2 | 2.3 ± 1.2 |
| Eat high fiber | 3.3 ± 1.1 | 3.4 ± 1.2 | 3.2 ± 1.2 | 3.3 ± 1.2 |
| Try to lose weight | 3.4 ± 1.0 | 3.4 ± 1.2 | 3.3 ± 1.2 | 3.4 ± 1.2 |
| Exercise | 3.3 ± 1.1 | 3.3 ± 1.3 | 3.2 ± 1.2 | 3.3 ± 1.2 |
| Have stress in my life* | 3.1 ± 1.1 | 3.0 ± 1.2 | 2.9 ± 1.2 | 2.9 ± 1.2 |
| Smoke cigarettes/tobacco[2] | 2.8 ± 0.9 | 2.7 ± 1.0 | 2.8 ± 1.0 | 2.8 ± 1.0 |
| Drink alcohol | 2.6 ± 0.9 | 2.6 ± 1.1 | 2.6 ± 1.1 | 2.6 ± 1.0 |
| Get a full night's sleep* | 2.8 ± 1.0 | 2.3 ± 1.1 | 2.2 ± 1.0[a] | 3.1 ± 1.1[b] |
| **Health perception and beliefs** | | | | |
| **Health self-efficacy–confidence to do consistently for at least 6 months (1 = not to 4 = very)** | | | | |
| Avoid eating high fat foods | 2.7 ± 0.9 | 2.8 ± 0.9 | 2.7 ± 1.0 | 2.8 ± 1.0 |
| Eat fruits/vegetables | 2.9 ± 1.0 | 2.9 ± 1.0 | 2.9 ± 1.0 | 2.9 ± 1.0 |
| Lose or maintain weight* | 2.6 ± 1.0 | 2.8 ± 1.0 | 2.8 ± 1.0[a] | 2.9 ± 1.0[b] |
| Exercise | 2.7 ± 1.0 | 2.8 ± 1.1 | 2.6 ± 1.0 | 2.7 ± 1.0 |
| Reduce amount of stress | 2.5 ± 1.0 | 2.6 ± 1.0 | 2.7 ± 1.0 | 2.7 ± 1.0 |
| Avoid smoking cigarettes[3] | 1.7 ± 0.9 | 1.9 ± 0.9 | 1.7 ± 0.9 | 1.8 ± 0.9 |
| Avoid alcohol or moderate | 3.5 ± 0.9 | 3.5 ± 0.9 | 3.6 ± 0.9 | 3.6 ± 0.8 |
| Get a full night's sleep | 2.7 ± 1.1 | 2.7 ± 1.1 | 2.8 ± 1.0 | 2.8 ± 1.0 |
| Meet most of job demands | 3.4 ± 0.8 | 3.4 ± 0.8 | 3.4 ± 0.8 | 3.5 ± 0.7 |
| **Internal health locus of control** | | | | |
| IHLOC (6–36) | 26.1 ± 5.6 | 25.1± 6.3 | 25.5 ± 6.0 | 26.0 ± 6.4 |

*$p < 0.05$.

*(1) Number of participants; N's (%) are based on valid responses to survey items. N's vary slightly among the rows, due to missing values for individual questionnaire item.*

*(2) Participants were instructed to answer "no change" if they had been a non-smoker for at least 3 months.*

*(3) Smoking self-efficacy was measured among former and current smokers, which were combined into one category.*

*(ab) Letters indicate the mean differences according to Scheffe method.*

mediator of the association between facility WHP level and employee health.

After adjusting for workforce socio-demographic characteristics, supervisor support stood out as higher in centers with well-developed programs, compared to centers with no programs (**Table 4**). Decision latitude was slightly lower in centers with well-developed and emerging programs, compared to those with none. Among behavioral outcomes, BMI was slightly lower among centers with well-developed, emerging, and unknown programs compared with none.

## DISCUSSION

This non-experimental study examined the association of a company-sponsored WHP in the long-term care sector with workers' health indicators, health beliefs and behaviors, and work environment conditions. There were no major differences across the programs with respect to most outcomes. The prevalence of non-smoking, surprisingly, was lower in the two centers with well-developed programs. Smoking behavior is often established early in life and is notoriously difficult to stop; job stress may be one obstacle to smoking cessation, although the literature is inconsistent (48–50). Failure of smoking cessation programs depends of the type occupational activities for example workers who work during the night are more likely to experience smoking cessation failure, and this could vary by age. Some older workers tend to have more fear about the possibility of health deterioration and some of their symptoms may affect smoking cessation in a positive way (51). Similarly, regular exercise was reported least often by workers in centers with well-developed programs, which may reflect lack of leisure time in this population (39). Among recent behavioral changes, workers in centers with well-developed WHP programs reported experiencing more stress and getting less sleep.

**TABLE 4 |** Adjusted odds ratios from Genmod multivariate regression modeling: One model each for well-developed, emerging, and unknown program status, with no programs as the reference group for each model.

| Dependent variable program | Well-developed aOR (95% CI) | Emerging aOR (95% CI) | Unknown aOR (95% CI) |
|---|---|---|---|
| Supervisory support | **1.09 (1.02–1.16)** | 1.03 (0.96–1.09) | 1.03 (0.97–1.10) |
| Coworker support | 1.03 (0.96–1.10) | 0.98 (0.92–1.04) | 1.00 (0.95–1.06) |
| Decision latitude | 0.94 (0.88–1.01) | **0.94 (1.13–1.00)** | 1.00 (0.94–1.06) |
| Recent increase in having stress in life | 1.09 (0.99–1.19) | 1.08 (0.99–1.17) | 1.04 (0.96–1.13) |
| Change in getting full night sleep | 0.94 (0.86–1.04) | 0.98 (0.90–1.07) | 1.00 (0.93–1.09) |
| Lose or maintain ideal weight self–efficacy | 0.94 (0.85–1.04) | 1.01 (0.93–1.10) | 1.01 (0.93–1.10) |
| Body mass index | **0.95 (0.92–0.98)** | **0.97 (0.94–1.00)** | **0.97 (0.94–0.99)** |

*ORs adjusted for worker age, job category, race, gender, and region of residence. adjusted Odds Ratios (aOR) are indicated in bold.*

Average BMI was slightly lower in centers with well-developed and emerging WHP programs, even after adjusting for several other health indicators and work environment features. This is in line with literature indicating that higher intensity programs targeting obesity have a better success rate (52). On the other hand, weight self-efficacy was reported less favorably in well-developed programs. BMI reflects a complex mixture of effects of unhealthy diet, lack of aerobic exercise, and stressful life conditions, as well as the "normal" aging process (32). In this same workforce, we have previously demonstrated a linear increase in BMI with number of workplace stressors: poor coworker support, low decision latitude, recent assault(s) at work, work at night, and lifting heavy loads (40). Others have also reported that work factors such as shiftwork play a role in obesity (36). None of these occupational obstacles to weight loss were addressed in the program evaluated here, which may have limited its impact.

In addition to the direct effects of work stressors on health behaviors, job conditions such as psychosocial strain, overtime, and work scheduling also affect participation in health promotion activities in the workplace (53–55). Poor health behaviors have also been associated with low participation in WHP programs, potentially creating a vicious circle (55). Thus, it is salient to consider the contributions of job stressors in this population. Decision latitude was slightly lower in centers with well-developed or emerging WHPs. The WHP activities did not seek to increase decision latitude at work, and there was also no reason to think that they would diminish it. Thus, it is likely that these differences were pre-existing. Low decision latitude could have exerted a small negative confounding effect on the lack of health benefits from facility WHP activities.

There was a weak pattern of higher social support (especially supervisory) where there were well-developed programs compared to none. Supervisory support was not correlated with health behaviors, so there was no indication that it mediated any benefits of the WHP. Social support was not directly targeted by the company's WHP program. However, it may have been the case that centers with more supportive administrators were more likely to implement WHP activities. Issues such as management support, financial resources, and release time for workers to participate in WHP activities have all been identified as potential barriers to a successful WHP program in this same long-term care company (56), so it would not be surprising if there had been self-selection into WHP adoption by more supportive facility administrators.

The findings of our study are in line with the literature with respect to some outcomes and not others. WHP effectiveness is determined by program scope; the most successful programs for positive health and financial outcomes are multi-resourced initiatives, with organizational leadership, health risk screening, individually tailored programs, and a supportive workplace culture (57). In contrast, the current study evaluated a health promotion effort with few resources invested and no WHP professionals to design and implement it. Thus, the limited results are not surprising, and in fact the positive associations, although weak, might be considered unexpectedly encouraging.

In addition to the extent of resources invested by the company, there is a more fundamental possible reason for lack of benefit. Program effectiveness may depend on how much the work environment itself does or does not support healthy behaviors (58). The work of direct healthcare providers is extremely stressful; the interaction between occupational and non-work factors, such as family demands and heath behaviors, could plausibly mitigate against effectiveness of a program that emphasizes individual behavior changes. Reducing those stressors in the work environment could produce "salutogenic" conditions which support rather than interfere with employee health (59). This is the concept underlying the NIOSH *Total Worker Health*®, program (4).

Another potential barrier to participation in WHP programs could be lack of access to group health insurance. In the current study population, a large proportion of nursing aides declined insurance offered by their employer due to its cost. As some of the programs were available via insurance only, not having appropriate coverage could be an obstacle to access.

This study has some important strengths. The response rate was high and similar across the centers, guarding against selection bias. The large population surveyed in different geographical areas was representative of the company workforce (over 200,000 employees). The data on WHP program activities came directly from the representatives responsible for overseeing and/or implementing the programs in each center. The same resources were distributed to all facilities, which all provided similar services, making it possible to evaluate the effect of differential implementation at the center level.

On the other hand, this is a cross-sectional study and, as such, the temporal association between exposure and outcome cannot be determined. The real timing of the advent of the programs is unknown. In addition, details about each program were not complete. We were not able to determine what actual activities were carried out by each center or what was the exact role of the champion, specifically the frequency and intensity of effort

devoted to the program and how much this varied among centers. To the best of our knowledge, no center had an on-site fitness program or provided release time for WHP activities, but we could not confirm this with each center.

Five of the 18 nursing centers did not provide the information needed to determine their WHP category. We speculate that these centers classified as missing were most likely to have no WHP programs in place and thus did not respond because they had no information to provide. This would be consistent with the results showing little difference between centers labeled as "no program" and as "unknown."

## CONCLUSIONS

This study's main finding is that a low-intensity, low-resourced workplace health promotion program may have benefited a few individuals but seems to have had only modest influence on average levels of the measured indicators. The fact that the study population was largely low-income women, many with family responsibilities and/or second jobs, may also be partly responsible for the extremely limited benefits observed. Full-time working adults spend more waking hours at work than anywhere else, but a limited program delivery during working hours may not be able to outweigh other influences on their health behaviors. Even if behavioral change is achieved at work, it might not be easily sustainable after work, in part because conditions of employment affect non-occupational factors such as work-family balance, extent of free time, and neighborhood of residence. Like many other WHP programs, this one was designed to help individuals achieve behavioral change without addressing environmental influences. Thus, it is not surprising that it showed limited effect.

Individual behavior is only the top tier of the health pyramid. Worksite programs should be organized as multilevel approaches, accounting for the influence of wages and working conditions, the organizational structure of work (e.g., decision autonomy), the impact of the social environment and work-life balance on health behaviors. They should also be coordinated with other efforts such as community involvement, incentives to the family, or public policy initiatives.

## DATA AVAILABILITY STATEMENT

The data were collected with assurance of confidentiality and privacy to all study subjects, with no provision for data sharing. Requests to access the datasets should be directed to [Laura Punnett, Laura_Punnett@uml.edu].

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board University of Massachusetts Lowell. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

GK conceptualized and carried out the study analyses and drafted the manuscript. MC advised on data analysis and provided critical input on the manuscript. RG supervised data cleaning and management and provided statistical expertise. DK assisted with study conceptualization. LP designed and directed the ProCare study and advised on data analysis and manuscript revisions. All authors contributed to the article and approved the submitted version.

## FUNDING

This work was supported by Grant Number 1 U19 OH008857 from the U.S. National Institute for Occupational Safety and Health. The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.

## ACKNOWLEDGMENTS

We are grateful for the participation of and support received from the nursing home employees and administrators. We thank the ProCare research team who assisted with data collection and entry.

## REFERENCES

1. Edington DW, Schultz AB, Pitts JS, Camilleri A. The future of health promotion in the 21st century. *Am J Lifestyle Med.* (2015) 10:242–52. doi: 10.1177/1559827615605789
2. Occupational Safety and Health. *Healthy People*. (2020). Available online at: https://www.healthypeople.gov/2020/topics-objectives/topic/occupational-safety-and-health (accessed October 10, 2020).
3. The Henry J. Kaiser Family Found. *Employer Health Benefits Survey*. (2019) Available online at: https://www.kff.org/health-costs/report/2019-employer-health-benefits-survey/019 (accessed October 10, 2020).
4. Punnett L, Henning R, Cavallari J, Nobrega S, Dugan A, Cherniack M. Defining "Integration" for total worker health®: a new proposal. *Ann Work Exposures Health*. (2020) 64:223–35. doi: 10.1093/annweh/wxaa003
5. Jones D, Molitor D, Reif J. What do workplace wellness programs do? Evidence from the illinois workplace wellness study. *Q J Econ.* (2019) 134:1747–91. doi: 10.1093/qje/qjz023
6. Pollitz K, Rae M. *Workplace Wellness Programs Characteristics and Requirements*. Kaiser Family Foundation. Available online at: https://www.kff.org/private-insurance/issue-brief/workplace-wellness-programs-characteristics-and-requirements/ (accessed January 12, 2020).
7. Ryan M, Erck L, McGovern L, McCabe K, Myers K, Nobrega S, et al. "Working on Wellness:" protocol for a worksite health promotion capacity-building program for employers. *BMC Public Health*. (2019) 19:111. doi: 10.1186/s12889-019-6405-1
8. Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Aff.* (2010) 29:304–11. doi: 10.1377/hlthaff.2009.0626
9. Pronk NP. Placing workplace wellness in proper context: value beyond money. *Prev Chron Dis*. (2014) 11:E119. doi: 10.5888/pcd11.140128

10. Berkland BE, Werneburg BL, Jenkins SM, Friend JL, Clark MM, Rosedahl JK, et al. A worksite wellness intervention: improving happiness, life satisfaction, and gratitude in health care workers. *Mayo Clin Proc Innov Qual Outcomes.* (2017) 1:203–10. doi: 10.1016/j.mayocpiqo.2017.09.002
11. Biswas A, Severin CN, Smith PM, Steenstra IA, Robson LS, Amick BC. Larger workplaces, people-oriented culture, and specific industry sectors are associated with co-occurring health protection and wellness activities. *Int J Environ Res Public Health.* (2018) 15:2739. doi: 10.3390/ijerph15122739
12. Bolnick H, Millard F, Dugas JP. Medical care savings from workplace wellness programs: what is a realistic savings potential? *J Occup Environ Med.* (2013) 55:4–9. doi: 10.1097/JOM.0b013e31827db98f
13. Claxton G, Rae M, Damico A, Young G, McDermott D, Whitmore H. Health benefits in 2019: premiums inch higher, employers respond to federal policy. *Health Aff.* (2019) 38:1752–61. doi: 10.1377/hlthaff.2019.01026
14. Kaiser CP. Absenteeism, presenteeism, and workplace climate: a taxonomy of employee attendance behaviors. *Econ Bus J Inquiries Perspect.* (2018) 9:69–86. Available online at: https://pdfs.semanticscholar.org/8ed7/329243e83c3f6fda2074407c0a0d880abcfd.pdf
15. Edwards A, Marcus S. Employee perceptions of well-being programs. *J Soc Behav Health Sci.* (2018) 12100–13. doi: 10.5590/JSBHS.2018.12.1.07
16. Linnan LA, Cluff L, Lang JE, Penne M, Leff MS. Results of the workplace health in America survey. *Am J Health Promot AJHP.* (2019) 33:652–65. doi: 10.1177/0890117119842047
17. Mattke S, Liu HH, Caloyeras JP, Huang CY, Van Busum KR, Khodyakov D, et al. *Workplace Wellness Programs Study: Final Report*. (2013). Available online at: https://www.rand.org/pubs/research_reports/RR254.html (accessed October 10, 2020).
18. Engbers LH, van Poppel MNM, Chin A, Paw MJM, van Mechelen W. Worksite health promotion programs with environmental changes: a systematic review. *Am J Prev Med.* (2005) 29:61–70. doi: 10.1016/j.amepre.2005.03.001
19. McCoy K, Stinson K, Scott K, Tenney L, Newman LS. Health promotion in small business: a systematic review of factors influencing adoption and effectiveness of worksite wellness programs. *J Occup Environ Med.* (2014) 56:579–87. doi: 10.1097/JOM.0000000000000171
20. Wierenga D, Engbers LH, Van Empelen P, Duijts S, Hildebrandt VH, Van Mechelen W. What is actually measured in process evaluations for worksite health promotion programs: a systematic review. *BMC Public Health.* (2013) 13:1190. doi: 10.1186/1471-2458-13-1190
21. Rongen A, Robroek SJW, van Lenthe FJ, Burdorf A. Workplace health promotion: a meta-analysis of effectiveness. *Am J Prev Med.* (2013) 44:406–15. doi: 10.1016/j.amepre.2012.12.007
22. Stanulewicz N, Knox E, Narayanasamy M, Shivji N, Khunti K, Blake H. Effectiveness of lifestyle health promotion interventions for nurses: a systematic review. *Int J Environ Res Public Health.* (2020) 17:17. doi: 10.3390/ijerph17010017
23. Chapman LS. Meta-evaluation of worksite health promotion economic return studies: 2012 update. *Am J Health Promot.* (2012) 26:TAHP1–12. doi: 10.4278/ajhp.26.4.tahp
24. Goetzel RZ, Ozminkowski RJ. The health and cost benefits of work site health-promotion programs. *Annu Rev Public Health.* (2008) 29:303–23. doi: 10.1146/annurev.publhealth.29.020907.090930
25. Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VIII 2008 to (2010). *J Occup Environ Med.* (2011) 53:1310–31. doi: 10.1097/JOM.0b013e3182337748
26. Song Z, Baicker K. Workplace wellness programs and health outcomes—reply. *JAMA.* (2019) 322:893. doi: 10.1001/jama.2019.9829
27. Horwitz JR, Kelly BD, DiNardo JE. Wellness incentives in the workplace: cost savings through cost shifting to unhealthy workers. *Health Aff Proj Hope.* (2013) 32:468–76. doi: 10.1377/hlthaff.2012.0683
28. Stiehl E, Shivaprakash N, Thatcher E, Ornelas IJ, Kneipp S, Baron SL, et al. Worksite health promotion for low-wage workers: a scoping literature review. *Am J Health Promot.* (2018) 32:359–73. doi: 10.1177/0890117117728607
29. Pomeranz JL, Garcia AM, Vesprey R, Davey A. Variability and limits of US state laws regulating workplace wellness programs. *Am J Public Health.* (2016) 106:1028–31. doi: 10.2105/AJPH.2016.303144
30. Schwatka NV, Smith D, Weitzenkamp D, Atherly A, Dally MJ, Brockbank CVS, et al. The impact of worksite wellness programs by size of business: a 3-year longitudinal study of participation, health benefits, absenteeism, and presenteeism. *Ann Work Expo Health.* (2018) 62 (Suppl. 1):S42–54. doi: 10.1093/annweh/wxy049
31. Cherniack M. Integrated Health Programs, Health Outcomes, and Return on Investment: Measuring Workplace Health Promotion and Integrated Program Effectiveness. *J Occup Environ Med.* (2013) 55 (12 Suppl):S38–45. doi: 10.1097/JOM.0000000000000044
32. Egger G, Dixon J. Beyond obesity and lifestyle: a review of 21st century chronic disease determinants. *BioMed Res Int.* (2014) 2014:731685. doi: 10.1155/2014/731685
33. Healthcare Occupations. *Occupational Outlook Handbook.* U.S. Bureau of Labor Statistics. (2020). Available online at: https://www.bls.gov/ooh/healthcare/home.htm
34. Konttinen H, van Strien T, Männistö S, Jousilahti P, Haukkala A. Depression, emotional eating and long-term weight changes: a population-based prospective study. *Int J Behav Nutr Phys Act.* (2019) 16:28. doi: 10.1186/s12966-019-0791-8
35. Saulle R, Bernardi M, Chiarini M, Backhaus I, La Torre G. Shift work, overweight and obesity in health professionals: a systematic review and meta-analysis. *Clin Ter.* (2018) 169:e189–97. doi: 10.7417/T.2018.2077
36. Sun M, Feng W, Wang F, Li P, Li Z, Li M, et al. Meta-analysis on shift work and risks of specific obesity types. *Obes Rev Off J Int Assoc Study Obes.* (2018) 19:28–40. doi: 10.1111/obr.12621
37. Qin J, Kurowski A, Gore R, Punnett L. The impact of workplace factors on filing of workers' compensation claims among nursing home workers. *BMC Musculoskelet Disord.* (2014) 15:29. doi: 10.1186/1471-2474-15-29
38. Miranda H, Punnett L, Gore RJ, ProCare Research Team. Musculoskeletal pain and reported workplace assault: a prospective study of clinical staff in nursing homes. *Hum Factors.* (2014) 56:215–27. doi: 10.1177/0018720813508778
39. Zhang Y, Punnett L, Mawn B, Gore R. Working conditions and mental health of nursing staff in nursing homes. *Issues Ment Health Nurs.* (2016) 37:485–92. doi: 10.3109/01612840.2016.1162884
40. Miranda H, Gore RJ, Boyer J, Nobrega S, Punnett L. Health behaviors and overweight in nursing home employees: contribution of workplace stressors and implications for worksite health promotion. *Sci World J.* (2015) 2015:915359. doi: 10.1155/2015/915359
41. Ware J, Kosinski M, Keller SD. A 12-Item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care.* (1996) 34:220–33. doi: 10.1097/00005650-199603000-00003
42. 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) 3:322–55. doi: 10.1037/1076-8998.3.4.322
43. Büssing A. Social tolerance of working time scheduling in nursing. *Work Stress.* (1996) 10:238–50. doi: 10.1080/02678379608256803
44. Griffin MA, Neal A. Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *J Occup Health Psychol.* (2000) 5:347–58. doi: 10.1037/1076-8998.5.3.347
45. Bandura A. *Self-efficacy: The exercise of control*. W H Freeman/Times Books/Henry Holt & Co. (1997).
46. Lee S, Lee DK. What is the proper way to apply the multiple comparison test? *Korean J Anesthesiol.* (2018) 71:353–60. doi: 10.4097/kja.d.18.00242
47. Greenland S. Modeling and variable selection in epidemiologic analysis. *Am J Public Health.* (1989) 79:340–9. doi: 10.2105/AJPH.79.3.340
48. Albertsen K, Borg V, Oldenburg B. A systematic review of the impact of work environment on smoking cessation, relapse and amount smoked. *Prev Med.* (2006) 43:291–305. doi: 10.1016/j.ypmed.2006.05.001
49. Heikkilä K, Nyberg ST, Fransson EI, Alfredsson L, Bacquer DD, Bjorner JB, et al. job strain and tobacco smoking: an individual-participant data meta-analysis of 166 130 adults in 15 European studies. *PLoS ONE.* (2012) 7:e35463. doi: 10.1371/journal.pone.0035463
50. Liu J, Zhao S, Chen X, Falk E, Albarracín D. The influence of peer behavior as a function of social and cultural closeness: a meta-analysis of normative influence on adolescent smoking initiation and continuation. *Psychol Bull.* (2017) 143:1082–115. doi: 10.1037/bul0000113

51. Cho YM, Kim HR, Kang M-Y, Myong J-P, Koo JW. Fixed night workers and failed smoking cessation. *J Occup Med Toxicol Lond Engl.* (2019) 14:23. doi: 10.1186/s12995-019-0243-z
52. Tabak R, Hipp JA, Dodson EA, Yang L, Adlakha D, Brownson RC. Exploring associations between perceived home and work neighborhood environments, diet behaviors, and obesity: results from a survey of employed adults in missouri. *Prev Med Rep.* (2016) 4:591–6. doi: 10.1016/j.pmedr.2016.10.008
53. Ghesmaty Sangachin M, Cavuoto LA. Interactive effects of work psychosocial factors on participation in workplace wellness programs. *J Workplace Behav Health.* (2018) 33:24–42. doi: 10.1080/15555240.2017.1408415
54. Hunter JR, Gordon BA, Bird SR, Benson AC. Perceived barriers and facilitators to workplace exercise participation. *Int J Workplace Health Manag.* (2018) 11:349–63. doi: 10.1108/IJWHM-04-2018-0055
55. Jørgensen MB, Villadsen E, Burr H, Punnett L, Holtermann A. Does employee participation in workplace health promotion depend on the working environment? A cross-sectional study of danish workers. *BMJ Open.* (2016) 6:e010516. doi: 10.1136/bmjopen-2015-010516
56. Zhang Y, Punnett L, Nannini A. Work-family conflict, sleep, and mental health of nursing assistants working in nursing homes. *Workplace Health Saf.* (2017) 65:295–303. doi: 10.1177/2165079916665397
57. Hendriksen IJM, Snoijer M, de Kok BPH, van Vilsteren J, Hofstetter H. Effectiveness of a multilevel workplace health promotion program on vitality, health, and work-related outcomes. *J Occup Environ Med.* (2016) 58:575–83. doi: 10.1097/JOM.0000000000000747
58. Nobrega S, Champagne N, Abreu M, Goldstein-Gelb M, Montano M, Lopez I, et al. Obesity/overweight and the role of working conditions: a qualitative, participatory investigation. *Health Promot Pract.* (2016) 17:127–36. doi: 10.1177/1524839915602439
59. Jenny GJ, Bauer GF, Vinje HF, Vogt K, Torp S. The application of salutogenesis to work. In: Mittelmark MB, Sagy S, Eriksson M, Bauer MF, Pelikan JM, Lindström B, Espnes GA, editors. *The Handbook of Salutogenesis*. Cham: Springer (2017). doi: 10.1007/978-3-319-04600-6_20


**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 Public Health

ORIGINAL RESEARCH
published: 10 November 2020
doi: 10.3389/fpubh.2020.576693

# Learning Processes as Key for Success in Workplace Health Promotion Interventions in Health Care

*Andrea Eriksson*[1]* *and Lotta Dellve*[2]

[1] Division of Ergonomics, Department of Biomedical Engineering and Health Systems, School of Engineering Sciences in Chemistry, Biotechnology and Health, KTH Royal Institute of Technology, Stockholm, Sweden, [2] Department of Sociology and Work Science, Gothenburg University, Gothenburg, Sweden

There is limited previous research on how learning processes contribute to the outcomes of workplace health promotion (WHP) leadership interventions. The aim of this study was to identify the outcomes of a system-based WPH education program for managers and investigated what impact the intervention program had on health-oriented leadership, improvement work, and employee well-being, as well as what factors (i.e., how manager's active work following the intervention and organizational learning climate) contributed to these outcomes. A mixed-methods approach was applied, including qualitative interviews with 23 managers and process leaders, as well as questionnaires to employees and managers representing 17 public health care units in Sweden. The results showed that health-oriented leadership, improvement work, work satisfaction, and vitality increased at workplaces that worked actively to implement WHP following the program. Working actively with WHP and health-oriented leadership was of central importance for success and was a covariate with improved social learning climate, improved developmental leadership, and increased degree of improvement work. All included factors of learning during the intervention were associated with improved job satisfaction, while the increase in vitality seemed unrelated to program implementation. In conclusion, successful outcomes of WHP interventions interact with dimensions of organizational learning climate in the workplace.

**Keywords: workplace health promotion, leadership, interventions, system approach, organizational learning climate**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic,*
*Monash University, Australia*

***Reviewed by:***
*Tsangyao Chang,*
*Feng Chia University, Taiwan*
*Sok King Ong,*
*Ministry of Health, Brunei*

***Correspondence:**
*Andrea Eriksson*
*andrea4@kth.se*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *26 June 2020*
***Accepted:*** *14 October 2020*
***Published:*** *10 November 2020*

***Citation:***
*Eriksson A and Dellve L (2020) Learning Processes as Key for Success in Workplace Health Promotion Interventions in Health Care. Front. Public Health 8:576693. doi: 10.3389/fpubh.2020.576693*

## INTRODUCTION

Despite wide-spread arguments concerning system approaches and leadership involvement for successful workplace health promotion (WHP) interventions (1, 2), there are limited leadership studies about more holistic approaches to employee health (3) and scarce research on how leadership interventions may contribute to improving employee well-being (4). The limited health outcomes of leadership interventions for employees have partly been explained by poor organizational preconditions (5, 6), limited managerial involvement in the planning of intervention content (7, 8), and challenges in capturing and measuring the effects of such holistic approaches (9). This paper sheds light on the organizational learning climate as a proximal process, contributing

to the outcomes of a system-based WHP leadership education program. A proximal process is a primary mechanism taking place in an individual's closest context. It includes social interactions that contribute to the development of both the individual and the surrounding environment (10).

## System Approaches to WHP Leadership Interventions

The current knowledge base on how to develop employee health and well-being points at the importance of implementing interventions with a system approach, including broad aspects related to leadership (2, 11). A system-based WHP leadership education program here means a program that integrates how individual, group, organizational, and societal factors are of interrelated importance in developing a workplace setting that promotes health (2, 12, 13). Previous studies have shown that leadership is of particular importance for both handling and affecting such interrelated health factors (14, 15). Developing a leadership program to improve employee health and well-being requires the strengthening both of leaders' broader awareness of interrelated individual and workplace conditions and leaders' prioritization of employee health. This study will focus on such *health-related leadership* as an outcome of WHP leadership interventions, defined by managers' consideration and prioritization of employee health and well-being (2, 16, 17).

There is extensive evidence to suggest that leadership affects many aspects of employees' health, including ratings of psychological well-being (55), job satisfaction (18), vitality (19), stress (20), depression symptoms (21), or healthy work attendance (14). The present study focused on *job satisfaction* and *vitality* as outcome measures of a system-based WHP leadership education program, representing employees' feelings of well-being. Job satisfaction includes here both being content with one's job and being content with specific aspects related to work such as the work environment, future prospects, and development opportunities (56). Vitality has been defined as the experience of having a high degree of energy in combination with a low degree of exhaustion (56).

Previous studies on leadership development programs have pointed out the various, and sometimes even limited, effects on employee health (22–24). More limited results of leadership interventions may be due to, among other causes, the offering of education programs as separate courses not linked to daily leadership practice (25, 26). Organizational preconditions for health-oriented leadership may also be a reason for limited effects. Specifically, managers within the public sector have reported adverse conditions for developing a health-oriented leadership due to clashes between continuous top-down governed rationalizations and opportunities to support employees to perform work according to professional and ethical standards (5, 8, 27). This suggests that interventions should simultaneously support employee health, engagement, productivity, and efficiency. This study thus concerns how a system-based WHP leadership education program contributes to *the work of improvement* in the workplace, including improvements in the psychosocial work environment, efficiency of work processes, and quality of work.

## WHP Leadership Interventions and Organizational Learning Climate

A longitudinal qualitative study by Gustavsson and Ekberg (28) has shown that analyzing a combination of learning processes and health-promoting processes can facilitate the understanding of changes taking place following WHP programs. There are, however, limited previous empirical studies that have investigated how specific learning processes affect the outcomes of workplace health interventions. (57) have performed a qualitative study of how learning factors in WHP interventions contribute to empowerment. Their study showed the importance of employees' reflections on their own well-being, shared insights into the work situation, and group coherence (57). The study presented in this article focused on how the organizational learning climate contributes to the outcomes of system-based WHP leadership education program. Organizational climate is a climate that enables learning to take place (29). It has been highlighted that successful WHP interventions need to be adapted and tailored to the context of the local workplace (12). A critical factor for leadership development work is supporting managers' active work to transfer the teachings from the program to their organizational context (26, 30). This argues for the broader learning of the managers themselves, but also for their competence to create such learning processes in their local units in practice through developmental-oriented leadership. Developmental leadership has been defined as a leadership style that is supportive and motivates employees' growth and development by providing a work environment that facilitates learning (31, 32). This kind of leadership has also been associated with employee health (33). In this study, *developmental leadership* is thus seen as an important part of the organizational learning climate that contributes to the outcomes of a WHP leadership intervention and is defined by a leadership style that provides and prioritizes good development opportunities for employees (56).

The importance of process evaluation has been argued for clarifying critical factors of successful implementation (12). Previous research has thus focused on the factors that hinder or facilitate the implementation of WHP (34), including, for example, having a participatory approach that includes both first-line managers and employees in the planning of the intervention (35), combining bottom-up engagement from employees with top-down managerial support (36), first-line managers clearly prioritizing and delimiting the implementation of feasible program components (2, 14), and a learning climate that promotes improvements (37). A general social learning climate, in the form of social capital in the workplace, can be important for employee health (38) and also support crucial collaboration and engagement in workplace developments that are important for healthy work conditions (39–41). This study will thus focus on the *social learning climate* as an important aspect of the organizational learning climate that contributes to the outcomes of a WHP leadership intervention. The social learning climate, including social capital, is in this study defined and measured

by the trusting and reciprocal relationships, both vertical and horizontal, in the organization, as well as collaboration and mutual responsibilities in developing work for the common good (42).

Besides developmental leadership orientation and learning climate, the importance of clear organizational goals and structures for organizational learning for WHP have been highlighted (43). This includes the importance of management structures that integrate systematic improvements to the work environment with ordinary development work (44), a process that requires regular workplace meetings. Such meetings can promote health by facilitating a continuous dialogue; they can also influence developments in the workplace in parallel with work environment issues (45). This study will thus include both continuous *dialogue* at the workplace about work environment issues (43) and *goal clarity* in the form of employees having a clear understanding of workplace goals and what is expected from them at work (58) as potentially important dimensions of the organizational learning climate that may contribute to the outcomes of a WHP leadership intervention. Managers' goal clarity has previously been shown to contribute to healthy work attendance (14, 46). Otherwise, there is, to our knowledge, no quantitative study that has investigated if and how dialogue in the workplace and goal clarity, as dimensions of organizational climate, contribute to WHP outcomes.

*The aim* of this study was to identify the workplace outcomes of a system-based WPH education program for managers, with a particular focus on how unit managers approached the intervention and how learning processes—in the form of the dimensions of the organizational learning climate—contributed to different outcomes. A previous study of the education program showed that managers perceived positive impacts on their leadership and development work following participation in the program, and they described the program as comprehensive, relevant, and useful (2). This study further investigated what impact the intervention program had on a health-oriented leadership, improvement work, and employee well-being, as well as what learning processes (i.e., how the manager's active work following the intervention and the dimensions of organizational learning climate such as developmental leadership, social learning climate, dialogue, and goal clarity) contributed to the results. Based on the content of the leadership program, the following processes affecting the outcomes are assumed:

- Managers change to a more health-oriented leadership following the intervention, which in turn may affect employee well-being.
- Managers involve employees in developing the work environment following the interventions. These participatory learning approaches and the subsequent improvements may affect employee well-being.
- Learning processes and health-promoting processes are interrelated, both with each other and with the organizational context. Increased learning can thus be an outcome of the intervention, but can also simultaneously be an organizational pre-condition contributing to health-oriented leadership and/or improved employee well-being.

# METHODS

## Study Design

This mixed-methods study analyzed the implementation and outcomes from a WHP intervention study for leaders in public health care, during the period 2014–2017, with qualitative interviews of the process leaders and managers ($n = 23$) and follow-up questionnaire data answered by the employees (T1, $n = 346$; T2, $n = 293$; T3, $n = 208$) representing 17 public health care units located in two regions in Sweden. More specifically, the analysis focused on how managers' active work and learning processes in the workplace contributed directly and indirectly to different outcomes following the education program. The effects on employees' perceptions of leadership, the learning environment, improvement work, and health following the interventions were analyzed. Informed consent was applied in all data collection. The study was approved by the Central Ethical Review Board at Karolinska Institutet, Stockholm, Sweden (EPN 2014/1883-31/5).

## The Intervention

The WHP interventions were based on an education program and were applied to three groups of managers during six half-day meetings. Two process leaders from HR and/or Occupational Health and Safety (OHS) introduced themes and triggered topics to facilitate participant dialogue, discussions, and reflections on how to integrate the content of the program into daily managerial practices. The WHP program was developed based on literature reviews (2, 47), own research (2, 14, 48), expert reviews, and in an iterative and participatory process that included input from ∼500 managers, organizational key actors, and process leaders in 30 different seminars and workshops before, during, and after the interventions. The core idea of the education program is to integrate evidence-based knowledge on how to improve working conditions and health in daily leadership practice. The program was based on working material on the following themes (2):

- health and work engagement;
- how to build health-promoting working conditions;
- how to decrease and prevent risk factors in work;
- strategies for balance and recovery;
- leadership and management to support well-being and engagement;
- co-working and well-functioning work groups;
- how to lead sustainable development work; and
- structures to improve health, the work environment and sustainable developments.

Each theme in the working material included summaries of important theories and evidence-based research, as well as dialogue questions and exercises aimed to support manager in integrating the content of the theme into their own managerial work practice in their workplace. An overarching focus was the interaction between individual and group and the organizational factors that contribute to improving health and preventing health risks. The working material also guided managers in building organizational capacity and resources for dealing with demands within the organization. This included

support for managers' action plans to develop general good working conditions, a learning climate, systematized health and occupational management; integrating values and norms for health and well-being into management, and communication to support improvement, coordination; and the building of trust across individual and groups at different organizational levels. The theoretical foundations of and pedagogical ideas for the program are described in greater detail in Dellve and Eriksson (2).

## Data collection and sample

Data were collected via qualitative interviews and questionnaires; 23 managers and process leaders were interviewed in 12 individual interviews and four focus groups during and just after the interventions. The average length of the individual and the focus group interviews were 60 min. The interviews focused on the participants' perspectives on the content of the program, the parts of the program the managers had implemented, and the factors hindering and facilitating implementation. All interviews were recorded and transcribed verbatim.

Staff questionnaires were distributed to all subordinates of the participating managers at baseline (before the intervention, T1), the first follow-up (5 months post intervention period, T2), and the second follow-up (9 months post intervention period, T3). All subordinates employed at T1, T2, respectively, T3 were invited to participate. Each participant was given a unique code to enable to follow the answers of the same respondent over time. Fifteen of the 17 workplaces participated in the intervention study until the last follow up. The response rate was 62–72% (T1, $n = 346$; T2, $n = 293$, and T3, $n = 208$). At T1, 88% of the respondents were female; 38% were registered nurses, 28% were assistant nurses, and 13% were dental nurses. Other professional groups (<10%) included administrators, dentists, and speech therapists. The managers' questionnaire was distributed at the same time points as the staff questionnaire to managers of the 17 units (response rate: 86–100%). For this study a selection of variables from the staff questionnaire was chosen for measuring intervention outcomes and different dimensions of organizational learning climate (see selected variables listed below). All variables selected for this study were measured T1, T2, and T3. The full questionnaire can be distributed by request to the authors.

## Variables

The following *outcome* variables in the staff questionnaire were analyzed:

- *Health-oriented leadership*: two items from a leadership quality instrument (56), including the experience that the leader (1) cares about staff and considers individual needs, (2) prioritizes positive general workplace conditions, and one item including the experience that the leader (3) highly prioritizes employees' health (Cronbach's alpha = 0.91)
- *Improvement work* (49): three items on whether the psychosocial work environment, efficiency of work performed at the work unit, and quality in work performed at the work unit improved in the last 6 months (Cronbach's alpha = 0.89)
- *Vitality, four* items [Cronbach's alpha 0.88; from Copenhagen Psychosocial Questionnaire, (56)]
- *Job satisfaction,* 6 items [Cronbach's alpha = 0.84; from Copenhagen Psychosocial Questionnaire, (56)].

The following variables of *organizational learning climate* in the staff questionnaire were analyzed:

- *Developmental leadership*: two items from the leadership quality index [Copenhagen Psychosocial Questionnaire, (56)]
- *Social learning climate*: five items on the presence of a trusting and collaborative work environment for innovation and one item on trust in higher management [from index on Social capital (42); Cronbach's alpha = 0.89]
- *Goal clarity*: three items from an index on sustainable employee engagement [(58) Cronbach's alpha = 0.76]
- *Dialogue*: three items on continuous dialogue at the workplace on the psychosocial work environment, the physical work environment and planning and development of work (Cronbach's alpha = 0.87).

The job satisfaction scale had a 4-point response scale (1 = *very dissatisfied*, 4 = *very satisfied*). All other items had a 5-point response scale (1 = *to a very low degree*, 5 = *to a very high degree*). The response scales for health-oriented leadership, developmental leadership, goal clarity, and vitality were transformed to a range of 0–100, where 100 represented a very high degree. The results of the staff questionnaire in each workplace (i.e., mean values) were reported to the participating managers directly after each time point measurement. Managers were, with support from the researchers and process leaders, included in the results from the questionnaires when developing intervention action plans. All variables were normally distributed. Histograms and normal quantile plots were used to check whether the variables were normally distributed.

From the managers' questionnaire, only their ratings on the intervention's impact on leadership execution and activity in development work (2 items), as well as an open-ended question on how the interventions had affected their leadership and development work were analyzed.

## Analysis

The generated data was analyzed stepwise. First, a Student's *t*-tests of differences between mean values at T1 (baseline) and T2 as well as between T1 and T3 was used to determine if there were any statistically significant differences in all included measures between T1 and T2 and T1 and T3. Second, the data from the qualitative interviews and the manager questionnaire were used to analyze what actions participating managers implemented following the interventions, as well as the managers' qualitative descriptions of factors affecting implementation. After the qualitative analyses, the participating workplaces were categorized according to whether or not (1/0) they had managers who had been working actively according to the intervention (30). Following these categorizations, Student's *t*-tests of differences in mean values for all included measures at T1, T2, and T3 between these two categories of workplaces

**TABLE 1 |** Mean values at baseline (T1) and the difference (diff) in how individuals rated the factors between T1–T2 and T1–T3.

| | Mean T1 (SE) | Diff T1-T2 (SE) | Diff T1-T3 (SE) |
|---|---|---|---|
| Health-oriented leadership | 62.1 (24.1) | −4.2** (16.9) | −0.6 (19.2) |
| Improvement work | 3.3 (0.8) | 0.0 (0.8) | 0.1 (0.9) |
| Vitality | 58.8 (19.8) | 4.2** (15.5) | 3.7 (17.5)** |
| Job satisfaction | 64.6 (15.9) | −0.1 (12.7) | 0.1 (12.2) |
| Dialogue | 3.3 (0.9) | 0.1 (0.9) | 0.2 (0.9)** |
| Goal clarity | 74.6 (19.2) | 3.2 (17.4)** | 4.0 (17.4)** |
| Social learning climate | 3.8 (0.7) | 0.0 (0.6) | 0.0 (0.7) |
| Developmental leadership | 61.3 (23.5) | −0.7 (19.5) | 0.4 (20.7) |

*SE, standard errors.*
***$p < 0.01$.*

were performed. Finally, to analyze how learning processes contributed to outcomes following the intervention, five linear regression models were performed. Independent variables in all five models were differences between T1 and T3 in the ratings for health-oriented leadership, improvement work, job satisfaction, and vitality. The outcomes were stepwise regressed on the dependent variables working actively (1/0) and the differences between T1 and T3 in the ratings for dialogue, goal clarity, social learning climate, and developmental leadership. This meant that linear regression models included: (1) working actively, (2) working actively and differences in dialogue, (3) working actively and differences in dialogue and goal clarity, (4) working actively and differences in dialogue, goal clarity and social learning climate and, (5) working actively and differences in dialogue goal clarity, social learning climate and developmental leadership.

Statistical significance was considered when $p < 0.05$.

# RESULTS

Changes in outcomes and learning factors following the intervention.

Vitality, dialogue, and goal clarity increased over time following the interventions (see **Table 1**). Health-oriented leadership decreased at the first follow-up, but no statistically significant changes in leadership ratings could be seen over time (see **Table 1**).

## Managers Working Actively Following the Interventions

A majority of participating managers stated that they had become more conscious of their own leadership practices following the intervention program. The program was described as giving insight into the importance of focusing on positive resources at the workplace and providing knowledge about structured and holistic approaches to improve the work environment. The program content was acknowledged as relevant for all managers interviewed, and a majority stated that the program gave them an awareness of the importance of leadership, as well as inspiration for new approaches for handling work environment issues.

*Through reflections and discussions* [during the program], *I have become more aware of my leadership style and how it can have consequences for employee health* (Answer to open-ended question in managers' questionnaire).

The interviews revealed that concrete actions in the workplace following the interventions were rather limited for most participants. Managers noted that their ongoing efforts to solve challenging work conditions hindered them from prioritizing working according to the interventions. Hindrances in the working conditions included time-consuming re-organizations, ongoing workplace conflicts among subordinates, understaffing, or problems in recruiting competent personnel. Some of the participating managers also struggled with their own working conditions as a manager, and some managers became sick, burnt out, or decided to quit as a manager during the intervention period.

*The education program has ended now and I can say that we haven't yet started to do anything following the program. [. . . ] It [WHP] has somehow been down prioritized; it [the prioritization of work] has more been about surviving and solving the most urgent problems.* (Unit manager, focus group interview).

A few of the participating managers ($n = 5$, altogether responsible for 108 employees) noted in the interviews that they had been working more actively (i.e., to a greater extent than the others) according to the intervention program. These managers focused on concrete developments in their own leadership style, engaging employees in work environment developments, and developing better structures for work environment improvements, which included engaging subordinates in planning, structuring, and visualizing the needed systematic work environment of the unit (e.g., when discussing the results from the employee survey at staff meetings and based on the discussions decided on what actions to take). Other examples of activities that the managers implemented included staff activities to create a better atmosphere or follow-up on work-life balance among employees.

*I have become more observant of the importance of well-being, that my presence makes a big difference, [I have become] better at seeing the needs of the staff.* (Answer to open-ended question, manager questionnaire).

*I have started to work in a more structured way with workplace health promotion [following the education].* (Unit manager, focus group interview).

## Changes in Outcomes and Learning Factors Following Active Work

Workplaces working actively had, at baseline, higher ratings for health-oriented leadership ($p < 0.001$), developmental leadership ($p = 0.04$), improvement work ($p = 0.01$), and social learning climate ($p = 0.02$). Over time, the ratings for health-oriented leadership, improvement work, work satisfaction vitality, dialogue, and goal clarity increased at the workplaces working actively (see **Table 2**). At workplaces not working actively according to the intervention program only vitality increased at the first follow-up and ratings of health-oriented leadership decreased over time (see **Table 2**).

## Learning Factors Contributing to the Outcomes

**Table 3** presents outcomes regressed on working actively, dialogue, goal clarity, social learning climate, and developmental leadership stepwise in model 1–5. Model 1 shows that working actively impacted all outcomes, expect vitality. All explaining factors, except dialogue were associated with an increased degree of improvement work in the linear regression models 1–4 (**Table 3**). However, in the final model (model 5), working actively and improved developmental leadership were the factors that remained associated with an increased degree of improvement work. All factors, except for goal clarity in model 4 and 5, were associated with improved health-oriented leadership in the different models. Except for improved dialogue in models 4 and 5, all factors were also associated with improved job satisfaction. None of the included factors were of statistically significant importance for improved vitality following the intervention.

# DISCUSSION

It has been suggested that a combination of analyzing learning processes and health-promoting processes can facilitate the understanding of why changes take place following of WHP programs (28). This study analyzed interrelated outcomes of a system-based WHP leadership education program, including the importance of the manager's active work and the organizational learning climate. The studied education program had a comprehensive approach to WHP and supported the managers in developing action plans for the most important work environment issues in their workplaces. The results showed that health-oriented leadership, improvement work, work satisfaction and vitality increased at workplaces that worked actively to implement WHP following the program. The overall results may demonstrate that the system-based WHP program supported managers to integrate issues of well-being and health into their routine leadership practices. The results thus suggest that comprehensive education programs can facilitate for workplaces to select measures reflecting their relevant needs and local context (2).

Working actively with WHP improved the social learning climate and developmental leadership, which contributed to increased improvement work in the workplace. The WHP activities implemented by the managers differed between each workplace and were based on the managers' judgments on the specific actions relevant to their workplace. These findings further support previous findings that that successful WHP interventions need to be adapted and tailored to the pre-conditions and needs of the local workplace (12). The employees' perceptions of an improved social learning climate and developmental leadership probably resulted from their managers engaging employees in improvement work at the workplace and that these processes contributed to an increase in the learning climate. Of the learning factors, developmental leadership was of specific importance for increased improvement work. This is in line with earlier work that developmental leadership can provide a work environment that supports and motivates learning (31, 32), which can be seen as a pre-condition for improvements in the work environment. It is noteworthy that the different factors included in the analysis only explained 15% of the variance in increased improvements, which means that other factors (not included in this study of WHP) are essential for an increased degree of improvement work. Improvement work in Swedish healthcare is often mandated using a top-down approach (50). This means that demands for improvement from higher levels of management also might have contributed to increased improvement work at the workplaces.

The results showed that a more limited number of workplaces worked actively following the program, which the participating managers explained by challenging existing work conditions that hindered them from prioritizing the implementation of the WHP. Limited outcomes of leadership interventions shown in previous research have also been explained by poor or non-conducive organizational pre-conditions (5, 6). This raises concerns about what kind of learning processes may facilitate the implementation of WHP in workplaces where managers are experiencing challenging conditions. The results suggest the importance of managers having the right pre-conditions to implement WHP, including having time for the development of the work. Previous research has pointed out that a trust-based management culture, that is, giving first-line managers the mandate to take decisions over how to organize work, also supports the managers' increased engagement in work environment improvements (51). A need for a management climate where the organization, including, for example, the top management and key actors from human resources, understand the managers' and employees' motivations for learning and needs for support can thus be seen as an important pre-condition for promoting more active work (8). More research is needed, however, on how the work organization, including the top management, can develop a supportive environment for bottom-up initiated improvement work (51). The results also point to the need for intervention programs within healthcare being flexible enough to support managers with more limited pre-conditions by, for example, supporting managers to limit their work and act on the (for them) most urgent issues.

All factors expect goal clarity were associated with improved health-oriented leadership. The results indicate that organizational goal clarity may be in conflict with the employees' own health. This also supports the idea that the development of health-oriented leadership interplays with the wider organizational learning climate, including social and participatory processes such as continuous dialogue, on work environment issues and the social learning climate at the workplace. The results indicate the importance of giving priority to employee health and a collaborative and supportive work climate (42), as well as setting aside time

**TABLE 2 |** Separate analysis of workplaces working actively/not working actively with WHP.

| | Working Actively with WHP | | | Not Working Actively with WHP | | |
|---|---|---|---|---|---|---|
| | **Mean T1 (SE)** | **Diff T 1-T2 (SE)** | **diff T 1-T3 (SE)** | **Mean T1 (SE)** | **Diff T 1–T2 (SE)** | **Diff T 1–T3 (SE)** |
| Health-oriented leadership | 65.0 (23.2) | −0.1 (16.9) | 6.3** (15.9) | 60.9 (24.4) | −6.4** (16.6) | −4.5* (19.9) |
| Improvement work | 3.4 (0.9) | 0.1 (0.74) | 0.4** (0.8) | 3.2 (0.8) | <0.1 (0.8) | 0.1 (0.6) |
| Vitality | 58.7 (20.2) | 6.3** (16.1) | 6.4** (16.4) | 58.8 (19.7) | 3.2** (15.1) | 2.3 (17.9) |
| Job satisfaction | 65.2 (16.1) | 0.2 (12.7) | 3.9* (12.5) | 64.4 (15.8) | −0.3 (12.8) | −2.1 (11.5) |
| Dialogue | 3.5 (0.9) | 0.2 (0.9) | 0.4** (0.72) | 3.3 (0.9) | <0.1 (0.9) | <0.1 (0.8) |
| Goal clarity | 74.6 (21.1) | 4.69* (18.6) | 6.5** (16.6) | 74.5 (18.4) | 2.5 (16.8) | 2.6 (17.5) |
| Social learning climate | 3.9 (0.7) | 0.1 (0.6) | 0.1 (0.5) | 3.8 (0.7) | −0.1 (0.6) | −0.1 (0.6) |
| Developmental leadership | 63.6 (23.3) | 1.0 (20.2) | 4.2 (17.7) | 60.4 (23.6) | −1.5 (19.1) | −1.9 (22.1) |

*Mean values at baseline (T1) and the difference (diff) in how individuals rated the factors between T1–T2 and T1–T3.*
*SE, standard errors.*
*$p < 0.05$ and **$p < 0.01$.

for learning and meaningful development work (43). A good organizational climate and effective communication processes may not only improve employee influence over their health, but also development work, and the workplace meetings may thus have health-promoting value (45). It has been pointed out that there are challenges in capturing and measuring the effects of holistic intervention programs (9). Due to the challenges of evaluating WHP, the importance of process evaluation has been highlighted (12, 34). There are few previous quantitative studies that have identified indicators for process evaluation of WHP (52), but dimensions of the organizational learning climate can be used as important process indicators based on the results from the present study. The policy implications from this study are thus that aspects of participatory processes, including continuous dialogue as well as the social learning climate, are important key indicators for WHP.

All included factors were associated with improved job satisfaction, but the results also showed that an increase in vitality was not a direct result of managers' active WHP work following the education program, nor was it associated with changes in the organizational learning climate. The results thus indicate that the studied WHP leadership education program contributed to an increase in job satisfaction, but that the increase in vitality was unrelated to program implementation. These results might be due to the measurements of job satisfaction being closely linked to actual work conditions and leadership practices, while feelings of high degree of energy/vitality (56) may also be affected by a number of factors external to the workplace, such as seasonal weather changes, private life circumstances, and life-course factors. The policy implications from this study are thus, that job satisfaction is a better outcome measurement of WHP, compared to vitality, for example.

The conditions of the learning climate can be viewed as an important proximal process, as it affected all intervention outcomes (i.e., health-oriented leadership, improvement work and job satisfaction). Still, learning and health-promoting processes (as well as organizational context) were interrelated. Thus, we cannot draw any conclusions on the causal relationships based on the study data. However, the results can be interpreted as showing that the organizational learning climate could be a pre-condition for succeeding with WHP, while other dimensions of the learning climate are outcomes of the WHP program. Workplaces that were working more actively with WHP had, at baseline, higher ratings for developmental leadership and social learning climate, which indicates the importance of the learning climate as a pre-condition for succeeding with WHP. The dialogue on work environment issues and goal clarity increased when the workplaces were working actively, which suggests that these factors are probable outcomes of the managers' active work with WHP.

There are some obvious limitations and strengths with this study. One limitation is that no control workplaces were included to compare outcome patterns. One particular strength is that the study was based on a mixed methods approach, including managers' own descriptions of how they were affected by and took actions following the program. Performing additional interviews with employees could, however, have given even more comprehensive information on the extent to which changes in the organizational climate were a consequence of the intervention program. Observations of workgroup meetings, for example, could moreover, have given more objective information of what, at workplace level, it actually meant to "have a dialogue" and "work actively."

Another strength was that long-term outcomes were studied by two follow-up measurements, although the decreased number of employees participating in the follow-up questionnaires due to workplace drop outs and staff turnover is another weakness. Intervention studies are time consuming and may be hard to prioritize for health care workplaces with high workloads, which has resulted in the rather limited number of workplaces that worked actively following the education program. Alternatives to extensive staff questionnaires could be single item questions distributed by short message services (SMS) (53) or focus group assessments (54) which in this context could

**TABLE 3 |** The associations of working actively, dialogue, goal clarity, social learning climate, and developmental leadership with the outcomes improvement work, health-oriented leadership, job satisfaction and vitality: The results of multivariate linear regression analysis.

| | Improvement work† β (SE) | Health-oriented leadership† β (SE) | Job satisfaction† β (SE) | Vitality† β (SE) |
|---|---|---|---|---|
| **Model 1** | | | | |
| Working actively | 0.2** (0.1) | 5.4** (1.5) | 3.0**(0.97) | 2.0 (1.4) |
| Intercept | 0.2 | 0.9 | −0.9 | 4.3 |
| Adj $r^2$ | 0.1 | 0.1 | 0.1 | <0.1 |
| **Model 2** | | | | |
| Working actively | 0.2** (0.1) | 4.7** (1.5) | 2.3** (1.0) | 1.3 (1.4) |
| Dialogue† | 0.1 (0.1) | 6.1** (1.7) | 3.3* (1.1) | 2.9 (1.6) |
| Intercept | 0.1 | −0.6 | 0.3 | 3.9 |
| Adj $r^2$ | 0.1 | 0.1 | 0.1 | <0.1 |
| **Model 3** | | | | |
| Working actively | 0.2** (0.1) | 3.95** (1.49) | 1.95*(0.99) | 0.80 (1.43) |
| Dialogue† | 0.1 (0.1) | 4.90** (1.71) | 2.40* (1.09) | 1.71 (1.65) |
| Goal clarity† | <0.1* (<0.1) | 0.3** (0.1) | 0.3** (0.1) | 0.2‡ (0.01) |
| Intercept | 0.1 | −1.7 | −0.4 | 2.9 |
| Adj $r^2$ | 0.1 | 0.2 | 0.2 | 0.1 |
| **Model 4** | | | | |
| Working actively | 0.2** (0.1) | 3.19* (1.45) | 1.94* (0.97) | 0.57 (1.43) |
| Dialogue† | 0.1 (0.1) | 4.32** (1.63) | 1.90 (1.08) | 1.89 (1.44) |
| Goal clarity† | <0.1 (<0.1) | 0.1 (0.1) | 0.1** (<0.1) | 0.2‡ (0.1) |
| Social learning climate† | 0.1 (0.1) | 12.1** (2.5) | 5.5** (1.6) | 0.5 (2.5) |
| Intercept | 0.1 | −1.0 | −0.1 | 3.2 |
| Adj $r^2$ | 0.1 | 0.2 | 0.3 | <0.1 |
| **Model 5** | | | | |
| Working actively | 0.2** (0.1) | 3.0* (1.23) | 1.8* (0.9) | 0.7 (1.5) |
| Dialogue† | 0.1 (0.1) | 3.1* (1.4) | 1.6 (1.1) | 1.9 (1.6) |
| Goal clarity† | <0.1 (<0.1) | <0.1 (0.1) | 0.1* (<0.1) | 0.1 (0.1) |
| Social learning climate† | 0.1 (0.1) | 8.5** (2.3) | 4.3** (1.6) | 0,0 (2.6) |
| Developmental leadership† | 0.01* (<0.1) | 0.4** (0.1) | 0.1** (<0.1) | 0.1 (0.1) |
| Intercept | 0.1 | −0.4 | 0.1 | 3.3 |
| Adj $r^2$ | 0.2 | 0.5 | 0.3 | 0.0 |

*β (SE)= Unstandardized b-coefficients (standard errors).*

*† Increased/improved health-oriented leadership, improvement work, job satisfaction, vitality dialogue, goal clarity, social learning climate, or developmental leadership = Differences in ratings between T1 and T3.*

*‡p < 0.10, *p < 0.05, and **p < 0.01.*

be considered less time consuming for workplaces to participate in intervention studies.

## CONCLUSIONS

Conclusions that can be drawn from this study include the fact that the outcomes of WHP leadership interventions interact with dimensions of the organizational learning climate in the workplace. These interactions can be seen as proximal processes that highly depend on individuals' active behaviors, including social interactions between managers and employees in the workplace (10). This study confirms the value of clustered analysis based on manager's active work to trace outcomes following leadership interventions (30). Practical implications from the study include confirmation that dialogue on work environment issues, developmental leadership, and social learning climate may be used as process indicators for development of comprehensive WHP interventions.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Central Ethical Review Board at Karolinska Institutet, Stockholm, Sweden, EPN 2014/1883-31/5. The patients/participants provided their written informed consent to

participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## AUTHOR CONTRIBUTIONS

AE and LD: conception or design of the work, data analysis and interpretation, critical revision of the article, and final approval of the manuscript version being submitted. AE: data collection and drafting the article. All authors contributed to the article and approved the submitted version.

## FUNDING

This project was financed by AFA Insurance, reference number 150336.

## REFERENCES


1. Parsons ML. Health promoting organizations: a systems model for advanced practice. *Holist Nurs Pract*. (1999) 13:80–9. doi: 10.1097/00004650-199907000-00012
2. Dellve L, Eriksson A. Health-promoting managerial work: a theoretical framework for a leadership program that supports knowledge and capability to craft sustainable work practices in daily practice and during organizational change. *Societies*. (2017) 7:12. doi: 10.3390/soc7020012
3. Eriksson A, Orvik A, Strandmark M, Nordsteien A, Torp S. Management and leadership approaches to health promotion and sustainable workplaces: a scoping review. *Societies*. (2017) 7:14. doi: 10.3390/soc7020014
4. Nielsen K, Taris TW. Leading well: Challenges to researching leadership in occupational health psychology-and some ways forward. *Work Stress*. (2019) 33:107–18. doi: 10.1080/02678373.2019.1592263
5. Skagert K, Dellve L, Eklöf M, Pousette A, Ahlborg Jr G. Leaders' strategies for dealing with own and their subordinates' stress in public human service organisations. *Appl Ergon*. (2008) 39:803–11. doi: 10.1016/j.apergo.2007.10.006
6. Dellve L, Wikström E. Managing complex workplace stress in health care organizations: leaders' perceived legitimacy conflicts. *J Nurs Manag*. (2009) 17:931–41. doi: 10.1111/j.1365-2834.2009.00996.x
7. Eriksson A, Axelsson R, Bihari Axelsson S. Development of health promoting leadership-experiences of a training programme. *Health Educ*. (2010) 110:109–24. doi: 10.1108/09654281011022441
8. Tjulin Å, Landstad B, Vinberg S, Eriksson A, Hagqvist E. (2019). Managers' learning process during a health-promoting leadership intervention. *Health Educ* 119. 350–365. doi: 10.1108/HE-02-2019-0004
9. Dooris M. Healthy settings: challenges to generating evidence of effectiveness. *Health Promot Int*. (2006) 21:55–65. doi: 10.1093/heapro/dai030
10. Bronfenbrenner U, Morris PA. The bioecological model of human development. In: Damon W, Lerner RM, editors. *Handbook of Child Psychology: Theoretical Models of Human Development*. New York, NY: Wiley (2006). p. 793–828.
11. Kelloway K, Teed M, Kelley E. The psychosocial environment: towards an agenda for research. *Int J Workplace Health Manag*. (2008) 1:50–64. doi: 10.1108/17538350810865596
12. Chu C, Breucker G, Harris N, Stitzel A, Gan X, Gu X, et al. Health-promoting workplaces-international settings development. *Health Promot Int*. (2000) 15:155–67. doi: 10.1093/heapro/15.2.155
13. Paton K, Sengupta S, Hassan L. Settings, systems and organization development: the Healthy Living and Working Model. *Health Promot Int*. (2005) 20:81–9. doi: 10.1093/heapro/dah510
14. Dellve L, Skagert K, Vilhelmsson R. Leadership in workplace health promotion projects: 1-and 2-year effects on long-term work attendance. *Eur J Public Health*. (2007) 17:471–6. doi: 10.1093/eurpub/ckm004
15. Biggs A, Brough P, Barbour JP. Enhancing work-related attitudes and work engagement: a quasi-experimental study of the impact of an organizational intervention. *Int J Stress Manag*. (2014) 21:43–68. doi: 10.1037/a0034508
16. Franke F, Felfe J, Pundt A. The impact of health-oriented leadership on follower health: development and test of a new instrument measuring health-promoting leadership. *German J Hum Resource Manag*. (2014) 28:139–61. doi: 10.1177/239700221402800108
17. Jiménez P, Winkler B, Dunkl A. Creating a healthy working environment with leadership: the concept of health-promoting leadership. *Int J Hum Resource Manag*. (2017) 28:2430–48. doi: 10.1080/09585192.2015.1137609
18. Kim S. Participative management and job satisfaction: lessons for management leadership. *Public Adm Rev*. (2002) 62:231–41. doi: 10.1111/0033-3352.00173
19. Tummers L, Steijn B, Nevicka B, Heerema M. The effects of leadership and job autonomy on vitality: survey and experimental evidence. *Rev Public Pers Administr*. (2018) 38:355–77. doi: 10.1177/0734371X16671980
20. Gill AS, Flaschner AB, Shachar M. Mitigating stress and burnout by implementing transformational-leadership. *Int J Contemp Hosp Manag*. (2006) 18:469–81. doi: 10.1108/09596110610681511
21. Munir F, Nielsen K, Carneiro IG. Transformational leadership and depressive symptoms: a prospective study. *J Affect Disord*. (2010) 120:235–9. doi: 10.1016/j.jad.2009.03.020
22. Avolio BJ, Walumbwa FO, Weber TJ. Leadership: current theories, research, and future directions. *Ann Rev Psychol*. (2009) 60:421–49. doi: 10.1146/annurev.psych.60.110707.163621
23. Vinberg S, Landstad BJ. Workplace-based prevention and rehabilitation programs in Swedish public human service organisations. *Int J Disabil Manag*. (2014) 9:1–10. doi: 10.1017/idm.2014.1
24. Greasley K, Edwards P. When do health and well-being interventions work? *Manag Commit Context Econ Indust Democr*. (2015) 36:355–77. doi: 10.1177/0143831x13508590
25. Enos MD, Kehrhahn MT, Bell A. Informal learning and the transfer of learning: how managers develop proficiency. *Hum Resour Dev Q*. (2003) 14:369–87. doi: 10.1002/hrdq.1074
26. Watkins KE, Lysø IH, deMarrais K. Evaluating executive leadership programs: a theory of change approach. *Adv Dev Hum Resour*. (2011) 13:208–39. doi: 10.1177/1523422311415643
27. Orvik A, Axelsson R. Organizational health in health organizations: towards a conceptualization. *Scand J Caring Sci*. (2012) 26:796–802. doi: 10.1111/j.1471-6712.2012.00996.x
28. Gustavsson M, Ekberg K. Learning to promote health at an emergency care department: identifying expansive and restrictive conditions. *Stud Continuing Educ*. (2015) 37:18–29. doi: 10.1080/0158037X.2014.904780
29. Mikkelsen A, Grønhaug K. Measuring organizational learning climate: a cross-national replication and instrument validation study among public sector employees. *Rev Public Pers Administr*. (1999) 19:31–44. doi: 10.1177/0734371X9901900404
30. Wilhelmson L, Åberg MM, Backström T, Olsson BK. Enabling transformative learning in the workplace: an educative research intervention. *J Transform Educ*. (2015) 13:219–38. doi: 10.1177/1541344615574599
31. Hudson FM. *The Handbook of Developmental Leadership: A Comprehensive Resource Guide for Managers, Executives, Consultants, and Human Resource Professionals*. San Francisco, CA: Jossey-Bass (1999).
32. Gilley JW, Shelton PM, Gilley A. Developmental leadership: a new perspective for human resource development. *Adv Dev Hum Resour*. (2011) 13:386–405. doi: 10.1177/1523422311424264
33. Ljungblad C, Granström F, Dellve L, Åkerlind I. Workplace health promotion and working conditions as determinants of employee health. *Int J Workplace Health Manag*. (2014) 7:89–104. doi: 10.1108/IJWHM-02-2013-0003

34. Rojatz D, Merchant A, Nitsch M. Factors influencing workplace health promotion intervention: a qualitative systematic review. *Health Promot Int*. (2017) 32:831–9. doi: 10.1093/heapro/daw015
35. Nielsen K, Taris TW, Cox T. The future of organizational interventions: addressing the challenges of today's organizations. *Work Stress*. (2010) 24:219–33. doi: 10.1080/02678373.2010.519176
36. Henning R, Warren N, Robertson M, Faghri P, Cherniack M, CPH-NEW Research Team. Workplace health protection and promotion through participatory ergonomics: an integrated approach. *Public Health Rep*. (2009) 124:26–35. doi: 10.1177/00333549091244S104
37. Fagerlind Ståhl AC. *Live long and prosper: health-promoting conditions at work* [Doctoral dissertation], Linköping University, Linköping, Sweden (2015).
38. Oksanen T, Kouvonen A, Kivimäki M, Pentti J, Virtanen M, Linna A, et al. Social capital at work as a predictor of employee health: multilevel evidence from work units in Finland. *Soc Sci Med*. (2008) 66:637–49. doi: 10.1016/j.socscimed.2007.10.013
39. Kramer RM. Social capital and cooperative behavior in the workplace: a social identity perspective. *Adv Group Proc*. (2006) 23:1–30. doi: 10.1016/S0882-6145(06)23001-7
40. Fujita S, Kawakami N, Ando E, Inoue A, Tsuno K, Kurioka S, et al. The association of workplace social capital with work engagement of employees in health care settings: a multilevel cross-sectional analysis. *J Occup Environ Med*. (2016) 58:265–71. doi: 10.1097/JOM.0000000000000605
41. Strömgren M, Eriksson A, Bergman D, Dellve L. Social capital among healthcare professionals: a prospective study of its importance for job satisfaction, work engagement and engagement in clinical improvements. *Int J Nurs Stud*. (2016) 53:116–25. doi: 10.1016/j.ijnurstu.2015.07.012
42. Kouvonen A, Kivimäki M, Vahtera J, Oksanen T, Elovainio M, Cox T, et al. Psychometric evaluation of a short measure of social capital at work. *BMC Public Health*. (2006) 6:251. doi: 10.1186/1471-2458-6-251
43. Eriksson A. *Health-promoting leadership: a study of the concept and critical conditions for implementation and evaluation* [Doctoral dissertation]. Nordic School of Public Health NHV, Göteborg, Sweden (2011).
44. Astnell S, von Thiele Schwarz U, Hasson H, Augustsson H, Stenfors-Hayes T. Integrating health promotion with quality improvement in a Swedish hospital. *Health Promot Int*. (2015) 31:495–504. doi: 10.1093/heapro/dav027
45. Bergman C, Dellve L, Skagert K. Exploring communication processes in workplace meetings: a mixed methods study in a Swedish healthcare organization. *Work*. (2016) 54:533–41. doi: 10.3233/WOR-162366
46. Eriksson A, Dellve L. Effekter av ledarprogram för hållbart och hälsofrämjande ledarskap på sjukfrånvaro, sjuknärvaro och utmattning. [Effects on sickness absence, sickness presenteeism and exhaustion following program for sustainable and health-promoting leadership]. *Socialmedicinsk Tidskrift*. (2020) 97:78–91.
47. Dellve L, Eriksson A. *Hållbart och Hälsofrämjande Ledarskap i Vardag och Förändring [Sustainable and Health-Promoting Leadership in Daily Work and During Change],* Styrning, Organisering och Ledning, 2016:1, Högskolan Borås (2016).
48. Eriksson A, Skagert K, Dellve L. Utveckling av hälsofrämjande ledarskap och medarbetarskap - Erfarenheter av att arbeta med interventioner utifrån ett arbetsmaterial. [Development of health-promoting leadership and co-workership - Experiences of working with interventions based on a work material]. *Socialmedicinsk Tidskrift*. (2013) 90:793–8.
49. Holden RJ, Eriksson A, Andreasson J, Williamsson A, Dellve L. Healthcare workers' perceptions of lean: a context-sensitive, mixed methods study in three Swedish hospitals. *Appl Ergon*. (2015) 47:181–92. doi: 10.1016/j.apergo.2014.09.008
50. Eriksson A, Holden RJ, Williamsson A, Dellve L. A case study of three Swedish hospitals' strategies for implementing lean production. *Nordic J Working Life Stud*. (2016) 6:105–31. doi: 10.19154/njwls.v6i1.4912
51. Gunnarsdóttir S, Edwards K, Dellve L. Improving health care organizations through servant leadership. In: van Dierendonck D, Patterson K, editors. *Practicing Servant Leadership*. Cham: Palgrave Macmillan. p. 249–273. doi: 10.1007/978-3-319-75644-8_14
52. Nielsen K. How can we make organizational interventions work? Employees and line managers as actively crafting interventions. *Hum Relat*. (2013) 66:1029–50. doi: 10.1177/0018726713477164
53. Arapovic-Johansson B, Wåhlin C, Kwak L, Björklund C, Jensen I. Work-related stress assessed by a text message single-item stress question. *Occup Med*. (2017) 67:601–8. doi: 10.1093/occmed/kqx111
54. Rydén L. *Diskursiv arbetsmiljö: ett nytt perspektiv på organisatorisk arbetsmiljö*. [*Discursive work environment: A new perspective on organizational work environment]* [Doctoral dissertation]. KTH Royal Institute of Technology, Stockholm, Sweden (2020).
55. Kelloway EK, Turner N, Barling J, Loughlin C. Transformational leadership and employee psychological well-being: The mediating role of employee trust in leadership. *Work Stress*. (2012) 26:39–55. doi: 10.1080/02678373.2012.660774
56. Kristensen TS, Hannerz H, Høgh 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) 31:438–49. doi: 10.5271/sjweh.948
57. Arneson H, Ekberg K. Evaluation of empowerment processes in a workplace health promotion intervention based on learning in Sweden. *Health Promot. Int*. (2005) 20:351–9. doi: 10.1093/heapro/dai023
58. Lutz Ö. Hållbart medarbetarengagemang i kommuner och regioner. *HME, modell och användaranvisningar [Sustainable employee engagement i municipalities and regions. HME, model and user instructions]*, SKL (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 Public Health

ORIGINAL RESEARCH
published: 23 November 2020
doi: 10.3389/fpubh.2020.546286

# The Effect of Physical Exercise Training on Neck and Shoulder Muscle Function Among Military Helicopter Pilots and Crew: A Secondary Analysis of a Randomized Controlled Trial

*Mike Murray*[1], *Britt Lange*[2], *Karen Søgaard*[1,3]* *and Gisela Sjøgaard*[1]

[1] Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, Denmark, [2] Department of Anesthesia and Intensive Care Medicine, Odense University Hospital, Odense, Denmark, [3] Department of Clinical Research, University of Southern Denmark, Odense, Denmark

OPEN ACCESS

**Edited by:**
*Danijela Gasevic, Monash University, Australia*

**Reviewed by:**
*Sok King Ong, Ministry of Health, Brunei*
*Christopher Scheibler, Harvard University, United States*

***Correspondence:**
*Karen Søgaard*
*ksogaard@health.sdu.dk*

**Specialty section:**
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

**Received:** *23 April 2020*
**Accepted:** *27 October 2020*
**Published:** *23 November 2020*

**Citation:**
*Murray M, Lange B, Søgaard K and Sjøgaard G (2020) The Effect of Physical Exercise Training on Neck and Shoulder Muscle Function Among Military Helicopter Pilots and Crew: A Secondary Analysis of a Randomized Controlled Trial. Front. Public Health 8:546286. doi: 10.3389/fpubh.2020.546286*

**Introduction:** This study presents secondary outcome analyses, in terms of muscle function [i.e., maximal voluntary contraction (MVC) and rate of torque development (RTD)] from a parallel group, single blinded, randomized controlled trial introducing a physical exercise training intervention aiming to reduce neck pain among military helicopter pilots and crew-members.

**Methods:** Participants (50 pilots, 58 crew-members) were recruited from the Royal Danish Air Force and randomized to either an exercise-training-group (ETG; $n = 35$) or a reference-group (REF; $n = 34$). Participants in ETG received 20 weeks of self-administered exercise training specifically tailored to target the neck and shoulder muscles. REF received no training. Outcome: (1) MVC was measured for cervical extension and flexion as well as shoulder elevation and abduction, (2) RTD was measured for cervical extension and flexion. Adherence to training was self-reported and categorized as regular if performed at least once a week.

**Results:** MVC for cervical extension was significantly increased at follow-up in ETG (37.5 ± 11.2 Nm at baseline, change: 2.1 ± 8.3 Nm) compared to REF (38.1 ± 10.7 Nm at baseline, change: −2.4 ± 6.8 Nm) according to intension-to-treat analysis ($p = 0.018$). Likewise, RTD was significantly increased in ETG for cervical extension (149.6 ± 63.3 Nm/s at baseline, change: 14.7 ± 49.0 Nm/s) compared to REF (165.4 ± 84.7 Nm/s at baseline, change: −16.9±70.9 Nm/s) ($p = 0.034$). The cervical extension/flexion MVC-ratio was significantly different at follow-up ($p = 0.039$) between ETG (1.5 ± 0.5 at baseline, change: −0.0 ± 0.3) compared to REF (1.5 ± 0.5 at baseline, change: −0.2 ± 0.4). Per-protocol analysis of MVC, including only participants in ETG with regular training adherence ($n = 10$), showed a significant increase for cervical extension (33.2 ± 7.3 Nm at baseline, change: 6.0 ± 5.4 Nm) and shoulder elevation right side (143.0 ± 25.8 Nm at baseline, change: 15.8 ± 18.1 Nm).

**Conclusion:** Physical exercise training significantly improved MVC and RTD in the upper neck extensors. Only approximately 1/3 of participants in ETG adhered to training regularly, which likely attenuated the effectiveness of the training intervention on neck and shoulder muscle function. Future studies should focus on the practical implementation of self-administered exercise training to improve adherence.

**Keywords: neck, exercise, intervention, muscle strength, rate of force development, musculoskeletal pain**

## INTRODUCTION

Neck pain is documented as highly prevalent within military helicopter communities (1–4). A Canadian survey reported that up to 81% of the surveyed helicopter pilots and 85% of the crew-members had experienced neck pain related to helicopter flights (5). Neck pain within the helicopter community is an important issue to address, but limited research has been conducted aiming to prevent the high prevalence of neck pain within this occupational group. Different aspects of helicopter flight and factors associated with neck pain among helicopter pilots and crew-members have been assessed (1). One factor often associated with neck pain and discomfort is the use of night vision goggles (NVG) (5). Studies conducted in laboratory settings have established that the helmet mass increase the metabolic response (6, 7) and muscle strain (8) in the cervical musculature. Muscle strain is also affected by adapted postures during flight, and studies have found positioning of the head and body to have greater influence on muscle strain than the load due to head-worn equipment such as NVG (9, 10). Recently, we addressed this issue during real flight scenarios (11). External loading on the cervical spine, by use of a helmet and NVG, may potentially evolve into excessive internal loading of the cervical vertebrae and the musculature supporting the neck. This might translate into the high prevalence of neck pain observed within the helicopter community.

Studies on patients with chronic neck pain have reported significant reductions in maximal isometric strength for cervical flexion (12) and cervical extension (13), or in both (14), as compared to healthy matched controls, with the greatest reduction seen in the extensor muscle groups (15). Selective impaired neck muscles strength in either flexor of extensor muscles may impact the normal balance between cervical extension and flexion strength, which among pain free individuals has been found to be approximately 1.7 (16). The extensive load on the upper neck extensors during flight may in particular call for proper cervical extension strength and an extension/flexion ratio of 1.7 or more (11). Rapid movements have been found to exacerbate fear of pain among patients with chronic pain (17, 18). In addition, rapid force development of painful muscles and pain-free synergistic muscles was also found to be more severely impaired among individuals with chronic musculoskeletal pain than maximal strength capacity (19). Pain may therefore not only impact isometric maximal force development but also the speed by which the movement can be performed (20). Physical exercise training may be beneficial in terms of pain development prevention and rehabilitation by means of increasing individual capacity and thereby lowering the relative workload (21).

Reduction in work related neck pain among a number of different working populations has been found using all-round physical exercise training (22), proprioceptive muscle coordination training (23), and in particular strength training (24–27). This was confirmed for office workers in a recent systematic review and meta-analysis (28). However, another systematic review of such training interventions reports uncertainty regarding the effectiveness of exercise in the relief of neck pain (29). Therefore, knowledge regarding effectiveness of exercise on neck pain within specific occupational groups still needs to be addressed. For instance, such evidence is needed in order to establish specific guidelines on physical exercise training for the prevention or rehabilitation of flight related neck pain within the helicopter community. This paper presents secondary outcome analyses, in terms of muscle strength, from a randomized controlled trial introducing a physical exercise training intervention aiming to reduce and prevent neck pain among military helicopter pilots and crew-members (30). At baseline the 12-month prevalence of neck pain was 82 and 90% for crew and pilots, respectively, and around 1/3 had experienced pain 8–30 days. Pain may lead to flying restrictions and jeopardize future employment opportunities thus legitimizing interventions such as strength training that may reduce such pain. Of interest was further if such training could also improve relevant physical capacities. The hypotheses were that the adherence to a self-administered physical exercise training intervention would: (1) significantly increase neck and shoulder maximal voluntary contraction (MVC), and rate of torque development (RTD), and (2) significantly increase MVC and RTD during cervical extension and flexion, maintaining a balanced extension/flexion MVC-ratio.

## METHODS

### Study Design

This study was a parallel group, single blinded, randomized-controlled trial, including baseline and follow-up measurements after 20 weeks. The study was conducted within the Royal Danish Air Force (RDAF) from November 2013 to April 2014 and the study was approved by the local Ethics Committee of Southern Denmark (S-20120121) and qualified for registration in ClinicalTrails.gov (NCT01926262). Each subject provided written informed consent before participation.

## Participants and Randomization

In total, 50 military helicopter pilots and 58 crew-members, from two squadrons within the RDAF were invited to participate in this study. After oral and written information regarding the study, informed consent was obtained from 69 participants (31 pilots—hereof 2 females, 38 crew-members—all males). Participant flow is depicted in **Figure 1**. Inclusion criteria were: (1) occupation as a helicopter pilot or crew-member (technician, systems operator, tactical helicopter observer, and/or navigator), (2) operational flight status at enrollment, (3) operational flying within the previous 6 months. Exclusion criteria were: (1) participation in a training intervention within the last 12 months. Participants were assigned a random identification number at enrollment and randomized 1:1 to either an exercise-training-group (ETG) or a reference-group (REF). The randomization procedure was performed after baseline assessments. A detailed description can be found elsewhere (30).

## Exercise Intervention

Participants randomized to REF received no training, but were encouraged to continue with their usual exercise activities. Participants in the ETG received 20 weeks of strength, endurance, and coordination training, specifically tailored to target the neck and shoulder muscles based on work exposure assessments (11). Training was based on self-management education and was to be performed three times 20 min a week within working hours. Every training session was initiated with one or two conditioning exercises for the neck, specifically targeting the deep cervical musculature. Exercises included: Upper cervical flexion/extension from a supine position, and cervical rotation against mild resistance. The conditioning exercise was followed by training exercises for the neck targeting larger muscle groups. Exercises included: cervical extension, cervical flexion (straight forward and in oblique directions), and lateral flexion. Lastly, participants performed two training exercises for the shoulders including shrugs and reverse flyes. Training exercises for the neck and shoulders were performed using elastic training bands for resistance (Thera-Band®, The Hygenic Corporation, USA) and a head harness (The Original Neck Flex® Head Harness, Gonzo Companies, USA). The training program was designed with systematic variation in intensity and volume based on undulating (non-linear) periodization securing a progressive overload. Sessions ranged between 2 and 4 sets and training intensity ranged between 12 and 20 repetitions over the 20 weeks of training. This has previously for each of the 20 weeks of training been described in details in the protocol for the study (30).

The training program was evidence based (31, 32) designed by an interdisciplinary team of sports exercise training specialists, physiotherapists, doctors and chiropractors. A complete exercise description has been published elsewhere (30).

## Outcome Measurements

Participant characteristics, including age, height, seated height, weight and neck circumference were measured with standard clinical rulers and measuring tapes both pre and post intervention. Measurements of muscle function included MVC and RTD for bilateral shoulder abduction and elevation, as well as cervical extension and flexion. Measurements were performed following 10 min of warming up on a rowing ergometer. All measurements have been described in detail previously (30) and will only be described briefly. During MVC for shoulder abduction participants were positioned seated with both arms held close to the body and elbows flexed 90 degrees. Two force transducers (load cell, KIS-2, 2kN, Vishay Nobel, Vishay Precision Group, USA) were positioned 1 cm above the lateral epicondyle. The lever arm between the lateral edge of acromion and the force transducers was used for later analysis. During MVC measurements for shoulder elevation, a force transducer was placed on each shoulder 1 cm medially from the lateral edge of the acromion. The lever arm was measured from the seventh cervical vertebra to the center of the transducers. During MVC and RTD for cervical extension and flexion the participants were positioned seated with their backs straight, arms positioned along the sides of the body, both feet on the floor, and head and neck held in an anatomical neutral position. Participants were positioned with their backs against the experimental set-up during cervical extension and the force transducers were positioned just above the external occipital protuberance. During cervical flexion participants were positioned with their front against the experimental set-up and a force transducer was positioned just above the eyebrows. The vertical distance between the seventh cervical vertebra and the center of the force transducer was measured as the lever arm. All MVC values were calculated as torque and presented in Nm. Regarding the cervical extension/flexion MVC-ratio the data were also calculated based on the values in N.

Before testing, subjects were strapped firmly into place using belts and MVC and RTD were measured using a standardized method and procedure (33). The instruction for participants during the MVC tests was to increase the force gradually during measurements reaching MVC in 5 s, hold the force at MVC for 2 s and slowly reduce the force again. A minimum of three MVC tests were performed. If the result of the third MVC was $\geq$5% compared to the first or second MVC, another MVC trial was performed. A maximum of five trials were allowed for each test. The MVC tests were performed with verbal encouragement. Force was amplified with a gain of 100 (National Instruments Corporation, Full bridge amplifier, SCC-SG24, USA), and sampled at 100 Hz using a 16-bit A/D converter (National Instruments Corporation, DAQ Card TM-6034E, USA). The MVC was determined as the peak torque (unit Nm) and the highest MVC value of all trials was saved and stored for analysis. For cervical extension and flexion, the MVC-ratio was calculated as MVC for cervical extension divided with MVC for cervical flexion. RTD was measured during MVC for shoulder elevation, cervical extension and flexion. For these trials the instruction to participants was: "on the command 3-2-1 you must apply a slight pressure against the force transducer and on the command NOW… press as hard and fast as possible. You must keep the pressure for a second and then slowly relax again" (30). Force was amplified with a gain of 100 and sampled at 1000 Hz using the A/D converter. A total of three RTD trials were performed. For each trial the RTD (unit Nm/s) was determined

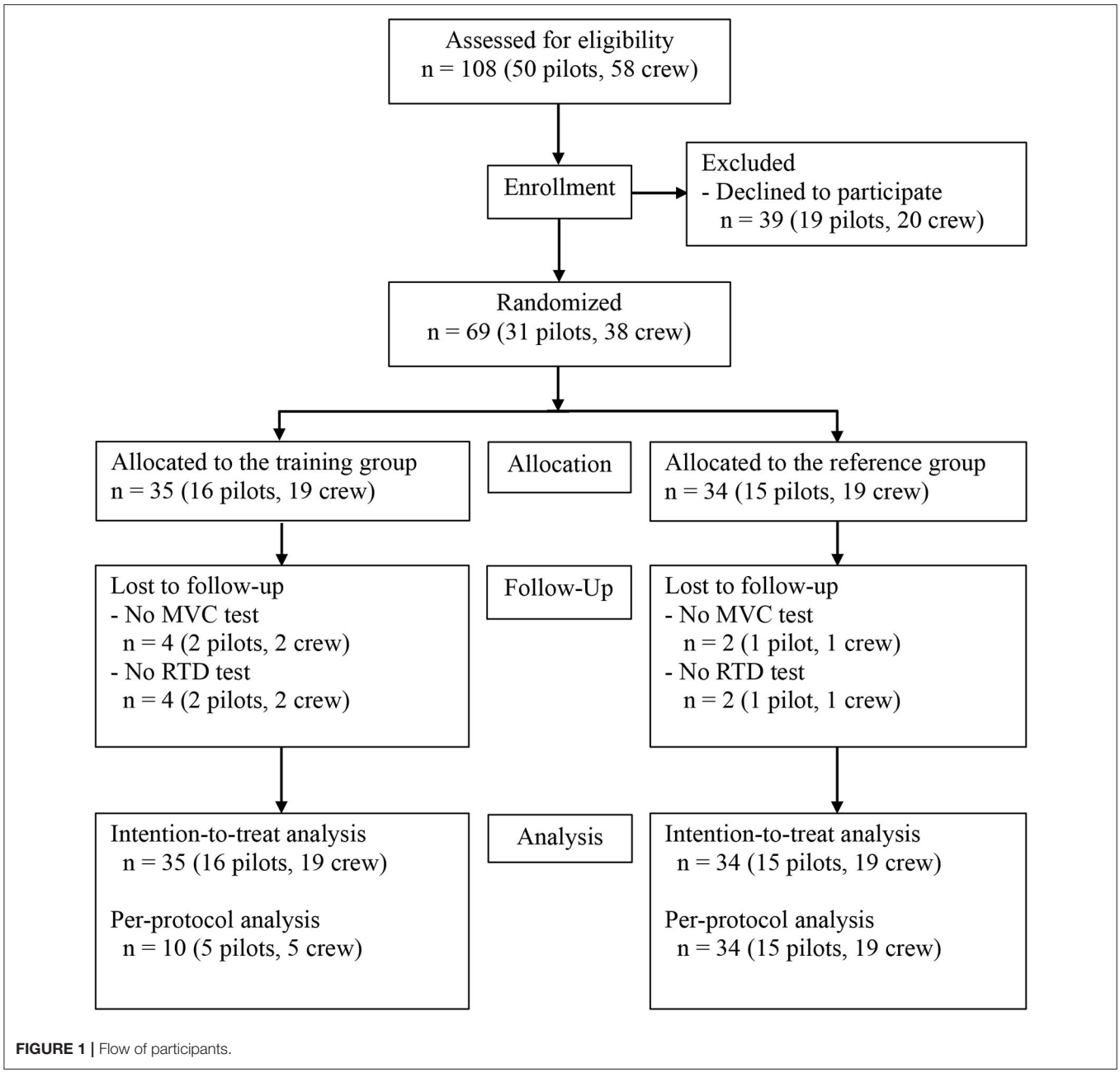


**FIGURE 1 |** Flow of participants.

as the steepest slope over 100 ms of the rising part of the filtered torque-time curve. The highest obtained value was determined as the peak RTD.

## STATISTICAL ANALYSIS

Normality of the residuals was assessed using a *Q*–*Q* plot, and a Shapiro Wilk's test and showed no consistent deviation from a normal distribution. Participant characteristics: age, height, seated height, weight, neck circumference and lever arms for shoulder abduction, shoulder elevation, cervical flexion, and cervical extension, were analyzed for between-group-difference at baseline using the Student's *t*-test. Between-group-differences for MVC and RTD were analyzed using delta values (change from pre- to post-intervention) using the Student's *t*-test. Within-group-changes were analyzed using a paired *t*-test. Two analyses were conducted: (1) an intention-to-treat analysis (ITT-analysis) including all randomized participants, and (2) a per-protocol analysis (PP-analysis) only including participants in ETG with regular training adherence defined as at least 1 training session a week throughout the 20-week intervention period (30). Missing data was imputed using last observation carried forward or backwards. When missing at both baseline and follow-up, baseline values were imputed as the mean value of the entire cohort and values at follow-up were imputed at the baseline value adjusted for the observed change (%) among those measured

**TABLE 1 |** Participant's baseline characteristics and lever arm length used for torque measurements.

| | ETG ($n = 35$) | REF ($n = 34$) |
|---|---|---|
| Age (years) | 40.4 ± 6.7 | 40.7 ± 8.4 |
| Height (m) | 1.82 ± 0.07 | 1.80 ± 0.08 |
| Seated height (cm) | 94.5 ± 4.5 | 94.5 ± 4.1 |
| Weight (kg) | 84.2 ± 12.7 | 83.7 ± 11.8 |
| Neck circumference (mm) | 390 ± 24 | 391 ± 20 |
| Lever arm: cervical extension (mm) | 151 ± 17 | 158 ± 13 |
| Lever arm: cervical flexion (mm) | 148 ± 17 | 154 ± 16 |
| Lever arm: shoulder elevation (right) (mm) | 182 ± 18 | 174 ± 12 |
| Lever arm: shoulder elevation (left) (mm) | 184 ± 17 | 175 ± 14 |
| Lever arm: shoulder abduction (right) (mm) | 274 ± 17 | 267 ± 31 |
| Lever arm: shoulder abduction (left) (mm) | 280 ± 26 | 269 ± 19 |

*Values are presented as mean and standard deviation.*

**TABLE 2 |** Intention-to-treat analysis of maximal voluntary contraction and rate of torque development.

| | | | ETG ($n = 35$) | REF ($n = 34$) | *P*-value |
|---|---|---|---|---|---|
| Rate of torque development | Cervical extension (Nm/s) | Baseline | 149.6 ± 63.3 | 165.4 ± 84.7 | 0.384 |
| | | Follow-up | 164.3 ± 73.4 | 148.4 ± 64.9 | 0.343 |
| | | Change | 14.7 ± 49.0 | −16.9 ± 70.9 | 0.034* |
| | Cervical flexion (Nm/s) | Baseline | 104.0 ± 47.7 | 109.1 ± 49.5 | 0.665 |
| | | Follow-up | 115.2 ± 57.0 | 104.0 ± 40.9 | 0.351 |
| | | Change | 11.2 ± 46.7 | −5.1 ± 47.3 | 0.153 |
| Maximal voluntary contraction | Cervical extension (Nm) | Baseline | 37.3 ± 11.2 | 38.1 ± 10.7 | 0.747 |
| | | Follow-up | 39.3 ± 10.2 | 35.8 ± 10.3 | 0.153 |
| | | Change | 2.1 ± 8.3 | −2.4 ± 6.8† | 0.018* |
| | Cervical flexion (Nm) | Baseline | 27.5 ± 9.8 | 26.5 ± 8.4 | 0.671 |
| | | Follow-up | 28.6 ± 9.9 | 27.0 ± 7.0 | 0.428 |
| | | Change | 1.2 ± 6.4 | 0.5 ± 4.3 | 0.595 |
| | Shoulder elevation (right) (Nm) | Baseline | 143.5 ± 39.2 | 135.9 ± 30.8 | 0.374 |
| | | Follow-up | 149.1 ± 40.4 | 134.8 ± 32.2 | 0.108 |
| | | Change | 5.6 ± 21.5 | −1.1 ± 20.5 | 0.188 |
| | Shoulder elevation (left) (Nm) | Baseline | 154.3 ± 45.8 | 142.6 ± 33.7 | 0.231 |
| | | Follow-up | 150.7 ± 45.3 | 137.2 ± 35.1 | 0.175 |
| | | Change | −3.6 ± 16.3 | −5.3 ± 15.7 | 0.662 |
| | Shoulder abduction (right) (Nm) | Baseline | 103.2 ± 28.4 | 108.1 ± 30.7 | 0.485 |
| | | Follow-up | 104.9 ± 33.7 | 109.5 ± 24.3 | 0.528 |
| | | Change | 1.8 ± 20.5 | 1.3 ± 18.2 | 0.917 |
| | Shoulder abduction (left) (Nm) | Baseline | 106.8 ± 31.7 | 108.6 ± 33.4 | 0.827 |
| | | Follow-up | 104.3 ± 36.6 | 109.9 ± 27.2 | 0.480 |
| | | Change | −2.5 ± 20.8 | 1.3 ± 14.8 | 0.387 |

*Values are presented as mean and standard deviation. Significant between-group-differences (*). Significant within-group-differences (†).*

in ETG or REF, respectively. Results are presented as mean ± SD if not otherwise specified. The level of statistical significance was $p < 0.05$. Statistical analyses were performed in Stata Statistics/Data Analysis version 14.0 (StataCorp LP, USA).

# RESULTS

## Pre-intervention

No significant between-group-differences were found at baseline regarding participant characteristics (**Table 1**). Measurements for MVC and RTD were also not significantly different between groups at baseline (**Table 2**). The pre-intervention extension/flexion MVC-ratio was: 1.5 ± 0.5 Nm in ETG and 1.5 ± 0.5 Nm in REF with no significant difference between groups ($p = 0.494$). The MVC-ratio based on calculations without lever arm measurements, was: 1.4 ± 0.5 N in ETG and 1.5 ± 0.5 N in REF with no significant difference between groups ($p = 0.632$).

## Post-intervention (ITT-Analysis)

### Training Adherence

In the ETG 25 out of 35 participants (71%) returned the post-intervention questionnaire regarding training adherence as previously reported (34). Among all participants in the ETG, 10 participants (29%) (5 pilots and 5 crew-members) reported having trained regularly 1–3 times a week throughout the intervention period, 9 participants (26%) reported having trained irregularly, but at least 2–4 times a month, 5 participants (14%) reported that they had done some training but stopped training after a while, and 1 participant (3%) did not use the training offer.

### MVC and RTD

At follow-up, a significant between-group-difference was found for change in MVC during cervical extension (**Table 2**). Furthermore, RTD during cervical extension also increased significantly in ETG as compared to REF (**Table 2**). No significant difference was observed for change in cervical flexion, shoulder abduction (right/left) or shoulder elevation (right/left) at post-intervention, according to the ITT-analysis. Within the REF group a significant reduction for MVC during cervical extension was found (**Table 2**). Results for MVC are presented in Nm but were also analyzed in N and showed the same significant between-group-differences. Also, no significantly different results were found when RTD was analyzed using N/s compared to Nm/s. Measurements of the lever arms used are depicted in **Table 1**. No significant difference in neck circumference was found post-intervention between ETG and REF (ETG, change: −1.0 ± 11 mm vs. REF, change: −6.0 ± 11 mm) ($p = 0.119$). A significant reduction in neck circumference within REF was present (391 ± 20 mm at baseline, change: −6.0 ± 11 mm) ($p = 0.006$). No significant within-group-change for neck circumference was observed for ETG.

### Cervical Extension/Flexion MVC-Ratio

A significant difference in change of MVC-ratio was present between groups with the intervention (ETG, change: 0.0 ± 0.3 vs. REF, change −0.2 ± 0.4) ($p = 0.039$). The difference was also significant when the MVC-ratio was calculated without lever arm measurements (ETG, change: 0.0 ± 0.3 vs. REF, change: −0.2 ± 0.4) ($p = 0.049$). Within REF, the reduction in MVC-ratio was significant from pre- to post-intervention based on Nm

**TABLE 3 |** Per-protocol analysis of maximal voluntary contraction and rate of torque development.

| | | | ETG ($n = 10$) | REF ($n = 34$) | *P*-value |
|---|---|---|---|---|---|
| Rate of torque development | Cervical extension (Nm/s) | Baseline | 139.6 ± 50.0 | 165.4 ± 84.7 | 0.366 |
| | | Follow-up | 162.4 ± 71.5 | 148.4 ± 64.9 | 0.562 |
| | | Change | 22.8 ± 51.1 | −16.9 ± 70.9 | 0.107 |
| | Cervical flexion (Nm/s) | Baseline | 99.8 ± 36.9 | 109.1 ± 49.5 | 0.588 |
| | | Follow-up | 116.3 ± 60.3 | 104.0 ± 40.9 | 0.460 |
| | | Change | 16.4 ± 72.0 | −5.1 ± 47.3 | 0.270 |
| Maximal voluntary contraction | Cervical extension (Nm) | Baseline | 33.2 ± 7.3 | 38.1 ± 10.7 | 0.181 |
| | | Follow-up | 39.2 ± 8.5 | 35.8 ± 10.3 | 0.345 |
| | | Change | 6.0 ± 5.4† | −2.4 ± 6.8† | 0.001* |
| | Cervical flexion (Nm) | Baseline | 25.1 ± 9.7 | 26.5 ± 8.4 | 0.657 |
| | | Follow-up | 26.7 ± 7.4 | 27.0 ± 7.0 | 0.897 |
| | | Change | 1.5 ± 5.9 | 0.5 ± 4.3 | 0.527 |
| | Shoulder elevation (right) (Nm) | Baseline | 143.0 ± 25.8 | 135.9 ± 30.8 | 0.512 |
| | | Follow-up | 158.7 ± 29.7 | 134.8 ± 32.2 | 0.042 |
| | | Change | 15.8 ± 18.1† | −1.1 ± 20.5 | 0.024* |
| | Shoulder elevation (left) (Nm) | Baseline | 157.0 ± 33.7 | 142.6 ± 33.7 | 0.240 |
| | | Follow-up | 151.8 ± 28.1 | 137.2 ± 35.1 | 0.238 |
| | | Change | −5.2 ± 16.3 | −5.3 ± 15.7 | 0.987 |
| | Shoulder abduction (right) (Nm) | Baseline | 104.2 ± 31.7 | 108.1 ± 30.7 | 0.725 |
| | | Follow-up | 102.9 ± 33.9 | 109.5 ± 24.3 | 0.495 |
| | | Change | −1.3 ± 32.3 | 1.3 ± 18.2 | 0.738 |
| | Shoulder abduction (left) (Nm) | Baseline | 103.2 ± 29.0 | 108.6 ± 33.4 | 0.648 |
| | | Follow-up | 95.9 ± 33.1 | 109.9 ± 27.2 | 0.181 |
| | | Change | −7.3 ± 34.2 | 1.3 ± 14.8 | 0.252 |

*Values are presented as mean and standard deviation. Significant between-group-difference (*). Significant within-group-difference (†).*

calculations (from: 1.5 ± 0.5 to: 1.4 ± 0.4) ($p = 0.007$), and also based on N calculations (from: 1.5 ± 0.5 to: 1.3 ± 0.3) ($p = 0.012$).

## Post-intervention (PP-Analysis)

Per-protocol-analysis included only participants from the ETG with regular training adherence ($n = 10$) vs. all participants in the REF group. Significant between-group-differences were present regarding change of MVC for cervical extension (change: 6.0 ± 5.4 Nm, vs. −2.4 ± 6.8 Nm), and shoulder elevation (right side) (change: 15.8 ± 18.1 Nm vs. −1.1 ± 20.5 Nm) (**Table 3**). Between-group-changes are presented in **Figure 2** as percentage of change. Within-group-changes for MVC in ETG were significant for cervical extension (33.2 ± 7.3 Nm at baseline, change: 6.0 ± 5.4 Nm) ($p = 0.007$), and for shoulder elevation (right side) (143.0 ± 25.8 Nm at baseline, change: 15.8 ± 18.1 Nm) ($p = 0.022$). No significant difference for change in neck circumference was observed between ETG and REF. No significant difference was observed for the cervical extension/flexion MVC-ratio between ETG (change: 0.0 ± 0.4) and REF (change: −0.2 ± 0.4) ($p = 0.122$). The non-significant difference persisted when the MVC-ratio was analyzed without lever arm measurements (ETG, change: 0.0 ± 0.4 vs. REF, change: −0.2 ± 0.4) ($p = 0.128$).

# DISCUSSION

The main findings of this study were that: (1) 20 weeks of physical exercise training, designed to reduce and prevent neck pain, significantly improved MVC and RTD in the cervical extensor muscles of military helicopter pilots and crew-members, (2) participants with regular training adherence additionally increased their MVC for shoulder elevation in the right side significantly, and (3) the physical exercise intervention proved preventive in terms of maintaining the cervical extension/flexion MVC-ratio, that decreased significantly in REF from baseline to follow-up.

## MVC and RTD

In agreement with our first hypothesis, self-administered physical exercise training resulted in significant changes between groups at follow-up. The overall difference between groups regarding MVC for cervical extension was ∼11% with an increase of ∼5% in ETG and a decrease of ∼6% in REF. The overall difference in RTD during cervical extension amounted to ∼20% with an increase of ∼10% in ETG and a decrease of ∼10% in REF. Helicopter pilots and crew-members may potentially benefit from increasing upper neck muscle strength, as improvements in strength would increase individual capacity and potentially reduce the relative workload on cervical musculature during flight (21). The ability to develop a fast force torque response to resist external loading may be important, as this will provide neck stabilization and prevent overload of neck tissue. Increasing MVC and RTD may therefore be of functional importance. The decrease in MVC and RTD observed in REF may be due to seasonal variation in work exposure. The winter period incorporates many flight hours with NVG as daylight is short, and pilots and crew-members may experience deterioration in muscle function during the winter period influenced by an excessive workload due to NVG use (11). This could also explain the significant reduction in neck circumference observed in REF, but not in ETG. If the reduction in REF is due to seasonal variation in work exposure, it would be especially important for pilots to engage in regular exercise training in preparation for the winter period. Physiological adaptions in response to exercise training are related to the specific characteristics of the exercises and stimuli used (35). This phenomenon is also referred to as the principle of specificity, underlining that the greatest improvements in muscle function will be found using a test protocol that reflects training mode (35). Our exercise training program included a high amount of repetitions maximum (12–20 RM) with between 2 and 4 sets. Only brief pauses between sets were incorporated to stimulate an increase in endurance to a greater extent than increased strength (30). This decision was based on a previous in-flight exposure assessment where electromyography recordings were used (11) and demonstrated prolonged activation of the neck/shoulder muscles. These former findings imply that neck/shoulder muscles might also benefit from endurance training and not strength training alone (1).

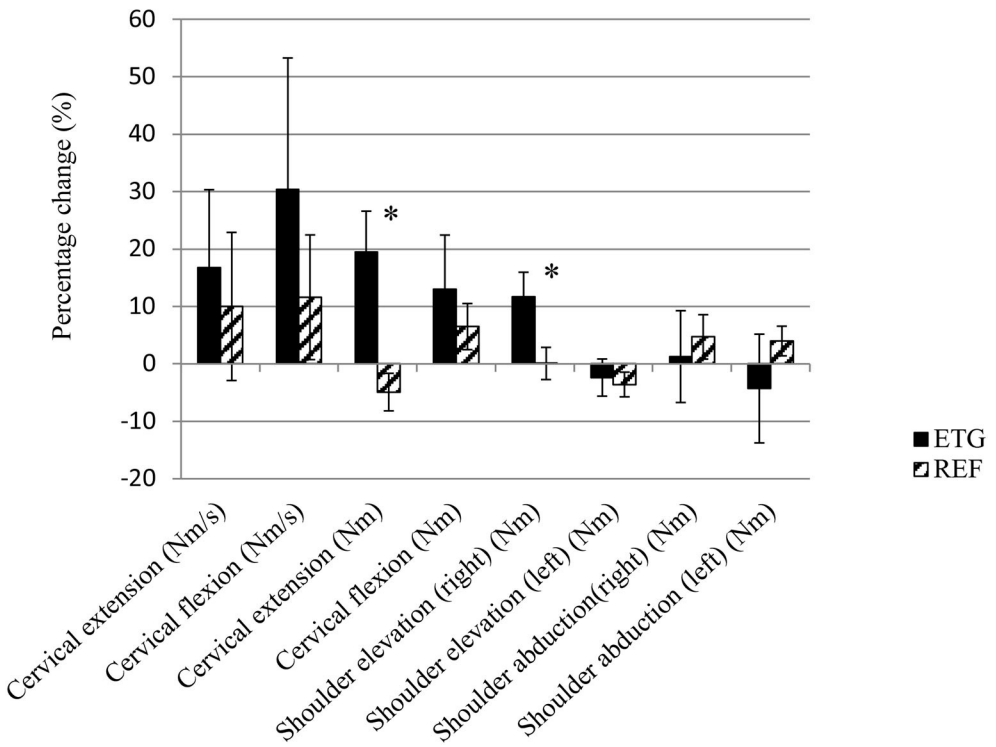


**FIGURE 2 |** Per-protocol analysis as percentage of change for maximal voluntary contraction and rate of torque development. Values are presented in mean and standard error. Exercise-training-group (ETG; $n = 10$). Reference-group (REF; $n = 34$). Significant between-group-difference (*).

Thus, our training program was designed to improve strength—endurance, and this should be taken into consideration when evaluating the improvements in MVC and RTD.

## Adherence

It is important to take into account training adherence in the interpretation of our results. Participants adhering to training regularly gained the largest increase in MVC regarding cervical extension of ∼18% in ETG, as compared to a reduction of ∼6% in REF. A significant increase in MVC in the right shoulder of ∼11% was also found among participants who adhered to regular training, as compared to a reduction of ∼1% in REF. The small magnitude of effect in our results may be caused by the low training adherence, as only 29% within ETG trained with a frequency of ≥1 day/week throughout the intervention period. This is low compared to previous exercise interventions with adherence rates of 53–77% found in studies on helicopter pilots and crew-members (36, 37). Furthermore, it must be underlined that only 25 out of 35 participants in ETG responded on the questionnaire regarding training adherence. Our adherence analyses are therefore based on roughly 2/3 of the ETG group. Self-reported adherence to training has been found reliable compared to actual registration of training participation (24). We used a cut-point of performing at least 1 training sessions a week as being regular and sufficient stimulus for physiological adaptions to occur (35). The same cut-point has previously been used (27). The low level of adherence in the present study is expected to have impacted on the effectiveness of the exercise intervention. Still, observed MVC difference according to the PP-analysis of ∼24% for cervical extension and ∼12% for shoulder elevation in the right side indicates that our exercise intervention was effective when performed regularly.

## The General Strength of Aircrew

Pilots and crew-members are exposed to some of the highest physical demands within the RDAF and undergo annual health and fitness evaluations (27). Pilots and crew-members are physically fit and healthy individuals, and accordingly, a potential strength gain from an exercise intervention would be expected to be lower compared to that of untrained individuals. This is supported when comparing our results with findings by Faber et al. (38), who reported MVC values for shoulder abduction of 67 Nm (dominant side) and 71 Nm (non-dominant side), and 130 Nm and 126 Nm for shoulder elevation, respectively, among gender- and age-matched subjects in Denmark with different work occupations. In the present study, values for shoulder abduction were ∼35% higher, and for shoulder elevation ∼10% higher (depending on dominant side). These results show

that pilots and crew-members are stronger in the shoulder musculature as compared to the general working population. In contrast, with regards to neck muscle strength, Jordan et al. (39) reported MVC values for cervical extension of around 55 Nm and cervical flexion of around 30 Nm for a large gender-matched Danish non-pilot population, with the present values being ∼10 and ∼30% lower. This is somewhat surprising, but the lack of superior neck muscle strength in our study group is supported by results by Seng et al. (40) who reported no significant difference between fighter aircraft pilots and non-pilots in neck muscle strength, calculated as MVC in neck extension, flexion, as well as left and right lateral bending. However, these results are not supported by Alricsson et al. (41), who reported a significantly higher level of muscle strength among Swedish air force jet pilots equal to ∼9% during cervical extension (65 Nm) and ∼31% during cervical flexion (47 Nm), as compared to a reference group of young conscripts doing their military service (59 Nm and 36 Nm). Thus, overall discrepancies regarding the cervical strength of pilot compared to the non-pilot populations are present. Likewise, discrepancies were found between previously published results from helicopter pilots and crew-members compared with our results with regards to cervical muscle strength. Ang et al. (42) previously reported values of MVC for cervical extension to be ∼38% (52 Nm) higher, and flexion to be ∼6% (29 Nm) higher as compared to corresponding values in our results. Furthermore, Van den Oord et al. previously published results of cervical extension and cervical flexion including both asymptomatic and symptomatic pilots and rear-aircrew with no significant difference between groups. Compared to our study, results from Van den Oord et al. (43) were ∼45% (55 Nm) higher for pilots and ∼60% (60 Nm) higher for crew-members during cervical extension, whereas cervical flexion for pilots was found to be ∼17% (23 Nm) lower, and ∼26% (22 Nm) lower for crew-members in comparison to our findings. Overall, our values are lower than those previously reported. However, that does not impact on the main finding of this study regarding changes in strength with training, since the same test procedure was used at baseline and follow-up.

Comparing results of cervical strength between studies may be challenging due to the use of different methods and protocols for quantifying cervical strength (44). In the study by Jordan et al. (39), participants trained on the measuring apparatus prior to the final tests in a protocol with light resistance (women: 2–3 kg in flexion and 3–4 kg in extension, men: 4–5 kg in flexion and 6–7 kg in extension), with 6–7 repetitions in each direction, to familiarize participants with the procedure, potentiate involved muscles, and overcome fear avoidance. The use of a familiarization procedure may have led to higher values in the study by Jordan et al. Lastly, participants were not strapped during the test procedure, but were instructed to grip onto armrests to maintain their position during measurements (39). The larger degree of freedom and arm placement may also have proven beneficial in terms of higher force values, as compared to our test protocol. We recognize that the reliability of MVC results between studies might be subject to methodological differences. However, based on an overall assessment of our results in addition to the above mentioned studies, aircrew may be considered stronger in the shoulder musculature, but equally strong during cervical extension (38–60 Nm) and flexion (22–27 Nm), as compared to a non-pilot population (39). This is an important finding, since pilots and crew-members must wear helmets and additional helmet mounted equipment that place considerable strain on their cervical musculature during flight (11). Enhancing upper neck muscle function may reduce the relative load with potential impact on the high prevalence of neck pain observed within this occupational group.

## Cervical Extension/Flexion MVC-Ratio

In agreement with our second hypothesis, the physical exercise intervention maintained the cervical extension/flexion MVC-ratio in the ETG group while the MVC-ratio was significantly decreased in REF from pre- to post-intervention as a result of a significant decline in MVC in cervical extension. Suryanarayana et al. (16) and Jordan et al. (39) both found a MVC-ratio of 1.7 to be the average among healthy individuals. In comparison, our MVC-ratio was slightly lower, and this may underline that pilots need to specifically address neck muscle training in order to maintain a normal strength relationship between cervical extension and flexion. The posterior neck muscles have a larger physiologic cross-sectional area compared to the anterior neck muscles (45) and should therefore be capable of higher force development. The significant decrease in MVC-ratio in the REF group compared to the ETG group may be important in relation to the risk of neck pain development. Cervical pain has been reported to influence MVC measurements in a number of individual studies of non-pilot populations (12, 14, 46–49). However, conflicting results have been reported in this regard, as Ang et al. (42), who compared MVC-measures between helicopter pilots with frequent neck pain episodes and helicopter pilots without pain, found no significant MVC differences. These findings are supported by Van den Oord et al. (43), who published MVC results on cervical extension and cervical flexion including both asymptomatic and symptomatic pilots and rear-aircrew, and reported no significant MVC differences. Based on the above mentioned relations, it may be questionable whether pain inhibition during MVC testing is directly comparable between military- and patient-populations. From a functional point of view, it would seem beneficial especially for helicopter pilots and crew-members to improve muscular capacity in the cervical extensors, as this muscle region has been found highly active during flight (11). The MVC-ratio may be used as a guideline for future training modalities, in order to individualize and balance training programs further in this occupational group.

## Limitations and Strengths

The limitation of this study was the low adherence to self-administrated exercise training. Further research is requested to identify ways to improve such training because supervised training is not possible in all job categories. The strengths of the study were the rigid randomized controlled design and the intervention protocol consisting of validated training exercises. Likewise, the possibility of performing a per protocol analysis

based on recordings of regular adherence is a strength, because this supported the training exercises to be effective if performed.

### Implications of Study Findings to Research and Practice

Specific exercise training targeting the neck and shoulder muscles can improve muscle strength and function that may combat muscle disorders among workers exposed to high physical loadings in the neck/shoulder region. Regular adherence to training is decisive for positive effects. If self-administrated training is the optimal choice due to, e.g., job specific logistics it is particularly important to identify means for attaining a high adherence.

## CONCLUSION

Specific exercise training targeting the neck and shoulder muscles significantly improved MVC and RTD in the upper neck extensors of participants in the ETG. Approximately 1/3 of participants in ETG adhered to regular training, and this is likely to attenuate the effectiveness of the training intervention on neck and shoulder muscle function. This is underlined by an additional increase in MVC for the right shoulder among participants with regular training adherence. The MVC results for pilots and crew-members were above population mean values for shoulder strength, but equal to such values for neck muscle strength. To accommodate job specific loading of cervical musculature during flight, pilots and crew-members should engage in regular exercise training of the neck muscles. Further, future studies should focus on the practical implementation of self-administered exercise training to improve adherence.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Regional Committees on Health Research Ethics for Southern Denmark (S-20120121). The patients/participants provided their written informed consent to participate in this study.

## DISCLOSURE

This study was financially supported by the Royal Danish Air Force and the University of Southern Denmark. There are no conflicting financial interests between institutions or between the authors of this paper.

## AUTHOR CONTRIBUTIONS

MM together with GS, KS, and BL were responsible for the design of the study. MM performed the measurements, analyzed the data, and drafted the manuscript. All authors have made significant intellectual contributions to the manuscript and approved the final version before publication.

## FUNDING

Hygenic Corporation (Akron, OH, USA) provided Thera-Band® training products used in the study. The Royal Danish Air Force and the University of Southern Denmark paid the salary for the PhD student Mike Murray involved in the project.

## ACKNOWLEDGMENTS

The authors would like to acknowledge the helicopter pilots and crew-members form the RDAF for participating in the study. The authors would also like to thank the Hygenic Corporation (Akron, OH, USA) for providing Thera-Band® training products.

## REFERENCES

1. Salmon DM, Harrison MF, Neary JP. Neck Pain in military helicopter aircrew and the role of exercise therapy. *Aviation Space Environ Med*. (2011) 82:978–87. doi: 10.3357/ASEM.2841.2011
2. Ang B, Harms-Ringdahl K. Neck pain and related disability in helicopter pilots: a survey of prevalence and risk factors. *Aviation Space Environ Med*. (2006) 77:713–19.
3. Van den Oord MHA, De Loose V, Meeuwsen T, Sluiter JK, Frings-Dresen MHW. Neck pain in military helicopter pilots: prevalence and associated factors. *Milit Med*. (2010) 175:55–60. doi: 10.7205/MILMED-D-09-00038
4. Bridger RS, Groom MR, Jones H, Pethybridge RJ, Pullinger N. Task and postural factors are related to back pain in helicopter pilots. *Aviation Space Environ Med*. (2002) 73:805–11.
5. Adam J. *Results of NVG-Induced Neck Strain Questionnaire Study in CH-146 Griffon Aircrew*. Defence R&D Canada—Toronto: DRDC Toronto Technical Report No. 2004-153 (2004).
6. Harrison MF, Neary JP, Albert WJ, Kuruganti U, Croll JC, Chancey VC, et al. Measuring neuromuscular fatigue in cervical spinal musculature of military helicopter aircrew. *Milit Med*. (2009) 174:1183–9. doi: 10.7205/MILMED-D-00-7409
7. Harrison MF, Neary JP, Albert WJ, Veillette DW, McKenzie NP, Croll JC. Trapezius muscle metabolism measured with NIRS in helicopter pilots flying a simulator. *Aviation Space Environ Med*. (2007) 78:110–6. doi: 10.3357/ASEM.2067.2007
8. Sovelius R, Oksa J, Rintala H, Huhtala H, Siitonen S. Neck muscle strain when wearing helmet and NVG during acceleration on a trampoline. *Aviation Space Environ Med*. (2008) 79:112–6. doi: 10.3357/ASEM.2130.2008
9. Thuresson M, Ang B, Linder J, Harms-Ringdahl K. Mechanical load and EMG activity in the neck induced by different head-worn equipment and neck postures. *Int J Ind Ergon*. (2005) 35:13–8. doi: 10.1016/j.ergon.2004.06.008
10. Thuresson M, Ang B, Linder J, Harms-Ringdahl K. Neck muscle activity in helicopter pilots: effect of position and helmet-mounted equipment. *Aviation Space Environ Med*. (2003) 74:527–32.
11. Murray M, Lange B, Chreiteh SS, Olsen HB, Nørnberg BR, Boyle E, et al. Neck and shoulder muscle activity and posture among helicopter pilots and crew-members during military helicopter flight. *J Electromyogr Kinesiol*. (2016) 27:10–7. doi: 10.1016/j.jelekin.2015.12.009

12. Barton PM, Hayes KC. Neck flexor muscle strength, efficiency, and relaxation times in normal subjects and subjects with unilateral neck pain and headache. *Arch Phys Med Rehabil.* (1996) 77:680–7. doi: 10.1016/S0003-9993(96)90008-8
13. Cagnie B, Cools A, De Loose V, Cambier D, Danneels L. Differences in isometric neck muscle strength between healthy controls and women with chronic neck pain: the use of a reliable measurement. *Arch Phys Med Rehabil.* (2007) 88:1441–5. doi: 10.1016/j.apmr.2007.06.776
14. Chiu TT, Sing KL. Evaluation of cervical range of motion and isometric neck muscle strength: reliability and validity. *Clin Rehabil.* (2002) 16:851–8. doi: 10.1191/0269215502cr550oa
15. Jordan A, Mehlsen J, Ostergaard K. A comparison of physical characteristics between patients seeking treatment for neck pain and age-matched healthy people. *J Manipulative Physiol Ther.* (1997) 20:468–75.
16. Suryanarayana L, Kumar S. Quantification of isometric cervical strength at different ranges of flexion and extension. *Clin Biomech.* (2005) 20:138–44. doi: 10.1016/j.clinbiomech.2004.10.003
17. Al-Obaidi SM, Al-Zoabi B, Al-Shuwaie N, Al-Zaabie N, Nelson RM. The influence of pain and pain-related fear and disability beliefs on walking velocity in chronic low back pain. *Int J Rehabil Res.* (2003) 26:101–8. doi: 10.1097/01.mrr.0000070750.63544.06
18. Feleus A, van Dalen T, Bierma-Zeinstra SM, Bernsen RM, Verhaar JA, Koes BW, et al. Kinesiophobia in patients with non-traumatic arm, neck and shoulder complaints: a prospective cohort study in general practice. *BMC Musculoskelet Disord.* (2007) 8:117. doi: 10.1186/1471-2474-8-117
19. Andersen LL, Holtermann A, Jorgensen MB, Sjogaard G. Rapid muscle activation and force capacity in conditions of chronic musculoskeletal pain. *Clin Biomech.* (2008) 23:1237–42. doi: 10.1016/j.clinbiomech.2008.08.002
20. Andersen LL, Andersen JL, Suetta C, Kjaer M, Sogaard K, Sjogaard G. Effect of contrasting physical exercise interventions on rapid force capacity of chronically painful muscles. *J Appl Physiol.* (2009) 107:1413–9. doi: 10.1152/japplphysiol.00555.2009
21. Sjogaard G, Justesen JB, Murray M, Dalager T, Sogaard K. A conceptual model for worksite intelligent physical exercise training —IPET— intervention for decreasing life style health risk indicators among employees: a randomized controlled trial. *BMC Public Health.* (2014) 14:652. doi: 10.1186/1471-2458-14-652
22. Blangsted AK, Sogaard K, Hansen EA, Hannerz H, Sjogaard G. One-year randomized controlled trial with different physical-activity programs to reduce musculoskeletal symptoms in the neck and shoulders among office workers. *Scand J Work Environ Health.* (2008) 34:55–65. doi: 10.5271/sjweh.1192
23. Waling K, Sundelin G, Ahlgren C, Jarvholm B. Perceived pain before and after three exercise programs - a controlled clinical trial of women with work-related trapezius myalgia. *Pain.* (2000) 85:201–7. doi: 10.1016/S0304-3959(99)00265-1
24. Andersen LL, Jorgensen MB, Blangsted AK, Pedersen MT, Hansen EA, Sjogaard G. A randomized controlled intervention trial to relieve and prevent neck/shoulder pain. *Med Sci Sports Exerc.* (2008) 40:983–90. doi: 10.1249/MSS.0b013e3181676640
25. Zebis MK, Andersen LL, Pedersen MT, Mortensen P, Andersen CH, Pedersen MM, et al. Implementation of neck/shoulder exercises for pain relief among industrial workers: a randomized controlled trial. *BMC Musculoskeletal Disord.* (2011) 12:205. doi: 10.1186/1471-2474-12-205
26. Jay K, Frisch D, Hansen K, Zebis MK, Andersen CH, Mortensen OS, et al. Kettlebell training for musculoskeletal and cardiovascular health: a randomized controlled trial. *Scand J Work Environ Health.* (2011) 37:196–203. doi: 10.5271/sjweh.3136
27. Lange B, Toft P, Myburgh C, Sjogaard G. Effect of targeted strength, endurance, and coordination exercise on neck and shoulder pain among fighter pilots a randomized-controlled trial. *Clin J Pain.* (2013) 29:50–9. doi: 10.1097/AJP.0b013e3182478678
28. Chen X, Coombes BK, Sjogaard G, Jun D, O'Leary S, Johnston V. Workplace-based interventions for neck pain in office workers: systematic review and meta-analysis. *Phys Ther.* (2018) 98:40–62. doi: 10.1093/ptj/pzx101
29. Gross A, Kay TM, Paquin JP, Blanchette S, Lalonde P, Christie T, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev.* (2015) 1:CD004250. doi: 10.1002/14651858.CD004250.pub5
30. Murray M, Lange B, Nornberg BR, Sogaard K, Sjogaard G. Specific exercise training for reducing neck and shoulder pain among military helicopter pilots and crew members: a randomized controlled trial protocol. *BMC Musculoskelet Disord.* (2015) 16:198. doi: 10.1186/s12891-015-0655-6
31. Andersen LL, Andersen CH, Mortensen OS, Poulsen OM, Bjornlund IBT, Zebis MK. Muscle activation and perceived loading during rehabilitation exercises: comparison of dumbbells and elastic resistance. *Phys Ther.* (2010) 90:538–49. doi: 10.2522/ptj.20090167
32. Gao Y, Kristensen LA, Grøndberg TS, Murray M, Sjøgaard G, Søgaard K. Electromyographic evaluation of specific elastic band exercises targeting neck and shoulder muscle activation. *Appl Sci.* (2020) 10:756. doi: 10.3390/app10030756
33. Essendrop M, Schibye B, Hansen K. Reliability of isometric muscle strength tests for the trunk, hands and shoulders. *Int J Ind Ergon.* (2001) 28:379–87. doi: 10.1016/S0169-8141(01)00044-0
34. Murray M, Lange B, Nornberg BR, Sogaard K, Sjogaard G. Self-administered physical exercise training as treatment of neck and shoulder pain among military helicopter pilots and crew: a randomized controlled trial. *BMC Musculoskelet. Disord.* (2016) 18:147. doi: 10.1186/s12891-017-1507-3
35. Ratamess NA, Alvar BA, Evetoch TE, Housh TJ, Ben Kibler W, Kraemer WJ, Triplett NT. Progression models in resistance training for healthy adults. *Med Sci Sports Exerc.* (2009) 41:687–708. doi: 10.1249/MSS.0b013e3181915670
36. Ang BO, Monnier A, Harms-Ringdahl K. Neck/shoulder exercise for neck pain in air force helicopter pilots: a randomized controlled trial. *Spine.* (2009) 34:544–51. doi: 10.1097/BRS.0b013e3181aa6870
37. Salmon DM, Harrison MF, Sharpe D, Candow D, Albert WJ, Neary JP. Exercise therapy for improved neck muscle function in helicopter aircrew. *Aviat Space Environ Med.* (2013) 84:1046–54. doi: 10.3357/ASEM.3593.2013
38. Faber A, Hansen K, Christensen H. Muscle strength and aerobic capacity in a representative sample of employees with and without repetitive monotonous work. *Int Arch Occup Environ Health.* (2006) 79:33–41. doi: 10.1007/s00420-005-0025-z
39. Jordan A, Mehlsen J, Bulow PM, Ostergaard K, Danneskiold-Samsoe B. Maximal isometric strength of the cervical musculature in 100 healthy volunteers. *Spine.* (1999) 24:1343–48. doi: 10.1097/00007632-199907010-00012
40. Seng KY, Lam PM, Lee VS. Acceleration effects on neck muscle strength: pilots vs. non-pilots. *Aviat Space Environ Med.* (2003) 74:164–8.
41. Alricsson M, Harms-Ringdahl K, Schuldt K, Ekholm J, Linder J. Mobility, muscular strength and endurance in the cervical spine in Swedish Air Force pilots. *Aviation Space Environ Med.* (2001) 72:336–42.
42. Ang B, Linder J, Harms-Ringdahl K. Neck strength and myoelectric fatigue in fighter and helicopter pilots with a history of neck pain. *Aviation Space Environ Med.* (2005) 76:375–80.
43. Van den Oord M, De Loose V, Sluiter JK, Frings-Dresen MHW. Neck strength, position sense, and motion in military helicopter crew with and without neck pain. *Aviation Space Environ Med.* (2010) 81:46–51. doi: 10.3357/ASEM.2602.2010
44. Dvir Z, Prushansky T. Cervical muscles strength testing: methods and clinical implications. *J Manipulative Physiol Ther.* (2008) 31:518–24. doi: 10.1016/j.jmpt.2008.08.008
45. Kamibayashi LK, Richmond FJ. Morphometry of human neck muscles. *Spine.* (1998) 23:1314–23. doi: 10.1097/00007632-199806150-00005
46. Ylinen J, Takala EP, Kautiainen H, Nykanen M, Hakkinen A, Pohjolainen T, et al. Association of neck pain, disability and neck pain during maximal effort with neck muscle strength and range of movement in women with chronic non-specific neck pain. *Eur J Pain.* (2004) 8:473–8. doi: 10.1016/j.ejpain.2003.11.005
47. Ylinen J, Salo P, Nykanen M, Kautiainen H, Hakkinen A. Decreased isometric neck strength in women with chronic neck pain and the repeatability of neck strength measurements. *Arch Phys Med Rehabil.* (2004) 85:1303–8. doi: 10.1016/j.apmr.2003.09.018
48. Silverman JL, Rodriquez AA, Agre JC. Quantitative cervical flexor strength in healthy subjects and in subjects with mechanical neck pain. *Arch Phys Med Rehabil.* (1991) 72:679–81.

49. Ylinen J, Ruuska J. Clinical use of neck isometric strength measurement in rehabilitation. *Arch Phys Med Rehabil.* (1994) 75:465–9. doi: 10.1016/0003-9993(94)90173-2

**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 Public Health

ORIGINAL RESEARCH
published: 22 December 2020
doi: 10.3389/fpubh.2020.579197

# Implementing Organizational WHP Into Practice: Obstructing Paradoxes in the Alignment and Distribution of Empowerment

*Katrin Skagert*[1] *and Lotta Dellve*[2]*

[1] Division Materials and Production, Research Institutes of Sweden (RISE), Gothenburg, Sweden, [2] Department of Sociology and Work Science, University of Gothenburg, Gothenburg, Sweden

**Background:** According to policy and theory, there is need for organizational workplace health promotion (WHP) to strengthen working conditions for all employees. However, earlier studies show it is hard to implement in practice. The aim was to critically analyze and identify interacting mechanisms and obstacles behind failures of organizational WHP projects from system perspectives.

**Methods:** A holistic case study was performed, to critically analyze data from an organizational WHP project approach at a public health care organization. The qualitative data was collected over 5 years and included interviews with key actors ($n$ = 80), focus groups ($n$ = 59 managers), structured observations ($n$ = 250 hours), continuous field observations and documents ($n$ = 180). Questionnaires to employees ($n$ = 2,974) and managers ($n$ = 140) was complementing the qualitative-driven mixed method approach.

**Results:** The analysis shows obstructing paradoxes of alignment and distribution of empowerment during the process of implementation into practice. The obstacles were interacting over system levels and were identified as: *Governance by logics of distancing and detaching, No binding regulation of WHP, Separated responsibility of results, Narrow focus on delegated responsibilities, Store-fronting a strategic model, Keeping poor organizational preconditions and support for developments* and *Isolate WHP from other organizational developments*.

**Conclusions:** The following premises can be formulated regarding successful organizational WHP programs. Consider (1) the uncertainty a distributed empowerment to all system levels may create; (2) the distributed impact to define the target and allow broader areas to be included in WHP; and (3) the integration into other development processes and not reducing the organizational WHP to the form of a project.

**Keywords: alignment, structural empowerment, distributed leadership, system theory, implementation, health care organizational setting**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic, Monash University, Australia*

***Reviewed by:***
*Siti Munira Yasin, MARA University of Technology, Malaysia*
*Nicola Mucci, University of Florence, Italy*

***Correspondence:**
*Lotta Dellve*
*lotta.dellve@gu.se*

***Specialty section:***
*This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health*

***Received:*** *01 July 2020*
***Accepted:*** *27 November 2020*
***Published:*** *22 December 2020*

***Citation:***
*Skagert K and Dellve L (2020) Implementing Organizational WHP Into Practice: Obstructing Paradoxes in the Alignment and Distribution of Empowerment. Front. Public Health 8:579197. doi: 10.3389/fpubh.2020.579197*

## INTRODUCTION

Empirical studies and theoretical developments relating to successful workplace health promotion (WHP) in organizations highlight the importance of integrated focus on strengthening resources for health and developments at all organizational and work system levels (1–3). The integrated system approach of WHP, which increases empowerment of conditions supporting health and healthy work conditions, is suggested to be more sustainable, but there are limited studies on the more holistic approaches of WHP, such as organizational WHP (4). However, the implementation of such organizational WHP approaches can meet significant barriers between and within system levels (5, 6). Increased knowledge of the interaction of obstacles at each level and between levels can have importance for implementation of WHP projects, i.e., to better recognize and meet barriers to alignment and to distribute mandates for assessing, defining and conducting WHP activities. This study critically analyzes the implementation of a public organization's organizational approach of WHP that failed despite high ambitions. The study contributes to development of WHP theory by highlighting the obstructing paradoxes of distributed influence and learning as a necessary condition for empowerment and managerialism as norm in accountable public organizations (7).

The workplace is one important setting for enhancing health and well-being (8, 9). Organizational WHP considers structural measures with the aim of improving health for all employees (10), e.g., through strengthening working conditions (5), influence and access to resources and support structures in organizations (structural empowerment) (11, 12). Such organizational approaches of WHP have been highlighted from many perspectives. Policies point to the more holistic, system approaches of WHP, i.e., how the work is organized and an employee's ability to influence at work (13, 14). Theories of WHP and organizational change imply the importance of not (only) focusing on the individual but also the system and organization. Also, empirical studies of outcomes have concluded that WHP is most effective and sustainable when organizational levels are approached; when preventive and promotive perspectives combined; and when improvement of health are all integrated with other organizational improvement processes [see e.g., (15–17)]. Earlier studies have reviewed and identified the most important factors for improving workers' health (18–22), and the evidence-based knowledge is quite robust. However, the significant interactions over and between individual, group, and organizational factors are less known. Some studies show a stronger magnitude of risks/resources for the interacting factors than for the single factors (15, 23). Therefore, WHP work based on the knowledge of how to handle interactions across organizational levels is needed and crucial for sustainable developments of employee health. This is also supported by studies showing that managerial work based on actively bridging organizational levels to integrate perspectives have had more success in producing sustainable organizational developments (24–26). Consequently, broader organizational approaches of WHP interventions would generally have a stronger effect than a WHP intervention focusing on single targets. Likewise, WHP at several levels could have a stronger effect than those focusing on one system level.

Nevertheless, WHP interventions most often focus on individual behavioral change rather than workplace change (27–31) even when the identified core challenges are clearly related to organizational conditions (32). Thus, despite the theoretical developments of WHP and global policies, knowledge about effective measures and approaches to improve working conditions is still needed (33–36). This includes knowledge of the central obstructing mechanisms and driving forces that hinder implementation and sustainability of organizational WHP.

Sustainable improvements of work organizations are understood, from a system perspective, as the continuous interaction between dimensions of intentions and the handling of actors, embedded in social and cultural conditions (37, 38). A theoretical framework for organizational WHP based on system theory suggests possible conditions of importance for crafting WHP conditions at each system level and in between (2). The framework integrates the key multi-conditions for WHP sorted into system levels, as well as the managerial work and organizing practices for crafting and bridging WHP across systems and levels. Such system perspectives on WHP focus more holistic approaches of factors, conditions and contexts at different levels: At the workplace in the daily work (micro-level); within the rules, structures, norms, and values of the organization (meso-level); with regard to impacts from the wider organization and society (macro-level) and related to temporal aspects and developments that may start at one level but have implications for all levels (chrono-level). Thus, implementation of organizational WHP requires distribution of empowerment, supporting influence and commitments (39) across systems. In connection to such system perspectives, alignment seems crucial for a stable common understanding of the organizations goals, purpose and vision regarding WHP (40). A functional alignment and distribution of empowerment is necessary (a) vertically so all the members of the organization know what and why a certain behavior is needed to contribute to the common goals of the organization, have mandates and can take actions, (b) horizontally between different work processes or units, and (c) diagonally, where superior executives and strategic management act as role models and synchronize and facilitate the desired actions at the lower hierarchical levels (the operative level) (41). Nevertheless, there is still a lack of knowledge of the mechanisms related to how conditions, drivers and obstacles interact between vertical, horizontal and diagonal levels.

This paper reports experiences from a case study of an implementation of organizational WHP at a medium-sized hospital in Sweden. The aim was to describe the implementation processes and critically analyze interacting mechanisms and obstacles behind failures of organizational WHP projects. Thus, the paper contributes to development of WHP theory by identifying the obstacles at each level involved in the proximal processes hindering distribution of empowerment over system levels.

# MATERIALS AND METHODS

## Study Design

To analyze global characteristics of a program, the study-design was a holistic case study approach (42). Case study design is recommended when (1) the aim is to understand complex interrelations between the phenomena studied [i.e., the implementation of and organizational WHP and their context (43)]; (2) the research ambition is to analyze 'thick' descriptions that represent different perspectives and (3) the researcher has little control over studied events but is interested in naturally occurring variability (44). The case was an implementation project of organizational WHP at a medium-sized hospital in Sweden. The study spans 5 years. Each phase of the implementation (the planning, active and integrated phase) (1), as well as the critical analyses of interacting obstacles, were primarily based on qualitative analyses of data from interviews, observations and documents, and supported by quantitative analysis of questionnaires. Thus, the major theoretical drive was inductive, i.e., a qualitative-driven mixed-method approach (45). The study was approved by the Regional Ethical Review Board (Dnr 433-10).

## Study Setting and the Studied Case

The study took place in Sweden, where occupational health and safety management has been legislated since the late 1800's. The Swedish Work Environment Act (1977:1160) aims to prevent ill-health and accidents at work and achieve a good work environment. The labor market in Sweden has a long tradition of cooperation between employers and employees (i.e., union representatives) and this is also stipulated both in the work environment law and collective labor agreements. Although the workplace is often highlighted as an important arena for enhancing health and well-being, there is no binding regulation regarding workplace health promotion. There are, however, regulations that have shaped, constrained, and/or strengthened the occupational health and safety management, aiming to prevent ill-health rather than promote health.

The initiative for WHP was taken by the county council (macro-level). A steering board of union and employer representatives at the top level decided to take a further step toward putting workplace health promotion into practice. They identified a hospital as a preferred organization for such an implementation initiative and also had initial contact with the research group to study the implementation process. The studied organization (meso-level) was a middle-sized public hospital where process management and continuous improvement of processes had been going on for several years when this study started. The hospital had acute and planned care (including psychiatric care), a total of 800 beds and ∼4,500 employees (82% women and 18% men). The hospital management teams' ambition was to implement workplace health promotion, with an organizational approach, and organized an implementation project for this purpose.

## Data Collection

The holistic case study used a qualitative-driven mixed method approach for data-collection. For the purpose of the study, the qualitative data from interviews, focus groups, documents and notes from observation was the main source of data. Data from structured observation and questionnaires was complementing to provide broader descriptions and general views of and conditions for organizational WHP. The materials included in the holistic case study are described below:

*Documents* From year one (Y1) to year three (Y3), the implementation process was followed in the hospital's WHP process plans, management protocols, interviews and field notes. Data collection included all meeting protocols from the hospital top management ($n = 60$, ∼250 pages) and from the three clinical divisions into which the care was organized ($n = 120$, ∼350 pages).

*Individual interviews* In-depth interviews were conducted (Y1-Y3) with key functions in the implementation process ($n = 5$) and line managers ($n = 12$). The interviews focused the implementation processes and important interacting conditions. The interviews were taped and additional notes were made. In order to better understand governance approaches, county council politicians ($n = 45$, Y1 and Y5) and key functions for organizational developments ($n = 18$) were interviewed about strategies to support improvements in hospital organizations. The majority of the interviews were transcribed; with the remainder careful notes were taken.

*Focus-groups* All first- and second-line managers and a strategic sample of employees from different professions and wards were invited to focus-group interviews, to discuss working conditions, their WHP approaches and the organizational WHP program. Altogether 59 managers participated in nine focus groups (Y1) and 68 employees participated in 12 focus groups (Y3). All focus-groups were transcribed.

*Observations* were made of work-place meetings ($n = 9$, Y2-Y3) and top-management meeting ($n = 7$, Y2-Y3). For the purpose of the study, continuous field notes were also taken from ongoing contacts on site with managers at different levels and key-functions for implementation (Y1-Y5). Additionally, the continuous contact through e-mails, meetings and phone with leaders of the WHP project (about 3–12 contacts per month, Y1-Y3) was also used as data. Field notes and theoretical memos were written throughout the research process.

*Structured observations* In order to further assess signs of implementation in practice, 12 randomly selected first-line managers were shadowed regarding their work and time allocated to development work and other tasks, contacts and places of work. The observations were directly coded through a computerized structured observation scheme. Thus, the time used for each activity was observed by a researcher and directly registered using a computer program (46).

*Questionnaires* All first line managers were invited to answer a questionnaire, distributed through emails ($n = 140$, response rate 75%, Y2). The responding managers ($n = 105$) mean age were 49 (md = 51, range 25–63 years of age). Most (85%, $n = 89$) worked full-time as managers, other part of their working-time. The

following variables were analyzed for the purpose of the present study: leadership approaches and support through superior manager (47). All employees were also invited to answer a questionnaire ($n = 2,974$, Y3, response rate 65%). For the purpose of the study, items of improvement work, improvement of quality of care, working conditions and efficiency were included in the analysis.

## Analysis

The transcribed interviews, focus groups, field notes and documents (the qualitative raw data) were analyzed stepwise coded with manifest and latent codes in line with content analyses (48). First, descriptive qualitative analysis of the qualitative data were made sentence by sentence, to describe the chronological time and activities in the implementation project at the hospital (manifest coding of content). The second step in the qualitative analysis (latent coding) focused contextual factors and conditions of importance for the implementation process. The analytic latent coding was conducted based on system theory perspectives of organizational WHP and alignment over macro-, meso-, micro and chrono-levels. The result from the manifest coding resulted in descriptions of failures at several levels that were observed to be connected. Therefore, we chose to focus the latent coding on a critical perspective of the central obstacles for the development of organizational WHP, i.e., approaches, conditions and mechanisms that bridged system levels.

The complementing quantitative data were used to serve as examples and add additional perspectives to the qualitative analysis. Structured observations of managers were analyzed with descriptive statistics of time used on different activities. Descriptive analyses were conducted with questionnaire data. Prevalence ratios was also calculated, with data from employee questionnaire, for assessment of statistical differences of proportions (PR95CI).

# RESULTS

The first result section describes the phases and central conditions of the implementation process. The second section presents the main categories from the critical analysis of proximal processes and key conditions for alignment and distribution over and within system levels.

## Case Description: Phases and Conditions for Implementation

First, the implementation process in terms of the initiative for the project, the organizing and the activities are described in three partly overlapping phases: the planning phase, the active phase and the integrated (or not integrated) phase. **Figure 1** and **Table 1** lists the activities and to what extent they were performed.

The *planning phase* lasted about one and a half year (Y1-Y2). The initiative to implement a WHP perspective in the organization came from a steering board with both union representatives and employers alongside the county council. One division in the county council was appointed to be a test arena for the implementation. A project organization was planned and the responsibility for the project was placed at the hospital's human resource (HR) unit by the hospital director. The project team consisted of a work environment strategist, two union representatives, one person who ordinarily was responsible for patient-related health promotion work, and an externally recruited project leader with a master's degree in public health. There was no project plan in place when the project leader was recruited, so her first task was to immediately start to write a project plan. It was an ambitious plan, based on a system theoretical holistic perspective and existing evidence on what distinguishes a WHP organization. The hospital's management team approved the project plan with goals and activities at the end of year one (the planning phase). The project plan had goals and activities on three (organizational, workplace and individual) levels. The overall goals were:

- Implement a WHP perspective in strategic management and governing documents
- Strengthen employee influence and participation in assessment of defining areas and resources to strengthen and open communication climate
- Enable health-promoting choices for the individual (employee)

According to the project plan, the *active phase* started at year two (Y2-Y3). When concrete activities were due to take place and be performed in the organization, several were rejected by the top management team with reference to economy or timing (see **Table 1**). Some of the activities seemed to disappear due to unclear communication and distribution of responsibility for the activities or mandates to take decisions. The top management's lack of responsibility and engagement was expressed in the interviews as an explanation for the uncertainty.

> *"One of the most important, if not the most important, things when you run this type of change process is to have the highest management fully engaged and I do not feel that the project has that/. . . / but I think you have to decide in the hospital management whether you should seriously do this work at present or if you should actually put it on ice." – interview with person within the project team*

Managers and employees also seemed to have different views on health. The project plan was based on the system theoretical view of health and activities mainly focused on organizational conditions, while the more traditional WHP focus on lifestyle activities was more widespread among operative managers and employees. In addition, at the organizational structural level, there were different views on whether the implementation was an HR-related process or an organizational improvement process. Altogether, this contributed to a lack of alignment and accountability of measures at different levels in the organization. The various views and expectations of the project collided, and the first project leader felt caught in the middle and resigned after 1.5 years. The next project leader was a HR specialist with more than 30 years of experience at the hospital. She also resigned after 1 year and was replaced with an externally recruited HR specialist who also resigned about a year later.

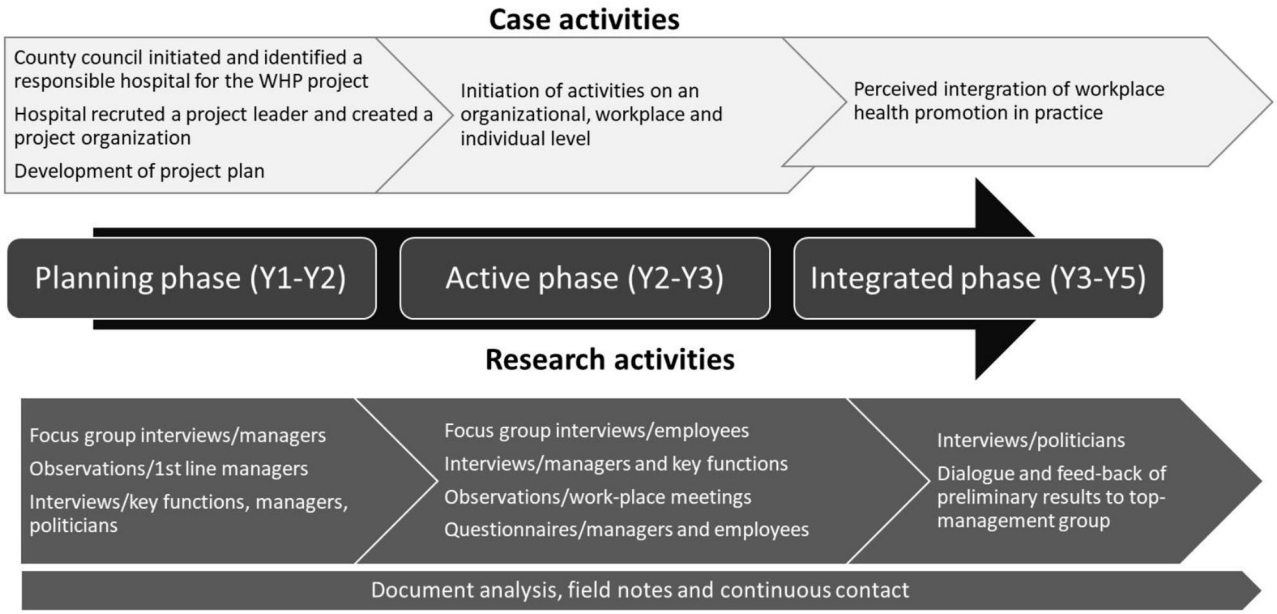


**FIGURE 1 |** Overall view of the case activities in the WHP project and the research activities.

According to the project plan, the *integrated phase* started at year three. To assess implications from the WHP project, all protocols from management teams at hospital- and clinical level were analyzed regarding their content. These protocols clearly indicated only one-way information from the WHP project team. Further, all initiatives for planned activities suggested by the WHP group or operative management to fulfill policy goals in practice were not approved by the hospital management group. For example, health coaches' desire to meet and share experiences and tools between organizational units was rejected. Despite the low activity regarding WHP, the law-regulated and prescribed health preventive measures seemed to function well at all levels. All agreed plans regarding prevention were followed by activities and follow-up regarding sick leave, work-related diseases and work-related injuries.

Second, conditions of importance for active work with WHP at operative levels were assessed. The managers, both first- and second-line, claimed that the support of communication flow between organizational levels and the support of empowerment and participation of subordinates were given the highest priority. Interviews, questionnaires and observations of the first-line managers showed their time conflicts related to allocation of time for the development work. The observation showed that work with developments happened during scheduled meetings (3% of their total working time). Little time was also allocated to communication between superiors and subordinates. First-line managers were on average communicating face-to-face with their own manager for 0.5% of their total working time and 10% met their manager every day. Most of the time (67%), first-line managers were working at their office alone. Most of their time was allocated to administration or staffing challenges to solve immediate problems in the clinical work (**Figure 2**). The majority (87%) of the first line managers assesses, through the questionnaire, that their leadership approach could be characterized as participative. And, that they gave their employees opportunities to have influence over the development work at the unit. The majority (82%) also rated that they often discussed challenges in improvement work with their own manager. However, only 12% met their own manager every day, to discuss challenges. One third (28%) met their own manager a few times per week or month (32%) and 23% even lesser.

Despite managers having little time for aligning the WHP program between strategic and operative levels, the improvement work at operative level was observed as having a high degree of dialogue, participation and influence between the employees at several units. At operative units working more actively with the improvement work, strengthened working conditions (PR95% CI 1.32 [1.25–1.39]), and also improved quality of care (PR95% CI 1.19 [1.15–1.22]) and efficiency (PR95% CI 1.58 [1.50–1.67]) was observed compared to units working less active with improvement work (from analysis of employee questionnaires).

## Obstructing Paradoxes for Alignment of Organizational WHP and Distribution of Empowerment

Here, the result of the critical analysis of the lack of alignment and distribution of structural empowerment for WHP across organizational levels are presented. The approaches and decisions are contradicting and interacting (paradoxes) across system-levels and thus obstructing alignment for organizational WHP and distribution of empowerment. The key obstacles are placed on the system level where they were based (**Table 2**).

**TABLE 1 |** Overall view of the implementation plan activities and the degree to which activities were performed.

| **Planned activities on the organizational level** | **Performed and/or implemented** |
|---|---|
| Clarify and define the WHP perspective in management strategies and goals, governing documents, and follow ups | Done in the active phase but disappeared in the (not) integrated phase |
| Integrate WHP competence development with ordinary process development | Partly done in the active phase but disappeared in the (not) integrated phase |
| Clarify cost and cons of workplace health | Not done or integrated in any phase |
| Develop support and guidelines for systematic workplace health and work environment management | Done in the active phase, no clear integration |
| Perform education in WHP leadership | Not done in any phase |
| Create a system to bring leaders and employees up to date with stress related health problems | Not done in any phase |
| **Activities on the workplace level** | **Performed and/or implemented** |
| Development of a WHP dialog material with different themes to be distributed to all workplaces. The objective was for it to be used at workplace meetings in order to assess areas and conditions to strengthen | Done and partly integrated in active phase |
| **Activities on the individual level** | **Performed and/or implemented** |
| Develop guidelines and health promotion advice, for example to night shift workers | Not done in active or integrated phase |
| Offer a wide range of wellness benefits for the employees | Not done in active or integrated phase |

## Macro-Level Obstacles

The governance approaches of the studied county council (macro-level) were characterized by *Logics of distancing and detaching*. This implied deciding and providing preconditions but having a detached approach, with delegation, separation of responsibilities of results and a filtering of communication between organizational levels and functions. The governance approach was observed to bridge system levels; i.e., the logics of distancing and detaching were propagated as the valid management approach for public organizations. The macro-level conditions were also characterized by the non-binding regulation of WHP, which meant a lot of talking about the importance of organizational WHP was not followed by action.

## Meso-Level Obstacles

Obstacles in hospital top-management (the meso-level) were connected to the macro-level governance. The following meso-level obstacles were identified:

*Focus on the clearly delegated responsibilities.* The decision to implement an organizational WHP project with no demands for results was taken at the county council level. The hospital management team focused on their clearly regulated and delegated responsibilities. Reasons for these choices were the macro-level lack of regulation and demands of WHP, the hospital management teams' lack of genuine interest in WHP, and the lack of competence to handle conflicting organizational interests. Thus, their approach implied a management focus that *reduced WHP to the regulated health prevention* measures, which were applied and reasonably well-managed and negotiated at all organizational levels. At the same time, the organizational WHP was strategically vaguely managed by rhetoric and a store-fronting policy model.

*Structure and store-fronting a planned policy model.* To fulfill the agreed WHP assignment, the management group decided a strategic plan and policy model for the WHP project based on best available evidence and with plans at meso- and micro system levels. This document was store-fronted upwards to county council levels to legitimize their accomplishment of the WHP project. This implied no further questioning from the county council level. Thereafter, a number of obstacles for the activity and integration phase were observed: (a) placing the project at the HR unit with a loose connection to the clinical core process and daily work practice, (b) dumping implementation on a group with little or no within-organizational power, (c) disenabling bureaucracy for distributing mandates, and (d) allowing complex systems that were hindering follow-ups.

An important obstacle was dumping the responsibility for implementation on a "satellite group" that was loosely anchored in the organization and had little power. The placement of WHP with a small group within the HR function served to isolate the WHP project from other organizational developments led by other organizational functions and spread over the hospital. The recruitment of a project leader with little earlier practical experience of hospital organizations was another approach to limit the influence of the group. Thus, the group and the project leader had difficulties in raising interest from clinical departments and supportive resources from staff functions. Instead, they further developed the written plans and handbooks despite their major difficulties in anchoring these at operative levels. Also at this level, the non-binding regulations regarding WHP meant that there was much talk and policy about intentions, interests and values but little action and prioritizing to fulfill those intentions.

The general governance approach of the county council, characterized by logics of distancing and detaching, acknowledged a detached approach of managing and organizing the WHP project, with delegation, separation of responsibilities and filtering of communication over organizational levels and functions. This seemed to hinder the operative managers, employees and professionals to have an overview of, engage with and exert influence over the WHP work. These approaches were in line with the governance of distancing and detaching, and can be characterized as measures of *disenabling bureaucracy* – a designed organizational structure that decreases the influence and control outside the management group while also delegating responsibility for the accomplishment of the required operative tasks. The disenabling bureaucracy hindered empowerment conditions through formal organizational structures and social formations of communities. The disenabling bureaucracy was

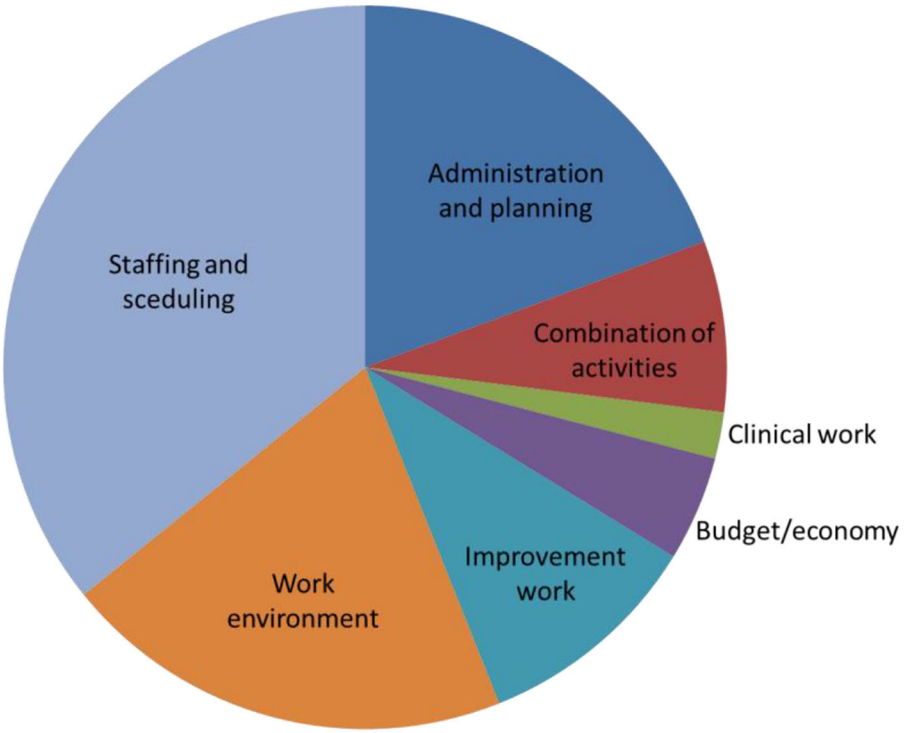


**FIGURE 2 |** Observed time-use among first-line managers.

observed as related to difficulties in fulfilling the goals of the strategic model in practice due to lack of mutual interest in the focused issue, economic resources, time and functional support. Further, the design of *non-bridging independent systems of the organizational structure* guaranteed the detached approach. Three main systems of register-based information were used in parallel and hindered follow-up regarding both accomplishment of responsibility and results. One collected information about economic issues, one about sick-leave and other vacancies and another about salary. None of these had the same picture of the organizational structure, including information about managers in charge that was shown on the hospital website. None of the systems covered all employees or followed the same organization structure.

## Micro-Level Obstacles

The analyses identified hindering conditions in terms of *poor organizational preconditions* that prevented operative managers and other functions from participating in, engaging with and taking wider action regarding WHP. In this case the setting was characterized by high administrative and staffing load as well as dumped responsibilities without mandates for WHP at operative levels.

A heavy *administrative and staffing load* was placed on operative managers, for example through a large span of control, delegated responsibility of administrative duties, and no organizational support in staffing. The *dumped* (*delegated*) *responsibilities for WHP* at operative levels implied no organizational support or even interest from staff resources or the management team. The lack of support was expressed by operative managers and WHP coaches and also observed in protocols where no general organizational support for local or central WHP initiatives was accepted. Some of the managers also expressed poor competence in the WHP area and

**TABLE 2 |** Key obstacles for alignment and distribution of WHP across organizational levels.

| Macro-level obstacles | Meso-level obstacles | Micro-level obstacles | Chrono-level obstacles |
|---|---|---|---|
| *No binding regulation of WHP: talking but little action* | *Focus clearly delegated responsibilities*<br>- WHP reduced to prevention | *General poor organizational preconditions and support for development*<br>- Administrative and staffing load on operative managers | WHP activities isolated from development of clinical core processes |
| *Governance by logics of distancing and detaching: separated responsibility of results* | *Creating and store-fronting a strategic model*<br>- Disenabling bureaucracy<br>- Dumping implementation on HR and a group with little power<br>- Persisting complex systems hindering follow-up | - Delegated and detached responsibilities for WHP at operative levels | - Bad timing<br>Non-bridging over levels and perspectives<br>- Isolated good examples |

experienced little support from WHP coaches at operative level. Instead, employees with specific interest in wellness and fitness activities took responsibility for involving colleagues in such individual-focused health-promoting life-style activities.

### Chrono-Level Obstacles for Development

The chrono-level encompasses the dimension of times, developments and trends of interests of WHP and work environment issues. Important conditions for developments are aligning the WHP activities over organizational levels and also integrating the perspectives of effectiveness, quality, and the work environment. Here, an important initial obstacle was to isolate the WHP activities from the development of clinical core processes by placing WHP within HR and isolated to a satellite group. Then, the *timing* of each WHP initiative was bad and the other obstacles observed and described above were successful in hindering the bridging and alignment of WHP activities and initiatives over organizational levels and units. This implied that there were isolated good examples of WHP that were not spread. Thus, the co-workers did not in general observe any WHP activities at the hospital.

## DISCUSSION

This case study aimed to describe and critically analyze the implementation process of organizational WHP projects. The key result describes the activities in the planning, active and integrated (or not integrated) phases of a WHP project and the analysis shows obstructing paradoxes of alignment and distribution of empowerment during the process of implementation into practice. Thus, the approaches and decisions were contradicting and interacting (paradoxes) across system-levels and thus obstructing alignment for organizational WHP and distribution of empowerment. The important obstacles were identified as: *Governance by logics of distancing and detaching, No binding regulation of WHP, Separated responsibility of results, Narrow focus on delegated responsibilities, Store-fronting a strategic model, Keeping poor organizational preconditions and support for developments* and *Isolate WHP from other organizational developments*.

To sustain organizational change, the WHP project needs to be integrated into work practice (1) in all system levels of an organization (2). This was also basically the stated objective in the studied organization's WHP program. Yet it failed to be integrated. In line with Rojatz et al. (6), obstacles (or barriers) was found at contextual, organizational, intervention, implementer, and participant level in the different phases. The result of the analysis identified a number of key obstacles at all system levels that "curtailed" subordinates' mandates and structural empowerment as well as the possibility for follow-up within the organization. In the following text, we will try to highlight and problematize proximal processes of importance which can contribute to theoretical developments of frameworks for implementing organizational WHP.

Firstly, organizational WHP programs need to *consider the uncertainty a true distributed empowerment to all system levels may create,* and also the variety of defensive mechanisms that are mobilized to curtail insight and influence over system levels, in terms of: managerialism, bureaucratism (7) and separated systems for documentation and follow-up (49). These increase the gap of knowledge and practice (alignment) between the organization's strategic and operative levels and is mainly described in large public organizations. The macro-level strategies of county council politicians can be understood from the nature of their work, i.e., being based on a high degree of ambiguity, inherent conflicts and uncertainties which often result in avoidance and compromise in trying to balance multiple components and achieve different organizational goals. Nevertheless, the logics of governance seemed to have significant impact on the improvement work across organizational levels. Earlier studies have contrasted local logics of governance strategies (50) and showed higher work engagement among employees over time in more practice-oriented servant governance compared to the detached and upward-focused logics of governance identified in the studied county council (41). In the present study the passively controlling governance was related to top-management's active store-fronting of the program, which was absent within the organization. This is in line with Alvesson's (51) critical conceptualizing of the "triumphs of emptiness," when management ideas of grandiose change occur without actions at operative levels, and the identification by MacBeath et al. (7) of empty, controlling managerialism as the norm for organizational accountability in public organizations. Consequently, WHP programs would benefit from downward-focused servant leadership, with sincere interest in serving changes at floor through aligning influence and distribution of empowerment in a downward-directed manner to subordinates (26).

Secondly, organizational WHP programs need to *consider the distributed impact to define the target and allow broader areas* to be included in WHP. To have relevance, the assessment and prioritizing of WHP areas and conditions to strengthen must be defined at each system level. This requires a great deal of freedom from normative assumptions of what is "the right WHP." In the analyzed case, the county council conducted a problem analysis before the project started that was based on earlier research (52), and came to the conclusion that individual-oriented measures only reached a limited amount of the employees and most often those who already had a health-promoting life style. Thus, the project plan aimed to mainly improve organizational conditions for WHP. However, the problem analysis and resulting project plan was distributed within the organization and not further anchored to the local context that had other views of what was needed. Further, previous studies of organizational improvement of working conditions have highlighted the importance of actions being adapted to the problems that really exist and being based on a clear problem analysis that has a broader involvement (31, 35, 53–55). Nevertheless, the concept of problem analysis might be ambiguous to use in a WHP context since it derives from pathogenic rather than salutogenic thinking. Experience showed, however, that when the strengthening activities really started, they often developed into more organizational WHP activities.

The current study is also an example of the contradictions regarding distribution of influence in defining organizational WHP activities: All suggested activities were rejected by

top management. Thus, employees were "allowed" to make efforts to improve WHP as long as it didn't have impact on ordinary management and distribution of work. Thus, the case gives a description of poor alignment where the strategy, structure, and culture were not combined to create a "synergistic whole" (56). Instead, the dysfunctional interactions between and within the organization's levels became apparent. This can be a reason for poor sustainability of WHP (40) and highlights the need for continuous critical thinking of structural organizational power dimensions during an organizational WHP project. Theories of empowerment touch the "power" field and need to be complemented with theories of structural power relations involving both formal and informal power (11, 12). This may also yield results from WHP projects as structural empowerment is strongly correlated to health dimensions such as organizational commitment and psychological empowerment in public health care organizations (39). Thus, considering structural empowerment in organizational WHP program support increased effective workplace culture and organizational performance.

Thirdly, organizational WHP programs need to be integrated in other development processes (here: clinical improvements) and cannot be reduced to the form of a project. This WHP project had a well-defined plan according activities to all levels in the organization. However, a plan or strategic policy was not a guarantee of actual implementation of workplace health promotion into practice. The linear idea of implementing work health promotion through activities on different organizational levels might not be useful when it comes to this kind of "zone of complexity" (1). The obstacles for implementation of WHP in the present study were obvious at the meso-levels but related to the macro-level's detachment of responsibility for the results. The timing and lack of integration with the core business made it almost impossible for implementation at the meso- and micro levels. Nevertheless, when WHP was integrated with increased quality of care and effectiveness, there was significantly higher activity and improved working conditions.

The WHP plan included activities of creating a system to bring leaders and employees up to date with stress related health problems. Those activities did not seem to be implemented, still mandatory preventive measures (regulated by the Swedish Work Environment Act) seemed to function both at meso- and micro levels. There is robustly research of the job demands-resources model (57), where job demands can cause burnout and job resources (contribute to work engagement and well-being (58). Due to evidence, The Swedish Work Environment Act has been strengthened lately regarding the employers responsibility to prevent imbalance between job demands and resources. One practical implication of this might be that responsibility and authority for WHP will be closer to core business, and not to a strategic HR department which may increase the distance between WHP and the core business. These results are in line with the findings of Astnell et al. (59), who showed WHP activities increased when integrated with quality improvement work.

Dedicated engagement from top management is crucial for allocating resources in terms of time and competence (49). The allocation of time and priority was not the problem in this case from top-management's perspective. From the observations of operative managers, however, it was clear that little time was allocated to improvement work. Implementation of workplace health promotion into practice seems to have its own challenges in terms of taking abstract visions and strategies and putting them into practice (2). Instead, theory may contribute to a vicious circle between preconditions when implementing WHP and the effects of it. For example, this studied organization had a goal to increase employee influence but did not include participation in the planning phase. That, and the different views of health and health promotion, contributed to the gap between the strategic plan and the core care business.

## Methodological Considerations and Limitations of the Study

The strength of the study is the 5-year long-term follow-up, the use of many measures for of data collection, from key actors representing many different views of and conditions for organizational WHP. The analysis would not come to the same conclusion if only one source of data were being used or the follow-up was shorter. The development of the project and the improvements were shaped and reshaped through contextual factors. The generalizability of the result is therefore not applicable and possible to replicate. Yet, the results may have transferability to similar contexts. Further, the results contribute to the theory frame of organizational WHP and points to the importance of considering broader methods for follow-up than merely chronological baseline-follow-up design. However, the broad descriptions of this article can also be seen as a limitation as results from in-depth analysis at individual and workplace levels was not included. Such in-depth analyses of individuals' and work-group perspectives are given in two thesis (46, 60). Another weakness is the single case-study design. An additional limitation, and at the same time a result of the study, is the lack of organizational follow-up data. One of the projects activities aimed to clarify costs and cons of workplace health. Data related to economic issues, quality of care and staff-related data such as short- and long-term sick-leave was collected in different systems and non-comparable organizational units. This makes it difficult for organizations to evaluate their own efforts to improve employee health.

# CONCLUSIONS

This study shows that a well-performed plan for organizational WHP is no guarantee for actual implementation of WHP into practice. The linear idea of implementing WHP in activities on different organizational levels might not be useful when it comes to complex public organizations. Organizational WHP should rather be evolved through continuous improvements related to improvements of core business. The conscious and continuous efforts to improve how work is organized to enable employee influence in the organization should not be underestimated. The following premises can be formulated regarding sustainable organizational WHP programs. (1) *Consider the uncertainty a distributed empowerment to all system levels may create;* (2) *Consider the distributed impact to define the target and allow*

*broader areas* to be included in WHP; and (3) *Consider the integration into other development processes* and do not reduce the organizational WHP to the form of a project.

## DATA AVAILABILITY STATEMENT

Due to the ethical principals, the researchers are responsible for storing data for 10 years. The data supporting the conclusions of this article will be made available by the authors for as long as that.

## ETHICS STATEMENT

The studies were reviewed and approved by The Regional Ethical Review Board at Sahlgrenska Academy, Dnr 433-10. The participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

KS and LD truly collaborated in design of the work, data collection, data analysis and interpretation, drafting the article, critical revision of the article, and final approval of the version to be published.

## ACKNOWLEDGMENTS

The authors thank Afa Insurance for financial support, E. T and C. B for data collection, and the participating politicians, managers and employees for sharing their time and knowledge.

## REFERENCES

1. Heward S, Hutchins C, Keleher H. Organizational change—key to capacity building and effective health promotion. *Health Promotion Intl.* (2007) 22:170–8. doi: 10.1093/heapro/dam011
2. Dellve L, Eriksson A. Health-promoting managerial work: A theoretical framework for a leadership program that supports knowledge and capability to craft sustainable work practices in daily practice and during organizational change. *Societies.* (2017) 7:12. doi: 10.3390/soc7020012
3. Andersen L, Fishwick D, Robinson E, Wiezer M, Mockallo Z, Grosjean V. Job satisfaction is more than a fruit basket, health checks and free exercise: Cross-sectional study among 10,000 wage earners. *Scand J Public Health.* (2017) 45:476–84. doi: 10.1177/1403494817698891
4. Eriksson A, Orvik A, Strandmark M, Nordsteien A, Torp S. Management and leadership approaches to health promotion and sustainable workplaces: A scoping review. *Societies.* (2017) 7:14. doi: 10.3390/soc7020014
5. Bauer G, Davies JK, Pelikan J. The EUHPID Health Development model for the classification of public health indicators. *Health Promotion Intl.* (2006) 21:153–9. doi: 10.1093/heapro/dak002
6. Rojatz D, Merchant A, Nitsch M. Factors influencing workplace health promotion intervention: a qualitative systematic review. *Health Promotion Intl.* (2017) 32:831–9. doi: 10.1093/heapro/daw015
7. MacBeath J, Dempster N, Frost D, Johnson G, Swaffield S. *Strengthening the Connections Between Leadership and Learning: Challenges to Policy, School and Classroom Practice*. London: Routledge (2018).
8. Chu C, Breucker G, Harris N, Stitzel A, Gan XF, Gu XQ, et al. Health-promoting workplaces – international settings development. *Health Promotion Intl.* (2000) 15:155–67. doi: 10.1093/heapro/15.2.155
9. World Health Organization (WHO). *The Ottawa Charter for Health Promotion.* (1986). https://www.who.int/healthpromotion/conferences/previous/ottawa/en/ (accessed June 26, 2020).
10. Giga SI, Noblet AJ, Faragher B, Cooper CL. The UK perspective: a review of research on organisational stress management interventions. *Aust Psychol.* (2003) 38:158–64. doi: 10.1080/00050060310001707167
11. Kanter RM. *Men and Women of the Corporation*. New York, NY: Basic books (2008).
12. Spreitzer GM. Taking stock: a review of more than twenty years of research on empowerment at work. In: Barling J, Cooper CL, editor. *Handbook of Organizational Behavior*, vol, 1. Thousand Oaks, CA: Sage (2008). p. 54–72. doi: 10.4135/9781849200448.n4
13. World Health Organization (WHO). *Good Practice in Occupational Health Services – A contribution to Workplace Health*. (2002). Available online at: https://www.euro.who.int/__data/assets/pdf_file/0007/115486/E77650.pdf (accessed June 26, 2020).
14. European Network for Workplace Health Promotion (ENWHP). *Luxembourg Declaration on Workplace Health Promotion in European Union*. (2007). Available online at: https://www.enwhp.org/resources/toolip/doc/2018/04/24/luxembourg_declaration.pdf (accessed June 26, 2020).
15. Dellve L, Skagert K, Vilhelmsson R. Leadership in workplace health promotion projects: 1- and 2-year effect on long-term work attendance. *Eur J Public Health*. (2007) 17:471–6. doi: 10.1093/eurpub/ckm004
16. Shain M, Kramer DM. Health promotion in the workplace: framing the concept, reviewing the evidence. *Occupat Environ Med*. (2004) 61:643–8. doi: 10.1136/oem.2004.013193
17. Bennett JB, Cook RF, Pelletier KR. Toward an integrated framework for comprehensive organizational wellness: concepts, practices, and research in workplace health promotion. In: Quick JC, Tetrick LE, editors. *Handbook of Occupational Health Psychology*. Washington, DC: American Psychological Association. (2003). p. 69–95.
18. Lindberg P, Vingård E. Indicators of healthy work environments – a systematic review. *Work*. (2012) 41:3032–8. doi: 10.3233/WOR-2012-0560-3032
19. 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
20. González R, Cockburn W, Irastorza X, Houtman I, Bakhuys Roozeboom M. *European Survey of Enterprises on New and Emerging Risks Managing Safety and Health at Work; European Agency for Safety and Health at Work*. Luxembourg: Publications Office of the European Union (2010).
21. Kelloway K, Teed M, Kelley E. The psychosocial environment: Towards an agenda for research. *Int J Workplace Health Manag*. (2008) 1:50–64. doi: 10.1108/17538350810865596
22. Schütte S, Chastang JF, Malard L, Parent-Thirion A, Vermeylen G, Niedhammer I. Psychosocial working conditions and psychological well-being among employees in 34 European countries. *Int Arch Occup Environ Health.* (2014) 87:897–907. doi: 10.1007/s00420-014-0930-0
23. Holmgren K, Hensing G, Dellve L. The association between poor organizational climate and high work commitments, and sickness absence in a general population of women and men. *J Occup Environ Med*. (2010) 52:1179–85. doi: 10.1097/JOM.0b013e3181fc5c1a
24. Dellve L, Wikström E. Managing complex workplace stress in health care organisations: Leaders' perceived legitimacy conflicts. *J Nurs Management.* (2009) 17:931–41. doi: 10.1111/j.1365-2834.2009.00996.x
25. Wikström E, Dellve L. Contemporary leadership in healthcare organizations: fragmented or concurrent leadership and desired support. *J Health Organ Manag*. (2009) 23:411–28. doi: 10.1108/14777260910979308
26. Gunnarsdóttir S, Edwards K, Dellve L. Improving health care organizations through servant leadership. in practicing servant leadership. In: van Dierendonck D, Patterson K, editors. *Developments in implementation.* Cham: Palgrave Macmillan) (2018). p. 249–73. doi: 10.1007/978-3-319-75644-8_14
27. Torp S, Eklund L, Thorpenbergs S. Research on workplace health promotion in the Nordic countries: a literature review, 1986–2008. *Global Health Promotion.* (2011) 18:15–22. doi: 10.1177/1757975911412401
28. Torp S, Kokko S, Ringsberg KC, Vinje HF. Is workplace health promotion research inte the Nordic countries really on the right track? *Scand J Public Health.* (2014) 42:74–81. doi: 10.1177/1403494814545106

29. Proper KI, van Oostrom SH. The effectiveness of workplace health promotion interventions on physical and mental health outcomes – a systematic review of reviews. *Scand J Work, Environ Health.* (2019) 45:546–59. doi: 10.5271/sjweh.3833
30. Montano D, Hoven H, Siegrist J. A meta-analysis of health effects of randomized controlled worksite interventions: does social stratification matter? *Scand J Work Environ Health.* (2014) 40:230–4. doi: 10.5271/sjweh.3412
31. Lamontagne AD, Keegel T, Louie AM, Ostry A, Landsbergis PA. A systematic review of the job-stress intervention evaluation literature, 1990–2005. *Int J Occupat Environ Health.* (2007) 13:268–80. doi: 10.1179/oeh.2007.13.3.268
32. Åkerström M, Severin J. Organisatoriska problem löses inte med hjälp av individåtgärder. [Organizational problems are not solved through individual actions]. *Socialmed Tidskrift*. (2020) 97:55–65.
33. Nielsen K, Randall R. Opening the black box: Presenting a model for evaluating organizational-level interventions. *Euro J Work Organ Psychol.* (2013) 22:601–17. doi: 10.1080/1359432X.2012.690556
34. Cox T, Karanika M, Griffiths A, Houdmont J. Evaluating organizational-level work stress interventions: beyond traditional methods. *Work Stress.* (2007) 21:348–62. doi: 10.1080/02678370701760757
35. Kompier MAJ, Cooper CL, Geurts SAE. A multiple case study approach to work stress prevention in Europe. *Euro J Work Organ Psychol.* (2000) 9:371–400. doi: 10.1080/135943200417975
36. Nielsen K, Randall R, Holten A-L, González ER. Conducting organizational-level occupational health interventions: What works? *Work Stress.* (2010) 24:234–59. doi: 10.1080/02678373.2010.515393
37. Kira M, van Eijnatten FM. Socially sustainable work organizations: conceptual contributions and worldviews. *Syst Res Behav*. (2011) 28:418–21. doi: 10.1002/sres.1083
38. Biggs A, Brough P, Barbour JP. Enhancing work-related attitudes and work engagement: A quasi-experimental study of the impact of an organizational intervention. *Int J Stress Manage.* (2014) 21:43–68. doi: 10.1037/a0034508
39. Fragkos KC, Makrykosta P, Frangos CC. Structural empowerment is a strong predictor of organizational commitment in nurses: A systematic review and meta-analysis. *J Adva Nursing.* (2020) 76:939–62. doi: 10.1111/jan.14289
40. von Thiele Schwarz U, Hasson H. Alignment for achieving a healthy organization. In: Bauer GF, Jenny GJ, editors. *Salutogenic Organizations and Change.* Dordrecht: Springer (2013). p. 107–25.
41. Dellve L. Tillitsskapande styrningspraktiker? [Trust-building governance?] *Socialmed Tidskrift.* (2018) 95:298–310.
42. Yin RK. Designing case studies. In: Maruster L, Gijsenberg MJ, editors. *Qualitative Research Methods.* London: Sage (2003). p. 359–86.
43. Stake, R. E. (2000). "Case studies," in *Handbook of Qualitative Research, 2nd Edn*., eds N. K. Denzin, and Y. S. Lincoln (Thousand Oaks, CA: Sage Publications), 435–455.
44. Ragin CC, Becker HS, (Eds.). *What Is a Case? Exploring the Foundations of Social Inquiry*. Cambridge: Cambridge University Press (1992).
45. Morse JM, Niehaus L, Wolfe RR, Wilkins S. The role of the theoretical drive in maintaining validity in mixed-method research. *Qual Res Psychol.* (2006) 3:279–91. doi: 10.1177/1478088706070837
46. Tengelin E. *Creating Proactive Boundary Awareness – Observations and Feedback on Lower Level Health Care Managers' Time Commitments and Stress*. [Licentatiate thesis]. Gothenburg: University of Gothenburg (2012).
47. Eklöf M, Pousette A, Dellve L, Skagert K, Ahlborg G. *Gothenburg Manager Stress Inventory (GMSI)*. ISM-Report Nr 7. Gothenburg: Institute of Stress Medicine (2010).
48. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*. (2004) 24:105–12. doi: 10.1016/j.nedt.2003.10.001
49. Andreasson J. *Organizational Preconditions and Supportive Resources for Swedish Healthcare Managers: Factors that Contribute to or Counteract Changes* [Doctoral Thesis], Stockholm: KTH Royal Institute of Technology (2018).
50. Kalkan A, Sandberg J, Garpenby P. Management by knowledge in practice – implementation of national healthcare guidelines in Sweden. *Soc Policy Administ.* (2015) 49:911–27. doi: 10.1111/spol.12102
51. Alvesson M. *The Triumph of Emptiness: Consumption, Higher Education, and Work Organization*. Oxford: OUP (2013).
52. Jonsdottir I, Börjesson M, Ahlborg GJr. Healthcare workers' participation in a healthy lifestyle-promotion project in western Sweden. *BMC Pub Health.* (2011) 11:448. doi: 10.1186/1471-2458-11-448
53. Hammer LB, Truxillo DM, Bodner T, et al. Exploration of the impact of organisational context on a workplace safety and health intervention. *Work Stress.* (2019) 33:192–210. doi: 10.1080/02678373.2018.1496159
54. Nielsen K, Randall R. Assessing and addressing the fit of planned interventions to the organizational context. In: Karanika-Murray M, Biron C, editors. *Derailed Organizational Interventions for Stress and Well-Being*. Dordrecht: Springer (2015). p. 107–13. doi: 10.1007/978-94-017-9867-9_12
55. McFillen JM, O'Neil DA, Balzer WK, Varney GH. Organizational diagnosis: an evidence-based approach. *J Change Manage.* (2013) 13:223–46. doi: 10.1080/14697017.2012.679290
56. Semler SW. Systematic agreement: A theory of organizational alignment. *Human Res Dev Quart.* (1997) 8:23–40. doi: 10.1002/hrdq.3920080105
57. Bakker AB, Demerouti E. The job demands-resources model: State of the art. *J Manag Psychol.* (2007) 22:309–28. doi: 10.1108/02683940710733115
58. Lesener T, Gusy B, Wolter C. The job demands resources model: a meta-analytic review of longitudinal studies. *Work Stress*. (2019) 33:76–103. doi: 10.1080/02678373.2018.1529065
59. Astnell S, von Thiele Schwarz U, Hasson H, Augustsson H, Stenfors-Hayes T. Integrating health promotion with quality improvement in a Swedish hospital. *Health Promot Int.* (2015) 31:495–504. doi: 10.1093/heapro/dav027
60. Bergman C. *Critical Conditions for Co-Workership in Healthcare Organizations: A Workplace Health Promotion Perspective* [thesis]. Gothenburg: University of Gothenburg (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 Public Health

ORIGINAL RESEARCH
published: 15 January 2021
doi: 10.3389/fpubh.2020.574765

# Serious Workplace Violence Against Healthcare Providers in China Between 2004 and 2018

*Jing Ma[1†], Xi Chen[1†], Qiongjuan Zheng[1], Yun Zhang[2], Zhi Ming[1], Dongxin Wang[1], Hua Wu[3], Haisen Ye[1], Xiaoxuan Zhou[1], Yunxuan Xu[1], Renjiao Li[1], Xia Sheng[1], Fangxiu Fan[1], Zuiwen Yang[1], Ting Luo[1], Yajun Lu[1], Ye Deng[1], Fen Yang[1], Chuntao Liu[1], Chunyu Liu[4*] and Xiaosong Li[5*]*

[1] Department of Child and Adolescent Psychiatry, School of Clinical Medicine, The Second People's Hospital of Hunan Province, Hunan University of Chinese Medicine, Changsha, China, [2] Medical College of Northwest University for Nationalities, Lanzhou, China, [3] Furong Forensic Center of The Second People's Hospital of Hunan Province, Yuhua, China, [4] Department of Psychiatry, Department of Neuroscience and Physiology, SUNY Upstate Medical University, Syracuse, NY, United States, [5] Hunan Provincial People's Hospital, Changsha, China

OPEN ACCESS

**Edited by:**
Danijela Gasevic,
Monash University, Australia

**Reviewed by:**
Nicola Mucci,
University of Florence, Italy
Jiansong Zhou,
Central South University, China

***Correspondence:**
Chunyu Liu
liuch@upstate.edu
Xiaosong Li
68872731@qq.com

[†]These authors have contributed equally to this work

**Specialty section:**
This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health

**Received:** 21 June 2020
**Accepted:** 30 November 2020
**Published:** 15 January 2021

**Citation:**
Ma J, Chen X, Zheng Q, Zhang Y, Ming Z, Wang D, Wu H, Ye H, Zhou X, Xu Y, Li R, Sheng X, Fan F, Yang Z, Luo T, Lu Y, Deng Y, Yang F, Liu C, Liu C and Li X (2021) Serious Workplace Violence Against Healthcare Providers in China Between 2004 and 2018. Front. Public Health 8:574765. doi: 10.3389/fpubh.2020.574765

**Introduction:** Workplace violence (WPV) against healthcare providers has severe consequences and is underreported worldwide. The aim of this study was to present the features, causes, and outcomes of serious WPV against healthcare providers in China.

**Method:** We searched for serious WPV events reported online and analyzed information about time, location, people, methods, motivations, and outcomes related to the incident.

**Result:** Serious WPV reported online in China ($n$ = 379) were mainly physical (97%) and often involved the use of weapons (34.5%). Doctors were victims in most instances (81.1%). Serious WPV mostly happened in cities (90.2%), teaching hospitals (87.4%), and tertiary hospitals (67.9%) and frequently in Emergency Department (ED), Obstetrics and Gynecology Department (OB-GYN), and pediatric departments; it was most prevalent in the months of June, May, and February. Rates of serious WPV increased dramatically in 2014 and decreased after 2015, with death (12.8%), severe injury (6%), and hospitalization (24.2%) being the major outcomes. A law protecting healthcare providers implemented in 2015 may have helped curb the violence.

**Conclusion:** Serious WPV in China may stem from poor patient–doctor relationships, overly stressed health providers in highly demanding hospitals, poorly educated/informed patients, insufficient legal protection, and poor communication. Furthering knowledge about WPV and working toward curtailing its presence in healthcare settings are crucial to increasing the safety and well-being of healthcare workers.

**Keywords: serious workplace violence, healthcare, reasons, outcome, China**

## INTRODUCTION

Workplace violence (WPV) refers to an individual's or group's socially unacceptable, aggressive (and sometimes destructive) behavior (1–3). WPV against healthcare workers is a global public health problem that has been underreported and largely ignored (4). World Health Organization (WHO) estimated that 8–38% of healthcare workers suffer from physical violence while working

in 2019 (5). Many more are threatened or exposed to verbal aggression (6). The damage due to workplace violence translates into physical and mental harm to the health workers (7). The research literature shows that such violence leads to issues such as death (8), heart and brain disease (9), anxiety, depression (10), and posttraumatic stress disorder (PTSD) (11, 12). Workplace violence also translates to high costs for the organization where it takes place, both in the short and long term, and decreases quality of care provided to all patients (13, 14). In China, workplace violence in hospitals causes a lot of to change their majors and decreases the integrity of the healthcare provider–patient relationship (15).

The perpetrators who carry out violent behavior against healthcare workers vary with respect to their relationship to the worker: some are patients, some are patients' relatives, and others are neither (16). Research literature from Greece and Nepal has shown that nurses are more likely to be the victims of WPV than doctors (17, 18) and that verbal violence is more common than physical violence (6, 13, 19). However, a study in China showed that doctors are more frequently the victims compared to the nurses (20). Additionally, physical violence against doctors appears to be more common than physical violence against nurses in China (21). There are only a few studies on WPV in China (17, 19, 22); the prevalence of WPV varies from province to province (21, 23), from hospital to hospital (19, 24), and from department to department (25, 26). China is the only country in which prevalence of WPV by month has been studied; according to previous research, it is most common in July (20).

Many researchers have tried to determine the reasons behind WPV, which can vary as a result of different medical systems and national conditions. There is a lot of literature that explores the outcomes of WPV (27, 28). Of all the countries with research on the topic, we found that WPV in China leads to the most serious outcomes (8).

Serious WPV against healthcare workers, although less common than milder forms of violence, possibly gets more attention from mass media and the public. It shows the worst relationship between healthcare providers and patients and also reflects particularly negative living situations of healthcare providers in certain medical systems. It reveals the suffering and helplessness of patients, as well as the defects of certain medical and legal systems. Serious WPV usually happens suddenly, which makes research on the topic hard to carry out through routine methods like checklists and interviews. Studying mass media reports may therefore currently be the best way to study serious WPV.

As far as we know, there have only been two studies about serious WPV against healthcare workers in China (with a few more studies focusing on less serious WPV) (8, 20). One of these articles examines the changes in prevalence and features of serious WPV against doctors and nurses in China, as reported online from 2000 to 2015 (8), but it did not study the reasons for and outcomes of serious WPV. This article will present the newest changes in, features of, reasons for, and outcomes of serious WPV trends against healthcare providers in China from 2004 through 2018 based on online reports.

**Abbreviations:** WPV, workplace violence; WHO, World Health Organization; PTSD, posttraumatic stress disorder; ED, Emergency Department; OB-GYN, Obstetrics and Gynecology Department.

# METHODS

The research data examined in this article came from online reports about workplace violence against healthcare workers in hospitals from January 2004 to December 2018. Baidu, Sogou, Souhu, and Lilac Garden were used as search engines, and "ShangYi" (do harm to doctors), "Yi Yuan," and "Bao Li" (hospital and violence), "Yi Nao" (medical harassment), "Da Yi Sheng" (beating doctors), "Da Hu Shi" (beating nurses), "Yi Huan Chong Tu" (healthcare provider-patient disputes), and "Bao Li Shang Yi" (healthcare workers' injury by workplace violence) were used as search words for finding news and reports online.

Relevant online information was screened, and secondary materials were excluded. We read the reports and collected the following information about the violence: causes, time (year, month), region (province, city, county, town), hospital (name, public/private, level of the hospital if public), department, types of violence (verbal, physical, or both), identity of victims (doctor, nurse, other staff member), identity of perpetrators (patient, relative of the patient, other person), and outcomes of the events [death, injury, type of injury, admission to inpatient department (IPD) or not]. We asked a coroner to read the outcome information that we collected and to determine how serious the injuries were (severe injury, minor wound, or slight bodily injury).

This study has been approved by the Ethics Committee of the Hunan Provincial Brain Hospital, ethics approval number 59.

SPSS17.0 was used to input data and to do statistical analyses. We calculated frequency and proportion of serious WPV with regards to location (province, city, county, town, hospital, and department), time (monthly and yearly changes), outcomes, reasons for violence (losing control of emotions, dissatisfaction and high expectations for treatment outcomes, unreasonable request for procedures), features of violent behavior, and identity of perpetrators and victims. The incidence of serious WPV in 2014 showed an increase compared to previous years. The difference in WPV rates across years was explored using chi-square test.

# RESULTS

## Sample Size

There were 379 violent events reported from January 2004 to December 2018. Some information was not included in the reports, which led to missing values. However, there was complete information for province, year, and name of hospital. The number of reports that included information for the remaining fields are as follows: department, 219; month, 378; day, 371; city, 368; hospital level, 258; teaching hospital or not, 364; identity of victim, 370; types of violence, 370; reasons:, 372; with weapon or not, 365; identity of perpetrator, 331; and outcomes, 265.

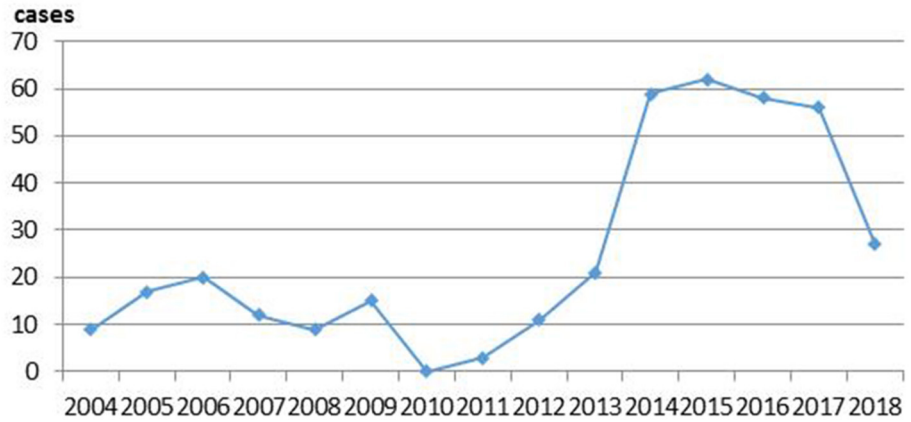


**FIGURE 1 |** The frequency of serious workplace violence (WPV) between 2004 and 2018.

## Identity of Victims and Perpetrators and Features of Violent Behavior

Doctors were victims in 300 events (81.1%), nurses were victims in 134 events (36.2%), and both nurses and doctors were injured in 64 events (17.3%). There were 30 events in which other persons (security guards, policemen, etc.) were injured, too.

Most common perpetrators were relatives of the patients (190 events, 57.4%), followed by patients themselves (132 events, 39.9%), and in some events, both patients and their relatives carried out the violent behavior (12 events, 3.6%). There were 28 acts of violence (8.4%) committed by nonrelatives of patients.

The reported violent events included physical violence (beating, slapping of the face, stabbing with knife, hitting with bricks/chairs, forcing victims to kneel, kidnapping, stalking, etc.) 97% of the time ($n = 359$). Verbal violence (insulting, cursing, swearing, shouting, threatening, intimidating, etc.) occurred in 21.1% of the events ($n = 78$). Almost one-fifth ($n = 67$, 18.1%) of the events included both physical and verbal violence, and 34.5% of perpetrators used a weapon (knife, brick, stick, table, stairs, etc.).

## Location: Province, City, County, Town, Hospital, and Department

There are 31 provinces and 4 municipalities in China, and none of them were free from workplace violence between 2004 and 2018, although the frequency of incidence varied from province to province. The five provinces/municipalities with the most WPV and the percentage of the total incidents that occurred in each are as followings: Guangdong, 52 (13.7%); Hunan, 30 (7.9%); Jiangsu, 25 (6.6%); Beijing, 22 (5.8%); and Guangxi, 21 (5.5%).

Most of the workplace violence in hospitals happened in cities (332, 90.2%), while only 36 events (9.8%) happened in counties and towns. Most of the workplace violence happened in tertiary hospitals (243, 67.9%), which are the highest-ranking hospitals in the system, and only rarely in first-level hospitals (10, 2.8%) or private hospitals (8, 2.2%). The remainder either happened in secondary hospitals (72, 20.1%) or other public hospitals whose level was not mentioned (25, 7.0%). Remarkably, of all the hospitals that reported violent workplace incidents, teaching hospitals accounted for 87.4% (318) while non-teaching hospitals accounted for 12.6% (46).

The top three departments with the highest rates of serious WPV were Emergency Departments (74, 33.8%), Obstetrics–Gynecology Departments (26, 11.9%), and pediatrics departments (20, 9.1%). In total, 18.3% of events happened in a department related to internal medicine ($n = 40$). A total of 20.1% of events happened in departments related to surgery not associated with obstetrics–gynecology ($n = 44$).

## Time: Year and Month

From 2004 to 2013, the incidence rate of WPV fluctuated. The incidence increased significantly over the year during 2014 and peaked in 2015, then decreased gradually in the following years. By the end of the timeframe of interest, rates had decreased to the lowest levels between 20014 and 2018, which were almost as low as the rates in 2013 (see **Figure 1**).

As shown in **Table 1**, there was no difference between the risk of serious WPV occurring in 2012 ("a") vs. 2013 ("a"), but there was a statistically significant difference ($P < 0.05$) between the risk of serious WPV occurring in 2013 ("a") vs. 2014 ("b"), and in 2012 ("a") vs. 2014 ("b").

The 5 months with most occurrences of serious WPV were June (72, 19%), May (40, 10.6%), July (35, 9.3%), and February (35, 9.3%) (see **Figure 2**).

## Outcome of Violent Events

Two hundred sixty-five reports (69.9% of the total sample) included information about the outcome of the injured persons. Out of these 265 reports, 171 had detailed description of injury severity and target body parts.

The severity of injuries was as follows: death (34, 12.8%); severe injury, such as pierced heart, paralysis of both lower limbs, decapitated arm, or intestinal perforation (16, 6.0%); minor wound, such as intracranial hemorrhage, orbital fracture, concussion, miscarriage, second-/third-degree burn, tendon rupture, or lung contusion (70, 26.4%); and slight bodily injury,

such as light closed encephalon injury, threatened miscarriage, soft tissue contusion, nose bleeding, head trauma, facial blood stasis, or waist injury (82, 30.9%). It is worth mentioning the injuries that were classified as "minor" were categorized according to a forensic standard in China and that many of these injuries would not be considered minor by most people.

Moreover, the injured persons suffered head and face injuries in 102 events (38.5%) and trunk injuries in 33 events (12.4%), while limb injuries accounted for 6.1% (16) of injuries; notably, many people suffered multiple injuries in 1 event; 64 events (24.2%) led to hospitalization.

## Reasons for Violent Behavior

The reasons behind the perpetrators' acts of violence in the hospital were as follows: refusing to accept the death of the patient (12.6%, 47), being dissatisfied with the treatment outcomes (10.5%, 39), thinking that the emergency treatment is not effective (7.3%, 27), wanting to get treatment as soon as possible without following medical procedures (6.5%, 24), being drunk (3.5%, 13), having a suspected mental disorder (3.2%, 12), believing that adverse effects of treatment were due to clinical operations (3.0%, 11), failure of operation (such as puncturing), leading to the need for a second operation (2.7%, 10), having a diagnosed mental disorder (1.3%, 5), asking staff for particular treatment and arrangements but being refused (1.08%, 4), and unspecified reasons (20.2%, 75).

**TABLE 1 |** The incidence and comparison of serious WPV in 2012, 2013, and 2014.

| | | | Year | | | Total |
|---|---|---|---|---|---|---|
| | | | 2012 | 2013 | 2014 | |
| Whether serious WPV happened this year | Yes | Count | 10[a] | 15[a] | 39[b] | 64 |
| | | Percentage (%) | 15.60% | 23.40% | 60.90% | 100.00% |
| | No | Count | 255[a] | 250[a] | 226[b] | 731 |
| | | Percentage (%) | 34.90% | 34.20% | 30.90% | 100.00% |
| Total | | Count | 265 | 265 | 265 | 265 |
| | | Percentage (%) | 33.30% | 33.30% | 33.30% | 33.30% |
| Pearson chi-square | | Value | | 24.504 | | |
| | | *P* | | <0.001 | | |

*Each subscript letter denotes a subset of year categories whose column proportions do not differ significantly from each other at the 0.05 level.*

# DISCUSSION

The purpose of this study was to reveal the features of serious WPV reported online against healthcare providers in China. Our results convey insights into the people involved in, the times of, the locations of, as well as the methods used for and the outcomes of serious WPV in Chinese hospitals. The major findings were as follows. (1) The vast majority of cases of serious WPV reported online were physical in nature (97%) and were often committed with weapons (34.5%). Doctors were more exposed to serious WPV than nurses. (2) Guangdong, Hunan, Jiangsu, Beijing, and Guangxi had the highest rates of serious WPV; Qinghai, Hainan, Ningxia, Neimeng, Taiwan, and Shanxi had the lowest prevalence rates. (3) Serious WPV mostly happens in cities (90.2%) and usually occurs in tertiary hospitals (67.9%), especially teaching hospitals, which account for 87.4% of serious WPV events in tertiary hospitals. (4) The three departments making up the highest proportion of serious WPV incidents were Emergency Department (ED), Obstetrics and Gynecology Department (OB-GYN), and pediatrics. (5) Serious WPV increased dramatically in 2014 and decreased gradually after 2015. The 3 months during which serious WPV occurred most frequently between 2004 and 2018 were June, May, and February. (6) The major reasons behind serious WPV were losing control of emotions, dissatisfaction with and high expectations for treatment outcomes, and unreasonable requests for procedures.

## Who and How

Our study found that the vast majority of cases of serious WPV reported online were physical in nature (97%) and were often committed with weapons (34.5%). Such a high occurrence of weapon use suggests extreme conflict between patients and healthcare providers. Our study also found that doctors were

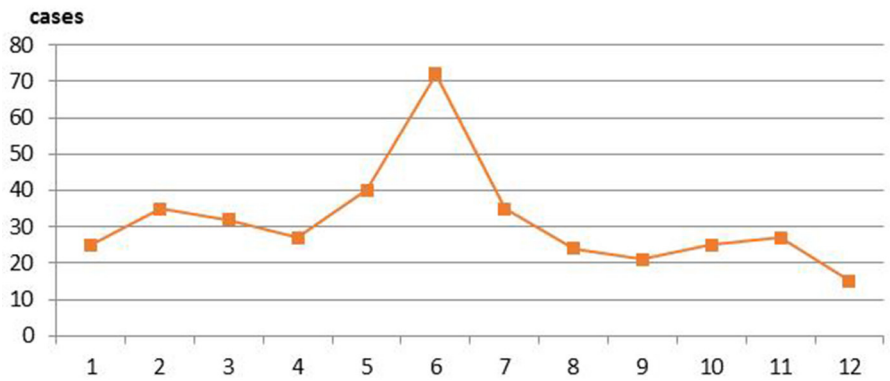


**FIGURE 2 |** Month distribution of serious workplace violence (WPV) between 2004 and 2018.

more exposed to serious WPV than nurses. Several previous studies showed that nurses were more exposed to verbal violence than doctors (6, 17, 29–31) and that doctors were more often the victims of physical workplace violence (32, 33). These results indicate that the most serious WPV may result from more major issues such as those related to diagnosis and treatment—which are primarily linked to doctors—rather than from smaller issues related to nurse–patient interactions. Perpetrators are more often relatives of patients than they are patients themselves. This finding has been reported cross-culturally (34, 35). This may be because patients are sometimes unable to move or to argue or fight due to medical conditions and age. Relatives may express themselves through violence as a result of anger, worry, dissatisfaction, or financial intentions (claim for compensation).

## Where

Guangdong, Hunan, Jiangsu, Beijing, and Guangxi had the highest rates of serious WPV; Qinghai, Hainan, Ningxia, Neimeng, Taiwan, and Shanxi had the lowest prevalence rates. Previous similar research in China reached similar conclusions, with the greatest prevalence occurring in Guangdong, Jiangsu, Sichuan, and Zhejiang and the lowest rates occurring in Gansu, Ningxia, Tianjin, Shanxi, and Taiwan (8). We searched the populations and gross domestic products (GDPs) of the above provinces on the National Bureau of Statistics of China's website (http://data.stats.gov.cn/search.htm) and found that the provinces with the top number of serious WPV incidents had high GDPs or large populations. Most provinces with low prevalence of WPV had among the lowest GDPs or among the smallest populations in China. We speculate that economically developed provinces attracting millions of migrant workers every year—and thus adding to the already overloaded burden of the health providers by local residents—has led to a higher frequency of serious WPV. Such a great need for medical attention may strain medical staff resources and thus result in worse patient–doctor relationships, contributing to the prevalence of serious WPV. The relationship between these socioeconomic variables and serious WPV is complicated and requires further research.

This study found that serious WPV mostly happens in cities (90.2%) and usually occurs in tertiary hospitals (67.9%)—especially teaching hospitals—which account for 87.4% of serious WPV events in tertiary hospitals. The finding regarding teaching hospitals differs from the conclusions of the study of Chen et al., which showed that the incidence of WPV in teaching hospitals was lower than the incidence of WPV in regional hospitals in China and was similar to incidences in developed countries (36). Difference in methods and regions of interest may account for the discrepancy between these findings. Some studies (8, 21, 37), such as the report of Yen et al. on Heilongjiang, have shown that Chinese tertiary hospitals usually have higher rates of WPV than hospitals in rural areas or small towns (37). The current study found similar results. It is worth mentioning that tertiary hospitals in cities of China usually have the best equipment and the best doctors, where patients with comparatively severe, challenging diseases usually seek help. That means that, at these kinds of hospitals, the death toll per year can be expected to be higher, increasing motivation behind serious WPV. Furthermore, almost every doctor in teaching hospitals faces great pressure to do research and publish articles in order to get a promotion, which forces them to reduce clinical hours. Routine service in the inpatient units of teaching hospitals is mostly performed by resident trainees, postgraduate students, and further educational doctors. These doctors have less experience interacting with patients, as well as fewer medical skills and abilities, which may raise their likelihood of getting into medical disputes (38).

According to our findings, the three departments making up the highest proportion of serious WPV incidents were ED, OB-GYN, and pediatrics. Emergency departments have been previously described as being at high risk for violent incidents (8, 20, 25, 33, 34, 39, 40), a finding that was corroborated by the current study. Samir et al. found that 86.1% of nurses in OB-GYN departments had been exposed to WPV (35). Li found that Chinese healthcare providers in children's hospitals experienced violence commonly and that 68.6% of staff members had experienced at least one WPV incident in the past year (34). Ferri et al. found that the top 3 departments for WPV were psychiatry (86%), emergency (71%), and geriatric wards (57%) (30). However, the study of Min et al. from China showed that the frequency of WPV in OB-GYN (9) and pediatric departments (7) were not higher than in other internal medicine and surgical departments (8). We think that the high number of incidents reported in OB-GYN departments and pediatrics may have to do with the dramatic increase in maternal and child care hospitals (primarily pediatrics and OB-GYN), as well as children's hospitals in China between 2014 and 2018. Serious WPV occurring in these child-related hospitals increases the counts in those related departments.

## When

We found that serious WPV increased dramatically in 2014 and decreased gradually after 2015. This shift may be the result of an article (article 31, page 11) added to the Criminal Law of the People's Republic of China (ninth revision) in 2015. The article reads: "Where people are gathered to disturb public order to such a serious extent that work in general, production, business operation, teaching or scientific research cannot go on and heavy losses are caused, the ringleaders shall be sentenced to fixed-term imprisonment of not <3 years but not more than 7 years; the active participants shall be sentenced to fixed-term imprisonment of not more than 3 years, criminal detention, public surveillance or deprivation of political rights."

The 3 months during which serious WPV occurred most frequently between 2004 and 2018 were June, May, and February. February is usually the month in which Spring Festival occurs. During Spring Festival, there is a shortage of staff members in hospitals, which may heighten risk of medical disputes. A report published in China by Yuqing et al. found that the top 3 months for WPV were May, June, and July (20). No research thus far has revealed the reasons behind the inordinately high amounts of serious WPV in June and May. This may be a good area of research for future study.

## Outcome

Serious WPV has very severe consequences. We are shocked by the rate of death (12.8%), severe injury (6%), and hospitalization (24.2%) that has resulted from serious WPV. Previous research in

developed countries has reported that WPV has more frequently resulted in nonphysical harm (9–12, 41). On the contrary, a research in China—including this study—has found that physical harm is more common; these instances of physical violence have sometimes led to death (8).

### Reasons

We separated the reasons we found for serious WPV into three categories:

(1) Losing control of emotions, including: "being drunk" and "having a diagnosed or suspected mental disorder." Previously, Bataille et al. found that alcohol abuse is one of the most common triggers of WPV in ED (42); a lot of other research has similarly found that drunkenness and mental disorders are often associated with physical violence against healthcare providers (30, 43–47).
(2) Dissatisfaction and high expectations for therapeutic outcome, including "failed clinical operation (like puncturing)," "operating for the second time," "thinking the emergency treatment is not effective," "believing that severe adverse effects of treatment were due to clinical operations," "refusing to accept the death of the patient," and "being dissatisfied with the treatment outcomes." The dissatisfaction of treatment outcome was due to two reasons: either actual poor quality of medical care or unreasonable expectations leading to dissatisfaction in the face of normal medical failures or flaws. Previous research showed similar results pertaining to ineffective treatment and high expectations related to WPV (48), but the level of physical harm we reported was more serious. We speculate that these intense conflicts in China stem, in part, from negative healthcare provider–patient relationships and a lack of relevant legal measures. Both of these issues may be consequences of flaws in the medical system. This also may be a good area of research for future study.
(3) Unreasonable requests for procedures, including "asking the professional staff to give treatment and arrangements as requested but being refused" and "wanting to get emergency treatment as soon as possible without following medical procedures." Alkorashy et al. found that misunderstandings and long waits for service are factors that contribute to WPV (49). Inadequate professional resources and poor communication between healthcare providers and patients may also sometimes be reasons behind unreasonable requests for procedures (33).

## LIMITATION

The main limitation of this study was that it was based on online reports, whose integrity and authenticity were influenced by factors such as government regulations, areas where reports were made, the interests of public media and internet companies, the professional ethics of the journalists responsible for the reports, and the validity of the resources. There is a chance that some incidents that occurred in rural areas and underdeveloped regions were not reported and thus not included in this study, which could bias some of the analyses.

## CONCLUSION

The current findings reflect a bleak healthcare setting in China, dangerous conditions for healthcare workers, and poor doctor–patient relationships, which may, in large part, be due to problems with the Chinese medical system, including overstressed health providers in the highly demanding hospitals, poorly educated/informed patients, insufficient legal protection, and poor communication between care providers and patients. Workplace violence against healthcare workers in China poses a serious threat to the well-being of doctors, nurses, and other providers; it may also be particularly distressing to more junior providers at the beginning of their careers, given the relatively high rate of WPV in teaching hospitals. We strongly believe that public education should be improved to reduce patients' unreasonable expectations. Furthermore, better allocation of medical resources and more legal action against serious WPV could reduce serious workplace violence.

## DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: If necessary, the data can be obtained by contacting the corresponding author. Requests to access these datasets should be directed to Chunyu Liu, liuch@upstate.edu.

## AUTHOR CONTRIBUTIONS

JM, XC, QZ, YZ, ZM, DW, HW, HY, XZ, YX, RL, XS, FF, ZY, TL, YL, YD, FY, and ChuntL contributed to data acquisition. ChunyL and XL came up with the idea of doing this research and are responsible for the whole work. JM, XC, and QZ participated in data analysis and writing and revision of the article. All authors read and approved the final version of the manuscript.

## FUNDING

We would like to acknowledge the support offered by the project in hospital level of Brain hospital of Hunan province: Study on the characteristics of stress model and risk factors of workplace violence in tertiary hospitals. Project number: 2017A03. Recipient: JM. The project of Technological Innovation Guidance Plan of Hunan province (title: a randomized controlled study of the effect of social skills training on Asperger syndrome). Project number: 2017SK50314 Recipient: JM. Project from Hunan Provincial Commission of Health. Project number: B2019045. Recipient: XC. Family education promotion project that focusing on children's mental health of Hunan province. Project number: 20200720. Recipient:

JM. Molecular pathologic mechanism and application of major neurodegenerative and neurodevelopmental diseases in human brain. Project number: S2018GCZDZX0036. Recipient: Zhuohua Zhang.

## ACKNOWLEDGMENTS

We would like to thank Tanya Horwitz for manuscript revisions. This manuscript has been released as a pre-print at medRxiv (50).

## REFERENCES


1. Pompeii L, Benavides E, Pop O, Rojas Y, Emery R, Delclos G, et al. Workplace violence in outpatient physician clinics: a systematic review. *Int J Environ Res Public Health.* (2020) 17:6587. doi: 10.3390/ijerph17186587
2. Tian Y, Yue Y, Wang J, Luo T, Li Y, Zhou J. Workplace violence against hospital healthcare workers in China: a national WeChat-based survey. *BMC Public Health.* (2020) 20:582. doi: 10.1186/s12889-020-08708-3
3. Kumar PN, Betadur D. Study on mitigation of workplace violence in hospitals. *Med J Armed Forces India.* (2020) 76:298–302. doi: 10.1016/j.mjafi.2019.09.003
4. Phillips JP. Workplace violence against health care workers in the United States. *N Engl J Med.* (2016) 374:1661–9. doi: 10.1056/NEJMra1501998
5. WHO. *Violenceagainst Health Workers.* Available online at: https://www.who.int/violence_injury_prevention/violence/workplace/en/ (accessed January 1, 2019).
6. Aksakal FN, Karasahin EF, Dikmen AU, Avci E, Ozkan S. Workplace physical violence, verbal violence, and mobbing experienced by nurses at a university hospital. *Turk J Med Sci.* (2015) 45:1360–8. doi: 10.3906/sag-1405-65
7. Li P, Xing K, Qiao H, Fang H, Ma H, Jiao M, et al. Psychological violence against general practitioners and nurses in Chinese township hospitals: incidence and implications. *Health Qual Life Outcomes.* (2018) 16:117. doi: 10.1186/s12955-018-0940-9
8. Min Z, Kaiming J, Lingling Y, Wanyong Q. The big data research on violence against doctor: based on the media reports from 2000 to 2015. *Med Philos.* (2017) 38:89–93. doi: 10.12014/j.issn.1002-0772.2017.01a.22
9. Xu T, Magnusson HL, Lange T, Starkopf L, Westerlund H, Madsen I, et al. Workplace bullying and workplace violence as risk factors for cardiovascular disease: a multi-cohort study. *Eur Heart J.* (2018) 40:1124–34. doi: 10.1093/eurheartj/ehy683
10. Palma A, Ansoleaga E, Ahumada M. Workplace violence among health care workers. *Rev Med Chil.* (2018) 146:213–22. doi: 10.4067/s0034-98872018000200213
11. Zhang SE, Liu W, Wang J, Shi Y, Xie F, Cang S, et al. Impact of workplace violence and compassionate behaviour in hospitals on stress, sleep quality and subjective health status among Chinese nurses: a cross-sectional survey. *BMJ Open.* (2018) 8:e19373. doi: 10.1136/bmjopen-2017-019373
12. Chan AO, Chan YH, Kee JP. Exposure to crises and resiliency of health care workers in Singapore. *Occup Med.* (2013) 63:141–4. doi: 10.1093/occmed/kqs202
13. Kumari A, Kaur T, Ranjan P, Chopra S, Sarkar S, Baitha U. Workplace violence against doctors: characteristics, risk factors, and mitigation strategies. *J Postgrad Med.* (2020) 66:149–54. doi: 10.4103/jpgm.JPGM_96_20
14. Kaur A, Ahamed F, Sengupta P, Majhi J, Ghosh T. Pattern of workplace violence against doctors practising modern medicine and the subsequent impact on patient care, in India. *PLoS ONE.* (2020) 15:e239193. doi: 10.1371/journal.pone.0239193
15. Juqian W, Wei G, Yihua L. Analysis of how doctor-patient relationship influences career-choosing and employment of medical students. *Modern Prev Med.* (2015) 42:2956–8.
16. Yaoling L, Yan G, Guilian W. A survey and analysis of the status quo of nursing violence in different medical areas in Guibei region Guangxi. *Chin Nurs Res.* (2010) 22:1997–9.
17. Fafliora E, Bampalis VG, Zarlas G, Sturaitis P, Lianas D, Mantzouranis G. Workplace violence against nurses in three different Greek healthcare settings. *Work.* (2015) 53:551–60. doi: 10.3233/WOR-152225
18. Pandey M, Bhandari TR, Dangal G. Workplace violence and its associated factors among nurses. *J Nepal Health Res Counc.* (2018) 15:235–41. doi: 10.3126/jnhrc.v15i3.18847
19. Mantzouranis G, Fafliora E, Bampalis VG, Christopoulou I. Assessment and analysis of workplace violence in a Greek tertiary hospital. *Arch Environ Occup Health.* (2015) 70:256–64. doi: 10.1080/19338244.2013.879564
20. Yuqing Z. Analysis on the present situation and countermeasures of medical locations violence in China. *Med Law.* (2016) 8:23–7. doi: 10.3969/j.issn.1674-7526.2016.06.005
21. Wang N, Wu D, Sun C, Li L, Zhou X. Workplace violence in county hospitals in Eastern China: risk factors and hospital attitudes. *J Interpers Violence.* (2018) 1687770062. doi: 10.1177/0886260518792242
22. Ullah R, Siddiqui F, Zafar MS, Iqbal K. Bullying experiences of dental interns working at four dental institutions of a developing country: a cross-sectional study. *Work.* (2018) 61:91–100. doi: 10.3233/WOR-182784
23. Gan Y, Li L, Jiang H, Lu K, Yan S, Cao S, et al. Prevalence and risk factors associated with workplace violence against general practitioners in Hubei, China. *Am J Public Health.* (2018) 108:1223–6. doi: 10.2105/AJPH.2018.304519
24. Liu W, Zhao S, Shi L, Zhang Z, Liu X, Li L, et al. Workplace violence, job satisfaction, burnout, perceived organisational support and their effects on turnover intention among Chinese nurses in tertiary hospitals: a cross-sectional study. *BMJ Open.* (2018) 8:e19525. doi: 10.1136/bmjopen-2017-019525
25. Hedayati EG, Alimohammadi H, Zolfaghari SA, Hatamabadi H. Workplace violence against residents in emergency department and reasons for not reporting them; a cross sectional study. *Emergency.* (2018) 6:e7.
26. Zhu L, Li L, Lang J. Gender differences in workplace violence against physicians of obstetrics and gynecology in China: a questionnaire in the national congress. *PLoS ONE.* (2018) 13:e208693. doi: 10.1371/journal.pone.0208693
27. Itzhaki M, Bluvstein I, Peles BA, Kostistky H, Bar ND, Filshtinsky V, et al. Mental health nurse's exposure to workplace violence leads to job stress, which leads to reduced professional quality of life. *Front Psychiatry.* (2018) 9:59. doi: 10.3389/fpsyt.2018.00059
28. Yang BX, Stone TE, Petrini MA, Morris DL. Incidence, type, related factors, and effect of workplace violence on mental health nurses: a cross-sectional survey. *Arch Psychiatr Nurs.* (2018) 32:31–8. doi: 10.1016/j.apnu.2017.09.013
29. Randell KA, Evans SE, O'Malley D, Dowd MD. Intimate partner violence programs in a children's hospital: comprehensive assessment utilizing a Delphi instrument. *Hosp Pediatr.* (2015) 5:141–7. doi: 10.1542/hpeds.2014-0054
30. Ferri P, Silvestri M, Artoni C, Di Lorenzo R. Workplace violence in different settings and among various health professionals in an Italian general hospital: a cross-sectional study. *Psychol Res Behav Manag.* (2016) 9:263–75. doi: 10.2147/PRBM.S114870
31. Perkins M, Wood L, Soler T, Walker K, Morata L, Novotny A, et al. Inpatient nurses' perception of workplace violence based on specialty. *J Nurs Adm.* (2020) 50:515–20. doi: 10.1097/NNA.0000000000000927
32. Tuya-Figueroa X, Mezones-Holguin E, Monge E, Arones R, Mier M, Saravia M, et al. External workplace violence against doctors in hospital services in Lima Metropolitana, Peru 2014. *Rev Peru Med Exp Salud Publica.* (2016) 33:670–9. doi: 10.17843/rpmesp.2016.334.2550
33. Anand T, Grover S, Kumar R, Kumar M, Ingle GK. Workplace violence against resident doctors in a tertiary care hospital in Delhi. *Natl Med J India.* (2016) 29:344–8.
34. Li Z, Yan CM, Shi L, Mu HT, Li X, Li AQ, et al. Workplace violence against medical staff of Chinese children's hospitals: a cross-sectional study. *PLoS ONE.* (2017) 12:e179373. doi: 10.1371/journal.pone.0179373
35. Samir N, Mohamed R, Moustafa E, Abou SH. Nurses' attitudes and reactions to workplace violence in obstetrics and gynaecology departments in Cairo hospitals. *East Mediterr Health J.* (2012) 18:198–204. doi: 10.26719/2012.18.3.198

36. Chen X, Lv M, Wang M, Wang X, Liu J, Zheng N, et al. Incidence and risk factors of workplace violence against nurses in a Chinese top-level teaching hospital: a cross-sectional study. *Appl Nurs Res.* (2018) 40:122–8. doi: 10.1016/j.apnr.2018.01.003
37. Yan Z, Ming WF, Yu ZZ, Wen X, Boshi P, Long M, et al. Investigation and analysis of present situation of workplace violence at tertiary hospitals and county hospitals in Heilongjiang Province. *Med Soc.* (2016) 29:2935–7. doi: 10.13723/j.yxysh.2016.09.011
38. Kumar M, Verma M, Das T, Pardeshi G, Kishore J, Padmanandan A. A study of workplace violence experienced by doctors and associated risk factors in a tertiary care hospital of South Delhi, India. *J Clin Diagn Res.* (2016) 10:C6–10. doi: 10.7860/JCDR/2016/22306.8895
39. Wu JC, Tung TH, Chen PY, Chen YL, Lin YW, Chen FL. Determinants of workplace violence against clinical physicians in hospitals. *J Occup Health.* (2015) 57:540–7. doi: 10.1539/joh.15-0111-OA
40. Afshari SL, Niroumand S, Dehghani Z, Afshari ST, Mousavi SM, Zakeri H. Relationship between workplace violence and work stress in the emergency department. *J Inj Violence Res.* (2020) 12:183–90. doi: 10.5249/jivr.v12i2.1526
41. Yang LQ, Spector PE, Chang CH, Gallant-Roman M, Powell J. Psychosocial precursors and physical consequences of workplace violence towards nurses: a longitudinal examination with naturally occurring groups in hospital settings. *Int J Nurs Stud.* (2012) 49:1091–102. doi: 10.1016/j.ijnurstu.2012.03.006
42. Bataille B, Mora M, Blasquez S, Moussot PE, Silva S, Cocquet P. Training to management of violence in hospital setting. *Ann Fr Anesth Reanim.* (2013) 32:165–9. doi: 10.1016/j.annfar.2012.12.010
43. Caldentey C, Tirado MJ, Ferrer T, Fonseca CF, Rossi P, Mestre-Pinto JI, et al. Intimate partner violence among female drug users admitted to the general hospital: screening and prevalence. *Adicciones.* (2017) 29:172–9. doi: 10.20882/adicciones.738
44. Petzall K, Tallberg J, Lundin T, Suserud BO. Threats and violence in the Swedish pre-hospital emergency care. *Int Emerg Nurs.* (2011) 19:5–11. doi: 10.1016/j.ienj.2010.01.004
45. Cooper AJ. A clinical study of violence in patients referred on a form I to a general hospital psychiatric unit. *Can J Psychiatry.* (1988) 33:711–5. doi: 10.1177/070674378803300808
46. Kramer EJ, Dodington J, Hunt A, Henderson T, Nwabuo A, Dicker R, et al. Violent reinjury risk assessment instrument (VRRAI) for hospital-based violence intervention programs. *J Surg Res.* (2017) 217:177–86. doi: 10.1016/j.jss.2017.05.023
47. Hufner A, Dudeck M, Zellner J, Mahr D. Violence and aggression in hospitals-what if the personnel need help? *Unfallchirurg.* (2020) 123:424–34. doi: 10.1007/s00113-020-00806-6
48. ALBashtawy M, Aljezawi M. Emergency nurses' perspective of workplace violence in Jordanian hospitals: A national survey. *Int Emerg Nurs.* (2016) 24:61–5. doi: 10.1016/j.ienj.2015.06.005
49. Alkorashy HA, Al MF. Workplace violence against nursing staff in a Saudi university hospital. *Int Nurs Rev.* (2016) 63:226–32. doi: 10.1111/inr.12242
50. Ma J, Chen X, Zhang Y, Ming Z, Wang D, Wu H, et al. Serious workplace violence against healthcare providers in China in the past 15 years. *medRxiv [Preprint].* (2020). doi: 10.1101/2020.05.20.20105072


**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 Public Health

ORIGINAL RESEARCH
published: 26 March 2021
doi: 10.3389/fpubh.2020.570458

# Pilot Feasibility Study of Incorporating Whole Person Care Health Coaching Into an Employee Wellness Program

*Anna Nelson*[1], *Olivia Moses*[1,2], *Brenda Rea*[1,3], *Kelly Morton*[4], *Wendy Shih*[1], *Fatimah Alramadhan*[1] *and Pramil N. Singh*[1,5]*

[1] School of Public Health, Loma Linda University, Loma Linda, CA, United States, [2] Risk Management, Loma Linda University, Loma Linda, CA, United States, [3] Department of Preventive Medicine, Loma Linda University, Loma Linda, CA, United States, [4] School of Behavioral Health, Loma Linda University, Loma Linda, CA, United States, [5] Transdisciplinary Tobacco Research Program, Loma Linda University Cancer Center, Loma Linda, CA, United States

OPEN ACCESS

**Edited by:**
Leah Okenwa Emegwa, Swedish Red Cross University College, Sweden

**Reviewed by:**
Paula Benevene, Libera Università Maria SS. Assunta, Italy
Yannis Alamanos, Institute of Preventive Medicine Environmental and Occupational Health, Greece

***Correspondence:**
Pramil N. Singh
psingh@llu.edu

**Specialty section:**
This article was submitted to Occupational Health and Safety, a section of the journal Frontiers in Public Health

**Received:** 08 June 2020
**Accepted:** 20 August 2020
**Published:** 26 March 2021

**Citation:**
Nelson A, Moses O, Rea B, Morton K, Shih W, Alramadhan F and Singh PN (2021) Pilot Feasibility Study of Incorporating Whole Person Care Health Coaching Into an Employee Wellness Program. Front. Public Health 8:570458. doi: 10.3389/fpubh.2020.570458

Prior research supports positive health coaching outcomes, but there is limited literature on the integration of employer-sponsored health coaching into employee wellness strategy. The aim of our mixed methods study was to assess feasibility, acceptability, and preliminary efficacy of incorporating a whole-person care model of health coaching into an employee wellness program (i.e., weight loss, smoking cessation) that is made available by an employer-sponsored health plan. For the quantitative study, eligible employees and covered spouses ($n = 39$) from Loma Linda University Health were recruited into a novel, 12-week, whole person care intervention that combined health coaching and health education and examined outcomes from surveys detailing the participants' experience and biometric data from the intervention and maintenance periods. For the qualitative study, data were collected through key informant interviews from three health coaches and six intervention participants who were recruited *via* random sampling. Health coaching was well-received by the participants, and led to a slight albeit positive behavioral change for obesity. A significant decrease in body mass index occurred over 12 weeks of intervention ($-0.36$ kg/m$^2$, $p = 0.016$), that did not continue during the maintenance phase ($-0.17$ kg/m$^2$, $p = 0.218$). Qualitative findings indicated improved personal health awareness, accountability, motivation, and self-efficacy along with goal setting and barrier overcoming skills among the key themes. Our pilot study findings identify positive behavior change effects of an employee health intervention based on a whole person care model of health coaching with integrated health education, and also identify the need for methods to maintain behavior change (i.e., mHealth, peer-support) post-intervention. Further investigation in randomized controlled trials is the next step in this research.

**Keywords: health coaching, corporate wellness, employee health, tobacco, smoking cessation**

# INTRODUCTION

According to the Centers for Disease Control and Prevention, chronic and mental health conditions accounted for 90% of healthcare costs in the United States in 2016 (1). This represents a continuous steady increase from 75% reported in 2009, and 86% in 2010 (2, 3). In addition to the rising trend of chronic diseases (3), nearly 90% of U.S. physicians report that their patients have social conditions affecting their health (4). Health care systems are recognizing that without addressing the social determinants of health, they may not be able to advance health care beyond the traditional clinical model (5, 6). A recent survey of Medicaid managed care plans found that 91% of the responding plans reported some activities to address social determinants of health (7).

## Health Coaching Success

Health coaching is a relatively new health profession that has formally joined the healthcare system in 2017 and is focused on partnering with patients to "foster healing, optimize health, and enhance well-being" (8). Studies have demonstrated effectiveness of health coaching, especially for patients with chronic conditions (9, 10). In one study looking to increase physical activity through health coaching among pre-diabetics, researchers found that the program was successful after just 12 health coaching sessions. Participants not only increased their physical activity levels, but also improved their food choices. The results were sustained 12 weeks after the end of the intervention (11). In a systematic review of health coaching studies with randomized clinical trial design, 11 articles were identified, and the review concluded that health coaching is effective in lowering weight and increasing healthy food consumption, even among diverse populations (12). Researchers, however, do suggest there remains a gap in the literature evaluating the use of health and wellness coaching among patients who have type 2 diabetes or cancer, are at a high risk for either disease, or have other chronic diseases (10, 12).

Few studies have evaluated whether health and wellness coaching can be incorporated into interventions that address social determinants of health in an employer sponsored health plan, but models that included health coaching and community health workers services helped address the needs of the communities and showed positive improvements in self-reported health, healthcare utilization, and increased confidence managing health issues (13).

## Health Coaching in Employee Health

Employee wellness has emerged as a high impact environment in which to introduce interventions (e.g., weight loss, smoking cessation, and preventive screening) based on social determinants of health. Further incorporation of a health coaching model into such workplace interventions represents a promising next step in employee health and has been tested in a few studies. In one study, where 286 businesses sponsored their overweight or obese employees ($N = 5{,}405$) to participate in a health coaching program to promote weight loss, the authors found that the intervention was effective and significantly lowered the BMI at 3, 6, and 12 months of follow-up (14). Another study of 7,778 employees found that older employees, females and those in poor health were more likely to participate in coaching activities. Worksite-level and employee-level factors had significant influence on engagement in coaching (15). A more recent example of 2,169 individuals who were enrolled in a health plan of a large health and well-being company, showed that following 6 months of health coaching intervention, there was a significant decrease in a total number of unhealthy days experienced by these employees (16). The limited literature in the field of health and wellness coaching and employee wellness justify further research into the success of integrating a health coaching model in employee health programs.

## Health Plan Model Incentivizing Social Determinants of Health

Loma Linda University Health (LLUH) offers an "opt in" health plan option—the Wholeness Health Plan (WHP)—to its benefit-eligible employees which incentivizes social determinants of health. Through this plan, employees have an opportunity to receive an "opt in wellness discount" on out-of-pocket health plan costs (i.e., monthly premiums, co-pays) (17) by completing specific wellness activities (i.e., interventions such as weight management for high risk patients, smoking cessation for current/relapsed smokers). To date, this innovative workplace health plan model was developed at LLUH and has been used to date to accomplish a high rate of participation (73%) and success (48% 4 months point prevalence abstinence) in WHP sponsored employee smoking cessation (17).

The aim of the mixed methods pilot study in this report was to assess the feasibility, acceptability, and preliminary efficacy of incorporating health coaching into LLUH's innovative WHP that incentivizes improvements in social determinants of health. In addition to efficacy measures in the quantitative study, our goal was to assess acceptability by obtaining during qualitative study interviews both employees' and coaches' perspective of the value of a whole-person health coaching program within a population in a care management program tied to their health plan.

# METHODS

This mixed methods study was designed to include: (1) a quantitative study (one-arm intervention) of the efficacy of the health coaching intervention on improving metabolic panel outcomes and anthropometric outcomes; and (2) a qualitative study (key informant interviews) on assessing feasibility and acceptability of the health coaching intervention among participants and coaches. These are described below.

## Quantitative Study for Assessment of Efficacy

The quantitative study of employee participants was designed to be a one arm uncontrolled intervention study. Consented employees were enrolled in the 12 weeks intervention phase and 12 weeks maintenance phase.

### Participant Recruitment

To be eligible for the study, Wholeness Health Plan (WHP) members had to meet the following three inclusion criteria: (a) blood pressure ≥ 130/80 mm Hg; (b) fasting blood sugar ≥ 100 mg/dl OR non-fasting blood sugar ≥ 140 mg/dl, and (c) total cholesterol ≥150 mg/dl OR LDL-C ≥ 130 mg/dl OR triglycerides ≥150 mg/dl OR HDL < 40 mg/dl. Eligible employees identified during the required Wholeness Health Plan wellness discount's biometric screening received an invitation letter from the Health Plan to visit their physician. Upon completion of the physician's appointment they were invited to join the study that used the health coaching methods described below. Since health coaching was being tested for inclusion in the incentivized health plan model that has over a 90% participation rate, we are not considering participation rate as a feasibility outcome. The participation rate for the present study (i.e., outside of health plan incentive model) was about 5% and consistent with other voluntary wellness programs that LLUH has run in previous years. Of the 50 subjects enrolled in health coaching, 11 dropped out during the follow-up (22% dropout).

### Health Coaching Intervention

The health coaching program consisted of 12 weekly 30-min phone sessions and was added to the medical standard of care. Additionally, participants received an initial foundation session of 45 min. The first 4 weeks of the program included a health education focus covering the topics of hypertension, dyslipidemia, diabetes, and weight management. These topics were customized to the participants based on their biometric screening, lab results, and the pre-program survey. The remaining 8 weeks of the program utilized standard models of health coaching combined with LLUH's approach to whole person care. Services were provided by certified health coaches. The program provided comprehensive coaching and tools focused on empowering members to make healthy lifestyle choices that may prevent, control or reverse their conditions. The detailed schedule of intervention activities is listed in the **Appendix**.

Coaches and participants contacted each other *via* email, telephone, and electronic conferencing; additional contacts occurred between scheduled coaching sessions as needed. Participants were encouraged to explore barriers to change and the need for spiritual support while receiving up-to-date evidence-based health information on lifestyle and chronic disease during the 12 weeks of active intervention.

### Data Collection and Analysis for Assessment of Preliminary Efficacy

Participants were administered surveys at baseline and 12 weeks. Diagnostic laboratory panels (creatinine, HbA1c, a full lipid panel, and comprehensive metabolic panel) and anthropometrics [body mass index, body fat% (TANITA scale)] were administered to participants at baseline, 6, 12, 18, and 24 weeks. A research physician monitored temporal changes in these wellness measures and provided feedback to patients.

Thus, surveys and lab panels during the first 12 weeks were used to assess pre-/post preliminary efficacy. A maintenance effect was assessed at week 18 and 24 weeks. To assess a preliminary pre/post effect we compared survey and lab data between baseline and 12 weeks using generalized linear models for repeated measures to compute contrasts for continuous variables from the lab panels and anthropometrics. The same method was used to assess a maintenance effect but here the contrasts of interest were as follows: (1) baseline to 24 weeks; and (2) post intervention 12–24 weeks.

## Qualitative Study for Assessment of Feasibility and Acceptability

The qualitative study included key informant interviews with health coaches and participants to assess the feasibility and acceptability of the whole person care health coaching intervention.

### Participant Recruitment

In order to gain additional insight into the feasibility and acceptability of the health coaching intervention, participants were randomly selected from the quantitative study and the first six who consented to a further interview were enrolled. Additionally, all health coaches in the program ($n = 3$) were invited and consented to participate in the key informant (KI) interviews upon completion of the intervention.

### Key Informant Interview Methods

The interviews were used to assess the perceived impact of the intervention on outcomes as well as to gain perspective from the participants and providers on the strengths and gaps of the health coaching model used. All interviews were completed during October-November, 2019. Six participants were approached by the health coaches with an invitation to participate in the key informant interviews. All of the approached participants provided written consents, and telephone appointments for the interviews were scheduled. The three health coaches in the program were also approached by the investigators, and consented to participate in the KI interviews. All of the interviews followed a KI guide developed specifically for this study. The interviews lasted between 40 and 60 min each and were audio recorded with participants' consent.

### Qualitative Data Analysis

The audio transcripts were transcribed, and then coded using NVivo Version 12 Pro (QSR International). Thematic analysis was used to determine the key semantic themes in the dataset. We used an inductive approach in which the analysis process was data driven—themes were identified based on the data rather than pre-existing codes. After reviewing the dataset, we generated the initial codes from the data organizing quotes into meaningful categories based on the patterns, and then, organized these into emergent themes.

## RESULTS

Findings from the mixed method study are summarized from the quantitative assessment ($n = 39$ enrolled in a one arm intervention) and the qualitative study (Interviews of six participants, Interviews of three coaches).

## Quantitative Assessment of Preliminary Efficacy

**Table 1** provides demographic information as well as the biometric profile of the participants in the study. To determine preliminary efficacy of health coaching (12 weeks coaching + 12 weeks maintenance) in a one arm uncontrolled study sample, we tested intervention contrasts [baseline to post intervention (week 12)], and maintenance contrasts [baseline to end of follow-up (week 24)], post intervention (week 12) to end of follow-up (week 24) across the biometric measures. For body fat, creatinine, HbA1c, and total cholesterol we found no significant or biologically important contrasts based on intervention and/or maintenance. For BMI we found a significant decrease in BMI (**Figure 1**) from baseline to post intervention ($-0.36$ kg/m$^2$, $p = 0.016$) that did not remain after maintenance ($-0.17$ kg/m$^2$, $p = 0.22$).

**TABLE 1 |** Demographic and biometric profile of the intervention sample ($n = 39$).

| | |
|---|---|
| **Demographic variable** | |
| Age (Mean [*SD*]) | 51.74 [10.96] |
| Female gender (%) | 64% |
| Ethnicity | |
| Hispanic or Latino | 18% |
| Not hispanic or Latino | 82% |
| **Baseline biometrics variables (Mean [*SD*])** | |
| Body mass index (kg/m$^2$) | 30.54 [6.53] |
| Body fat (kg) | 36.12 [9.50] |
| Creatinine | 0.85 [0.18] |
| HbA1c | 6.04 [1.16] |
| Total cholesterol | 208.34 [59.29] |

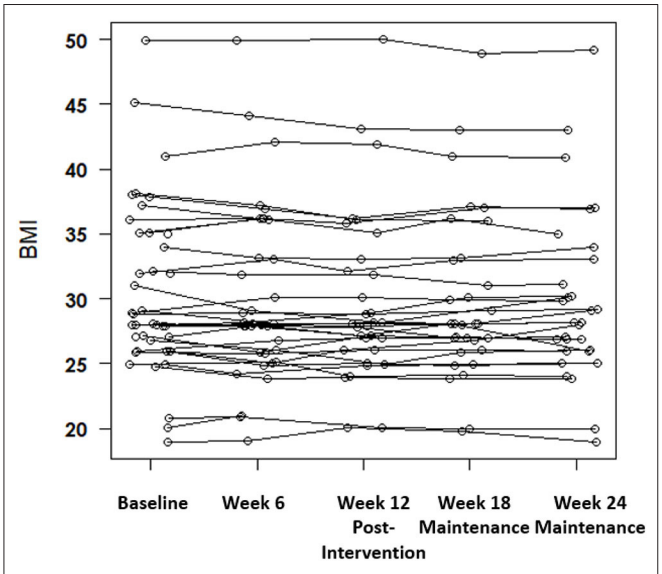


**FIGURE 1 |** Intervention and maintenance phase BMI measures for a one-arm health coaching intervention with a significant decrease in BMI from baseline to post intervention ($p = 0.016$).

## Qualitative Assessment of Acceptability

Key Informant interviews were conducted with six Wholeness Health Plan members participating in the study and three health coaches (HC), who led the coaching sessions for this group. Participants mean age was 50 years old (SD = 9.4), four of the plan member participants were female, and five were non-Hispanic/Latino.

Based on the thematic analysis, the value of health coaching was identified in five key themes expressed by the participants and validated by the health coaches: (1) increased personal health awareness and motivation; (2) goal setting and accountability; (3) self-efficacy; (4) value of individualized support; and (5) value of employer-offered coaching.

### Increased Personal Health Awareness and Motivation

All of the participants expressed that the health coaching program improved their personal health awareness, as well as increased their health knowledge: "It basically opened my eyes to things I was not fully aware of." "It just helped me take the time to look at areas that I wanted to improve in." A number of participants remarked of the awareness and motivational value of the frequent lab work combined with coach-led health education: "It helped me by learning that my levels were high, so I need to get it down. That is what helped me with the diet."

Additionally, several participants mentioned the value of the digital apps recommended by their health coaches: "I was able to download apps and stuff that was able to help me work out." Yet, another participant appreciated the use of MyFitnessPal for making better dietary choices: "During the study I was using MyFitnessPal app where I was just documenting everything I ate and the quantities. And that helped me identify, like, these foods that I thought were healthy… but it turns out that, um, every time I punch that into the app, it's like, okay, that has a gram of sodium in it."

The health coaches validated these findings expressing that health coaching sessions allowed the participants to focus on personal health: "Some people were just putting some of their goals on the back burner. It was something they knew they had to do, but it didn't seem real, until they were really talking about it and then emphasizing how important it was."

### Goal Setting and Accountability

Five of the participants spoke of the value of the skills they learned through health coaching, in setting goals and overcoming barriers: "It really helped, like, setting up my own goals… and slowly reaching that plan we set up." "I continued to improve in my goal setting abilities… If my coach wasn't constantly asking me what goals I wanted to achieve, I wouldn't have necessarily thought about all the different factors that ended up being addressed during the time we were working on them." The health coaches validated these findings by sharing that the goal setting process was among the most helpful factors of health coaching for their clients: "This particular person found this very practical and not overwhelming. Being able to, to have something on a weekly basis that would challenge themselves to meet that overall goal they're working on. So those were helpful in terms of helping them with just over all aspects of lifestyle."

As part of the goal setting, participants mentioned the value receiving guidance on how to overcome potential barriers. For example, one participant stated: "When we were approaching Thanksgiving holiday, and I was actually really concerned… that it's the beginning of the end because, you know, Halloween and then Thanksgiving and then Christmas. They would say for this party, bring um, your own healthy alternative. If you're at Thanksgiving dinner, have your first serving and then wait 10 min before you have a second serving. Like very, very specific, not vague like 'oh just try to be healthy.' Which, I thought was really, really practical."

Along with goal setting, the theme of accountability was present in all but one of the participant interviews. The weekly contact with the health coaches resulted in accountability ensuring participants made better health choices throughout the week: "I needed to be attentive, I am doing this study, and I need to either lie through my teeth and say I am going to do it, or I need to get it done… I need to be accountable." "Knowing that next week she is going to call me and ask me how I did… Knowing that in the back of my head, I am, like, okay, I should do better this week, because I don't want to have to tell her that I did bad." This theme was validated by all health coach interviews.

### Self-Efficacy

Through learning of the goal setting skills and planning for potential barriers, the participants felt more confident about making changes to their lifestyle and achieving the desired outcomes. One participant stated, "It helped me realize that it's possible. That something can be done. I get home and my family has this food on the table, and that's the only thing I am going to eat, but I have the confidence that if I am on top of things, if I plan things out in advance, if I am prepared, I can do it."

All three of the coaches validated the increase in confidence among the participants: "I can think of that particular participant that was struggling with eating a lot of fast food, his confidence increasing with being more comfortable in the kitchen and, I think, in part that was due to some of the encouragement, you know, getting that crock pot out and experimenting with recipes and new cookbooks; and I think just the accountability or the feedback they received was very helpful in increasing that confidence that they can achieve their goals."

Another coach mentioned: "Seeing the actual changes, in their lab work was also reassuring for them and boosted their confidence... Some of these people had not seen these types of changes, ever. You know, they never saw their numbers begin to go the opposite direction. Whether it was weight, or cholesterol, A1C. So it was just reaffirming that what they were doing was positive because it was actually causing changes in their, in their numbers and also in the way that they were just feeling overall."

### Value of Individualized Support

Three of the participants spoke specifically of the value of health coaching as encouraging personal support and useful resources: "Having the personal connection with somebody is a huge factor for me. I'm not a book learner. I don't go on the internet to learn a lot so to have somebody calling and touching base and a human voice attached to it was a huge success factor for me." The value of the encouraging support was underscored by another participant: "HC was not judgmental. HC was encouraging. HC taught me to forgive myself if I didn't make my goals, not be so hard on myself. You know what else? HC shared with me sometimes own personal struggles to be relatable and I appreciated that... It just really showed me how much connecting with people and accountability make a difference in my health." Another participant stated: "I think they were on point because, we discussed personally my personal needs vs. you know in general, kind of like, what I needed to work on myself, you know, so it wasn't just like a, like a doctor's appointment kind of thing."

This was validated in one of the coach interviews: "In the health coaching itself there's a lot of affirmation. So for example, you know, um we kind of praise them when they do something positive… And the same can be said for the other thing too. When there was a kind of a lapse, like a relapse in their behavior or in their numbers, just being there to provide support and say hey you know this isn't the end of the world, we can just do these things different and kind of go back to the drawing board."

### Value of Employer-Offered Health Coaching

All participants and coaches expressed that employer-sponsored health and wellness coaching programs would be valuable to them. Two of the participants specifically mentioned the organization's overall health and wholeness focus as well as the Blue Zone connection. All participants expressed hope that the health coaching programs could be expanded further: "I hope that it ends up being something they offer to employees." "I think it should be wide spread. I think it should be part of the insurance coverage."

All of the health coach interviews validated this theme, with one adding that it is important that people do not feel obligated to participate in health coaching: "It just depends how it's pitched. You know, because as a health coach I think when somebody's kind of required to do something… sometimes they don't, their motivation isn't as high. They're being forced to do something…, so the motivation isn't really there. They're just kind of jumping through the hoops basically… I think, you just get more results and it's a better experience for the health coach and for the participant when the person really wants to be there rather than they're being forced to be there."

## DISCUSSION

The focus of our mixed methods study was to determine the preliminary efficacy, feasibility, and acceptability of implementing a whole-person health coaching program by conducting a one-arm intervention and a set of interviews (participants, coaches) within a population in a care management program tied to their health plan. In the quantitative assessment, preliminary efficacy of the intervention was shown for obesity with a significant decrease in BMI being evident at 12 weeks post intervention, but attenuating at 24 weeks (maintenance). The intervention also provided feasibility

outcomes indicating a 22% dropout rate during health coaching. We note that health coaching was being tested for inclusion in Wholeness Health Plan that currently has a >90% "opt in" participation rate that supports feasibility. Our qualitative study provided interviews indicating a high level of participant and coaches acceptability of whole person health coaching as a valuable intervention model to improve health.

### Acceptability of Whole Person Health Coaching

Some of the reasons for high acceptability included the value of health coaching in raising personal health awareness and the resulting engagement and motivation to improve health, specifically referencing the value of the frequent lab work. This follows the current literature suggesting biometric screening promotes individual awareness and understanding of the results (18). Based on the qualitative data, the combination of regular biometric screening, health coaching, and coach-led health education resulted in the participants becoming better aware of their health status and identifying goals for improvement.

Literature also confirms that the inclusion of the common key features that were a part of our intervention: goal setting, motivational interviewing, and collaboration with primary care providers do increase the effectiveness of the health coaching programs (19). Raising client's accountability is a key outcome of interactions between the client and the coach as was also seen among our participants (20). It has been suggested that including aspects of accountability in healthcare may improve the adherence to the outlined healthcare plan and help reach personalized health goals (21–23). Additional studies point out the value of combining accountability with real-time feedback, which is exactly how health coaching works (24, 25).

Furthermore, planned or responsive adaptations or assisting clients with potential barriers as they engage in behavioral changes as was done in this intervention has been seen as effective tools for overcoming these barriers in prior studies and is associated with enhanced motivation and self-efficacy (26).

Both participants and coaches were satisfied with the frequency of their coaching sessions and only expressed a wish that these sessions would continue beyond the 12-week cut off. A systematic review of 41 health coaching trials suggests there is no current evidence of a dose response effect on the biomarker or health behavior outcomes (20). Our quantitative data, however, present evidence of the behavioral decay following the completion of the coaching program, suggesting that the health coaching effect may dissipate during the maintenance stage possibly due to decreased accountability. The undetermined cost effectiveness of health coaching may be a potential barrier preventing integration of long-term health coaching into health plans. In a review of 27 studies relating to health coaching and costs, Hale and Giese (27) found that while health coaching has been found effective for chronic disease management, the literature was inconclusive whether it lowered health cost expenditures; however, suggested potential long-term future savings.

While it may be financially challenging to offer on-going health coaching, one way coaching interventions may be sustainable is if participants became involved in "peer-coaching" becoming accountable to each other at the end of the professional health coaching intervention. The approach of social accountability was found to improve effectiveness of health interventions in the past (24). A similar component has been found successful in 12-Step Programs. In the study of outcomes among Alcoholic Anonymous, Witbrodt et al. (28) found that those participants who maintained a regular or even somewhat regular connection with their sponsor, had better abstinence outcomes than those who did not. Future health coaching studies could explore whether such "sponsor-model" utilizing "peer-coaching" would be effective in maintaining health behaviors after the completion of the professional health coaching intervention.

Furthermore, health and wellness coaching efforts could be complemented by the utilization of smartphone-based virtual health coaching which has demonstrated positive effects in recent studies (29–33). At the completion of the live health coaching intervention, digital health coaching could take over, providing the lower-cost self-management tools and accountability which would help individuals to remain on track. Similar models exist, and the combination of live, electronic and peer coaching should be researched further (30).

### Limitations

The study's uncontrolled design and small sample size limits the inferences that could be made about the quantitative assessment of the preliminary efficacy of the intervention.

## CONCLUSIONS

Our study suggests that incorporation of a whole-person care health coaching component into an employee wellness program may receive positive reception by the interested employees, and can result in positive behavioral changes, as well as statistically significant decreases in certain biomarkers. We did find that this effect dissipated during the maintenance stage. Future trial studies utilizing larger sample sizes and combining peer-coaching with digital health coaching as part of the follow-up to the initial health coaching intervention should be explored before finalizing the coaching model to be integrated in an employee wellness program.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board of Loma Linda University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

AN wrote the report and conducted the qualitative research data analysis. OM conceptualized the study, directed the study, collection of data, and edited the report. BR provided clinical oversight of the study and edited the report. KM worked on study design and edited the report. WS analyzed quantitative data for the report and edited the report. PS collaborated on conceptualizing the study, designing the study, obtaining funding, and editing and writing the report. FA contributed to the writing of the report. All authors contributed to the article and approved the submitted version.

## ACKNOWLEDGMENTS

The authors acknowledge the LLUH Risk Management team for their contributions: Mark Hubbard, Martha Quesada, and Cynthia Terukina.

## REFERENCES

1. National Center for Health Statistics, Health, United States, in Health, United States. *2016: With Chartbook on Long-term Trends in Health*. Hyattsville, MD: National Center for Health Statistics (US). (2017).
2. Blackwell J, Collins M, Scribner C, Guillen J, Moses K, Gregory-Mercado K. Health and wellness coaching implemented by trainees: impact in worksite wellness. *Glob Adv Health Med.* (2019) 8:2164956119831226. doi: 10.1177/2164956119831226
3. Raghupathi W, Raghupathi V. An empirical study of chronic diseases in the United States: a visual analytics approach to public health. *Int J Environ Res Public Health*. (2018) 15:431. doi: 10.3390/ijerph15030431
4. Norbeck T. *Survey of America's Physicians: Practice Patterns and Perspectives*. Merritt Hawkins, on behalf of the Physicians Foundation. (2018).
5. Houlihan J, Leffler S. Assessing and addressing social determinants of health: a key competency for succeeding in value-based care. *Primary Care.* (2019) 46:561–74. doi: 10.1016/j.pop.2019.07.013
6. Thomas KS, Durfey SN, Gadbois EA, Meyers DJ, Brazier JF, McCreedy EM, et al. Perspectives of Medicare Advantage plan representatives on addressing social determinants of health in response to the CHRONIC care act. *JAMA Netw Open*. (2019) 2:e196923. doi: 10.1001/jamanetworkopen.2019.6923
7. Artiga S, Hinton E. Beyond health care: the role of social determinants in promoting health and health equity. *Health*. (2019) 20:10. Available online at: https://www.kff.org/racial-equity-and-health-policy/issue-brief/beyond-health-care-the-role-of-social-determinants-in-promoting-health-and-health-equity/
8. Kreisberg J, Marra R. Board-certified health coaches? what integrative physicians need to know. *Integr Med.* (2017) 16:22.
9. Boehmer KR, Barakat S, Ahn S, Prokop LJ, Erwin PJ, Murad MH. Health coaching interventions for persons with chronic conditions: a systematic review and meta-analysis protocol. *Syst Rev*. (2016) 5:146. doi: 10.1186/s13643-016-0316-3
10. Sforzo GA, Kaye MP, Todorova I, Harenberg S, Costello K, Cobus-Kuo L, et al. Compendium of the health and wellness coaching literature. *Am J Lifestyle Med.* (2018) 12:436–47. doi: 10.1177/1559827617708562
11. DeJesus RS, Clark MM, Rutten LJF, Jacobson RM, Croghan IT, Wilson PM, et al. Impact of a 12-week wellness coaching on self-care behaviors among primary care adult patients with prediabetes. *Prev Med Rep.* (2018) 10:100–5. doi: 10.1016/j.pmedr.2018.02.012
12. Kennel J. Health and wellness coaching improves weight and nutrition behaviors. *Am J Lifestyle Med.* (2018) 12:448–50. doi: 10.1177/1559827618792846
13. Russell D, Oberlink MR, Shah S, Evans L, Bassuk K. Addressing the health and wellness needs of vulnerable rockaway residents in the wake of hurricane sandy: findings from a health coaching and community health worker program. *J Public Health Manag Practice*. (2018) 24:137–45. doi: 10.1097/PHH.0000000000000545
14. Merrill R, Aldana S, Bowden D. Employee weight management through health coaching. *Eating Weight Disord.* (2010) 15:e52–9. doi: 10.1007/BF03325280
15. Grossmeier J. The influence of worksite and employee variables on employee engagement in telephonic health coaching programs: a retrospective multivariate analysis. *Am J Health Promotion*. (2013) 27:e69–80. doi: 10.4278/ajhp.100615-QUAN-190
16. Cole S, Zbikowski SM, Renda A, Wallace A, Dobbins JM, Bogard M. Examining changes in healthy days after health coaching. *Am J Health Promotion*. (2019) 33:774–7. doi: 10.1177/0890117118816286
17. Moses O, Rea B, Medina E, Estevez D, Gaio J, Hubbard M, et al. Participation in a workplace smoking cessation program incentivized by lowering the cost of health care coverage: findings from the LLUH BREATHE cohort. *Tobacco Prev Cessation*. (2020) 6:118237. doi: 10.18332/tpc/118237
18. Kaufman HW, Williams FR, Odeh MA. Value of laboratory tests in employer-sponsored health risk assessments for newly identifying health conditions: analysis of 52,270 participants. *PLoS ONE*. (2011) 6:28201. doi: 10.1371/journal.pone.0028201
19. Olsen JM, Nesbitt BJ. Health coaching to improve healthy lifestyle behaviors: an integrative review. *Am J Health Promotion*. (2010) 25:e1–12. doi: 10.4278/ajhp.090313-LIT-101
20. Gierisch JM, Hughes JM, Edelman D, Bosworth HB, Oddone EZ, Taylor SS, et al. *The Effectiveness of Health Coaching*. Washington, DC: Department of Veterans Affairs (US) (2017).
21. Hardcastle SJ, Glassey R, Salfinger S, Tan J, Cohen P. Factors influencing participation in health behaviors in endometrial cancer survivors. *Psycho-oncology*. (2017) 26:1099–104. doi: 10.1002/pon.4288
22. Oussedik E, Cline A, Su JJ, Masicampo EJ, Kammrath LK, Ip E, et al. Accountability in patient adherence. *Patient Preference Adherence*. (2019) 13:1511. doi: 10.2147/PPA.S213113
23. Oussedik E, Foy CG, Masicampo EJ, Kammrath LK, Anderson RE, Feldman SR. Accountability: a missing construct in models of adherence behavior and in clinical practice. *Patient Preference Adherence*. (2017) 11:1285. doi: 10.2147/PPA.S135895
24. Forster HA, Zaval L, Jachimowicz J, Berry D, Weber EU. Friends with benefits: social accountability increases physical activity. *PsyarXiv* [Preprint]. (2020). doi: 10.31234/osf.io/dkce2
25. Stubbins R, He T, Yu X, Puppala M, Ezeana CF, Chen S, et al. A behavior-modification, clinical-grade mobile application to improve breast cancer survivors' accountability and health outcomes. *JCO Clin Cancer Inform.* (2018) 2:1–11. doi: 10.1200/CCI.18.00054
26. Betts AC, Froehlich-Grobe K, Driver S, Carlton D, Kramer MK. Reducing barriers to healthy weight: planned and responsive adaptations to a lifestyle intervention to serve people with impaired mobility. *Disabil Health J.* (2018) 11:315–23. doi: 10.1016/j.dhjo.2017.10.008
27. Hale R, Giese J. Cost-effectiveness of health coaching. *Professional Case Manag.* (2017) 22:228–38. doi: 10.1097/NCM.0000000000000223
28. Witbrodt J, Kaskutas L, Bond J, Delucchi K. Does sponsorship improve outcomes above Alcoholics Anonymous attendance? A latent class growth curve analysis. *Addiction.* (2012) 107:301–11. doi: 10.1111/j.1360-0443.2011.03570.x
29. Everett E, Kane B, Yoo A, Dobs A, Mathioudakis N. A novel approach for fully automated, personalized health coaching for adults with prediabetes: pilot clinical trial. *J Med Internet Res.* (2018) 20:e72. doi: 10.2196/jmir.9723
30. Kowitt SD, Tang PY, Peeples M, Duni J, Peskin S, Fisher EB. Combining the high tech with the soft touch: population health management using eHealth and peer support. *Population Health Manag.* (2017) 20:3–5. doi: 10.1089/pop.2016.0027
31. Mao AY, Chen C, Magana C, Barajas KC, Olayiwola JN. A mobile phone-based health coaching intervention for weight loss and blood pressure reduction in a national payer population: a retrospective study. *JMIR mHealth uHealth.* (2017) 5:e80. doi: 10.2196/mhealth.7591
32. Wayne N, Ritvo P. Smartphone-enabled health coach intervention for people with diabetes from a modest socioeconomic strata community: single-arm longitudinal feasibility study. *J Med Internet Res.* (2014) 16:e149. doi: 10.2196/jmir.3180

33. Willey S, Walsh JK. Outcomes of a mobile health coaching platform: 12-week results of a single-arm longitudinal study. *JMIR mHealth uHealth*. (2016) 4:e3. doi: 10.2196/mhealth.4933

**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.

# APPENDIX

## Health Coaching Intervention Schedule

| Week | Health coaching modules |
|---|---|
| 1 | **Introduction of coach and client and program review.** A review of biometric screening numbers will be done to determine areas which the client is willing to work on depending on the condition(s) present. The session will collaboratively identify goals and strategies to support goals. The session will help the client identify barriers to reaching and maintain health goals. The final part of the session will consist of a summary of what was covered, and a discussion of the tasks participants will do during the next week. The session (an each thereafter) will end with arranging for a follow-up appointment |
| 2 | **Review basics of a healthy diet.** After the review of dietary intervention methods, the session will end with a summary of what was covered, and a discussion of the tasks participants will do during the next week. |
| 3 | **Review the benefits of exercise.** The session reviews the basic physical activity recommendations. The final part of the session consists of a summary of what was covered, and a discussion of the tasks participants will do during the next week. |
| 4 | **Review the importance of stress management and sleep.** This session teaches participants how to reduce and deal with stress. The final part of the session consists of a summary of what was covered, and a discussion of the tasks participants will do during the next week. |
| 5–11 | **Review progress of health goals.** These sessions are client centered and less didactic and/or prescriptive in nature. The coach meets the client at their point of need and concern and follows the interests and needs of the client. The sessions are designed to motivate participants to go forward with their goals. |
| 12 | **Review overall progress of health goals.** Finalize action plan. |

frontiers in Psychiatry

BRIEF RESEARCH REPORT
published: 20 August 2021
doi: 10.3389/fpsyt.2021.581876

# An Ecological Study of a Universal Employee Depression Awareness and Stigma Reduction Intervention: "Right Direction"

*Benjamin Doty[1], Adrienne Grzenda[1,2], Seungyoung Hwang[1,3], Sean Godar[4], Darcy Gruttadaro[1], Kimberly A. Hauge[5], Bruce Sherman[6] and Diana E. Clarke[1,7]**

[1] American Psychiatric Association, Washington, DC, United States, [2] Department of Psychiatry & Biobehavioral Sciences, David Geffen School of Medicine at UCLA, UCLA-Olive View Medical Center, Los Angeles, CA, United States, [3] Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, United States, [4] Employers Health, Dublin, OH, United States, [5] Human Resources, Kent State University, Kent, OH, United States, [6] School of Medicine, Case Western University, Cleveland, OH, United States, [7] Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, United States

**Objective:** Right Direction (RD) was a component of a universal employee wellness program implemented in 2014 at Kent State University (KSU) to increase employees' awareness of depression, reduce mental health stigma, and encourage help-seeking behaviors to promote mental health. We explored changes in mental health care utilization before and after implementation of RD.

**Methods:** KSU Human Resources census and service use data were used to identify the study cohort and examine the study objectives. A pre-post design was used to explore changes in mental health utilization among KSU employees before and after RD. Three post-intervention periods were examined. A generalized linear mixed model approach was used for logistic regression analysis between each outcome of interest and intervention period, adjusted by age and sex. Logit differences were calculated for post-intervention periods compared to the pre-intervention period.

**Results:** Compared to the pre-intervention period, the predicted proportion of employees seeking treatment for depression and anxiety increased in the first post-intervention period (OR = 2.14, 95% Confidence Interval [CI] = 1.37–3.34), then declined. Outpatient psychiatric treatment utilization increased significantly in the first two post-intervention periods (OR =1.89, 95% CI = 1.23–2.89; OR = 1.75, 95% CI = 1.11–2.76). No difference was noted in inpatient psychiatric treatment utilization across post-intervention periods. Unlike prescription for anxiolytic prescriptions, receipt of antidepressant prescriptions increased in the second (OR = 2.25, 95% CI = 1.56–3.27) and third (OR = 2.16, 95% CI = 1.46–3.20) post-intervention periods.

**Conclusions:** Effects of RD may be realized over the long-term with follow-up enhancements such as workshops/informational sessions on mindfulness, stress management, resiliency training, and self-acceptance.

**Keywords: depression, anxiety, substance use disorders, wellness program, health care resource utilization, ecological study, employee depression awareness**

OPEN ACCESS

***Edited by:***
*Danijela Gasevic, Monash University, Australia*

***Reviewed by:***
*Sok King Ong, Ministry of Health, Brunei*
*Ruth, ZHUOZHUO SHEN, University of Macau, China*

***Correspondence:**
*Diana E. Clarke*
*dclarke@psych.org*

***Specialty section:***
*This article was submitted to Public Mental Health, a section of the journal Frontiers in Psychiatry*

***Received:*** *10 July 2020*
***Accepted:*** *27 July 2021*
***Published:*** *20 August 2021*

***Citation:***
*Doty B, Grzenda A, Hwang S, Godar S, Gruttadaro D, Hauge KA, Sherman B and Clarke DE (2021) An Ecological Study of a Universal Employee Depression Awareness and Stigma Reduction Intervention: "Right Direction". Front. Psychiatry 12:581876. doi: 10.3389/fpsyt.2021.581876*

# INTRODUCTION

Approximately one in five adults aged 18 and over in the United States (US) has a diagnosable mental disorder (1). The sequelae of mental disorders can impair the ability or motivation to work, contributing to absenteeism, increased cost to employer-sponsored health plans, and overall lower productivity (2–5). In recent years, employers and employees in the US are increasingly aware of the need to address mental health in the workplace, an important but underutilized venue for promoting wellness and increasing access to mental health services (6, 7). While feasible for employers and organizations to implement workplace-based mental health initiatives, there is a need to continue building the evidence base as to the impact of these interventions on mental health-related outcomes.

Mental health care utilization metrics, such as receipt of treatment, are valuable for quantifying the effects of workplace mental health initiatives. These data help demonstrate return on investment and support future service planning. Population-based surveys of healthcare utilization in the US show that a large proportion of adults with depressive disorders do not receive treatment. A study of the Medical Expenditure Panel Survey database found that while the proportion of depressed patients who receive antidepressant treatment has increased in recent decades, approximately one-third of adults diagnosed with major depressive disorder were not on any antidepressant treatment in 2015 (8). A study of the National Survey on Drug Use and Health found that approximately 34% of adults with major depressive episode received no treatment at all in 2019, and this treatment gap has remained steady since 2009 (9). While undertreated at the population level, depression is a leading cause of work disability and, thus, a chief driver of health and disability claims in many organizations (6, 10). From 2005 to 2010, the economic costs of major depressive disorder (MDD) increased by 21.5% with 50% of costs attributable to the workplace (9).

While many studies have been conducted on workplace-based mental health interventions, large-scale evidence is needed on the effectiveness of these initiatives for specific mental health outcomes, including mental health care utilization (11–13). From a public health perspective, universal interventions may be an effective approach for preventing mental illness or improving mental health in the workplace because organizations have existing channels to reach employees, enabling assessment of targeted outcomes (12). Such evidence helps demonstrate intervention value to stakeholders and justifies future organizational commitment to these initiatives. The current study aimed to explore differences in mental health utilization outcomes before and after implementation of a large-scale workplace intervention at Kent State University (KSU).

# METHODS

## Intervention

KSU is a public research university located in Kent, Ohio that employs over 6,000 academic and administrative staff members. The KSU administration identified depression as one of the most burdensome mental disorders contributing to absenteeism and reduced productivity among its employees. In 2012, KSU launched a five-year universal employee wellness program (Wellness Your Way) that took a holistic approach to employee health management and promotion by focusing on personal well-being, work-life balance, and mental health. Wellness Your Way included Right Direction (RD), a depression awareness initiative developed by the American Psychiatric Association (APA) Foundation's Center for Workplace Mental Health and Employers Health. RD sought to increase depression awareness, reduce mental health stigma, and promote help-seeking behaviors. RD offers turnkey and customizable tools, resources, and guidance that employers can use to supplement existing employee assistance programs (EAP) and healthcare benefits.

A customized version of RD was implemented at KSU and rolled out in two phases from May through September 2014. In the first phase, 400 KSU managers and supervisors were: (1) provided with informational resources to recognize signs and symptoms of depression and how to support affected employees; and (2) informed about available services resources at KSU (e.g., EAP) for employees experiencing depression or other mental health problems by attending at least one of 36 educational or informational sessions held across KSU's eight campuses. Following phase one, the second phase of RD was rolled out to all 6,000 KSU employees through: (1) dissemination of promotional materials (e.g., informational posters and emails, monthly wellness newsletters), including the contact and website information for RD and the university's EAP; (2) ten open enrollment benefit fairs for employees, which included information to increase the visibility of available health services and resources at KSU; Following the initial implementation of RD in 2014, activities to promote and extend its reach were carried out in 2015 through 2017. For instance, enhancements and wellbeing activities (i.e., workshops and/or informational sessions for mindfulness, mindfulness meditation walks, yoga, stress management, resiliency training, and gratitude and self-acceptance) were included with RD and rolled out to the KSU employee population in 2016 and 2017.

## Data

An evaluation of RD at KSU was not planned *a priori*. However, after the intervention ended, secondary administrative data (i.e., KSU Human Resources (HR) census, insurance, and pharmacy claims data) were used to determine if RD affected the KSU employee population. The study involved secondary data analysis of limited data and did not involve direct employee contact; therefore, informed consent was not required. The research protocol received expedited review and approval from APA's Institutional Review Board. The HR census data contained information on 5,463 KSU employees who were actively employed at the institution on May 1, 2013–the target population for the study. A combination of generalization and suppression techniques using a k-anonymity privacy model of $k = 5$ (14), resulted in 36 employees being excluded from the target sample. In addition, those who terminated employment with KSU before the start of the RD program were excluded, leaving a final eligible population of 3,977 employees. The final dataset included sociodemographic information including age,

gender, race, marital status, and employment status. International Classification of Diseases (ICD)-9-Clinical Modification (CM) codes (290–319) and associated ICD-10-CM codes for mental and substance use disorders were used to identify employees with any diagnosed mental or substance use disorders from Anthem and/or Medical Mutual claims data under university insurance benefits.

## Statistical Analysis

The outcomes of interest were changes in mental health utilization, specifically the changes in the estimated proportion of employees with insurance or pharmacy claims for: (1) treatment of depression or anxiety; (2) inpatient treatment for any psychiatric diagnosis; (3) outpatient treatment for any psychiatric diagnosis; (4) receipt of anxiolytic medications; or (5) receipt of antidepressant medications. We utilized a pretest-posttest design with 1 pre-intervention period and 3 post-interventions periods where each participant's pre-intervention (i.e., non-exposure) and post-intervention (i.e., exposure) periods were compared. The pretest period represented the 12 months (i.e., May 1, 2013–April 30, 2014) prior to the initiation of RD, which ran for 5 months (May 1–September 30, 2014). The posttest periods represented 1 to 12 (posttest 1: October 1, 2015–September 30, 2016), 13 to 24 (posttest 2: October 1, 2016–September 30, 2016), and 25 to 33 (posttest 3: October 1, 2016–June 30, 2017) months after the 5-month intervention period. These post-intervention periods were selected to demarcate relatively similar timeframes for comparison and to examine the potential sustainability of the effects of RD.

All statistical analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, North Carolina) with alpha = 0.05 as the cutoff for determining statistical significance. Descriptive statistics were calculated for sociodemographic variables for each period. Differences between the pre-intervention group and each post-intervention group were evaluated by Wilcoxon signed-rank test for continuous variables and Chi-square test for categorical variables. A generalized linear mixed model (GLM) approach was used for logistic regression analysis between each outcome of interest and period, adjusting for age and sex (binomial model with logit link). Least squares means (LS-means), or the predicted population margins of the logits, were calculated for each period. Pairwise comparisons were made between logit estimates for all post-intervention periods to the pre-intervention period. Tukey-Kramer multiple comparison adjustment was made for the *p*-values for the differences of LS-means (difference in the logits). Differences are presented as LS-mean differences as well as odds ratios (exponentiation of the logit differences).

# RESULTS

**Table 1** shows the sociodemographic composition of the pre-intervention and post-period KSU employees. Attrition in this study was cumulative; those who left KSU were not sought at the later study period. These employees were more likely to be younger and to not report race or marital status (data not shown). Despite attrition, the sociodemographic composition of employees was comparable across all time periods except for race ($X^2$ $P = 0.0001$), likely due to the high rate of missingness in this variable in the pre-intervention and first post-period. When missing values were excluded, the time periods demonstrated no differences in race distribution ($X^2$ $P = 0.96$).

**Table 2** and **Figure 1** show the differences in predicted population margins for each outcome for each post-intervention period compared to the pre-intervention period. The difference in the proportion of employees seeking treatment for depression or anxiety increased in the first post-intervention period (+0.76, $P < 0.0001$ OR = 2.14; +0.94, $P < 0.0001$, OR = 2.55, respectively) but decreased in subsequent post-treatment periods. No significant differences were found for any post-intervention period in the proportion of employees with an inpatient hospitalization for treatment of any psychiatric illness. The proportion of employees with outpatient treatment for any mental health diagnosis was higher during post-intervention period 1 (+0.63, $P = 0.0005$, OR = 1.89) and 2 (+0.56, $P = 0.008$, OR = 1.75). The proportion of employees receiving antidepressant medications was higher during post-intervention period 2 (+0.81, $P < 0.0001$, OR = 2.25) and 3 (+0.77, $P < 0.0001$, OR = 2.16) compared to the pre-intervention period. No significant differences were found between the pre- and post-intervention periods for receipt of anxiolytic medications.

# DISCUSSION

In this study, we explored differences in mental health utilization by KSU employees following implementation of Right Direction—a depression awareness and stigma reduction intervention implemented at KSU in 2014. We found that the predicted margin of employees seeking treatment for depression and anxiety increased in the first post-intervention period but subsequently decreased in the other post-intervention periods. Employees seeking outpatient treatment for any mental health diagnosis increased during the first two post-intervention periods, then decreased. Receipt of antidepressant medication increased during post-intervention periods especially the second and third post-intervention periods.

This pattern would indicate that increased awareness of available resources resulted in an increased number of employees seeking assistance. The lag in receipt of antidepressant medication is anticipated. An employee seeking care would be likely to have more frequent visits while initiating or adjusting medications with the number of visits (e.g., claims) reducing as the individual enters remission or maintenance (also evident from the plateau in receipt of antidepressants). In addition, the modest increase or no change between pre-intervention and post-intervention periods with regards to anxiolytic prescriptions suggests patient were primarily prescribed antidepressants, which is the accepted first line treatment (15).

Given RD's focus on educational activities, we surmise that the short-term increase in employees using antidepressant and outpatient services may be attributable to greater employee awareness of the symptoms of depression and availability of mental health services. The lagged increased

**TABLE 1 |** Sociodemographic and diagnostic characteristics of KSU employees across study periods.

| Characteristic[a] | Pre-intervention *N* = 3,977 | Post-period 1 *N* = 3,547 | Post-period 2 *N* = 2,927 | Post-period 3 *N* = 2,492 |
|---|---|---|---|---|
| Age in 2017 (Mean, SD) | 50.3 ± 12.0 | 50.6 ± 11.9 | 50.6 ± 11.6 | 50.8 ± 11.4 |
| Female | 2,255 (56.7) | 2,005 (56.5) | 1,645 (56.2) | 1,382 (55.5) |
| Race* | | | | |
| White | 2,548 (64.1) | 2,392 (67.4) | 2,143 (73.2) | 1,808 (72.6) |
| Black | 391 (9.8) | 353 (10.0) | 304 (10.4) | 269 (10.8) |
| Asian | 368 (9.3) | 348 (9.8) | 328 (11.2) | 296 (11.9) |
| Other or Missing | 655 (16.5) | 454 (12.8) | 152 (5.2) | 119 (4.8) |
| Marital status | | | | |
| Married / Life Partner | 2,295 (57.7) | 2,065 (58.2) | 1,712 (58.5) | 1,481 (59.4) |
| Single | 744 (18.7) | 668 (18.8) | 549 (18.8) | 463 (18.6) |
| Divorced / Separated / Widowed | 373 (9.4) | 336 (9.5) | 277 (9.5) | 231 (9.3) |
| Other or Missing | 565 (14.2) | 478 (13.5) | 389 (13.3) | 317 (12.7) |

[a] *Data are presented as raw frequency (percentages) unless otherwise indicated. Differences in distribution of variables across study periods were examined by Wilcoxon-rank sum test (continuous) or Chi-square test (categorical).*

** = Chi-square p-value < 0.0001.*

**TABLE 2 |** Comparison of mental health utilization between post- and pre-intervention periods.

| Outcome | Contrast | Difference in LS-means (SE)[a] | OR (adj. 95% CI)[b] | Adj. *p*-value[c] |
|---|---|---|---|---|
| Depression treatment | Post-period 1 vs. Pre-intervention | +0.76 (0.16) | 2.14 (1.37–3.34) | <0.0001 |
| | Post-period 2 vs. Pre-intervention | −1.11 (0.21) | 0.33 (0.19–0.59) | <0.0001 |
| | Post-period 3 vs. Pre-intervention | −1.67 (0.25) | 0.20 (0.10–0.37) | <0.0001 |
| Anxiety treatment | Post-period 1 vs. Pre-intervention | +0.94 (0.16) | 2.55 (1.65–3.96) | <0.0001 |
| | Post-period 2 vs. Pre-intervention | −0.22 (0.20) | 0.81 (0.47–1.38) | 0.81 |
| | Post-period 3 vs. Pre-intervention | −0.35 (0.21) | 0.71 (0.39–1.27) | 0.49 |
| Inpatient psychiatric treatment | Post-period 1 vs. Pre-intervention | +1.5 (0.68) | 4.47 (0.69–29.92) | 0.19 |
| | Post-period 2 vs. Pre-intervention | +0.28 (0.85) | 1.32 (0.13–13.3) | 0.99 |
| | Post-period 3 vs. Pre-intervention | −0.69 (1.19) | 0.50 (0.02–12.77) | 0.98 |
| Outpatient psychiatric treatment | Post-period 1 vs. Pre-intervention | +0.63 (0.16) | 1.89 (1.23–2.89) | 0.0005 |
| | Post-period 2 vs. Pre-intervention | +0.56 (0.17) | 1.75 (1.11–2.76) | 0.008 |
| | Post-period 3 vs. Pre-intervention | +0.32 (0.18) | 1.38 (0.84–2.27) | 0.39 |
| Antidepressant prescriptions | Post-period 1 vs. Pre-intervention | +0.26 (0.13) | 1.29 (0.91–1.83) | 0.26 |
| | Post-period 2 vs. Pre-intervention | +0.81 (0.14) | 2.25 (1.56–3.27) | <0.0001 |
| | Post-period 3 vs. Pre-intervention | +0.77 (0.14) | 2.16 (1.46–3.20) | <0.0001 |
| Anxiolytic prescriptions | Post-period 1 vs. Pre-intervention | −0.02 (0.13) | 0.98 (0.70–1.38) | 0.99 |
| | Post-period 2 vs. Pre-intervention | +0.33 (0.13) | 1.40 (0.98–1.98) | 0.07 |
| | Post-period 3 vs. Pre-intervention | +0.03 (0.14) | 1.03 (0.70–1.51) | 0.99 |

[a] *Least squares means (LS-means) and standard errors (SE) were calculated from a generalized linear mixed model (e.g., binomial model with logit link) for each outcome and study period, adjusted by age and sex. Post-intervention periods were contrasted to the pre-intervention period, presented here as the differences in LS-means (logit scale).*

[b] *OR = Odds ratio (Tukey-adjusted 95% Confidence Interval).*

[c] *P-values were adjusted to account for multiple comparison testing by the Tukey method.*

in receipt of antidepressant medications and reduction in the number of claims for depression treatment may indicate maintenance management of these individuals since there were no modifications in KSU health plan design. However, this also suggests that the effects of RD were short-lived and one implementation of RD without enhancements may be insufficient to significantly change the proportion of employees seeking care over time at the institutional population level. A systematic review of universal workplace interventions on depressive symptoms found overall positive but small effects, but a challenge for these approaches is resource and time allocation to sufficiently engage the target population, especially in broad organizational level approaches which are less frequently studied (11). An investigation of a variety of workplace wellness programs implemented in more than 300 businesses in the US found higher overall employee participation rates in small

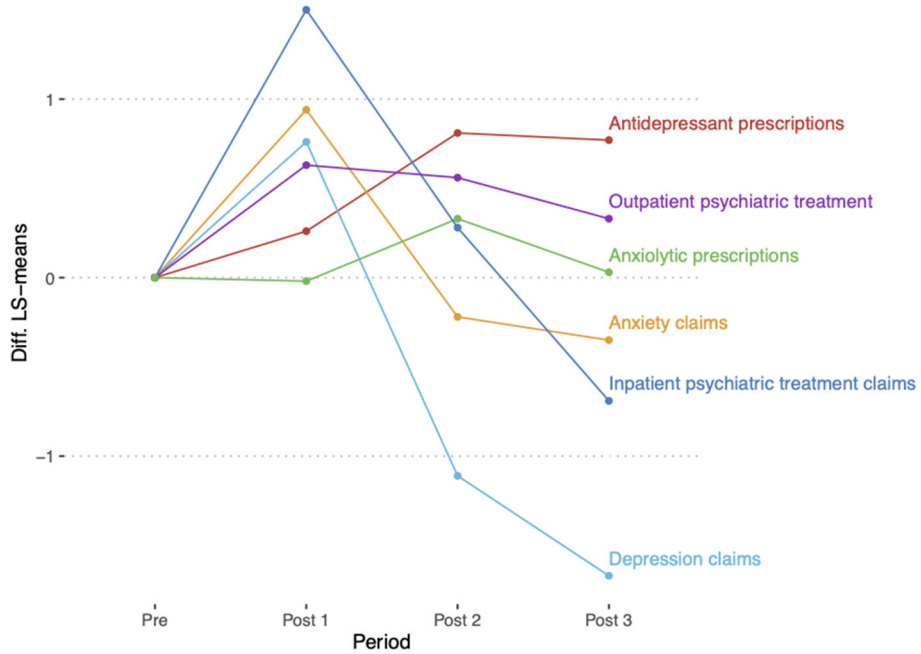


**FIGURE 1 |** Comparison of mental health utilization between post- and pre-intervention periods. Differences in the least square means (LS-means, predicted population margins in logit scale) were calculated for each outcome for each post-intervention period compared to the pre-intervention period.

organizations (<500 employees) than in large organizations (>500 employees), perhaps because employee engagement is less administratively complex or more compelling in small networks of employees (16). Other drivers of employee engagement are organizational health norms and sustained organizational efforts to create a culture of employee health (17). While KSU employees' level of participation in RD activities is unknown, mental health engagement was a focal point in the university's employee health strategy, and the present study's findings suggest that the effects of broad organizational level approaches deserve further attention.

The present study's findings also have implications for the practice of employee mental health management. First, employee wellness officials implementing RD at their institution could anticipate that the effects of the program may be realized slowly, given that individual health behavior change tends to happen gradually (18, 19). Officials implementing RD in the future should consider long-term monitoring of program effects. Second, planning follow-up enhancements after initial RD program implementation may be helpful. In complex organizations, a guiding principle for achieving change is to aim for incremental improvements within a comprehensive strategy (20). As the KSU implementation illustrates, implementing RD at large institutions could entail a long-term, tailored communications strategy accompanied by frequent and consistent workshops and informational sessions on topics such as mindfulness, meditation, stress management, resiliency training, and gratitude and self-acceptance (21). A recent meta-analysis of 57 studies of message- and material-focused behavior change interventions found that program tailoring (e.g., to the target population and context), number of intervention contacts, and length of follow-up, among other factors, all significantly moderated intervention effects (22). Dedicated staff (i.e., "program champions") were essential to the sustained, tailored roll out of RD at KSU, and prior research also points to the benefits of training employers on best practices for designing, implementing, and evaluating workplace health programs (23).

This study had several limitations. This was an ecological analysis done several years after RD was implemented. We did not have information on the degree of exposure to the intervention that individual KSU employees received. RD at KSU was implemented as a multi-component intervention, and the data do not enable an analysis to tease apart the effects of the various components. As our analyses were only adjusted for age and sex, the possibility of uncontrolled confounding cannot be ruled out. Evaluating the effects of workplace-based interventions is complex, as there are many individual, organizational, and societal factors that affect employee mental health (24, 25). It is possible that a secular trend or other macro-level phenomena may explain the findings. Recent studies suggest that mental health awareness and attitudes toward mental illness are slowly improving in the population (26). Other macro-level phenomena, such as changes in economic climate or university policies, could also explain the findings. However, the multiple pre-post comparisons over multiple years in this study somewhat mitigate these concerns. These methodological challenges highlight the importance of designing interventions and planning for evaluation concurrently. The employees of KSU are not likely to be representative of the general adult working

population in the US, so the findings may not generalize to other sectors, such as private industry, or specific occupational groups not typically employed by a university.

In summary, we were able to link census data with medical and pharmacy claims data to explore mental health utilization outcomes following exposure to this workplace intervention, using multiple follow-up periods to better understand the long-term effects of RD and other follow-up enhancements.

## CONCLUSION

Employers are becoming increasingly cognizant of employee mental health. Turnkey workplace mental health programs, such as RD, offer a customizable approach for employers to promote employee mental health without straining organizational resources. Employers can use RD as a stand-alone or as a supplemental program to augment existing initiatives, such as EAPs and other mental health benefits. Increased employee awareness of available resources and services may result in increased employee care-seeking and engagement in care over time. The intended effects of the RD intervention may be observable in the long-term, and follow-up enhancements after initial implementation could be beneficial.

## DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions. The datasets generated for this study will not be made publicly available. The data license agreement restricts the access only to the American Psychiatric Association. Requests to access these datasets should be directed to dclarke@psych.org.

## ETHICS STATEMENT

The study was approved by the American Psychiatric Association (APA) Institutional Review Board. The APA IRB and the study team took steps to ensure the study was not unduly influenced by the sponsor, Takeda Pharmaceuticals U.S.A., Inc. (TPUSA). The study was a secondary data analysis of data collected during routine service use by KSU employees. The study protocol, data, and analytic methods were approved by the APA IRB, whose members are not employed by APA and do not receive remuneration for their role on the IRB. Data collection, data analysis, and the interpretation of results were conducted independently of TPUSA. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

DC and SG designed the study. KH collected the data. AG, SH, BD, and DC analyzed the data. All authors contributed to the writing of the manuscript. All authors reviewed and edited the final version of the manuscript. All authors read and approved the final manuscript.

## FUNDING

The authors declare that this study received funding from Takeda Pharmaceuticals U.S.A., Inc. (TPUSA) and Lundbeck U.S. under a contract with the American Psychiatric Association Foundation and Employers Health. TPUSA and Lundbeck U.S. were not involved in the study design, data collection, data analysis, interpretation of data, the writing of this article or the decision to submit it for publication.

## ACKNOWLEDGMENTS

The Right Direction materials library is freely available (http://www.rightdirectionforme.com/ForEmployers.html).

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2021.581876/full#supplementary-material

## REFERENCES

1. Center for Behavioral Health Statistics and Quality SAaMHSA. Key Substance Use and Mental Health Indicators in the United States: Results from the 2018 National Survey on Drug Use and Health (HHS Publication No. PEP19-5068, NSDUH Series H-54) 2019. (2021). Available online at: https://www.samhsa.gov/data/
2. Dewa CS, Goering P, Lin E, Paterson M. Depression-related short-term disability in an employed population. *J Occup Environ Med.* (2002) 44:628–33. doi: 10.1097/00043764-200207000-00007
3. Beck A, Crain LA, Solberg LI, Unutzer J, Maciosek MV, Whitebird RR, et al. The effect of depression treatment on work productivity. *Am J Manag Care.* (2014) 20:e294–301.
4. Rost KM, Meng H, Xu S. Work productivity loss from depression: evidence from an employer survey. *BMC Health Serv Res.* (2014) 14:597. doi: 10.1186/s12913-014-0597-y
5. 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
6. Goetzel RZ, Roemer EC, Holingue C, Fallin MD, McCleary K, Eaton W, et al. Mental Health in the Workplace: A Call to Action Proceedings From the Mental Health in the Workplace-Public Health Summit. *J Occup Environ Med.* (2018) 60:322–30. doi: 10.1097/JOM.0000000000001271
7. Bush DM, Lipari RN. Workplace policies and programs concerning alcohol and drug use. In: *The CBHSQ Report*. Rockville, MD: Substance Abuse and Mental Health Services Administration (US) (2014). Available online at: https://www.ncbi.nlm.nih.gov/books/NBK384657/
8. Luo Y, Kataoka Y, Ostinelli EG, Cipriani A, Furukawa TA. Corrigendum: National prescription patterns of antidepressants in the treatment of adults with major depression in the US Between 1996 and 2015: a population representative survey based analysis. *Front Psychiatry.* (2020) 11:171. doi: 10.3389/fpsyt.2020.00171
9. 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

10. Wulsin L, Alterman T, Timothy Bushnell P, Li J, Shen R. Prevalence rates for depression by industry: a claims database analysis. *Soc Psychiatry Psychiatr Epidemiol.* (2014) 49:1805–21. doi: 10.1007/s00127-014-0891-3
11. Tan L, Wang MJ, Modini M, Joyce S, Mykletun A, Christensen H, et al. Preventing the development of depression at work: a systematic review and meta-analysis of universal interventions in the workplace. *BMC Med.* (2014) 12:74. doi: 10.1186/1741-7015-12-74
12. Stratton E, Lampit A, Choi I, Calvo RA, Harvey SB, Glozier N. Effectiveness of eHealth interventions for reducing mental health conditions in employees: A systematic review and meta-analysis. *PLoS ONE.* (2017) 12:e0189904. doi: 10.1371/journal.pone.0189904
13. Carolan S, Harris PR, Cavanagh K. Improving employee well-being and effectiveness: systematic review and meta-analysis of web-based psychological interventions delivered in the workplace. *J Med Internet Res.* (2017) 19:e271. doi: 10.2196/jmir.7583
14. Emam KE, Dankar FK, Vaillancourt R, Roffey T, Lysyk M. Evaluating the risk of re-identification of patients from hospital prescription records. *Can J Hosp Pharm.* (2009) 62:307–19. doi: 10.4212/cjhp.v62i4.812
15. Bandelow B, Michaelis S, Wedekind D. Treatment of anxiety disorders. *Dialogues Clin Neurosci.* (2017) 19:93–107. doi: 10.31887/DCNS.2017.19.2/bbandelow
16. Schwatka NV, Smith D, Weitzenkamp D, Atherly A, Dally MJ, Brockbank CVS, et al. The impact of worksite wellness programs by size of business: A 3-year longitudinal study of participation, health benefits, absenteeism, and presenteeism. *Ann Work Expo Health.* (2018) 62:S42-S54. doi: 10.1093/annweh/wxy049
17. Hall ME, Bergman RJ, Nivens S. Worksite health promotion program participation: a study to examine the determinants of participation. *Health Promot Pract.* (2014) 15:768–76. doi: 10.1177/1524839913510721
18. Prochaska JO, DiClemente CC, Norcross JC. In search of how people change. Applications to addictive behaviors, *Am Psychol.* (1992) 47:1102–14. doi: 10.1037/0003-066X.47.9.1102
19. Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of change. In Glanz K, Rimer BK, Viswanath, editors. *Health Behavior: Theory, Research, and Practice* Jossey-Bass/Wiley (2015). p. 125–48.
20. Willis CD, Saul J, Bevan H, Scheirer MA, Best A, Greenhalgh T, et al. Sustaining organizational culture change in health systems. *J Health Organ Manag.* (2016) 30:2–30. doi: 10.1108/JHOM-07-2014-0117
21. Prochaska JO, Butterworth S, Redding CA, Burden V, Perrin N, Leo M, et al. Initial efficacy of MI, TTM tailoring and HRI's with multiple behaviors for employee health promotion. *Prev Med.* (2008) 46:226–31. doi: 10.1016/j.ypmed.2007.11.007
22. Noar SM, Benac CN, Harris MS. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychol Bull.* (2007) 133:673–93. doi: 10.1037/0033-2909.133.4.673
23. Cluff LA, Lang JE, Rineer JR, Jones-Jack NH, Strazza KM. Training employers to implement health promotion programs: results from the CDC Work@Health(R) Program. *Am J Health Promot.* (2018) 32:1062–9. doi: 10.1177/0890117117721067
24. 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
25. Association AP. *Survey: Americans Becoming More Open About Mental Health2019 May 1*. (2021). Available online at: https://www.apa.org/news/press/releases/2019/05/mental-health-survey
26. Jagdeo A, Cox BJ, Stein MB, Sareen J. Negative attitudes toward help seeking for mental illness in 2 population-based surveys from the United States and Canada. *Can J Psychiatry.* (2009) 54:757–66. doi: 10.1177/070674370905401106

**Conflict of Interest:** The Center for Workplace Mental Health, a program of the American Psychiatric Association Foundation, also receives funding support for its work from Sunovion, Janssen, Otsuka Pharmaceutical, and Myriad. SG has received funding support from Jansson Pharmaceuticals for a research study in conjunction with Tufts University. The funding had no impact on the current research. BS discloses advisory board compensation from, Amgen, Regeneron and Medtronic; is a consultant to the National Alliance of Healthcare Purchaser Coalitions and Employers Health Coalition, Inc.; has received research grants from Takeda/Lundbeck, Pfizer, Sanofi, and the National Pharmaceutical Council; and is a speaker/received honoraria from IBM Watson, Pfizer, Merck, and AbbVie. DC served on the advisory panel for the RAND Corporation Mental Health Landscape project, which was funded by Otsuka Pharmaceuticals.

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.

**Publisher's Note:** All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

# 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