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Implications of remote work on employee well-being and health

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Implications of remote work on employee well-being and health

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Editorial: Implications of remote work on employee well-being and health

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Editorial on the Research Topic
Implications of remote work on employee well-being and health

Introduction

Employee health and wellbeing are crucial for organizations in regard to improved productivity, employee performance, job satisfaction, staff retention, reduced absenteeism, increased job satisfaction, and work commitment. Thus, research relating to employee health and wellbeing has produced some significant results and furthered our understanding of this subsection of the organizational psychology field. The evolvement of the way we work has also gained traction in organizational psychology in relation to remote working. Since the COVID-19 pandemic, many employers have adapted to hybrid work, enabling their employees to partially telework. This is a huge shift in how we work as hybrid work has become the new standard—and many employees desire and expect to have this option.

When Frontiers invited us to organize a Research Topic to highlight the latest advancements on the implications of remote working for employee health, we were thrilled. When the call for papers was published, we received an overwhelming number of submissions, culminating in this Research Topic of 10 papers. We drafted the call in late 2022, and it was published in January 2023. Since then, much has changed and the field continues to evolve. Vacchiano et al. (2024) recently published a scoping review on hybrid work, summarizing findings from over 130 papers. Their review highlights the complexity of the issue. Hybrid work appears to balance reduced social interaction with increased flexibility for individual employees. Yet, much is unknown and Vacchiano et al. (2024) emphasize the need for more research into how telework interacts with employees' preferences, personalities, and life stages. They conclude that "a straightforward answer on the positive or negative effects of teleworking is neither useful nor necessary."

The 10 papers included in this Research Topic are authored by a total of 34 researchers from various countries, including the Netherlands, Spain, Norway, Israel, and Germany, and they represent a range of institutions. These papers employ diverse methodologies, ranging from reviews and diary studies to expert group analyses and longitudinal studies with two or more measurement points and relatively large sample sizes. While we concur with Vacchiano et al. (2024) that simple answers are elusive, we believe the contributions in this Research Topic reflect the complexity of the subject and, collectively, offer valuable insights.

Overview of the Research Topic articles

Castro-Trancón et al. present a systematic review of 37 studies examining the effects of teleworking on wellbeing from a gender perspective. Their findings show that 10 studies report positive effects of telework, while five papers highlight both positive and negative effects on wellbeing. However, the majority–22 of the reviewed studies—indicate a negative impact of telework on work-family interaction and work-family balance. As expected, the studies reveal stronger negative effects for women, with women teleworkers experiencing lower job and life satisfaction, as well as increased work-family conflict.

Baum and Rau explored the interaction between teleworking and job autonomy to determine when workplace flexibility can help balance work and private life. Experienced occupational psychologists analyzed various workplaces within an organization across an entire shift using a task-related instrument, focusing particularly on autonomy in terms of task content and scheduling. They then surveyed 110 employees, assessing their use of telework, perceived job demands, and work-family conflict. The results indicate that teleworking is associated with a reduction in work-family conflict, particularly for individuals with limited autonomy at work.

Kunz et al. conducted a five-day diary study involving two daily surveys, examining the effects of continuing work tasks and being contacted by supervisors or colleagues after official working hours. Results from a multilevel path analysis revealed that a more positive appraisal of technology-assisted supplemental work (TASW) was associated with increased work engagement. However, positive appraisal of TASW events was not linked to psychological detachment, suggesting that while employees may feel more engaged, they may struggle to fully disconnect from work.

Rigotti et al. examined differential effects of social challenge and hindrance stressors depending on the work location in a 10-day diary study. The relationship between these stressors and exhaustion was moderated by the work location. The positive link between challenge-oriented social stressors and exhaustion occurred only on days spent teleworking, while social hindrance stressors were positively associated with exhaustion exclusively on days spent working at the employer's premises. Interestingly, the absolute level of social stressors did not differ between the two locations. Their findings suggest that mainly the impact of specific stressors may vary depending on the physical work location.

Krick et al. conducted a longitudinal study with over 700 employees to explore SelfCare in the telework context. SelfCare, a part of the Health-Oriented Leadership model, involves prioritizing health, recognizing stress, and promoting wellbeing. Results showed that SelfCare is more prevalent when teleworking. Higher telework intensity was associated with reduced strain, fewer health complaints, and improved relaxation and performance through enhanced SelfCare. Both SelfCare at home and on-site predicted strain and health complaints, with a notable interaction effect on strain. These findings highlight the importance of SelfCare in telework, suggesting organizations should implement continuous support tools for employees and leaders.

Picker-Roesch et al. conducted online surveys with over 1,000 employees at three measurement points between 2020 and 2022. They found significant differences for six out of seven psychosocial risk factors, including social relationships with supervisors and colleagues, with work intensity being the only factor unchanged. The study also revealed challenges for teleworking parents while caring for children, leading to decreased work continuity compared to those without childcare responsibilities. While teleworking can reduce job stressors in the long term, it relies on strong social support, especially for full-time remote workers. Parents with childcare duties need additional support to manage their unique challenges in a remote work setting.

Sedefoglu et al. studied how leadership behavior affects employee work engagement during remote work in a crisis, focusing on "consideration" as a leadership dimension. They also explored optimism as a potential mediator. The study involved 729 employees in a three-wave study conducted over 6 weeks in 2020. Longitudinal analysis showed that considerate leadership positively influenced changes in work engagement between the second and third measurement points, but optimism did not mediate this effect. The findings highlight the critical role of leadership in enhancing employee motivation and wellbeing during remote work and crises.

Birman et al. examined how job crafting affected changes in employee engagement following an abrupt shift to remote work using a three-wave longitudinal study. Data collected via Amazon Turk during the first 3 months of the pandemic revealed that high levels of approach-oriented job crafting, such as increasing challenging demands, negatively impacted employees' ability to maintain engagement over time. The study found a decline in engagement over the study period, with increasing challenging demands exacerbating this decrease. The results suggest that approach-oriented job crafting added unnecessary workload and depleted resources, worsening engagement. This research highlights that such job crafting strategies were counterproductive during the pandemic.

Bendixen and Scheel showed in two online surveys during different stages of the COVID-19 pandemic (November 2020 and November 2021) that work intensification was positively related to both procrastination and irritation. In one survey, the extent of teleworking amplified the link between work intensification and procrastination, but only for those without a dedicated home workspace. Unexpectedly, social support did not moderate these effects. This research highlights the downsides of remote work, revealing that work intensification can increase irritation and procrastination, which negatively impacts wellbeing and task performance.

Fostervold et al. studied how the number of telework days affected employee loneliness during and 2 years after the COVID-19 lockdown, focusing on role overload as a mediator and social support as a moderator. Data were collected from almost 7,000 participants in January 2021 and January 2023. More telework days were linked to increased loneliness during the lockdown, with this effect decreasing afterward. Role overload mediated this relationship, worsening loneliness during telework but having less impact post-lockdown. Interestingly, while higher social support usually reduced role overload and loneliness, it paradoxically intensified these issues for those with extensive telework. The study

highlights that telework can lead to greater loneliness and role overload, particularly during lockdowns, and that substantial social support may not fully mitigate these challenges.

Together, these studies paint a nuanced picture of the benefits and risks of remote work and potential boundary conditions, paving the way for successful work design that is tailored to the modern workforce. However, some results are pandemic-specific and need to be validated under post-pandemic conditions.

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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.

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SelfCare when working from home: easier but also more important

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Introduction: Telework brings opportunities (e.g., flexibility) but also potential risks for health (e.g., fewer boundaries, constant availability). SelfCare could be a relevant work-related resource to reduce these health risks when working from home. SelfCare is part of the Health-oriented Leadership model and describes how individuals prioritize their own health, are aware of signs of stress, and actively promote their own health. In this paper, we postulate that telework enables more SelfCare at home, e.g., due to higher flexibility and autonomy. As SelfCare at home can be used more flexibly, it is also conceivable that the effectiveness of SelfCare increases the more employees work from home. Additionally, for hybrid working employees, the question arises whether SelfCare at both work contexts is distinct and makes an independent contribution to health and whether they even reinforce each other.

Methods: Our hypotheses were tested in a longitudinal study with $N = 727$ employees from different industries. This study examined (1) the level of SelfCare on-site and at home (within- and between-person-effects), (2) the moderating effect of telework intensity on the effectiveness of SelfCare at home on health and performance indicators, and (3) direct and interacting effects of SelfCare at home and on-site for health.

Results: Between- and within-person-differences show that SelfCare is more prevalent when working from home. Furthermore, SelfCare at home is related to less strain and health complaints as well as more relaxation and performance for individuals with higher telework intensity. SelfCare at home and on-site independently predict strain and health complaints and interact with regard to strain.

Discussion: SelfCare appears to be more relevant with higher telework intensity and is thus an even more important health resource in the telework context. Organizations should provide continuing interventions and online tools to promote SelfCare among employees and leaders. Since little is known about the level and the effects of SelfCare in the telework context, these findings expand previous research on Health-oriented Leadership in the telework context.

KEYWORDS

telework, working from home, SelfCare, Health-oriented Leadership, health, wellbeing

1 Introduction

Telework and particularly hybrid work arrangements (working both from home and on-site) have become the new normal and will characterize the future world of work (Bonin et al., 2020; Wang et al., 2021; Kunze and Hampel, 2023). The terms telework and working from home will be used as synonyms here. Telework has clear advantages when compared to work on-site in terms of higher autonomy and flexibility but also may have risks for health (Felfe et al., 2022). Potential risks are extended working hours, reduced recovery

periods, and an increase in sedentary behavior (Göpner-Reinecke, 2019; Bonin et al., 2020; Bouziri et al., 2020). Niebuhr et al. (2022) even showed that a higher amount of weekly time working from home was associated with more stress-related symptoms. Therefore, it seems also important to counteract these health risks and to maintain and promote health when working at home. SelfCare could be a relevant work-related resource to reduce these health risks. SelfCare is part of the Health-oriented Leadership (HoL) concept (Franke et al., 2014) and describes how followers and leaders take care of their own health at work. SelfCare encompasses health-specific behavior and attitudes toward the own health. SelfCare is differentiated into three facets, Value, Awareness, and Behavior: (1) Individuals high in SelfCare prioritize their own health (Value), (2) are aware of their own health-related warning signs (e.g., signs of stress and overload such as depressed mood, social withdrawal, concentration difficulties; Awareness), (3) and take appropriate action to actively promote their own health (e.g., optimizing work routines, work conditions, or work-life-balance by setting priorities, caring for undisturbed working, avoiding unbalanced body-posture, caring for enough space, taking regular breaks, or avoiding overtime; Behavior; Franke et al., 2014).

So far, SelfCare has been mainly studied in the traditional work context. Ample research has already shown that SelfCare at the workplace (on-site) is beneficial to employees' health (Grimm et al., 2021; Kaluza and Junker, 2022; Arnold and Rigotti, 2023). But it is unknown, if SelfCare is also important when working at home. SelfCare at home and SelfCare on-site refer to the same behavior, just being displayed at different work locations. However, the extent to which employees exhibit SelfCare may depend on the workplace. For example, employees in one location may be more aware of their own warning signs, prioritize their health and adopt more positive health behaviors instead of compromising their health than in another location. As telework is associated with more flexibility and autonomy (Felfe et al., 2022) this could potentially offer better opportunities for SelfCare at home than in the office. The question if there are actually better opportunities for SelfCare at home has not yet been studied. The *first aim* of this study is therefore, to investigate the differences in the level of SelfCare depending on the work location and show that the SelfCare level will be higher at home. For this purpose, not only between-person differences between employees working fully from home and employees solely working on-site were examined, but also within-person differences were considered (employees working both from home and on-site).

Moreover, the effectiveness of SelfCare when working from home is yet unclear. As the effects of SelfCare on health indicators are well-examined in the traditional work context (Grimm et al., 2021; Arnold and Rigotti, 2023), it has to be shown that SelfCare at home is also effective for followers' health. As the effects of SelfCare on work-related attitudes and work performance are less examined in previous research, we also considered work performance as a relevant outcome to extend previous evidence for the effectiveness of SelfCare. If SelfCare levels are higher at home and SelfCare is also effective at home, it is conceivable that SelfCare at home is more effective the more days employees work from home (e.g., 4 days at home compared to 1 day at home). Golden and Veiga (2008) and Santiago Torner (2023) have already postulated the moderating effect of telework intensity on the relationship between leadership and employee outcomes. Therefore, the *second aim* of this study is not only to examine the effectiveness of SelfCare at home for health indicators and performance but also if this effect depends on telework intensity (defined as days per week working from home; from 1 day to 5 days; 1 or 2 days working from home represents a less intense form of telework compared to spending the major portion of one's work week away from the office which represents a high intense form of telework).

For hybrid work, there are two venues for taking care of one's health while at work: SelfCare at the office and SelfCare at home. The question arises whether SelfCare at both work contexts is distinct and contributes independently to health and whether they even reinforce each other. Concerning consistency, it could be most conducive to health if hybrid employees take care of their health at both places of work. Inconsistent patterns, however, may be detrimental to employees' health, e.g., when employees are successful in displaying SelfCare at home (i.e., taking regular breaks, reducing demands by optimizing their work routine by setting priorities, caring for undisturbed working, etc.), but endanger their health when working on-site (e.g., get often disturbed, miss taking breaks). Therefore, the *third aim* of this study is to examine the independent effects of SelfCare at home and SelfCare on-site and their interplay with regard to health.

This study offers significant *theoretical and empirical contributions*. *First,* from a theoretical perspective, findings contribute to the knowledge of hindering and facilitating context factors influencing the effectiveness of HoL. While there is research on boundary conditions for the effectiveness of StaffCare (Klebe et al., 2021a, 2023; Pischel et al., 2022), our study identifies work location (i.e., telework intensity) as a facilitating boundary condition for SelfCare and enhances our understanding of the situational contingencies of SelfCare that emerge from ongoing digitization (Krick and Felfe, 2022; Klebe et al., 2023). This study further aligns with research on the opportunities and risks associated with work digitization (Day et al., 2012; De Vincenzi et al., 2022; Niebuhr et al., 2022).

Second, theoretically, it is yet unclear if SelfCare displayed in different locations should be differentiated. Until now, SelfCare has been operationalized without reference to the work location. By focusing on hybrid working employees, this study provides first insights into the independent and amplifying effects of SelfCare at different work locations on health. This allows for a theoretical distinction between SelfCare in remote work environments and on-site and directly leads to practical implications in that our findings have important implications for workplace health promotion. From a practical point of view, examining the differing levels and the interaction of SelfCare at home and on-site provides important knowledge for organizations and practitioners about the importance and the effectiveness of SelfCare when working from home to develop and implement adequate occupational health promotion offers. This knowledge could be a starting point for valuable suggestions and practical implications regarding the use of SelfCare in everyday work life and provides guidelines for designing future work environments, on-site and at home.

Third, from an empirical point of view, this study is one of the first to examine SelfCare at home, considering the growing digital and hybrid working context. Against the background of

hybrid work, it is important to know if opportunities for SelfCare differ between contexts and whether SelfCare at home is also relevant. The study contributes to the ongoing discourse on health promotion and Health-oriented Leadership in the digitalized world and provides initial empirical evidence for the relevance of SelfCare in remote work settings (Efimov et al., 2020; Felfe et al., 2022; Krick and Felfe, 2022). Our findings will complement and extend previous literature on SelfCare in the traditional context. By demonstrating the positive impact of SelfCare in remote and hybrid work environments, and initially on work performance as an outcome beyond health, this study extends the validity of the HoL concept and provides additional insights into its effectiveness in digital environments.

From a *methodological perspective*, this study allows for between-person and within-person differences in SelfCare. Comparing between-person and within-person effects offers a more differentiated picture and helps to clarify potential under- or overestimation due to working conditions. Furthermore, previous studies mainly measured whether employees work from home or not and examined telework as a dichotomous variable (e.g., Caniëls, 2023). Multiple studies criticize such a dichotomous approach and call for a more precise measurement of the intensity of digitalized work and telework (e.g., Bonin et al., 2020; Borle et al., 2021). We follow that call by considering telework intensity as a continuous moderator. Additionally, the study design with two measurement points expands upon previous cross-sectional findings and qualitative studies on SelfCare.

2 Risks and benefits of telework for health

The effects of telework on employee health and wellbeing are not clearly understood. On the one hand, telework is expected to enhance flexibility, potentially impacting both work and health positively. By eliminating commuting, telework reduces stress associated with travel (Murphy et al., 2023). The time saved from commuting can be used for recovery or physical activity, promoting overall health. In addition, telework allows employees to better manage their time and balance family and work commitments, especially for those with young children. This improvement in work-life-balance can positively impact health and wellbeing (Lunau et al., 2014).

Nevertheless, there are also potential risks of telework for employee health and wellbeing, highlighting the need for SelfCare at home. Niebuhr et al. (2022) showed that a higher amount of weekly time working from home was associated with more stress-related symptoms. First, telework can increase individual stress levels because employees try to manage both work and personal life simultaneously. Second, the overarching trend of extended working hours during telework beyond the typical office schedule leads to detrimental effects in the long term, e.g., impeded psychological detachment and recovery from work, decreased sleep quality as well as physical and mental wellbeing (Bonin et al., 2020; Wöhrmann et al., 2020; Cropley et al., 2023). Third, the blurring of work and personal boundaries may eliminate the expectation of being available only during designated working hours, leading to a feeling of being constantly available, even on weekends, potentially increasing work-related stress and negatively impacting overall wellbeing. Fourth, if employers are not legally obliged to address ergonomic concerns for telework, telework may result in poor posture and inadequate work setups at home, potentially leading to physical discomfort (e.g., Bouziri et al., 2020; Moretti et al., 2020). In addition, studies found an increase in sedentary behavior when working from home, which in turn can lead to adverse health effects (McDowell et al., 2020; Hunter et al., 2021). Lastly, while telework may have short-term benefits for minor illnesses, the lack of sufficient downtime can have negative health consequences in the long run if employees do not take adequate breaks. Given the aforementioned arguments, previous research shows both benefits for health but also potential risks when working from home. SelfCare seems to be a relevant resource to counteract these potential risks. Telework brings a shift in responsibility from employer to employee (Cropley et al., 2023). With this shift of control, employees have to regulate their working behavior, e.g., decide when they take rest breaks, design their working place at home, create personal boundaries between private life and work, or find a way to integrate both according to one's own needs (Müller and Niessen, 2019; Diewald, 2020; Niskanen, 2021). Sjöblom et al. (2022) particularly focused on self-related strategies. They found that these are negatively related to burnout among remotely working employees and call for additional research in this field.

3 SelfCare in the remote work context

SelfCare describes how leaders and followers take care of their health by prioritizing their health (Value), being aware of health-related warning signs (Awareness), and actively promoting their health (Behavior: e.g., reducing demands by optimizing personal work routine and working conditions such as setting priorities, caring for undisturbed working, daily planning, avoiding unbalanced body-posture, caring for enough, space, or avoiding draft; Franke et al., 2014). SelfCare is part of the Health-oriented Leadership concept (Franke et al., 2014) which differentiates between StaffCare (promoting followers' health) and SelfCare (promoting one's own health). SelfCare is well-studied for traditional work contexts (Grimm et al., 2021; Kaluza et al., 2021; Klug et al., 2022; Arnold and Rigotti, 2023), but it is an open question how important SelfCare is in digital and hybrid work arrangements, i.e., when SelfCare is displayed at home.

We are only aware of two qualitative studies that deal with HoL in a remote setting. Efimov et al. (2020) conducted an interview study with leaders of virtual teams and identified first insights regarding the feasibility of SelfCare when working from home. Their results showed that virtual leaders value health highly and are aware of health-oriented warning signs. Physical activity and boundary management were particularly mentioned as SelfCare behaviors. Tautz et al. (2022) focused more on StaffCare. Still, their interviews also showed that employees feel a high responsibility for their own health ("I think it is difficult for my supervisor to be responsible for my health while working from home. I see more of the responsibility on myself")—indicating a high relevance of SelfCare when working from home. So far, however, it is not known

whether SelfCare is facilitated or impeded when working from home than on-site.

We argue that telework offers more favorable circumstances for SelfCare compared to traditional office settings for several reasons: First, due to saved commuting time, employees working from home may have more opportunities (in terms of time) to take care of themselves. Second, due to high degrees of flexibility (Gajendran and Harrison, 2007; Ervasti et al., 2022), employees working from home can more easily adapt their work schedule to fit with their individual needs and have thus more possibilities to take care of their health, e.g., employees can ideally choose when to take a break, go for a walk, or do physical exercises (Nickson and Siddons, 2004; Kauffeld et al., 2016). SelfCare strategies could thus be more easily incorporated into the working day. This aligns with studies indicating that flexible work arrangements and the ability to work remotely contribute to enhanced employee wellbeing, fostering an improved balance between work and personal life, and boosting feelings of autonomy and self-leadership (Lundqvist et al., 2022). Third, as telework typically involves greater control and autonomy regarding daily routines, work design, work environment, and other aspects of the workday, such as scheduling, prioritization, and selection of work tasks (Eurofound, 2020; Moretti et al., 2020; Wöhrmann et al., 2020), implementing SelfCare strategies may be facilitated at home. It might be easier to reduce demands by optimizing personal work routines and working conditions (setting priorities, caring for undisturbed working, daily planning, avoiding unbalanced body posture, and caring for enough space). This is further underlined by a study that showed autonomy as a prerequisite for promoting self-leadership (Ho and Nesbit, 2014). Taken together these initial findings and based on this theoretical reasoning, we expect the following:

Hypothesis 1: SelfCare is more pronounced when working from home than when working on-site. These differences appear both on the between-person level (comparing employees fully working from home with employees not working from home) and the within-person level (comparing both working from home and on-site among hybrid working employees).

4 Effectiveness of SelfCare

Based on the assumptions of the HoL model, SelfCare is assumed to have positive effects on health (Franke et al., 2014). Many studies have already shown associations between SelfCare and various health indicators (*positive with* general health, e.g., Franke et al., 2014; Klug et al., 2019, 2022; Gosch et al., 2023; and wellbeing, e.g., Santa Maria et al., 2019; *negative with* strain and health complaints, e.g., Franke et al., 2014; Klug et al., 2019, 2022; Gosch et al., 2023; exhaustion, e.g., Grimm et al., 2021; Klebe et al., 2021b; Arnold and Rigotti, 2023; Gosch et al., 2023) and work engagement (Grimm et al., 2021; Kaluza et al., 2021; Arnold and Rigotti, 2023). While there is much evidence for positive effects of SelfCare for employees' health in the traditional office setting, it is unclear if these findings can be transferred to the remote setting (Tautz et al., 2022). Thus, the effectiveness of SelfCare when working from home remains unclear.

Previous studies have already examined other boundary conditions limiting or facilitating the effectiveness of HoL. Regarding StaffCare, studies showed that crises and ICT hassles (Information Communication Technology hassles, i.e., technology malfunctions such as program breakdowns, crashed, and freezing displays; Day et al., 2012) are such crucial factors for its effectiveness (Klebe et al., 2021a, 2023). For example, ICT hassles were shown to impair the effectiveness of StaffCare. Leaders' StaffCare is less related with employee work engagement, strain, and exhaustion with more ICT hassles. Regarding SelfCare, there is still a lack of research examining hindering and facilitating conditions for effectiveness.

We propose telework intensity as a possible moderator based on the calls for further research clarifying the role of high-intensity telework for employee health and well-being (Gajendran and Harrison, 2007; Beckel and Fisher, 2022; Lundqvist et al., 2022). Following the idea of Golden and Veiga (2008) or others (e.g., Santiago Torner, 2023) who showed that telework intensity moderates the relationship between leadership and well-being, we also consider telework intensity as a boundary condition for SelfCare. Golden and Veiga (2008) showed a more pronounced relationship between leadership and wellbeing for those working from home to a high extent compared to those who worked from home to a lesser extent. If telework is also a fruitful environment for SelfCare (regarding its level and efficiency), it is plausible that telework intensity may strengthen the relationship between SelfCare at home and employee health and performance.

At home, SelfCare may be more effective, as employees can choose the best time to take care of their health. Employees working from home are also more able to choose the most fitting strategies, while at the office, opportunities may be restricted for employees to care for their health (e.g., colleagues may interrupt, the feeling to be observed by others, missing materials such as a yoga mat). Due to the high autonomy and flexibility when working from home (Moretti et al., 2020), the telework setting might be a better environment for SelfCare to unfold its positive health effects (Sjöblom et al., 2022). The beneficial effects of SelfCare on health and performance might be higher for employees with the opportunity to work more days from home (high telework intensity) compared to those working fewer days from home (low telework intensity). For high levels of telework intensity, we expect stronger negative relationships of SelfCare with strain and health complaints and also stronger positive relationships with relaxation and performance. At low levels of telework intensity however, we expect a smaller but negative relationship of SelfCare with strain and health complaints and a smaller but positive relationship with relaxation and performance. In other words, if telework intensity is high, the lowest levels of strain/health complaints and the highest levels of performance can be expected with high SelfCare at home. However, high telework intensity may also come at a risk: for high telework intensity but low SelfCare we expect even higher strain levels due to specific health risks at home, such as extended working hours or permanent sedentary behavior. If telework intensity is low, less positive effects on outcomes can be expected with high SelfCare at home.

To replicate previous findings for the office context and provide first empirical evidence for the effectiveness in the telework context, we chose strain and health complaints as health outcomes. To extend previous evidence for the effectiveness of SelfCare, we also include relaxation as a relevant aspect of recovery and work

performance (both at home) as further outcomes besides health. These outcomes have not yet been studied in the context of SelfCare. Based on these assumptions, we expect the following:

Hypothesis 2: Telework intensity moderates the relationship between SelfCare at home and health (H2a: strain, H2b: health complaints, H2c: relaxation at home) and work performance at home (H2d). The more a person works from home, the more effective their SelfCare is.

Research has already started on how the work location influences the effectiveness of leadership in general (e.g., Amano et al., 2021; Lamprinou et al., 2021), but has not yet considered Health-oriented Leadership. Until now, research on the independent within-person effects of on-site and remote leadership is missing (Lundqvist et al., 2022). The same applies to SelfCare as part of Health-oriented Leadership (Franke et al., 2014; Klug et al., 2022).

As hybrid working arrangements will be the new normal of the future working world (Kniffin et al., 2021; Mckinsey, 2021), a closer look is needed at SelfCare in hybrid work settings. Regarding these hybrid work settings, employees have two venues to take care of their health while working: on-site and at home. As the telework setting and the office setting are different workplaces, it is an open question whether SelfCare displayed at home and on-site are distinct and independently contribute to employees' health. SelfCare at home and on-site might have different qualities (e.g., social aspects, organizational restrictions, flexibility, and autonomy) and address different health risks. Although SelfCare on-site and at home may be related, some employees may better care for themselves at home, and others have better opportunities on-site. This reasoning leads to the expectation that SelfCare at home and on-site are distinct and might independently predict health.

Hypothesis 3: In hybrid working employees, SelfCare on-site and at home independently predict health indicators (H3a: strain, H3b: health complaints).

It is also an open question whether SelfCare at home and on-site even interact and reinforce each other. While the previous hypothesis (H3) focuses on the independent effects, the focus of the next hypothesis refers to the interplay between SelfCare at home and SelfCare on-site. Both types of effects can coexist independently. A possible interaction effect does not necessitate the presence of main effects, and having main effects does not yet constitute an interaction.

Considering different configurations of Care components, there is already research that looks at the consistency of SelfCare and StaffCare (e.g., Klug et al., 2019), which found distinct consistent und inconsistenten profiles, i.e., employees who experience high StaffCare but low SelfCare (self-sacrifice) and vice versa (follower sacrifice). Similarly, this differentiated perspective can be applied with a more fine grained perspective on SelfCare at different work locations.

In terms of consistency, it is conceivable that hybrid employees are the healthiest if they take care of their health in both work settings (at home and on-site) and are less healthy if they are not able to display SelfCare at all. Low opportunities for SelfCare at one workplace may jeopardize the positive effects of SelfCare at the other workplace, e.g., when employees are successful in displaying SelfCare at home (i.e., taking regular breaks, reducing demands by optimizing their work routine by setting priorities, caring for undisturbed working, etc.), but endanger their health when working on-site (e.g., often get disturbed, miss taking breaks). Poor SelfCare at home could also cause detrimental effects on health, e.g., employees take regular breaks when working on-site, they have an ergonomic work setting, but at home, employees do not care for an ergonomic work setting by their own. Based on this reasoning, we expect the following:

Hypothesis 4: In hybrid working employees, on-site SelfCare moderates the relationship between home SelfCare and health (H4a: strain, H4b: health complaints). Individuals who display SelfCare both at home and on-site are healthier.

5 Materials and methods

5.1 Data collection and samples

The study was conducted as an online survey, including two measurement points with a time lag of 3 months. There is an ongoing discussion in the literature regarding the appropriate time lag for assessing the relationship between dependent (DVs) and independent variables (IVs; Dormann and Griffin, 2015). Some scholars propose relatively short intervals (Dormann and Griffin, 2015), while others argue for longer intervals to capture the stronger relationship between work stressors, resources, and health outcomes over time (Ford et al., 2014). In our study, we opted for a time lag of 3 months as it appeared to strike a balance, allowing us to minimize confounding effects while still capturing the potential effects of SelfCare and health.

Data was collected by a market research institute. All participants gave their informed consent. The first wave of data (t1) was collected in spring 2022, and the second in autumn 2022 (t2). At t1, 1,058 employees participated, while 727 participated at t2, which corresponds to a dropout rate of 31.3%. The sample consisted of 100% full-time working employees. Employees included in the sample had different non-remote and remote working arrangements with 17.9% of participants working solely on-site ($n = 130$) and 82.1% working from home ($n = 597$) with varying telework intensity (15.4% working at least 1 day a week from home, 19.8% with 2 days a week, 17.1% with 3 days a week, 12.1% with 4 days a week to 17.7% of participants working 5 days a week or more from home). In total of 52.1% of the participants were female. In total of 57.9% of the participants had no leading position, while 42.1% were responsible for at least five employees (up to more than 20 employees). The mean age was $M = 48.31$ years ($SD = 11.05$). Participants worked in several sectors such as IT and telecommunication (11.1%), metal and electrical industry (8.9%), insurance and banking (10.2%), or transport and traffic (5.0%)—either in the private sector (73.7%) or in public services (26.3%). More than two-thirds of the participants reported that they worked in companies with more than 100 employees (100 to 500 employees: 25.6%; more than 500 employees: 45.5% (8.4% up to 10, 10.9% between 11 and 49, 9.6% between 50 and 99). Most of the participants (64.9%) lived in a household with two persons [single 26.7%, with child(ren) 33.3%, with others 3.6%]. When working at home, 69.8% indicated that they never need to care for children (9.5% rarely, 12.9% sometimes, 6.2% often, 1.5% almost always). A

total of 80.2% reported that they never had to take care of relatives when working at home (5.7% rarely, 7.7% sometimes, 4.7% often, 1.7% almost always).

5.2 Measures

5.2.1 Telework intensity

Telework intensity was measured by using a single item. Participants were asked to rate the degree of working from home ("On average, how often did you work from home in the last 4 weeks?"). The scale included 1 = *never, but my job could theoretically be done from home*, 2 = *maximum 1 day per week*, 3 = *2 days per week*, 4 = *3 days per week*, 5 = *4 days per week*, and 6 = *at least 5 days per week*.

5.2.2 SelfCare

We assessed SelfCare by the subscale "SelfCare" of the Health-oriented Leadership instrument by Pundt and Felfe (2017). SelfCare was measured at both t1 and t2. Participants were asked to rate their SelfCare within the last 4 weeks. Participants who never work at home were asked to rate their SelfCare when working at the office (SelfCare on-site assessed by employees fully working on-site), while participants who work both at the office and from home (SelfCare on-site and SelfCare at home) rated their SelfCare for both work locations separately. We focused on the subscales "awareness" and "behavior" but excluded "value" because we expect no difference in the attributed value of health between work locations. For reasons of economy, we selected 11 items (awareness: 4 items; behavior: 7 items; sample item: "I try to reduce my demands by optimizing my personal work routine, e.g., set priorities, care for undisturbed working, daily planning)." The scale ranged from 1 = *not at all true* to 5 = *completely true*. Cronbach's Alpha was $\alpha = 0.81$ for t1 ($\alpha = 0.84$ for t2) regarding SelfCare at home, $\alpha = 0.81$ for t1 ($\alpha = 0.83$ for t2) regarding SelfCare on-site (both assessed by employees working at both work locations), and $\alpha = 0.86$ for t1 ($\alpha = 0.84$ for t2) regarding SelfCare on-site for employees fully working on-site.

5.2.3 Strain (irritation)

Emotional irritation served as an indicator of participants' strain. Emotional irritation was measured at t2 with one subscale of the irritation scale by Mohr et al. (2005). For reasons of economy, we have dispensed with one item ("*From time to time I feel like a bundle of nerves*"), so that the scale consisted of four items. Items were for example "*I get irritated easily, although I don't want this to happen.*" The scale ranged from 1 = *never* to 5 = *almost always*. Cronbach's Alpha was $\alpha = 0.89$.

5.2.4 Health complaints

We measured health complaints by using common physical and somatic symptoms adapted from a scale developed by Mohr (1986). Participants were asked to rate the frequency they experienced each physical (4 items, "headache, back, shoulder or neck pain," "sleep disturbance," "cardiopulmonary problems, hypertension," "gastrointestinal problems") and mental health complaints (2 items, "symptoms of depression and anxiety," "exhaustion") within the past 4 weeks. The scale ranged from 1 = *never* to 5 = *almost always*. Cronbach's Alpha was $\alpha = 0.85$.

5.2.5 Relaxation

We measured relaxation as an important recovery aspect using the subscale of the Recovery Experience Questionnaire by Sonnentag and Fritz (2007). We omitted one item due to parsimony. Participants were asked to rate their relaxation when working from home (3 items, "I kick back and relax," "I do relaxing things," and "I use the time to relax"). The scale ranged from 1 = *never* to 5 = *almost always*. Cronbach's Alpha was $\alpha = 0.91$.

5.2.6 Work performance

We measured work performance by using a self-developed single item. Participants were asked to rate their overall work performance when working at home ("Based on the last 4 weeks, how would you rate your overall work performances in terms of effectiveness and productivity when working from home?"). The scale ranged from 1 = *sufficient* to 5 = *excellent*.

5.2.7 Control variables

As some populations might have more strain and health complaints when working from home, we controlled for age and gender. For example, Matthews et al. (2022) showed that working from home was associated with increased odds of psychological distress in women. Oakman et al. (2023) revealed that telework was associated with increasing stress levels in older participants.

To analyze direct effects and indirect moderating effects on outcomes, and to reduce the risk for common method bias (Podsakoff et al., 2013), SelfCare both at home and on-site and telework intensity were used at t1 and outcomes 3 months later at t2.

5.3 Data analyses

We conducted a CFA to test our measurement model. We compared the fit of a differentiated 5-factor model with competing 4-, two 3-, and a single factor model. The hypothesized 5-factor model showed a better fit [$\chi 2 = 1{,}528.97(349)$, $p < 0.001$; CFI = 0.900; RMSEA = 0.075] than the 4-factor model that did not differentiate between SelfCare at home and SelfCare on-site. The 5-factor model includes (1) SelfCare at home (higher order factor) separating awareness and behavior facets, (2) SelfCare on-site (higher order factor) separating awareness and behavior facets, (3) health complaints, (4) strain, and (5) relaxation. The improvement in the model fit was significant [$\Delta\chi 2 = 20(4)$; $p < 0.001$], supporting the differentiation between five factors. The 3-factor model which also combined irritation and complaints revealed a lower fit. In contrast, the single factor model showed the lowest fit [$\chi 2 = 4{,}782.99(363)$, $p < 0.001$; CFI = 0.625; RMSEA = 0.143].

To test whether SelfCare differs among employees who both work from home and on-site (H1a), we conducted a paired sample

t-test (within-person-effects: SelfCare on-site vs. SelfCare at home, both assessed by employees working at both work locations). To analyze whether SelfCare differs between employees who fully work from home and employees who work completely on-site (H1b), we conducted a *t*-test for independent samples (between-person-effects: SelfCare on-site [employees working fully on-site] vs. SelfCare at home [employees working fully at home]). We analyzed these effects both at t1 and t2.

To test H2, H3, and H4, we conducted moderated linear regression analyses (model 1) using the SPSS macro PROCESS. *Regarding H2*, SelfCare at home and telework intensity were modeled as IVs predicting health (i.e., strain [H1a], health complaints [H1b], relaxation at home [H1c]) and work performance at home at t2 (H1d, DVs). Telework intensity at t1 was modeled as the moderating variable modifying the relationship between SelfCare at home at t1 (IV) and the health and performance outcomes at t2 (DVs). Before computing the product of telework intensity and SelfCare at home, both variables were mean-centered. *Regarding H3 and H4*, SelfCare at home and SelfCare on-site were modeled as IVs predicting health outcomes (i.e., strain [H3a] and health complaints [H3b]; DVs). Additionally, SelfCare on-site t1 was modeled as the moderating variable modifying the relationship between SelfCare at home at t1 (IV) and health outcomes at t2 (DVs) to test H4a and H4b. Before computing the product of SelfCare at home and SelfCare on-site, both variables were mean-centered. H3 and H4 were only tested with the two general health outcomes strain and health complaints. To account for individual differences in the outcomes, we controlled for age in years and gender. For the analyses, only complete datasets were considered. An overview of the study hypotheses can be found in Figure 1.

6 Results

6.1 Differences in SelfCare regarding work location (between- and within-person-effects)

In H1 we expected that SelfCare is higher when working from home than when working on-site. Regarding within-person-effects (SelfCare on-site vs. SelfCare at home, both assessed by employees working at both work locations), the paired sample *t*-test revealed a significant difference: When assessing SelfCare at both work locations, SelfCare at home ($M = 3.47$, $SD = 0.57$) is higher than SelfCare on-site ($M = 3.37$, $SD = 0.58$; $t_{(853)} = 8.82$, $p < 0.001$, Cohen's $d = 0.34$), confirming H1a. Regarding between-person-effects (SelfCare on-site vs. SelfCare at home), the *t*-test for independent samples also showed a significant difference, with higher values in SelfCare for employees when working fully at home ($M = 3.59$, $SD = 0.62$) compared to employees working fully on-site ($M = 3.37$, $SD = 0.63$; $t_{(376)} = 3.34$, $p < 0.001$; Cohen's $d = 0.62$), supporting H1b. Similar results were found when analyzing SelfCare 3 months later (within-person-effects: $t_{(660)} = 6.15$, $p < 0.001$; between-person-effects: $t_{(304)} = 2.30$, $p < 0.01$). We additionally tested the difference between SelfCare on-site assessed by persons working fully or partly from home and persons solely working on-site. We found no differences ($t_{(1,056)} = -0.032$, $p = 0.975$).

We additionally tested the differences in the sub-facets of SelfCare Awareness and Behavior separately. There were both significant between- and within-person differences for Behavior: Regarding within-person-effects, employees report higher SelfCare Behavior when working from home ($M = 3.40$, $SD = 0.62$) compared to working on-site ($M = 3.26$, $SD = 0.62$; $t_{(853)} = 9.38$, $p < 0.001$). Regarding between-person-effects, employees who fully work from home showed higher SelfCare Behavior ($M = 3.53$, $SD = 0.66$) compared to employees who fully work on-site ($M = 3.24$, $SD = 0.68$; $t_{(376)} = 4.20$, $p < 0.001$). For Awareness, there was a within-person difference showing that employees reported higher levels of Awareness when working at home ($M = 3.61$, $SD = 0.68$) than when working on-site ($M = 3.57$, $SD = 0.70$; $t_{(853)} = 3.08$, $p < 0.01$), but no significant difference between employees who working fully on-site ($M = 3.61$, $SD = 0.71$) and employees working fully at home ($M = 3.69$, $SD = 0.75$; $t_{(376)} = 1.08$, $p = 0.283$). Similar results were found at t2.

6.2 Effectiveness of SelfCare on health and performance

Regarding the main effects of SelfCare, all regression models showed that SelfCare at home negatively predicted strain and health complaints and positively predicted relaxation and work performance at home. All regression coefficients for the main and interaction effects, standard errors, 95% confidence intervals, and model summaries for all health and performance indicators are presented in Table 1.

6.2.1 Moderating effects of telework intensity

In H2, we postulated that the association between SelfCare at home and strain (H2a), health complaints (H2b), relaxation (H2c), and job performance (H2d) is higher for employees working more days from home. Regarding H2a, the overall moderation model accounted for significant variance in strain ($R^2 = 0.17$). As predicted, the interaction term revealed that telework intensity interacted with SelfCare at home [$B = -0.10$, $SE = 0.04$, $t = -2.51$, $p < 0.05$, 95 % CI (−0.18, −0.02), $\Delta R^2 = 0.01$, $F_{(1,591)} = 6.31$, $p < 0.05$]. The conditional effect was coeff. = −0.43 ($SE = 0.08$, $t = -5.11$, $p < 0.001$, 95 % CI [−0.59, −0.26]) for low telework intensity and coeff. = −0.72 ($SE = 0.08$, $t = -8.85$, $p < 0.001$, 95 % CI [−0.88, −0.56]) for high telework intensity. The negative relationship between SelfCare at home and strain was stronger for higher telework intensity (Figure 2). H2a was supported.

Regarding H2b, the overall moderation model accounted for significant variance in health complaints ($R^2 = 0.20$). As predicted, the interaction term revealed that telework intensity interacted with SelfCare at home [$B = -0.09$, $SE = 0.04$, $t = -2.52$, $p < 0.05$, 95 % CI (−0.17, −0.02), $\Delta R^2 = 0.01$, $F_{(1,591)} = 6.34$, $p < 0.05$]. The conditional effect was coeff. = −0.36 ($SE = 0.08$, $t = -4.74$, $p < 0.001$, 95 % CI [−0.51, −0.21]) for low telework intensity and coeff. = −0.63 ($SE = 0.07$, $t = -8.48$, $p < 0.001$, 95 % CI [−0.78, −0.48]) for high telework intensity. The negative relationship between

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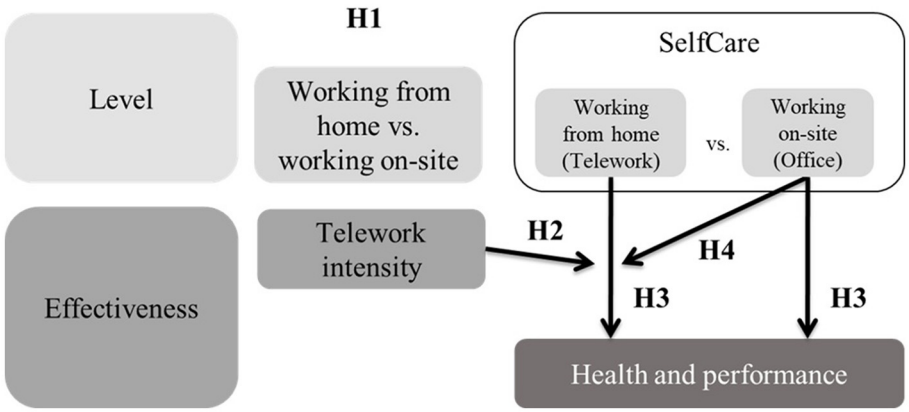

FIGURE 1
Overview of hypotheses.

SelfCare at home and health complaints was stronger for higher telework intensity (Figure 3). H2b was supported.

Additionally, there was a main effect of SelfCare at home [$B = -0.09$, $SE = 0.04$, $t = -2.52$, $p < 0.05$, 95 % CI (−0.17, −0.02), $\Delta R^2 = 0.01$, $F_{(1,591)} = 6.34$, $p < 0.05$], but not for telework intensity [$B = -0.09$, $SE = 0.04$, $t = -2.52$, $p < 0.05$, 95 % CI (−0.17, −0.02), $\Delta R^2 = 0.01$, $F_{(1,591)} = 6.34$, $p < 0.05$].

Regarding H2c, the overall moderation model accounted for significant variance in relaxation ($R^2 = 0.21$). As predicted, the interaction term revealed that telework intensity interacted with SelfCare at home [$B = 0.13$, $SE = 0.04$, $t = 3.49$, $p < 0.001$, 95 % CI (0.06, 0.21), $\Delta R^2 = 0.02$, $F_{(1,576)} = 12.20$, $p < 0.001$]. The conditional effect was coeff. = 0.44 ($SE = 0.08$, $t = 5.54$, $p < 0.001$, 95 % CI [0.29, 0.60]) for low telework intensity and coeff. = 0.82 ($SE = 0.08$, $t = 10.73$, $p < 0.001$, 95 % CI [0.67, 0.98]) for high telework intensity. The positive relationship between SelfCare at home and relaxation at home was stronger for higher telework intensity (Figure 4). H2c was supported.

Regarding H2d, the overall moderation model accounted for significant variance in job performance ($R^2 = 0.13$). Contrary to our assumption, telework intensity did not interact with SelfCare at home [$B = 0.07$, $SE = 0.04$, $t = 1.66$, $p = 0.09$, 95 % CI (−0.01, 0.15), $\Delta R^2 = 0.004$, $F_{(1,549)} = 2.76$, $p = 0.097$]. H2d was thus not supported. The interaction term missed the significance level of 0.05, but interaction effect and conditional direct effects are in the expected direction. The conditional effect was coeff. = 0.32 ($SE = 0.08$, $t = 3.76$, $p < 0.001$, 95 % CI [0.15, 0.48]) for low telework intensity and coeff. = 0.51 ($SE = 0.08$, $t = 6.29$, $p < 0.001$, 95 % CI [0.35, 0.66]) for high telework intensity. Despite missing significance, the relationship between SelfCare at home and work performance at home was stronger for higher telework intensity (Figure 5). As can be seen in Table 2, telework intensity did not exert an influence on the relationship between SelfCare at home and work performance but showed a direct effect on work performance ($B = 0.10$, $SE = 0.02$, $t = 4.11$, $p < 0.001$, 95 % CI [0.05, 0.15]). Telework intensity did not show direct associations with the health indicators.

6.2.2 Direct and moderating effects of SelfCare on-site

In H3, we postulated that SelfCare at home and SelfCare on-site independently predict strain (H3a) and health complaints (H3b). Moreover, we expected that SelfCare at both work locations amplify each other. Employees displaying SelfCare both on-site and at home are supposed to experience less strain (H4a) and fewer health complaints (H4b).

Regarding H3a and H4a, the overall moderation model accounted for significant variance in strain ($R^2 = 0.18$). As expected, SelfCare at home and SelfCare on-site both show significant main effects and independently predict strain (at home: $B = -0.30$, $SE = 0.11$, $t = -2.66$, $p < 0.01$, 95 % CI [−0.52, −0.08]); on-site: ($B = -0.29$, $SE = 0.11$, $t = -2.59$, $p < 0.01$, 95 % CI [−0.52, −0.07]). Employees with high levels of SelfCare at home report less strain and employees with high levels of SelfCare on-site report less strain. Additionally, the interaction term revealed that SelfCare at both work locations interacted [$B = -0.15$, $SE = 0.08$, $t = -2.02$, $p < 0.05$, 95 % CI (−0.30, −0.01), $\Delta R^2 = 0.01$, $F_{(1,591)} = 4.08$, $p < 0.05$]. The conditional effect was significant for high SelfCare on-site (coeff. = −0.39, $SE = 0.12$, $t = -3.16$, $p < 0.01$, 95 % CI [−0.863, −0.15]), but not for low SelfCare on-site (coeff. = −0.21, $SE = 0.12$, $t = -1.77$, $p = 0.08$, 95 % CI [−0.45, 0.23]). The negative relationship between SelfCare at home and strain was stronger for higher SelfCare on-site (Figure 6). H3a and H4a were supported.

Regarding H3b and H4b, the overall moderation model accounted for significant variance in health complaints ($R^2 = 0.20$). As expected, SelfCare at home and SelfCare on-site both show significant main effects and independently predict health complaints (at home: $B = -0.24$, $SE = 0.10$, $t = -2.33$, $p < 0.05$, 95 % CI [−0.45, −0.04]); on-site: $B = -0.29$, $SE = 0.11$, $t = -2.76$, $p < 0.01$, 95 % CI [−0.49, −0.08]). SelfCare at home and SelfCare on-site are each negatively associated with fewer complaints. The interaction term revealed no interaction effect [$B = -0.04$, $SE = 0.07$, $t = -0.60$, $p = 0.55$, 95% CI (−0.18, 0.09), $\Delta R^2 = 0.00$, $F_{(1,591)} = 0.36$, $p = 0.55$]. SelfCare on-site did not amplify the association between SelfCare at home and health complaints. H3b was thus supported, but not H4b. All regression coefficients for the main and

TABLE 1 Descriptives and correlations of variables for both studies.

		Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Age	48.31	11.05	-												
2	Gender[a]			−0.06**	-											
3	WFH intensity t1	3.37	1.71	0.05	−0.03	-										
4	SelfCare at home t1	3.47	0.57	0.11**	−0.04	0.08*	(0.81)									
5	SelfCare at home t2	3.48	0.62	0.12**	−0.05	0.05	0.69**	(0.84)								
6	SelfCare on-site t1 (WFH persons)	3.37	0.58	0.08*	−0.10**	0.04	0.82**	0.65**	(0.81)							
7	SelfCare on-site t2 (WFH persons)	3.40	0.61	0.10*	−0.06	−0.04	0.61**	0.85**	0.69**	(0.83)						
8	SelfCare on-site t1 (non-WFH persons)	3.37	0.63	0.04	0.14	c	c	c	c	c	(0.86)					
9	SelfCare on-site t2 (non-WFH persons)	3.38	0.59	0.11	0.02	c	c	c	c	c	0.74**	(0.84)				
10	Strain T2	2.34	0.89	−0.09**	0.08*	0.03	−0.38**	−0.42**	−0.38**	−0.42**	−0.40**	−0.51**	(0.89)			
11	Health complaints T2	2.15	0.85	−0.12**	0.21**	0.03	−0.36**	−0.40**	−0.37**	−0.41**	−0.45**	−0.50**	0.62**	(0.85)		
12	Relaxation T2	3.73	0.90	0.09*	0.00	0.06	0.44**	0.47**	0.41**	0.42**	c	c	−0.38**	−0.29**	(0.91)	
13	Work performance T2	3.57	0.84	0.10**	0.04	0.16**	0.30**	0.30**	0.21**	0.24**	c	c	−0.26**	−0.26**	0.28**	-

SD, standard deviation; N, 584 to 1,085 due to listwise deletion; WFH, working from home. [c] = not available. Cronbach's α on the diagonal. [a]Gender coded as 0 = male and 1 = female. $^{**}p < 0.01$, $^{*}p < 0.05$.

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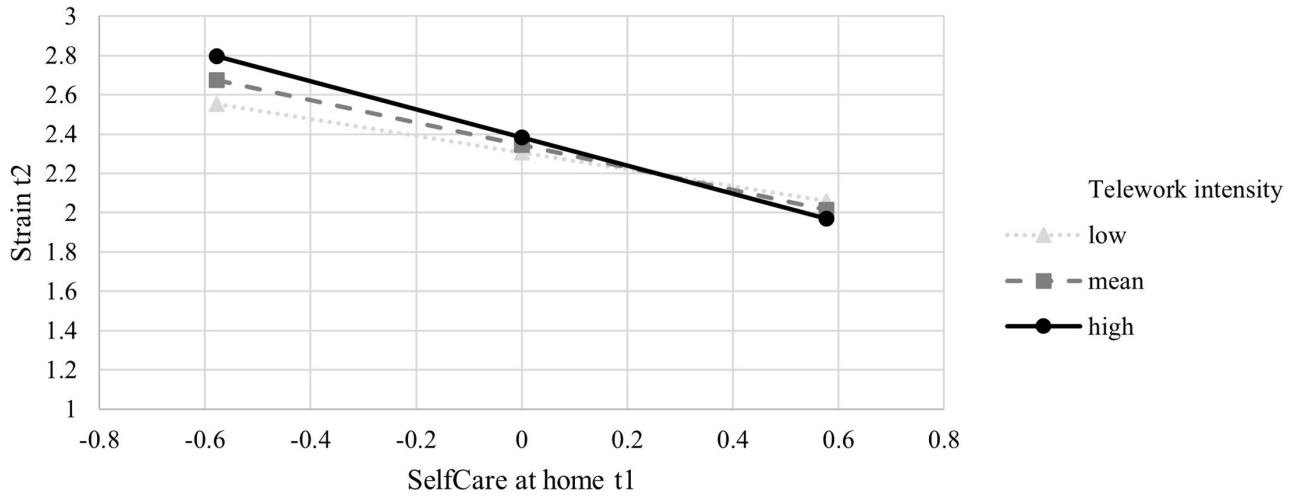

FIGURE 2
Moderation effect of telework intensity −1SD, M, and 1SD on the association between SelfCare at home and Strain (Simple Slopes).

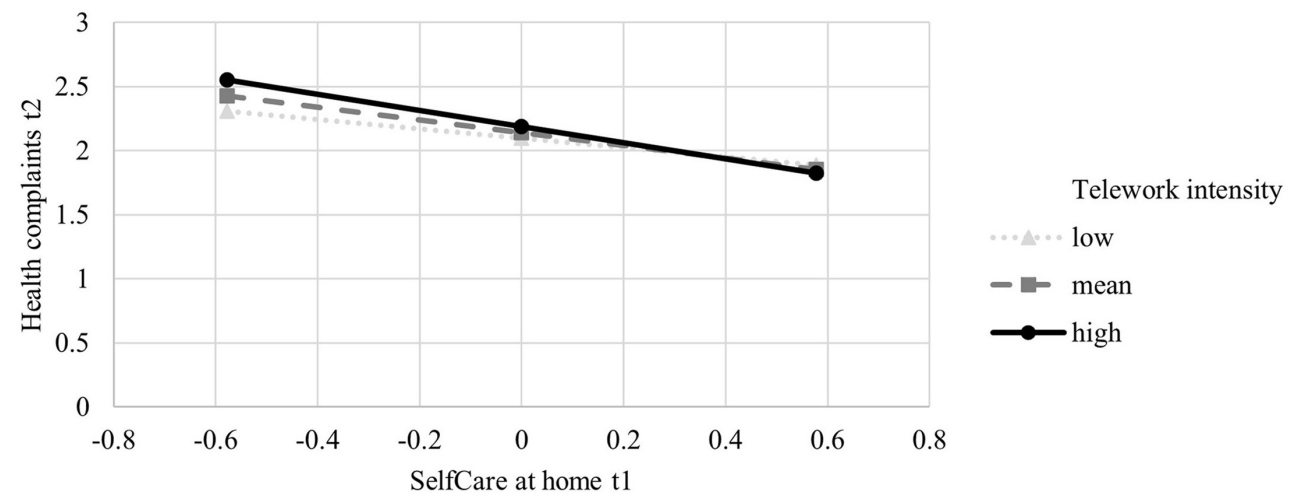

FIGURE 3
Moderation effect of telework intensity −1SD, M, and 1SD on the association between SelfCare at home and Health complaints (Simple Slopes).

interaction effects, standard errors, 95% confidence intervals, and model summaries are presented in Table 3.

7 Discussion

This study aimed to understand the differential relationships between SelfCare and health and performance outcomes when considering the hybrid work environment as a contextual factor. The results of the study show that SelfCare at home is more pronounced than on-site both, for within-person and between-person comparisons of the SelfCare level. Looking at the sub-facets of SelfCare separately, we found clear within- and between-person differences for SelfCare Behavior. For Awareness there were also clear within-person differences, but no differences between employees with and without telework. Employees without teleworking may have overestimated their SelfCare because they had no direct comparison. A direct comparison of the two experiences could make the assessment more realistic. One detail we would like to highlight here is that the level of SelfCare on-site for employees working entirely on-site did not differ from the SelfCare on-site for employees in hybrid work arrangements. Thus, we can conclude that the differences in levels of SelfCare are not an artifact of people who are more competent choosing to work more from home but that it is much more likely that the home as a work environment allows for more SelfCare than the office environment.

Furthermore, the results support the assumption that the relationship between SelfCare and employee outcomes is stronger when working from home. This could be supported for strain, health complaints, and relaxation. Answering the call by Beckel

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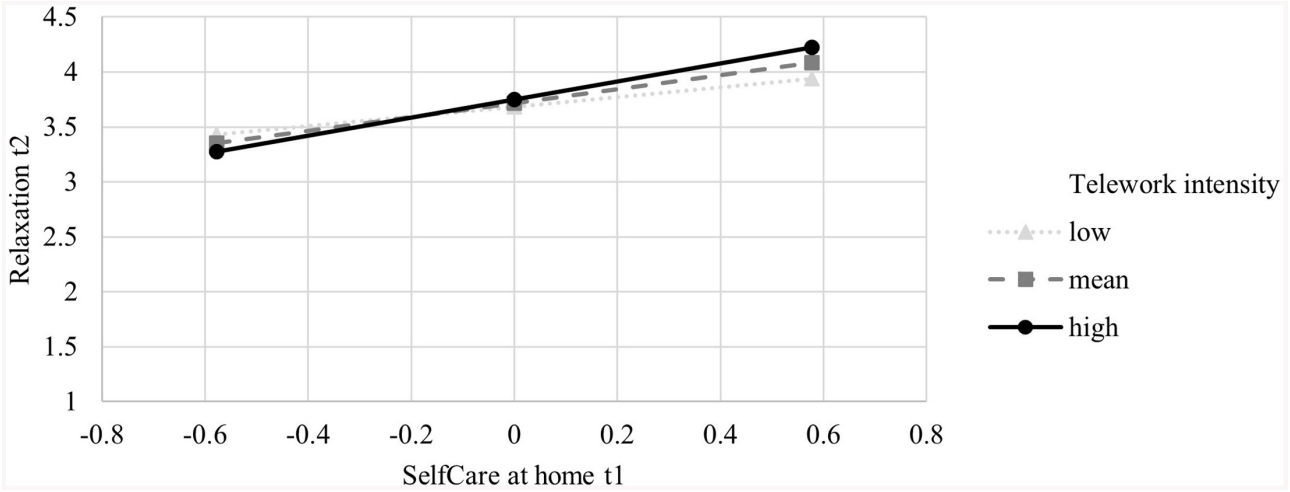

FIGURE 4
Moderation effect of telework intensity −1SD, M, and 1SD on the association between SelfCare at home and Relaxation (Simple Slopes).

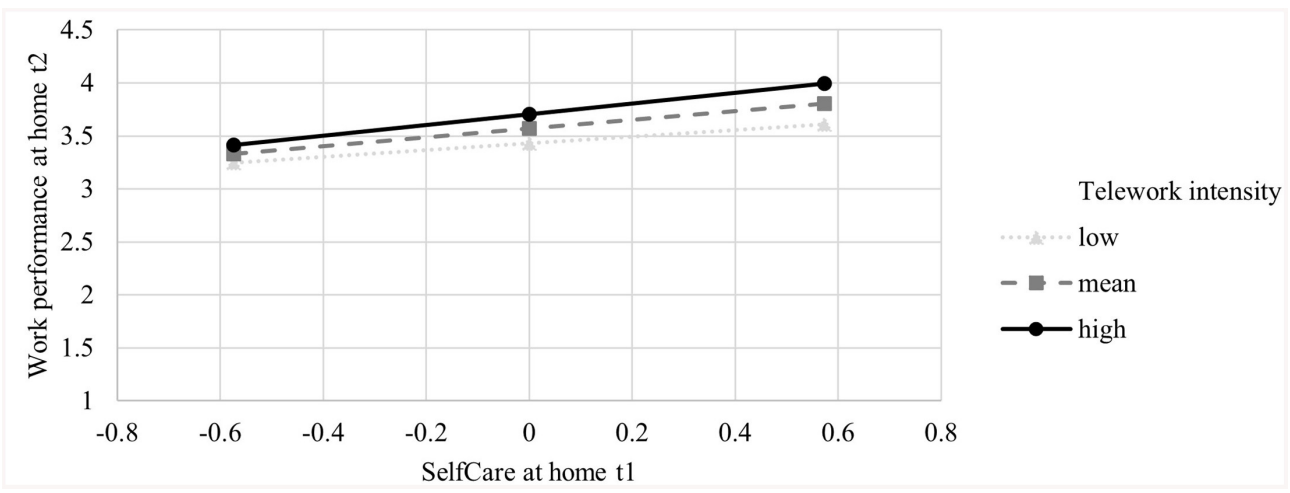

FIGURE 5
Moderation effect of SelfCare at the office −1SD, M, and 1SD on the association between SelfCare at home and Work performance (Simple Slopes).

TABLE 2 Results of the moderated regression analyses (H2).

	Strain	Health complaints	Relaxation at home	Work performance at home
	H2a	H2b	H2c	H2d
	Coeff.	Coeff.	Coeff.	Coeff.
Constant	2.57***	2.35***	2.50***	3.23***
SelfCare at home	−0.57***	−0.50***	0.63***	0.41***
Telework intensity	0.03	0.03	0.02	0.10***
SelfCare at home x telework intensity	−0.10*	−0.09*	0.13***	0.07†
Gender[a]	0.18**	0.35***	−0.01	0.10
Age	−0.01*	−0.01*	0.00	0.01†
R^2	0.17***	0.20***	0.21***	0.13***

[a]Gender coded as 0 = male and 1 = female. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, †$p < 0.10$.

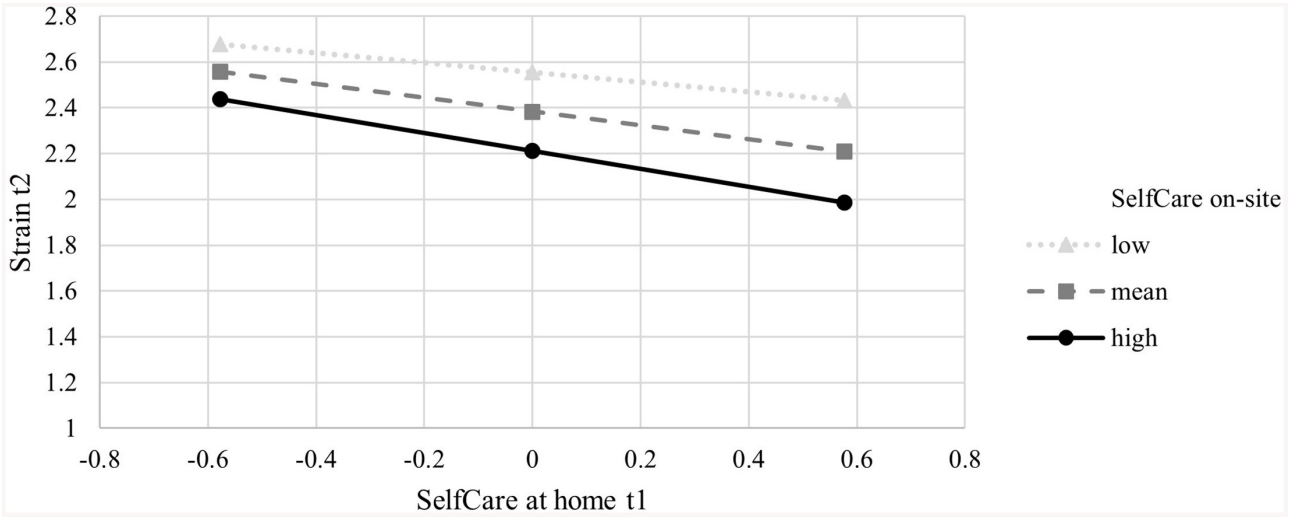

FIGURE 6
Moderation effect of SelfCare at the office −1SD, M, and 1SD on the association between SelfCare at home and Strain (Simple Slopes).

TABLE 3 Results of the moderated regression analyses (H3 and H4).

	Strain	Health complaints
	H3a/4a	H3b/4b
	Coeff.	Coeff.
Constant	2.60***	2.35***
SelfCare at home	−0.30**	−0.24*
SelfCare on-site	−0.29**	−0.29**
SelfCare at home x SelfCare on-site	−0.15*	−0.04
Gender[a]	0.15*	0.33**
Age	−0.01†	−0.01*
R^2	0.18***	0.20***

[a]Gender coded as 0 = male and 1 = female. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, †$p < 0.10$.

and Fisher (2022) to clarify the role of high-intensity telework for employee health and wellbeing, we found telework intensity as one relevant moderator in the relationship between SelfCare and employee outcomes. These results allow the conclusion that SelfCare is especially important in reducing mental and physical health problems when working from home. Although the data did not support this assumption for performance as an outcome, the main effect showed that the higher the telework intensity, the higher employees' self-rated performance is. This shows that the widespread assumption among practitioners that employees slack off or are lazy when working from home does not apply. On the contrary: they report higher performance with higher telework intensity.

Testing both, SelfCare when working from home and on-site as parallel predictors of strain and health complaints as outcomes revealed that they independently predict the outcomes. Moreover, concerning strain as the outcome, the data supported the interaction between SelfCare when working from home and on-site (but not for health complaints). On the one hand, this indicates that high SelfCare when working on-site can boost the positive effects of SelfCare when working from home. On the other hand, these results show that low SelfCare when on-site impairs the effects of SelfCare when working from home as this relationship is not significant anymore under the condition of low on-site SelfCare. Thus, we enlarge the earlier findings by Klug et al. (2019) and show that consistency in SelfCare across work locations is important for the beneficial effects on employee strain.

7.1 Theoretical implications

First, against the background of hybrid work as the "new normal" (Franken et al., 2021) this study is the first to show that it is important to assess SelfCare specific to the working location. The present study underlines the notion that SelfCare also represents an important workplace resource for employees in digital and hybrid working contexts. As we found significant within-person differences in the level of SelfCare when working from home compared to on-site, we can conclude that there is not one general competency of SelfCare but that employees adapt their SelfCare according to the context they are working in.

Second, as previous research had focused on boundary conditions of the effectiveness of StaffCare on health outcomes, our results confirmed the intensity of telework as the first boundary condition for the relationship between SelfCare and outcomes and, therefore, extended previous research. It is a new insight that SelfCare still unfolds its positive effects when working from home, even more for employees who work more days from home. By showing the positive effects of SelfCare in the digital and hybrid work context for the first time, this study extends the existing validity of the HoL concept and adds to our knowledge on hindering and facilitating working conditions for the effects of

SelfCare. To better understand how and why the effectiveness of SelfCare is amplified in digital and hybrid working environments, further theory development should take a differentiated view on potential underlying mechanisms and individual factors that facilitate or hinder SelfCare. For example, Neidlinger et al. (2022) showed that leaders with lower core self-evaluation benefit more in terms of health and work-life-balance when working from home. Other individual factors might be self-regulation or segmentation preferences.

Third, we provide a first answer to the question of whether SelfCare across working locations should be consistent or if inconsistency between different working locations is not problematic. Until now, most research has ignored different working locations. The results of the moderation analysis in this study reveal that consistency is important with regard to employee strain, as the negative relationship of SelfCare when working from home was stronger when SelfCare on-site was also high. More importantly, when SelfCare on-site was low, the negative relationship between SelfCare and strain was not significant anymore. This result supports the notion that few opportunities for SelfCare in the office can undermine the otherwise positive effects of SelfCare at home. Thus, consistency in SelfCare across working locations is an important aspect to consider.

Although we have only measured SelfCare as a specific form of self-leadership in this study, it can be assumed that also other strategies of self-leadership vary when comparing on-site work with work from home.

7.2 Practical implications

Our results show that SelfCare is slightly higher when working from home compared to working on-site. Means show that SelfCare levels are only medium. This highlights the importance of recognizing that both employees and organizations need to develop SelfCare skills to effectively maintain and promote their health in a remote work environment. However, while our study does not explicitly discuss whether remote work might threaten traditional leadership behaviors, it underscores the need for a more effective integration and implementation of SelfCare into daily work routines. Thus, organizations should implement interventions to promote SelfCare in both work contexts. Organizations and practitioners should develop interventions to effectively foster SelfCare, e.g., GoFüKo—a training to develop SelfCare and StaffCare competences (Krick and Felfe, 2024). This intervention familiarizes employees with the HoL concept and provides concrete exercises on how to develop SelfCare. Other studies showed that a mindfulness-based resource intervention especially developed for the work context was effective in increasing SelfCare (Krick and Felfe, 2020, 2023). Another study showed that employees high in SelfCare benefitted more from such interventions (Krick et al., 2021). In addition, intervention concepts and tools are needed that specifically address SelfCare in digital and hybrid contexts and focus on specific barriers and challenges that make SelfCare difficult when working from home. Recently, an online learning platform for leaders (DigiLAP; Digital Leadership Assistance Platform) was developed, specifically addressing SelfCare in the context of remote work and hybrid work (Krick et al., 2023). Future research is needed to further identify effective interventions to promote SelfCare, increasing both, SelfCare at home and on-site.

7.3 Limitations and directions for future research

Although this study makes valuable contributions to both theory and practice, it is important to acknowledge its limitations, which can provide valuable insights for future research. *First,* our data is primarily reliant on self-report measures, which potentially increases the possibility of response biases, same-source biases, and common method biases. These biases may have resulted in overestimating the correlations between study variables and underestimating interactions (Podsakoff et al., 2003). There are also multiple Monte Carlo studies (Evans, 1985; Lai et al., 2013) and statistical proof by Siemsen et al. (2010) indicating that an interaction effect cannot be produced by common method variance. However, we minimized these biases to some extent by utilizing diverse response options across the scales and ensuring confidentiality, thereby reducing the likelihood of habitual responding and response biases. To further minimize the potential common method bias, we employed longitudinal data and collected data on predictors and DVs at different time points. Despite this limitation, we believe that self-report measures were appropriate for our study objectives. Many of our variables focus on individual experiences that are challenging to assess without directly asking participants to describe and report their own experiences. However, future research should complement and validate self-reported data by incorporating more objective measures, particularly for health. Replicating our findings using alternative data sources and perspectives, such as leader-rated performance or objective physiological health measures like heart rate variability, cortisol, and blood pressure for assessing health indicators, would be beneficial.

Second, in this study, we chose a 3-month time interval to separate predictors and outcomes. Future studies could aim to establish knowledge on temporal dynamics in SelfCare. Therefore, it is recommended that future studies examine our model and other potentially relevant variables in shortitudinal field studies, such as a diary study. For example, a dairy study could investigate the interaction effect of SelfCare at home and on-site throughout the week to better understand interaction effects on a daily or weekly level. This would also allow for identifying optimal conditions for effective and sustainable SelfCare in hybrid work settings. The present study can serve as a starting point for further investigations in this area.

Third, it is an open question if SelfCare might also have a dark side. On the one hand, interdependence theory (Rusbult and van Lange, 2003) would suggest that, especially in jobs with high task interdependence, some aspects of SelfCare behavior can include the risk of being costly to coworkers. SelfCare behaviors such as taking part in stress management courses, prioritizing tasks, or asking for support from coworkers could enhance the workload of colleagues while relieving the burden of the person showing high SelfCare behaviors. On the other hand, based on social learning

theory (Bandura, 1969) and the assumptions in the HoL model itself (Franke et al., 2014), one can expect that high SelfCare of individuals will be picked up by coworkers and thus might even contribute to an overall more positive health climate within a team. The findings by Gosch et al. (2023) support this notion, as the authors found a positive correlation between SelfCare and PeerCare. Further empirical evidence is necessary to test these competing assumptions in future studies to make sure that SelfCare does not comprise a dark side.

Fourth, with regard to the between-person comparisons, employees working fully from home at the time of the survey did not have a direct comparison when currently working on-site, but rather a comparison with their previous work on-site. The analyses were also conducted without employees who worked fully from home. The results were similar.

Fifth, although we could show a clear difference between SelfCare at home and SelfCare on-site, we can only speculate about the reasons. The literature emphasizes autonomy and flexibility (Moretti et al., 2020; Ervasti et al., 2022; Felfe et al., 2022), but other factors also may play a role. For example, flexibility might be a double-edged sword, as the perceived flexibility might depend on the hierarchy level/job position (e.g., perhaps only employees at lower job/hierarchy levels enjoy more flexibility at home, i.e., in the absence of close supervision from one's superior) or the job design (e.g., employees with tasks that highly depend on others might experience limited flexibility). To better understand the reasons why SelfCare is higher at home than on-site, these factors should be investigated in future studies (e.g., job level, experienced control by leaders, etc.). Furthermore, it would be interesting for future research to examine motivational aspects for SelfCare on-site and SelfCare at home to better understand the reasons why individuals engage in SelfCare behavior at the office and at home.

8 Conclusion

This study aimed to deepen our understanding of SelfCare in remote and on-site working contexts. The core finding underscores the significance of SelfCare practices, revealing that individuals exhibit higher levels of SelfCare when working from home compared to working on-site. Moreover, an intriguing result emerged as SelfCare at home demonstrated stronger associations with various outcomes the more employees work from home. Thereby, this study sheds light on the pivotal role of SelfCare in the context of teleworking, emphasizing its positive impact on individual wellbeing and performance. However, the study also highlights the importance of maintaining a consistent commitment to SelfCare across different working environments. As we navigate an era marked by increased flexibility in work arrangements, it becomes imperative for future studies to delve deeper into the frequency with which work is conducted outside traditional on-site settings. Understanding the dynamics of SelfCare in these varied contexts will provide invaluable insights for both researchers and practitioners aiming to promote employee health and productivity. In practical terms, the implications of our findings suggest that trainings on SelfCare should not only emphasize its importance but also integrate actionable strategies into the daily work routines of individuals.

Data availability statement

The datasets presented in this article are not readily available because of privacy restrictions. Requests to access the datasets should be directed to JF, felfe@hsu-hh.de.

Ethics statement

Ethical approval was not required for the study involving humans because participation was completely voluntary and anonymous. Answering our questions did not cause any harm and was neither mentally nor psychologically stressful. The questionnaire did not contain any distressing material. The study was conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AK: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Project administration. MA: Writing – original draft, Writing – review & editing. JF: Conceptualization, Methodology, Supervision, Writing – review & editing, Project administration.

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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

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What if I like it? Daily appraisal of technology-assisted supplemental work events and its effects on psychological detachment and work engagement

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Introduction: Information and communication technologies (ICT) allow employees to engage in technology-assisted supplemental work (TASW), such as continuing work tasks and being contacted by supervisors or colleagues after their official working hours. Research has found that TASW can have positive and negative effects on employee wellbeing. Yet, it remains unclear under which circumstances TASW is beneficial or harmful. Building on appraisal theories, we hypothesized that a more positive appraisal of TASW events is related to higher levels of daily psychological detachment and work engagement. We further proposed that daily psychological detachment is positively associated with daily work engagement and mediates the relationship between appraisal of TASW events and daily work engagement.

Methods: To test our hypotheses, we conducted a diary study with two surveys per day over five consecutive workdays ($N = 135$; 245 daily observations).

Results: Results of multilevel path analysis showed that a more positive appraisal of TASW was positively related to work engagement. However, appraisal of TASW events was not associated with psychological detachment and, therefore, there was no mediating effect on work engagement.

Discussion: Our results contribute to existing research by investigating potential beneficial aspects of TASW and its effects on work engagement. Future research avenues and practical implications are discussed.

KEYWORDS

appraisal, technology-assisted supplemental work, TASW events, psychological detachment, work engagement, daily diary study

Introduction

Continuous developments and innovations of information and communication technologies (ICT) have changed how, when, and where we work. ICT, such as smartphones, laptops or software solutions (e.g., cloud working options, instant messenger services), make it possible to work remotely while staying connected to work or accessing work-related information and tasks. Remote work (also referred to as mobile work, distributed work, telework or telecommuting) describes situations in which employees work at a location away from their typical office, such as their home or field offices (cf. Allen et al., 2015). As such, technology-assisted supplemental work (TASW) represents a

sub form of remote work (Fenner and Renn, 2010). TASW is defined as the performance of work-related tasks away from one's typical workplace (e.g., at home) and after one's regular working hours with the help of ICT (Fenner and Renn, 2010). It includes all types of tasks, such as answering phone calls from work-related contacts, reading e-mails or continuing to work on a specific task. Due to the high prevalence of ICT in work and private life, engaging in TASW is rather the norm than the exception for today's workforce. This development was further reinforced by the COVID-19-pandemic. Before the pandemic, around 52% of German employees engaged in work-related task during their off-job time (DGB-Index Gute Arbeit, 2016). During the pandemic, this number increased to 73% (DGB-Index Gute Arbeit, 2022).

As TASW includes different types of work-related activities, it can be used as an umbrella term for related constructs that describe work-related ICT use during off-job time. These include but are not limited to "extended availability for work", "smartphone use after hours" or "work-related ICT use after hours" (cf. Eichberger and Zacher, 2021). The majority of these studies focused on quantitative aspects of TASW (e.g., its frequency or duration; for an overview of different approaches, see Hu et al., 2021) and neglected qualitative aspects (i.e., how TASW is experienced; cf. Reinke and Ohly, 2021). To date, research yielded evidence for ambiguous effects, leading to TASW being considered as a double-edged sword (Diaz et al., 2012; Kühner et al., 2023) or the emergence of the "high-performance-low-wellbeing paradox" (Schöllbauer et al., 2021). On the one hand, TASW evokes negative outcomes for wellbeing and health, such as problems with psychological detachment (Eichberger et al., 2021; Thörel et al., 2021), impaired sleep (Lanaj et al., 2014) or increased emotional exhaustion (Dettmers et al., 2016; Thörel et al., 2021). On the other hand, research also revealed positive consequences of TASW on motivational factors, such as increased work engagement (Ragsdale and Hoover, 2016; Carvalho et al., 2021) or work satisfaction (Diaz et al., 2012).

With our study, we make the following contributions to scholarly knowledge. First, we use an event-based approach by measuring the appraisal of daily TASW events. Often, employees cannot avoid TASW events (e.g., when receiving a work-related call or having to finish an important task in the evening). Therefore, we investigate whether it is the mere *occurrence* of TASW events or the *specific appraisal* of such events (hereafter: TASW event occurrence and TASW event appraisal, respectively) that affects employees' wellbeing. We are especially interested in potential beneficial outcomes of TASW. Building on appraisal theories (e.g., Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996), we propose that a more positive TASW event appraisal on a daily basis is beneficial for employees' daily psychological detachment in the evening (i.e., not thinking about work-related issues, Sonnentag and Fritz, 2007) and their work engagement the next morning (i.e., having an energetic sense of connection to one's work, Schaufeli et al., 2006). Second, we extend research on the interplay between TASW, psychological detachment and work engagement. Doing so is important because employees' ability to detach from work enhances their work engagement (Ten Brummelhuis and Bakker, 2012; e.g., Sonnentag and Kühnel, 2016) which, in turn, leads to better performance. Previous research suggests a positive relationship between TASW and work engagement (e.g., Ragsdale and Hoover, 2016; Carvalho et al., 2021), but a negative relationship between TASW and psychological detachment (e.g., Derks et al., 2014a; Reinke and Ohly, 2021; see also a recent meta-analysis by Kühner et al., 2023). Considering both variables—psychological detachment and work engagement—along with testing the mediating role of psychological detachment may help to understand whether TASW can have both positive and negative effects simultaneously. To address these research questions, we conducted a daily diary study with two measurement points per day among knowledge workers. Our proposed model is presented in Figure 1.

Theoretical background

TASW event appraisal

Research on the effects of TASW has recently evolved from a feature-oriented approach (e.g., frequency or duration of TASW) to an event-oriented approach that focuses on the daily occurrence of TASW events (e.g., Reinke et al., 2016; Braukmann et al., 2018) and takes the appraisal of TASW into account (e.g., Eichberger et al., 2021; Reinke and Ohly, 2021; Darouei et al., 2023). As the appraisal of TASW events may vary between events (cf. Lazarus and Folkman, 1984), this shift allows to better account for employees' varying reactions and, therefore, may help to better understand differing effects of TASW on employees (Duranová and Ohly, 2016; Braukmann et al., 2018; Reinke and Ohly, 2021).

Based on the aforementioned definition of TASW, *TASW events* are discrete happenings that (a) involve using ICT for work-related tasks (b) during off-job time (cf. Braukmann et al., 2018) and (c) evoke cognitive, emotional, or motivational reactions (e.g., interest, stress, motivation; Weiss and Cropanzano, 1996). For example, an employee receives a call from their colleague (a—work-related via ICT, e.g., smartphone) in the evening (b—off-job time). The employee may feel relieved because they had received important information for solving a problem (c—reaction).

Both TASW event occurrence and TASW event appraisal can vary from day to day and from event to event. In line with appraisal theories (e.g., Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996), the specific reaction to an event depends on how it is appraised by the individual. If the individual appraises the event as beneficial for their wellbeing and goals and/or their capability to cope as high, the event is appraised as more positive which is likely to evoke positive emotions such as pride, happiness, or exhilaration (Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996). Experiencing positive emotions broadens the employee's thought-action repertoires (Fredrickson, 2001) which, in turn, enhances their wellbeing (Reinke et al., 2016). On the other hand, if the event is appraised as detrimental and the capability to cope is low, the event is appraised as negative, resulting in negative emotions and stress reactions (Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996). For example, an employee receives phone calls from colleagues on two evenings in a week. They may appraise the phone call as positive on one evening because they receive favorable information or enjoy talking to that colleague. However, they may appraise the call as

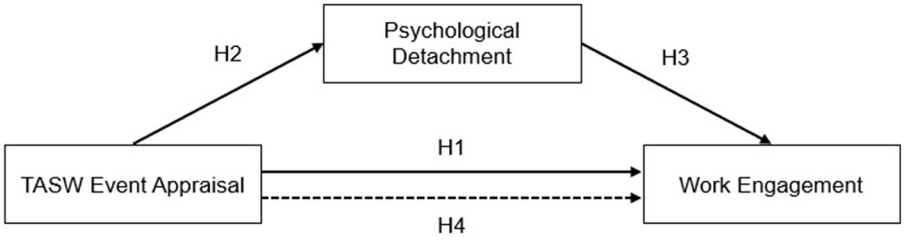

FIGURE 1
The conceptual research model. All hypotheses refers to the day level. Solid lines represent direct effects. Dotted lines represent indirect effects.

negative on the next evening because they receive unfavorable information or are disturbed while spending time with their children. As a consequence, the employee may experience positive emotions and feel more satisfied with their job on one evening, while they may experience negative emotions and stress on the other. Therefore, when a similar TASW event is appraised differently on two days, it may have different effects for the same person.

TASW event appraisal and work engagement

One aim of this study is to explore the *positive* consequences of TASW for employees by investigating their effects on work engagement. Work engagement is an affective-motivational state (Bledow et al., 2011) that is characterized by high levels of energy, involvement in work tasks, full concentration, and the willingness to invest effort in handling work-related demands (cf. Schaufeli et al., 2002). Therefore, work engagement is highly influenced by the experience of and related to the presence of positive (work-related) emotions (cf. Bledow et al., 2011).

Although meta-analytic results suggest a positive relationship between TASW and work engagement when considering both the person and day level (Kühner et al., 2023), diary studies could not confirm this positive association between TASW and work engagement at the within-person level. Whereas some diary studies found a negative relationship between daily TASW and work engagement the next day (Ten Brummelhuis and Bakker, 2012; Lanaj et al., 2014), other diary studies did not find significant associations between the two variables (Derks et al., 2015; van Laethem et al., 2018; Darouei et al., 2023). Hence, we assume that TASW event appraisal—rather than the mere TASW event occurrence—may provide valuable insights into these inconsistent results.

Building on our theoretical framework, a positive TASW event appraisal should evoke positive emotions (e.g., satisfaction, joy or enthusiasm), which, in turn, results in work engagement the next morning. Accordingly, we hypothesize:

Hypothesis 1: A more positive TASW event appraisal after hours is associated with higher levels of work engagement the following morning.

TASW event appraisal and psychological detachment from work

In addition to testing positive effects of TASW event appraisal on work engagement, we were interested in exploring positive effects on psychological detachment. Psychological detachment is a core recovery experience that implies to mentally disengage from job-related thoughts and activities during non-work time (Sonnentag and Fritz, 2007, 2015). Per definition, TASW event occurrence is negatively associated with psychological detachment, because an employee naturally thinks about work when continuing work tasks or receiving work-related e-mails and phone calls after hours. This is supported by several studies that have shown negative associations between smartphone and technology use after work and psychological detachment in the evening (Derks et al., 2014a,b; Braukmann et al., 2018; Reinke and Ohly, 2021). Interestingly, some studies have shown that specific characteristics of TASW can have beneficial effects on psychological detachment (e.g., when autonomous motivation to use ICT was high, Ohly and Latour, 2014; when employees engaged in boundary creation behavior, Barber and Jenkins, 2014).

Building on appraisal theories (e.g., Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996), we claim that it is not only the mere occurrence of a TASW event that effects psychological detachment but also its appraisal. More specifically, we argue that a more positive appraisal is associated with positive emotions. These positive emotions broaden one's momentary thought-action repertoires (Fredrickson, 2001) and, therefore, employees' attention is likely to steer away more easily from the current work experience and to expand to people, activities or subjects not related to work. As a consequence, employees with positive emotions can get more easily physically or mentally involved in non-work situations which goes along with detaching from work. For example, employees may appraise a TASW event as positive when they make visible progress or finish a task. Indeed, positive experiences have been shown to be positively related to psychological detachment (e.g., Weigelt and Syrek, 2017; Heissler et al., 2022). Contrary, a negative appraisal (e.g., employees identify a problem when working on a task or they receive unpleasant information) goes along with negative emotions. These are likely to narrow one's thought-action repertoires. Consequently, the focus of attention will be narrowed down to the work-related issues that evoked the negative emotions, resulting in problems to detach. Again, previous studies found that a more negative TASW appraisal was related to lower levels of

psychological detachment (e.g., Eichberger et al., 2021; Reinke and Ohly, 2021). However, these studies examined both positive and negative appraisal of TASW but did not examine the relationship between the effects of both positive and negative appraisal on the same outcomes (e.g., psychological detachment and sleep quality, Braukmann et al., 2018; psychological detachment, positive affect and negative affect, Reinke and Ohly, 2021). It thus remains unclear whether positive vs. negative TASW event appraisals have different effects on psychological detachment on days when TASW events occur. Therefore, we hypothesize:

Hypothesis 2: A more positive TASW event appraisal after hours is associated with higher levels of psychological detachment in the evening.

The relationship between TASW event appraisal, psychological detachment from work, and work engagement

Several studies have shown a positive relationship between psychological detachment and work engagement, both on a person and a day level (e.g., Kühnel et al., 2009; Ten Brummelhuis and Bakker, 2012; Sonnentag and Kühnel, 2016). This may be due to the replenishment of the individual's resources during a recovery period (Meijman and Mulder, 1998). Employees' resources are drained when they are exposed to work demands, but their resources can be replenished to a pre-work level during a recovery period (e.g., the evening or weekend). By mentally disconnecting from work, employees are no longer confronted with work demands (e.g., unfinished tasks or conflicts) which helps to decrease strain and replenish their resources (Sonnentag and Fritz, 2007), such as work engagement. Therefore, it can be assumed that detaching from work promotes employees' work engagement. Consequently, on days when employees can detach from work in the evening, they should experience more work engagement the next morning (Ten Brummelhuis and Bakker, 2012; Sonnentag and Kühnel, 2016). Thus, we hypothesize:

Hypothesis 3: Psychological detachment in the evening is associated with higher levels of work engagement the following morning.

Besides this direct effect, the literature suggests a mediating role of psychological detachment between work demands, on the one side, and work engagement, on the other side (cf. Sonnentag and Fritz, 2015). Studies using related constructs at the within-person level showed that psychological detachment mediates the relationship between work-related tasks after hours and work engagement (Ten Brummelhuis and Bakker, 2012). In addition to the proposed direct effect of TASW event appraisal on psychological detachment and the proposed direct effect of psychological detachment on work engagement, we suggest an indirect effect of positive TASW event appraisal on work engagement via psychological detachment. For example, an employee who finishes an important work task at home no longer thinks about work (i.e., psychological detachment) and, therefore, has more energy to perform at work (i.e., work engagement) the following day. Accordingly, we hypothesize:

Hypothesis 4: Positive TASW event appraisal after hours has a positive indirect effect on work engagement the following morning via psychological detachment in the evening.

Method

Sample and procedure

The study was conducted online in November 2020 in Germany. Respondents were recruited via an online panel provider (respondi AG, https://www.respondi.com). Registration is open for anyone, and participation in surveys is not mandatory. Participants receive bonuses for regularly participating in studies that can be exchanged for different kinds of compensation (e.g., vouchers).

Participants were invited to take part in a general survey 1 week before the diary surveys. Next, they received two daily surveys (morning and bedtime questionnaire) over the course of 5 consecutive workdays (Monday to Friday). We chose a time period of 1 week for data collection as participants had to complete two surveys per day and we aimed to retrieve a large sample with low attrition rates (e.g., Ohly et al., 2010). Previous studies using similar constructs had shown that the time period works well (e.g., Breevaart et al., 2012; Cambier et al., 2019; Eichberger et al., 2021; Reinke and Ohly, 2021). The morning survey took ~5 min to complete and had to be filled out in the morning before work. Participants could only fill out the survey if they were planning to work on the respective day. The bedtime survey took ~2 min to complete and had to be filled out before going to bed. Participants could only fill out the survey if they had worked on the respective day.

In the general survey, informed consent from all individual participants was obtained and inclusion criteria had to be fulfilled: Participants had (a) to work at least 20 h, (b) regularly between 6 a.m. and 8 p.m., (c) were not allowed to do shiftwork or on-call duty, and (d) had to engage in TASW (at least "seldom"). For our final sample, we only included data from participants who provided at least one matching day-level data set (evening survey and the following morning survey) and if the processing time per item was more than 1 s in all daily surveys. We could only include data points from Monday evening until Friday morning, resulting in a maximum of four matching data sets per person.

In the general survey, 466 respondents qualified for participation in the daily surveys. Of these 466 respondents, 240 failed to provide at least one matching day-level survey set. Another 11 participants were excluded for completing the surveys too quickly (i.e., processing time per item was under 1 second). Therefore, the final sample for our analyses consisted of 215 participants (89 women, 41.4%) who completed a total of 686 daily survey sets. Age ranged from 20 to 65 years ($M = 43.69$ years, $SD = 11.16$); 32.6% reported having at least one child living at home. The most frequent educational level was master's degree or diploma (30.2%), followed by vocational training (25.6%), high school degree (13.0%), and bachelor's degree (11.6%). Participants worked in diverse industries, including the service sector (23.3%), finance and insurance (9.8%), and IT/telecommunications (8.4%). The professional experience ranged from 1 to 46 years ($M = 15.52$ years, $SD = 11.91$), and the mean working time was 38.65 hours per week

($SD = 6.39$), ranging from 20 to 60 hours. Participants had either full-time or part-time jobs or were self-employed (79.1%, 10.7% and 10.2%, respectively); 30.7% had leadership responsibilities.

Measures

The general survey assessed demographics. In the daily surveys, we measured our study variables.

TASW event occurrence and TASW event appraisal

We measured TASW event occurrence and TASW event appraisal after hours in the evening survey. Following appraisal theories (Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996), we assessed TASW event occurrence and TASW event appraisal after hours separately. For TASW event occurrence, we build on validated scales measuring TASW in general (Fenner and Renn, 2010; e.g., Derks and Bakker, 2014) and the event taxonomy developed by Braukmann et al. (2018). We adapted two items measuring TASW event occurrence. We measured TASW event occurrence with the items "Today, in my free time, I continued to work on or completed unfinished work tasks" (TASW event *continuing work tasks*) and "Today, I was contacted in my free time for professional reasons (e.g., via smartphone, e-mail, SMS)" (TASW event *being contacted*). Participants were asked to indicate if they had experienced the events in the evening (1 = yes, 0 = no).

When participants indicated TASW event occurrence, they were asked to also indicate TASW event appraisal. The items read "How did you feel about continuing or completing unfinished work tasks today?" (TASW event *continuing work tasks*) and "How did you feel about being contacted today in your free time for professional reasons?" (TASW event *being contacted*). As we were interested in the effects of TASW event appraisals, we chose to use a scale ranging from a negative, through a neutral to a positive labeling. Consequently, both items were rated on a 5-point scale ranging from −2 (*very stressful*) to 2 (*very enriching*), with 0 as a neutral mean. For days on which both events were appraised, we included the mean of both TASW event appraisals in our main analysis.

Psychological detachment

We measured psychological detachment with regard to the previous evening in the morning survey, using four items from the Recovery Experience Questionnaire (REQ; Sonnentag and Fritz, 2007), adapted for day-specific assessment. A sample item is "Yesterday evening, I forgot about work". Responses were provided on a 5-point Likert scale ranging from 1 (*I fully disagree*) to 5 (*I fully agree*). The within-person Cronbach's α was 0.88; the between-person Cronbach's α was 0.98.

Work engagement

We measured work engagement with regard to the upcoming work day in the morning survey, using the nine-item Utrecht Work Engagement Scale (UWES-9; Schaufeli et al., 2006), adapted for daily predictive assessments. Sample items are "When I think of the upcoming workday, I am full of energy" for vigor, "…I am enthusiastic about my work" for dedication, and "…I am looking forward to working intensively" for absorption. Responses were provided on a 5-point Likert scale ranging from 1 (*I fully disagree*) to 5 (*I fully agree*). The within-person Cronbach's α was 0.88; the between-person Cronbach's α was 0.99.

We presented the items measuring psychological detachment on a separate webpage and temporally before the items assessing work engagement.

Construct validity

We ran multilevel confirmatory factor analyses (CFA) with latent factors at the day and the person level to examine the construct validity of our measures. We specified three different models containing the items of psychological detachment and work engagement (items on TASW event occurrence and TASW event appraisal are excluded as these display manifest items). Specifically, we modeled a 1-1-model, a 2-1-model and a 2-2-model. The results can be obtained from Table 1. Overall, model 3 had a good model fit and fit the data better than the other two models. As a result, we conclude that the measures psychological detachment and work engagement capture two distinct constructs on both levels.

Analytical strategy

For data preparation, we used IBM SPSS Statistics (Version 28). For all other analyses, we used R Version 4.1.1. Cronbach's α was calculated on both levels, using the semTools package (Jorgensen et al., 2022). Because days were nested within individuals, we calculated the intraclass coefficients (ICCs) for our study variables using the multilevel package (Bliese, 2022) and found substantial between-person variance for all day-level variables (see Table 2). As a result, we conducted multilevel path analysis using the lavaan package (Rosseel, 2012), applying the maximum likelihood estimation method with robust standard errors (MLR)[1] in both the preliminary and the main analysis.

To test our hypotheses, we modeled all relationships between our day-level variables on both analytical levels,[2] as recommended by Preacher et al. (2010). With this approach, the variance of day-level variables is decomposed into latent between-person and within-person components. Therefore, path estimates at the day-level represent within-person relationships while person-level relationships represent between-person relationships. Consequently, variance conflation is avoided and centering of

1 We also estimated our models with the ML estimator and obtained on both levels identical results for the estimates and slightly different results for the SEs and *p*-values.

2 We considered age, sex, underaged children, and having leadership responsibilities as control variables for this study. Of these, only underaged children correlated with a study variable (positively with psychological detachment). We tested our hypotheses with and without having children as a control variable and obtained identical results. Therefore, we report the results of the analysis without any control variables.

TABLE 1 Results of the multilevel confirmatory analyses.

Model	Contained factors	χ^2	χ^2/df	CFI	TLI	RMSEA	$SRMR_{within}$	$SRMR_{between}$
M1: 1-1-model	PD + WE; PD + WE	2,006.110*	130	0.729	0.674	0.145	0.340	0.704
M2: 2-1-model	PD, WE; PD + WE	905.857*	129	0.888	0.864	0.094	0.142	0.252
M3: 2-2-model	PD, WE; PD, WE	685.170*	128	0.919	0.902	0.080	0.070	0.081

PD, Psychological detachment; WE, Work engagement. In the column "Contained Factors", a plus (+) symbolizes that the different constructs are specified as one factor, a comma (,) symbolizes that the different constructs are specified as different factors.
*$p < 0.001$.

TABLE 2 Means, standard deviations (SDs), ICCs, and intercorrelations among study variables.

Variable	*M*	SD_b	SD_w	ICC	1.	2.	3.	4.
1. TASW event occurrence [a]	0.37	0.36	0.48	0.29		- [c]	−0.21***	0.08*
2. TASW event appraisal [b]	−0.12	0.73	0.83	0.39	0.02		0.25***	0.34***
3. Psychological detachment	3.58	0.86	0.99	0.61	−0.24***	0.24**		0.26***
4. Work engagement	3.17	0.88	0.94	0.82	0.09	0.39***	0.26***	

M = person-level mean. SD_b = person-level standard deviation. SD_w = day-level standard deviation. ICC = intraclass correlation (ICC1). Correlations below the diagonal are person-level correlations (for correlations with TASW event appraisal $N = 135$; for all other correlations $N = 215$), and correlations above the diagonal are day-level correlations (for correlations with TASW event appraisal $N = 245$; for all other correlations $N = 686$).
[a] 0 = no TASW event occurred, 1 = at least one of both TASW events occurred. [b] Higher values indicate a more positive appraisal. [c] As the day-level values for TASW event appraisal are only available for TASW event occurrence = 1, a correlation between both variables cannot be calculated on the day level.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

variables is not necessary (Preacher et al., 2010). To test the indirect relationship (H4), we followed recommendations by Preacher and Selig (2012) and used Monte Carlo simulation procedures. Specifically, we calculated 95% Monte Carlo confidence intervals (CIs) with 20,000 replications in the semTools package (Jorgensen et al., 2022).

Results

Descriptive analysis

The 215 participants provided 686 matching survey sets (on average 3.19 days per person). However, TASW event occurrence and, therefore, TASW event appraisal was only reported by 135 participants in 245 matching survey sets ($M = 1.81$ days per person). More specifically, 80 participants provided no data on TASW event appraisal (37.2%), whereas 62 participants provided data on TASW event appraisal on only one evening (28.8%), 42 on two evenings (19.5%), 25 on three evenings (11.6%), and six on four out of the four evenings (2.8%).

Table 2 presents the means, standard deviations at the day and the person level, intraclass correlations (ICC1) as well as bivariate correlations. We averaged the day-level variables across days to calculate all bivariate correlations on the person level. As hypothesized, all study variables correlated significantly positively with one another, both on the day and the person level. However, TASW event occurrence correlated significantly negatively with psychological detachment on both levels. A positive correlation between TASW event occurrence and work engagement reached significance only on the day level.

Preliminary analysis

In this study, TASW event appraisal was only reported on days with TASW event occurrence. Therefore, we chose to also analyze the effects of TASW event occurrence on daily psychological detachment and work engagement as a preliminary analysis. We conducted multilevel path analysis in one overall two-level model with parallel paths on both levels. Specifically, we modeled direct paths from TASW event occurrence on daily psychological detachment and work engagement as well as from daily psychological detachment on work engagement. We further modeled an indirect effect of TASW event occurrence on work engagement via psychological detachment. This model had a good fit, $\chi^2 = 75.791$, df = 6, $p < 0.001$; CFI = 0.812; RMSEA = 0.000; $SRMR_{within} = 0.000$; $SRMR_{between} = 0.002$. The results for both levels are shown in Table 3.

At the day level, most relationships were in line with previous studies. TASW event occurrence after hours was negatively related to psychological detachment in the evening (est. = −0.32, $p < 0.001$). Further, psychological detachment in the evening was positively related to work engagement the next morning (est. = 0.18, $p < 0.001$). Also, psychological detachment mediated the relationship between TASW event occurrence after hours and work engagement the next morning (est. = −0.06, CI [−0.10; −0.03]). However, TASW event occurrence after hours was not directly related to work engagement the next morning (est. = 0.04, $p = 0.445$).

At the person level, TASW event occurrence was negatively related to psychological detachment (est. = −0.73, $p = 0.019$). Further, psychological detachment was positively related to work engagement (est. = 0.35, $p < 0.001$). Contrary to the day level, TASW event occurrence was positively related to work engagement

TABLE 3 Results from the multilevel path analysis for the preliminary analysis.

Level and variable	Psychological detachment			Work engagement		
	Est.	SE	*z*	Est.	SE	*z*
Person-level						
Intercept	3.83	0.11	35.94***	1.66	0.38	4.38***
TASW event occurrence [a]	−0.73	0.31	−2.36*	0.82	0.33	2.50*
Psychological detachment				0.35	0.10	3.67***
Indirect effect [b]				−0.25	0.14	−1.78
Day-level						
TASW event occurrence [a]	−0.32	0.07	−4.62***	0.04	0.04	0.80
Psychological detachment				0.18	0.03	6.40***
Indirect effect [b]				−0.06	0.02	−3.74***
R^2 person-level	0.059			0.123		
R^2 day-level	0.043			0.081		

$N_{persons} = 215$, $N_{days} = 686$. Estimates are unstandardized estimates from one overall two-level model test in R using the lavaan package (Rosseel, 2012).
[a] 0 = no TASW event occurred, 1 = at least one of both TASW events occurred. [b] Indirect effect of TASW event occurrence on work engagement via psychological detachment.
*$p < 0.05$. ***$p < 0.001$.

TABLE 4 Results from the multilevel path analysis for the main analysis.

Level and variable	Psychological detachment			Work engagement		
	Est.	SE	*z*	Est.	SE	*z*
Person-level						
Intercept	3.37	0.09	38.51***	2.26	0.42	5.39***
TASW event appraisal [a]	0.83	0.23	3.61***	0.55	0.21	2.61**
Psychological detachment				0.32	0.13	2.56*
Indirect effect [b]				0.26	0.11	2.34*
Day-level						
TASW event appraisal [a]	0.02	0.10	0.15	0.12	0.05	2.57*
Psychological detachment				0.16	0.05	2.97**
Indirect effect [b]				0.00	0.02	0.15
R^2 person-level	0.233			0.303		
R^2 day-level	0.000			0.126		

$N_{persons} = 135$, $N_{days} = 245$. Estimates are unstandardized estimates from one overall two-level model test in R using the lavaan package (Rosseel, 2012).
[a] We used a scale ranging from−2 (very stressful) to +2 (very enriching) with a neutral middle. Higher values indicate a more positive appraisal. [b] Indirect effect of TASW event appraisal on work engagement via psychological detachment.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

(est. = 0.82, $p = 0.012$), whereas psychological detachment did not mediate this relationship (est. = −0.25, CI [−0.04; 1.15]).

Main analysis

As participants could provide TASW event appraisal only on days with TASW event occurrence, all days without TASW event occurrence were automatically excluded from the main analysis. This resulted in a smaller sample size (245 observations nested in 135 persons) compared to the preliminary analysis. Table 4 shows the results from the multilevel path analysis of our overall two-level model with parallel paths on both levels.[3] This model had a very good fit, $\chi^2 = 56.125$, df = 6, $p < 0.001$; CFI = 0.989; RMSEA = 0.000; $SRMR_{within} = 0.000$; $SRMR_{between} = 0.000$.

At the day level, the results reveal that a more positive TASW event appraisal after hours was positively related to work engagement the next morning (est. = 0.12, $p = 0.010$). Therefore, Hypothesis 1 was supported. However, we did not find a significant relationship between TASW event appraisal

3 Because of the high percentage of singletons (i.e., only one data set per person), we tested our hypothesized model with and without them and obtained identical results on the day level. Therefore, we report the results including the singletons.

after hours and psychological detachment in the evening (est. = 0.02, $p = 0.879$). Thus, Hypothesis 2 was not supported. Further, psychological detachment in the evening was positively related to work engagement the next morning (est. = 0.16, $p = 0.003$), supporting Hypothesis 3.

Hypothesis 4 suggested a positive indirect relationship between TASW event appraisal after hours and work engagement the next morning via psychological detachment in the evening on the day level. In our path analysis, we found no indirect effect (est. = 0.00, $p = 0.878$). This is supported by the calculated Monte Carlo CI of [−0.032; 0.036]. Thus, Hypothesis 4 was not supported.

Although we do not have hypotheses on the person level, we find it important to point to the following findings. In line with the day-level results, at the person level a more positive TASW event appraisal (est. = 0.55, $p = 0.009$) and psychological detachment (est. = 0.32, $p = 0.011$) were positively related to work engagement. Contrary to the day level, a more positive TASW event appraisal was also positively related to psychological detachment (est. = 0.83, $p < 0.001$) on the person level. Finally, psychological detachment mediated the relationship between TASW event appraisal and work engagement (est. = 0.26, CI [0.06; 0.50]).

Discussion

The aim of our study was (1) to investigate whether TASW event appraisal affects psychological detachment and work engagement on a daily basis and (2) whether psychological detachment mediates the relationship of TASW event appraisal on work engagement. With this, we aimed to contribute to the question of whether it is the mere occurrence of TASW events or rather their specific appraisal that affects employees' wellbeing and motivation. In the following we discuss three key findings:

First, we found no relationship between daily TASW event occurrence and daily work engagement which is in line with previous diary studies (e.g., van Laethem et al., 2018; Darouei et al., 2023). However, as hypothesized, when TASW events occurred, a positive appraisal was associated with higher levels of daily work engagement. This supports meta-analytic findings conducted at both the day and person level (Kühner et al., 2023) and is also in line with the assumption of appraisal theories (Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996) which state that it is the specific appraisal and not the event *per se* that determines an individual's reaction to the event. Interestingly, at the person level, both TASW event occurrence *and* TASW event appraisal were positively related to work engagement. That is, participants who—on average—experienced more TASW events over the course of our study also reported higher levels of work engagement. Similarly, participants who appraised the experienced TASW events as more positive in general, also reported higher levels of work engagement. This could imply that TASW occurrence can foster work engagement over a longer period of 1 week. However, it is also possible that we see a reverse effect, such that participants with—on average—higher levels of work engagement are more likely to work after hours.

Second, turning to psychological detachment, we found that the mere occurrence of TASW events after hours had a negative effect on psychological detachment in the evening. We found no association between daily TASW event appraisal and psychological detachment. Taken together, these results suggest that the daily *occurrence* of TASW events is always detrimental to employees' psychological detachment, regardless of their specific *appraisal*. These findings are in line with previous studies: in a study by Braukmann et al. (2018), participants reported lower levels of psychological detachment on days when positive as well as negative TASW events occurred. Also, Reinke and Ohly (2021) found that a (more) positive appraisal of TASW did not affect psychological detachment in the evening. To explain the effects of daily TASW events on psychological detachment we need to go back to the assumption made by the Effort-Recovery Model (Meijman and Mulder, 1998) which states that recovery can only occur when employees are not confronted with work demands. While we hypothesized a mediating effect on work engagement through psychological detachment building on the Broaden-and-Build Theory (Fredrickson, 2001), the finding of this study rather nourishes the assumption of parallel processes—health impairment and motivational process—as proposed by the Job Demands-Resources Model (Bakker and Demerouti, 2007). TASW events impair health as they negatively affect psychological detachment which serves as a measure for wellbeing. At the same time, TASW events have the potential to evoke a motivational process and lead to work engagement *if* appraised positively as discussed in the previous paragraph.

The third key finding concerns the mediating effect of daily psychological detachment. Psychological detachment in the evening mediated the relationship between TASW event occurrence after hours and work engagement the next day. In other words, daily TASW event occurrence is detrimental to employees' ability to detach from work-related issues. This lack of psychological detachment leads to employees not being able to replenish their resources to the pre-work level, resulting in lower levels of work engagement the next day (cf. Meijman and Mulder, 1998). Here, we clearly see that it is the mere occurrence that matters for psychological detachment. Turning to TASW event appraisal, we found that, contrary to our hypothesis, psychological detachment in the evening did not mediate the positive relationship between daily TASW event appraisal and work engagement the next morning. Thus, psychological detachment does not explain this relationship. We therefore turn to an alternative explanation of this process: an employee who appraises a TASW event positively (e.g., they receive praise from their supervisor during a phone call) may not stop thinking about work (i.e., they do not detach as initially argued). Instead, they continue to think positively about their work which increases their work engagement the next day. This explanation is entirely hypothetical. Future studies should therefore explore mediators, such as positive work reflection (Cropley et al., 2012; Jimenez et al., 2022). Turning to the person level, we found that the findings are reversed. Psychological detachment mediated the relationship between TASW event appraisal and work engagement. This indicates that employees who generally appraised TASW events as more positive, also reported higher levels of psychological detachment. This higher level of psychological detachment fosters employees' work engagement over the course of 1 week. However, when looking into TASW event occurrence also

at the person level, we see that TASW event occurrence taken alone is indeed harmful for psychological detachment. This lines up with the daily results.

In summary, the results of our study imply that TASW event occurrence is detrimental to employees' psychological detachment, both on the day and the person level. However, under certain circumstances—namely a positive appraisal of these TASW events—engaging in TASW after hours is beneficial for employees' work engagement on the day level and over the course of 1 week.

Limitations and future research

The first limitation of this study are the response options we used for TASW event appraisal. We were especially interested in potential positive effects of TASW events but did not want to leave out possible negative effects entirely. For reasons of parsimony, we chose to use single items for TASW event appraisal which had to be answered on a single scale. As a consequence, we chose to use a scale ranging from very stressful (representing a negative appraisal) through neutral to very enriching (representing a positive appraisal). However, this also came along with some disadvantages. Whereas appraisal theories (Lazarus and Folkman, 1984; Weiss and Cropanzano, 1996) assume that the appraisal of an event is either negative, neutral or positive, research suggests that people can perceive events as ambivalent, that is, they experience positive and negative aspects simultaneously (Ashforth et al., 2014). Specifically, the scale we used may have forced participants to average their appraisal (e.g., make an overall judgement when events had both positive and negative aspects), resulting in a neutral appraisal. Indeed, we found most TASW events were appraised as neutral. Previous studies indicate that both a negativity bias (i.e., negative aspects of events are more salient and dominant and, therefore, have a greater impact on one's perceptions and behaviors, resulting in a more negative appraisal of the event, cf. Baumeister et al., 2001; Rozin and Royzman, 2001) as well as a positivity bias (i.e., the tendency to use positive words more often and have positive experiences to a higher frequency than negative ones, cf. Podsakoff et al., 2023) exist. As both biases represent general tendencies, they may have skewed the daily appraisals on our scale in one or the other direction (Podsakoff et al., 2023).We can assume that when negativity bias is more pronounced in participants, they are more inclined to appraise TASW events as negative despite positive aspects in an event. Likewise, participants with a more prone positivity bias may have been more inclined to appraise TASW events as positive despite negative aspects. Therefore, future studies should investigate general negativity and positivity biases among participants and include separate items on positive and negative appraisal.

Second, we did not test how different features of TASW events affect TASW event appraisal. For instance, the frequency, duration, and intensity of TASW events are likely to affect how they are appraised. Receiving one short work-related call after work may be appraised differently to one long or multiple short calls due to a longer or repeated disturbance. It may also directly affect psychological detachment as a longer duration or higher frequency of TASW events decreases the time left for psychological detachment. Next, TASW event appraisal may be influenced by the predictability (synchronous vs. asynchronous availability) and content (pleasant vs. unpleasant news) of the TASW event as well as the importance of the situation when being interrupted (e.g., receiving a phone call while not being occupied vs. while spending quality time with family or friends), the motivation to engage in TASW events (i.e., controlled vs. autonomous motivation; cf. Reinke and Ohly, 2021) or the initiator of the TASW event (self- vs. other-initiated; Kühner et al., 2023). Also, more enduring variables may affect the relationship between TASW event occurrence, TASW event appraisal and their outcomes. For instance, a general obligation to engage in TASW may be perceived as feelings of external control and limited autonomy (Ohly and Latour, 2014). As a consequence, employees who feel obliged to engage in TASW events may appraise them more negatively (Chesley et al., 2013) which is likely to lead to rumination about work and lower work engagement. Next, employees' boundary management preference (i.e., preference to separate the work from other life domains vs. to integrate them, Kreiner, 2006) may affect TASW event appraisal: employees with higher segmentation preferences may appraise TASW events more negatively. Future studies should combine quantitative and qualitative aspects of TASW events as well as person-level variables which may influence the daily relationships between TASW events and different wellbeing and motivational outcomes.

Third, as stated in the extended SDM (Sonnentag and Fritz, 2015), we can assume that TASW event appraisal may moderate the relationship between TASW event occurrence and psychological detachment. Unfortunately, due to the operationalization of TASW event occurrence (yes = 1 vs. no = 0) and TASW event appraisal (only if TASW event occurrence = 1), we were not able to analyze an interaction between occurrence and appraisal. To address these limitations, future studies could apply an event-sampling design. For example, participants could fill out a short survey after every TASW event occurrence, indicating which event(s) they experienced, how they appraised them, and possibly providing additional information such as on the duration or content of the events. This may help to minimize recall bias (Shiffman et al., 2008) and provide a more nuanced picture of the relationship between TASW event occurrence and TASW event appraisal. As a result, researchers may generate a more sophisticated database, which may provide them with the information necessary to analyze interactions.

Fourth, in contrast to previous studies on TASW, we focused on solely two aspects of TASW (i.e., being contacted and continuing work tasks). We did not include other TASW events, such as self-initiated contacts using ICT (e.g., calling a colleague) or availability expectations. Therefore, we cannot rule out the possibility that additional TASW events occurred in addition to the events investigated in this study. Furthermore, as these two TASW events represent two distinct types of TASW, it would have been interesting to also calculate their specific effects on psychological detachment and work engagement separately. Unfortunately, the small sample size on the day level is already small. Conducting separate analyses for both TASW events would result in even smaller sample sizes and in power problems. Further, it needs to be mentioned that 62 participants provided only one matching data

set. Including these so-called singletons does not provide additional information on the day level (Bell et al., 2008). As there is only one data point to estimate person-level effects, the person-level estimates may be biased (Bell et al., 2008), especially for variables that are highly fluctuating from day to day. Consequently, our person-level results should be interpreted with caution. In this context, we also have to discuss that work engagement showed low variation at the day level with only 18% of variance (ICC = 0.82). Usually, we can calculate with 30% to 40% of the variance in daily work engagement (cf. Breevaart et al., 2012). This made it more difficult to find day-level effects on work engagement in our study. To increase the number of days with TASW event occurrence and TASW event appraisal, future studies should extend the survey period. This may include daily surveys over two or more work weeks as well as longer-term studies (e.g., on a weekly basis over several weeks or months). The latter would help to understand long-term and cumulative effects of TASW events.

Our data collection took place in November 2020. At the time, the second wave of the COVID-19 pandemic had started and employers were advised to allow their employees to work from home whenever possible. Also, employees were given more flexibility regarding their working hours in order to meet the demands of this particular time (e.g., avoiding internet outages during peak working hours; homeschooling and taking care of their children). Thus, employees may have shifted their working time to early mornings and late evenings or fragmented their work time into smaller but more time segments. We asked for TASW event occurrence and TASW event appraisal during the participants' free time. However, they may have perceived the events as regular work, resulting in fewer TASW event occurrence and influencing the reported TASW event appraisal. Indeed, working from home has been found to be positively related to the extent of TASW and the positive appraisal of TASW on the day level (Darouei et al., 2023). This needs to be taken into account when interpreting and generalizing the findings.

Finally, another methodological limitation concerns the timing of the daily surveys and the resulting time lags. We instructed the participants to complete the evening surveys as close to their bedtime as possible so that the time lag between the end of their work day and the survey completion would be as long as possible. With this, we aimed to maximize the period for potential TASW occurrence. As we have a diverse sample of employees (i.e., different industries and a range in the working hours per week) with different daily routines (e.g., work schedules, bedtime and wake up time), we chose a time frame for the completion (i.e., between 7 pm and 12 pm) rather than a specific time point. Therefore, we cannot rule out that participants filled out the daily surveys right after their work day or in the middle of the evening. As a consequence, participants may have reported no TASW event occurrence in their evening surveys, but engaged in TASW events afterwards. To control for the respective time lags between daily survey points, future studies should specifically ask and control for these time lags. For example, they could ask participants for the exact time of their work day's end and use the survey completion time recorded by the system. Another option is to ask participants in the morning whether they experienced TASW events after the evening survey.

In addition to the limitations addressed above, we also wish to highlight one implication for future research on TASW, extended and remote work. As ICT provide higher flexibility for employees in terms of time and place, they do not only blur the boundaries between work and private life (Mullan and Wajcman, 2019) but may also blur employees' definition of what counts as their actual working time vs. their off-job time. Hence, different employees may understand work in the evening as working time vs. work during their off-job time. As a consequence, some participants may have experienced TASW events (e.g., they continued a work task in the evening) but answered "no" to the respective items because they understood them as work extension (Mullan and Wajcman, 2019; Hoppe et al., 2023). As the question of what counts as working time and what does not can differ more and more on an individual or even the day level, future studies could ask directly what participants consider to be their working time and what is work during off-job hours (i.e., TASW)—in general (e.g., during a baseline questionnaire) or on a daily basis (e.g., during every evening questionnaire).

Practical implications

Our findings imply that employees experience TASW events in their free time regularly over the course of a week. However, TASW event appraisal and its consequences vary from day to day. Whereas the mere TASW event occurrence is detrimental to psychological detachment in the evening, a more positive appraisal of such events is beneficial for employees' work engagement the next morning. Therefore, if employees cannot avoid or wish to continue work tasks or to be available for work-related contacts after hours, they should be supported to experience positive events to the largest possible share compared to negative events (cf. Ohly and Draude, 2021). This has two major practical implications. First, arrangements regarding different forms of remote work should be individualized, and strict limits or prohibitions of TASW should be avoided (Ohly and Latour, 2014; Reinke and Ohly, 2021). Likewise, TASW should not be generally expected from employees. Both strict limitations as well as generally expected TASW can be perceived as feelings of external control and limited autonomy (Ohly and Latour, 2014) which, in turn, may result in more negative TASW event appraisals. Nevertheless, to ensure that cooperation with colleagues or customers functions well, employees and supervisors should openly discuss and communicate their preferences. For instance, they could use their e-mail signature or out-of-office notification to share information on their (non-)availability or response times.

Second, organizations could arrange trainings or workshops to raise awareness of the potential consequences of TASW (for an overview of practical examples, see Eurofound, 2021). Such trainings could help employees to identify which events may be potentially more positive or negative. Thus, employees may be supported in managing their (non-)availability times outside of regular work hours or the office. Especially when employees cannot avoid engaging in TASW (e.g., when TASW is necessary to meet their workload), this knowledge may help them to organize work tasks in such a way that they experience positively appraised TASW events.

Conclusion

Our results indicate that the mere occurrence of TASW events is detrimental to employees' psychological detachment from work—irrespective of how they are appraised. Moreover, a positive TASW event appraisal on days with TASW events was associated with higher levels of work engagement the following day. Taken together, these findings imply that engaging in TASW events after hours is detrimental to one's wellbeing but can also be beneficial for one's work engagement under certain circumstances, namely when engagement in TASW is appraised as positive. This finding sheds light into the double-edged effects of TASW (cf. Diaz et al., 2012; Kühner et al., 2023) and may help to solve the "high-performance-low-wellbeing paradox" (Schöllbauer et al., 2021). Therefore, we encourage researchers to build on our results and consider both occurrence and appraisal of TASW events in future studies along with our suggestions for more fine-grained measurement of TASW.

Data availability statement

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

Ethics statement

The studies involving humans were approved by Ethics Committee of the Department of Psychology, Humboldt-Universität zu Berlin. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LK: Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Visualization, Writing—original draft, Writing—review & editing. AD: Conceptualization, Resources, Supervision, Writing—review & editing. AH: Conceptualization, Resources, Supervision, Writing—review & editing.

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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.

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Balancing work and private life: when does workplace flexibility really help? New insights into the interaction effect of working from home and job autonomy

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Introduction: Empirical research has reported variable and inconsistent findings regarding the relationship between working from home (WFH) and work-life balance (WLB). We propose that the inconsistency in the relationship between WFH and WLB may be due to unexplored moderators of this relationship. The work characteristic "job autonomy," defined as the degrees of freedom in terms of time and content, is examined as one such possible moderator. We address the question of whether different types of negative spillover (strain-based and time-based spillover) from work to private life are dependent on an interaction effect between the use of WFH and job autonomy.

Method: Experienced occupational psychologists analyzed heterogeneous workplaces in an organization over a whole shift using a task-related instrument (TAG-MA: Tool for task analyses and job design in jobs with mental work requirements). The degrees of freedom in terms of content and time were assessed within this. Online questionnaires were used to measure WFH use, perceived job demands, and negative spillover from work to private life. Four moderator models were tested in a sample of 110 employees from various occupations.

Results: The results show that WFH is associated with a decrease in negative work-life spillover, especially when people have limited autonomy at work.

Discussion: The results are discussed and differentiated in more detail for the different types of spillover. The implications for health-promoting work design are derived.

KEYWORDS

remote work, working from home (WFH), job autonomy, content-related degrees of freedom, temporal degrees of freedom, work-life balance (WLB), negative spillover

1 Introduction

The shift to remote working during the pandemic has renewed interest in the question of whether increasing work flexibility, in particular working from home (WFH), improves or jeopardizes employees' work–life balance (WLB) and health. After all, WFH leads to a merging of generally separate domains of life and the roles of people within these domains. It is obvious that this can affect work–life balance. Specifically, the demands from different life domains can overlap. This can result in an intra-individual transmission of *time* (e.g., longer working hours can impair recovery processes, more housework can reduce work performance) and a transmission of *strain* (e.g., strenuous work activities reduce the energy for private activities),

as well as a transmission of domain-specific *behaviors* (e.g., incompatible role behavior at work and home) from one life domain to the other. The term *spillover* has been introduced for this purpose (Edwards and Rothbard, 2000; Bakker and Demerouti, 2013). While positive spillover of time, strain, or behavior improves WLB (Hill et al., 2001; Ferguson et al., 2012; Greenhaus et al., 2012), negative spillover impairs WLB and can lead to conflict (Syrek et al., 2013; Brough et al., 2014; Haar et al., 2019). In the literature to date, flexible work arrangements, in general, and working from home, in particular, have mostly been seen as a resource for balancing work and private demands (e.g., Gajendran and Harrison, 2007; Morganson et al., 2010; Nijp et al., 2012; Ter Hoeven and Van Zoonen, 2015). This assumption can initially be explained by the fact that when WFH, the physical distance between work and home (or domestic responsibilities) is eliminated, allowing individuals to save a significant amount of time. The time saved in this way increases temporal autonomy and planning flexibility. This applies equally to working and non-working domains, as well as the coordination of both. Increased temporal autonomy is also seen as a possible explanation for the finding that WFH is associated with increased sleep duration (Hazak et al., 2020; Staller and Randler, 2021). Improved sleep, in turn, is an important resource for coping with daily demands in all areas of life (Staller and Randler, 2021). However, some negative effects of WFH have also been reported. Indeed, there is some evidence that WFH leads to poorer WLB for those who are forced to work remotely but find it difficult to define boundaries between work and non-work (e.g., Allen et al., 2021). Furthermore, work-related satisfaction has been shown to decrease when remote workers do not perceive organizational support (defined as the extent to which the organization values their contributions and cares about their wellbeing; Bentley et al., 2016). Additionally, a lack of structure when WFH can promote an increase in work effort (Rupietta and Beckmann, 2016) and an extension of working hours (Wöhrmann et al., 2020; Backhaus et al., 2021) as well as a general intensification of work, increasing an imbalance in life domains (Shirmohammadi et al., 2022). According to the role scarcity hypothesis (Edwards and Rothbard, 2000; Barnett, 2014), it is assumed that people only have a limited amount of role resources (e.g., energy, time). Spillover can therefore always arise when different roles or life domains rely on the same resources. If there is an increased time overlap between the demands of work and private life when WFH, negative spillover effects can increase (Schuller and Rau, 2013).

The current state of research does not provide a clear answer as to whether WFH improves or worsens WLB. Simplified statements about the general impact of WFH on WLB should therefore be treated with caution. The question arises as to whether the influence of WFH on the occurrence of WLB is dependent on additional moderating influences and circumstances. Beigi et al. (2018) locate sources of moderating influences either within the person (e.g., preference for boundary management), in a situational context (e.g., career or family), or in the work itself (e.g., specific work characteristics). The focus of this study is to investigate possible moderating influences of work characteristics on the relationship between WFH and WLB.

If we first look at the research that deals with negative spillover effects from work to non-work, negative spillovers are mainly found to occur as a result of poor working conditions. A large body of research shows that high job demands (such as long working hours, high work pressure) and a lack of control in the workplace have a strong association with high levels of negative work–life spillovers (Bakker et al., 2011; Ikeda et al., 2021), even in longitudinal studies (Demerouti et al., 2004; Butler et al., 2005; Oshio et al., 2017). According to the job demands/resources theory (Bakker and Demerouti, 2017), autonomy can act as a buffer against high demands. It facilitates wellbeing, reduces strain, and prevents the spillover of strain into other areas of life (see also the meta-analysis by Matei et al., 2021). However, high job autonomy does not only have a buffering function. Drawing on German action theory, Hacker and Sachse (2013) argue that job autonomy allows employees to choose appropriate strategies to deal with work situations and tasks, resulting in feedback and the learning of new competencies. For example, people with high autonomy at work are able to try out new ways of working and consequently learn new skills for problem-solving and work organization (Rau, 2006; Van Ruysseveldt and van Dijke, 2011). All these skills, in turn, also are prerequisites for the full use of autonomy in the workplace, in general (Hacker and Sachse, 2013), and remote working or WFH, specifically (Charalampous et al., 2019). In line with this, Dettmers and Bredehöft (2020) argue that employees in flexible work arrangements (e.g., WFH) should be equipped with self-organization skills in order to avoid impairments to wellbeing. However, the authors are more likely to envisage human resource development measures, while a high degree of autonomy at work allows these skills to be learned by doing.

Specifically, because of these two functions of job autonomy (buffering of job demands, learning/skill enhancement), the aim of this article is to examine the influence of job autonomy on the relationship between WFH and WLB. Following the German theory of action regulation (Hacker and Sachse, 2013) autonomy is defined as the degree of freedom in terms of content and time available to employees in the accomplishment of their work tasks (see also the next section for a detailed definition of the different degrees of freedom).

Overall, our research question is whether content-related or temporal degrees of freedom at work moderate the relationship between WFH use and perceived negative time-based and strain-based spillover from work to private life.

1.1 Degrees of freedom in terms of time (temporal df) and content (content df) and their relation to WFH and spillover effects from work to private life

Autonomy as a work characteristic can be described as the sum of different degrees of freedom (Hacker and Sachse, 2013). These can be roughly divided into degrees of freedom in terms of time (temporal df) and content (content df). The degree of temporal freedom refers to the discretion of employees to independently determine the temporal sequence of individual activity components or tasks, their duration, to decide on the pace of work and determine the temporal position of work performance within a

working shift (also called "work scheduling autonomy") (Breaugh, 1985; De Jonge et al., 1999; De Spiegelaere et al., 2016). An additional level of temporal degrees of freedom would be the flexibility of working hours (start, end, and timing). This aspect is particularly not included here in the definition of temporal degrees of freedom. The degree of freedom in terms of content refers to the discretion in the choice of work tools and work methods up to the possibility of developing one's own working methods (also called "method autonomy"; see, e.g., Breaugh, 1985; De Jonge et al., 1999; Morgeson and Humphrey, 2006). In its most comprehensive form, degrees of freedom in terms of content allow modifying or determining outcome characteristics or work goals (also called "criteria autonomy"; see, e.g., Breaugh, 1985; De Jonge et al., 1999; Kubicek et al., 2014; Hacker, 2016). The range extends from jobs with no or limited degrees of content-related freedom, which provide stricter guidelines for task completion and leave employees less scope for their own mental input and control during work, to jobs that offer individuals to set and pursue their own work goals. In order for people to use their content-related degrees of freedom, they also need to have sufficient temporal degrees of freedom during work (Hacker and Sachse, 2013). The different degrees of freedom allow for a varying degree of self-determined and self-regulated task completion. Therefore, they are a basis for the development of an intrinsic motivation (Hackman and Oldham, 1976). In conjunction with feedback on the success of one's own actions, a scope for action enables learning and the development of skills (Rau, 2006; Van Ruysseveldt and van Dijke, 2011). Degrees of freedom also allow employees to adapt their own way of working (content df) or at least its temporal process (temporal df) to their current mental and physical state. For example, if an activity is perceived as too strenuous or tiring or if concentration on an activity can no longer be maintained, employees with high job autonomy can cope with different strategies: They could choose an alternative way of working in a self-controlled manner, exchange their current activity for another work-relevant activity, or change their own level of ambition regarding the work performance or outcome. As a result of these changes, the individual's psychological and physical resources required for work will vary. Consequently, resources that are no longer used can be restored (Meijman and Mulder, 1998; Geurts and Sonnentag, 2006; Zijlstra et al., 2014).

The question arises as to what role job autonomy plays in a possible relationship between WFH and WLB. Relatively little is known about the relationship between the temporal degrees of freedom at work and WLB. This type of temporal autonomy is usually tested as part of the overall autonomy (tested as job autonomy or job control) at work. A lack of job autonomy, including temporal autonomy, has been shown to strongly relate to negative spillover from work to private life (Aryee, 1992; Butler et al., 2005; Grzywacz and Butler, 2005; Schuller et al., 2012). One study that explicitly measures the level of job autonomy regarding work speed indicates that this type of autonomy is negatively correlated work–life conflict (Nordenmark et al., 2012). More common are studies that examine "temporal flexibility", that is, flexibility in terms of working hours. Regarding temporal flexibility, it can be generally assumed that employees with high temporal degrees of freedom may find it easier to fragment their working hours and thus combine work, private commitments, and leisure time flexibly. Accordingly, there are studies that report greater temporal flexibility can enhance WLB (e.g., Carnicer et al., 2004; Nijp et al., 2012; Tuttle and Garr, 2012; Wöhrmann, 2016). Allen et al. (2013), as well as Shockley and Allen (2007), even stress that the compatibility of demands in both work and private life depends more on flexibility in time than flexibility in place. Golden et al. (2006) further investigate the role of perceived temporal flexibility when WFH and find that WFH reduces work–family conflict at a slightly faster rate when people experience more temporal flexibility. To summarize the results of all the studies, both the degree of temporal freedom at work (process, pace, and duration of task components) and the flexibility of working hours and shifts are associated with a better WLB. We could expect a similar picture regarding the degrees of freedom in terms of *content*. If the work takes place at home (WFH), content-related degrees of freedom offer the opportunity to use this autonomy across life domains. Both the demands of domestic obligations and the opportunities for recreation in leisure time could be varied with the demands of work to suit one's current mental and physical state or one's current prioritization of a life domain. All in all, we assume that the temporal and content-related degrees of freedom at work differ in the way in which they enable the different spheres of life to be combined. When WFH, the temporal degree of freedom at work should allow the coordination and management of time that can be used for work, domestic tasks, or leisure. At best, good timing could create additional leisure time. More than temporal coordination should be possible with sufficient content-related degrees of freedom. The demands of work, domestic tasks, and leisure may be coordinated in terms of content. This could be done by choosing ways of working (for work, domestic tasks, and leisure activities) that require different levels of mental or physical effort and attention. We thus assume to find a direct effect of degrees of freedom on spillover effects, as previous research has reported (Nijp et al., 2012; Ikeda et al., 2021), and additionally a moderating influence of these degrees of freedom on the relation between the use of WFH and spillover effects. We state the following hypotheses:

Hypothesis 1.1: The more *temporal* degrees of freedom at work, the lower (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life.

Hypothesis 1.2: The relationship between the use of WFH (days WFH) and (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life is moderated by the temporal degrees of freedom at work.

Hypothesis 2.1: The higher *content-related* degrees of freedom at work, the lower (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life.

Hypothesis 2.2: The relationship between the use of WFH (days WFH) and (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life is moderated by the content-related degrees of freedom at work.

2 Method

2.1 Participants and procedure

The sample was drawn from a German company located in the municipal services sector in the areas of electricity, gas, water,

and transport. In this company, we conducted risk analyses for all workplaces based on German occupational health and safety law (Arbeitsschutzgesetz), which prescribes that every employer has to analyze workplaces for potential health risks/strain according to mental load. In the first step, the company's workplaces were grouped according to their similarity in terms of job content and context. This grouping was based on a document analysis (job descriptions and organizational charts) and then revised and confirmed by the company's human resource department and managers. In the second step, four professional work psychologists visited the participants at their workplaces to conduct a job analysis. Additionally, all job holders were asked to fill out two questionnaires on (1) their perception of work characteristics, WFH use (days WFH) and socio-demographics and (2) their perception of WLB and wellbeing. These questionnaires were administered separately in time to avoid possible common method bias. Participation in the questionnaires was voluntary. All participants were informed about the study (before both the objective work analyses and the questionnaires) and gave their written consent to participate in the research. In addition, a written declaration of consent for the publication of the data was obtained from each person. Data from the objective measure (objective work analyses) and the subjective measures (online questionnaires) could be linked through encrypted coding. After combining data sources, complete data sets were available for a total number of 110 employees. Of these employees, 32.7% stated they were female, 67.3% male, and none diverse. Employees were between 22 and 65 years old ($M = 48.46$, $SD = 9.92$). Within the sample, there was a wide range of hierarchical positions and an equally wide range of job complexity (from simple tasks to highly complex tasks). Of the 110 employees, 40 were in a supervisory position, a category that includes very different management levels. There was a high range regarding the time spent commuting to work, with a minimum of 1 min and a maximum of 60 min per way ($M = 17.12$, $SD = 9.59$). WFH use varied between 0 and 5 days per week. The average use of people working from home was 1.85 days per week.

2.2 Measures

2.2.1 WFH use (days WFH)

WFH use was measured with an online questionnaire, using two items. First, employees were asked whether they have worked remotely (at home) during the last 4 weeks (dichotomous answer: yes/no). If they answered yes, they were additionally asked how many days they worked from home during this time. A continuous variable (WFH days per week) was calculated based on these items. If people answered no to the first question, their answer was coded as "zero days".

2.2.2 Autonomy/degrees of freedom in terms of content and time

In keeping Spector's (1992, 2006) requirement that work characteristics should be rated independently of job incumbents' autonomy was measured by experts of job analysis (work psychologists) by using the Tool for Task Analyses and Job Design in jobs with Mental Work Requirement (TAG-MA: Rau et al., 2021). The TAG-MA counts as an objective method because it provides a standard protocol for experts to rate work characteristics independent of employees' perceptions. The analysts observe workplaces and conditions over a whole working day evaluating different work characteristics on anchored rating scales of the TAG-MA instrument. In particular, *degrees of freedom in terms of time* were measured by the TAG-MA scale Temporal Degrees of Freedom (A7.1). This scale contains five verbally anchored levels, describing different types of temporal bindings at work. *Degrees of freedom in terms of content* was measured by the two TAG-MA scales Procedural Degrees of Freedom (A7.2) and Decision-Making (A7.3). Both scales contain five verbally anchored levels. The means of the two scales were added for a total value. The assessment of work characteristics took place at the regular workplace. The raters were trained in advance in the use of the TAG-MA instrument. Admission to the rating in the field was only granted if two raters achieved the same results in four trial counseling sessions during the training. The overall interrater reliability for trained experts of the TAG-MA is Cohen's $\kappa = 0.89$ ($p < 0.000$; Rau et al., 2021). Hence, for trained experts (applicable to the raters in this study), there is almost complete agreement on the judgement (Wirtz and Caspar, 2002).

2.2.3 Negative spillover from work to private life

WLB was subjectively assessed (online questionnaire) with two scales of the German "Questionnaire on spillover from work to time for obligatory duties and for leisure" (B-AOF by Schuller and Rau, 2013), measuring two different facets of negative spillover from work to private life. In particular, one scale measures negative *time*-based spillover with four items (e.g., "Because my work schedule is not predictable, I often have difficulties fulfilling my private obligations") and a second scale measures negative *strain*-based spillover, also with four items (e.g., "After I have done my work and fulfilled my private obligations I do not have the energy to enjoy my leisure time"). Answers are rated on a 5-point Lickert scale from 1, *(almost) never*, to 5, *(almost) always*. According to a previous study, the internal consistency of both scales is high, and reliability, validity and economy are given (Schuller and Rau, 2013).

2.2.4 Control variables

We decided to include several control variables in the analysis. First, we added *perceived work intensity* (workload) as a control variable because previous findings such as Schuller et al. (2012) showed that work intensity is highly related to both negative time-based and strain-based spillover. *Perceived work intensity* was assessed using five items from the German questionnaire "Perceived work intensity and job control - FIT" by Richter et al. (2000). Similarly, we included *extended work availability for work tasks* as a covariate as there is evidence that employees who have to be available for work demands after regular working hours experience higher work–life conflict (Dettmers, 2017). Extended work availability was objectively measured by the TAG-MA scale A.9, which contains eight verbally anchored levels (see the earlier description of TAG-MA). Third, *age and gender* (1= female, 2 = male, 3 = diverse) were added as person-related covariates. There

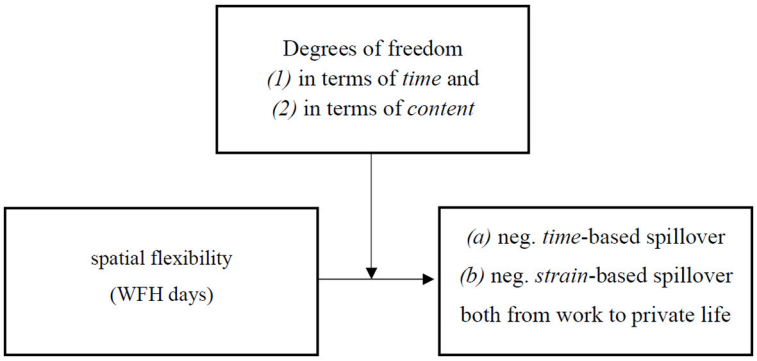

FIGURE 1
Summary of the moderation models 1–4. Control variables are not visualized in this model.

are mixed findings on the role of gender and age influencing the perception of WLB, respectively, conflict (see, e.g., Walia, 2015; Richert-Kazmierska and Stankiewicz, 2016; Pace and Sciotto, 2022). However, a relatively high average age in our sample as well as an unbalanced gender ratio raised concerns that potential sampling effects would bias the analysis. Finally, *commuting time* (minutes) was assessed as long commutes (as well as avoiding long commutes when WFH) could have an impact on how much people experience spillover effects or conflict (Allen et al., 2021; Baek et al., 2023). Age, gender, and commuting time were all self-rated by the employees via the first online questionnaire. Further information on the psychometric quality of the tests and instruments used in this study can be found in the digital appendix (Supplementary Table 1).

2.3 Statistical analyses

Four separate moderation analyses were conducted with IBM SPSS Statistics 25 using the PROCESS macro by Hayes (2018). The PROCESS macro uses ordinary least squares regression, yielding unstandardized coefficients for all effects. Bootstrapping with 5,000 samples was used together with heteroscedasticity-consistent standard errors, HC3 (Davidson and MacKinnon, 1993), to calculate the confidence intervals. In all analyses, *WFH use* (days WFH) was added as the independent variable as well as *age*, *gender*, *commuting time*, *perceived job intensity*, and *extended availability* as control variables. When using the PROCESS macro, the covariates are tested in an overall model with the independent variable and the moderator (simultaneous testing of the effects). In the first two analyses, *temporal df* was added as the moderator. The criterion in analysis 1 was *negative time-based spillover*; in analysis 2, it was *negative strain-based spillover*. In the other two moderation analyses, *content df* was added as the moderator. Again, we added *negative time-based spillover* as the dependent variable in model 3 and *negative strain-based spillover* as the criterion in model 4. Figure 1 shows an overview of the four moderation models. We conducted *post-hoc* power analyses for each of these interaction models using G*Power calculator (Faul et al., 2009). In order to better understand the potential influence of the control variables in the model, all models were also recalculated without covariates. However, the following results mainly refer to the analyses with control variables.

3 Results

3.1 Descriptive statistics

Means, standard deviations, and correlations of all variables used in the study are shown in Table 1. As assessed by visual inspection of scatterplots after LOESS smoothing, the relationships of all variables involved in the four moderation analyses were approximately linear.

3.2 Influence of temporal degrees of freedom and interaction with WFH

First, two moderation analyses were run to determine whether temporal degrees of freedom (main effect) as well as the interaction between temporal degrees of freedom and WFH use significantly predict negative time-based and negative strain-based spillover from work to private life (in reference to hypotheses 1.1a and 1.1b as well as 1.2a and 1.2b). Table 2 displays the relevant model coefficients of both analyses. The overall model with negative *time*-based spillover as the dependent variable was significant, $F_{(8,101)} = 8.166$, $p > 0.001$, predicting 34.68% of the variance. As visible in Table 2, we found a significant negative effect of temporal degrees of freedom on negative time-based spillover and found that temporal degrees of freedom moderated the effect between WFH use and negative time-based spillover from work to private life significantly, $\Delta R^2 = 7.48\%$, $F_{(1,101)} = 16.331$, $p < 0.001$, 95% CI (0.100, 0.327). According to the Johnson–Neyman interval, WFH use reduced negative time-based spillover at the moderator value smaller than 3.618 ($p < 0.05$). At higher moderator values, the conditional effect was insignificant. We found a marginally significant inverse interaction effect with the highest possible value of the moderator variable (temporal $df = 5.000$, $p < 0.10$). Figure 2 visualizes the conditional effect of WFH use on negative time-based spillover. Also, the covariate *perceived job intensity* occurred as a significant predictor in the model (see Table 2). The

TABLE 1 Means, standard deviations, and correlations of all variables including control variables ($N = 110$).

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Neg. time-based spillover	2.25	0.81	1	0.646***	−0.102	−0.244**	−0.023	−0.219*	0.359***	−0.084	0.008	0.063	0.010
2. Neg. strain-based spillover	2.32	0.86		1	−0.047	−0.142	0.069	−0.226*	0.397***	0.047	−0.042	0.054	0.102
3. WFH use	0.86	1.22			1	0.189*	0.071	0.192*	0.091	−0.198*	−0.086	0.318***	0.015
4. Temporal degrees of freedom	3.66	0.87				1	0.577***	0.244*	0.134	0.035	0.107	0.053	0.188*
5. Content-related degrees of freedom	3.91	0.68					1	−0.124	0.403***	0.040	0.416***	−0.007	0.574***
6. Extended availability[a]	7.25	1.69						1	−0.038	0.118	−0.219*	0.045	−0.079
7. Perceived job intensity	2.75	0.74							1	0.098	0.276**	0.098	0.463***
8. Age	48.46	9.92								1	−0.048	0.051	0.208*
9. Gender	1.67	0.47									1	−0.140	0.326***
10. Commuting time (minutes)	17.12	9.59										1	0.062
11. Hierarchical position[b] (supervisor 1 = no; 2 = yes)	1.364	0.483											1

Neg., negative; WFH, working from home.
[a]Counterintuitive scale polarity: the higher the scale value, the better the work design (less risk for extended availability).
[b]Hierarchical position was reported to describe the sample but was not included as a control variable in the analyses.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

TABLE 2 Bootstrap model coefficients (with 95% confidence intervals), model parameters and Johnson-Neyman statistics of moderation analyses 1 and 2 with vs. without covariates (moderator: temporal related df).

	Moderation Analysis 1		Moderation Analysis 2	
	Neg. time-based spillover (Y1)		Neg. strain-based spillover (Y2)	
	Without covariates	With covariates	Without covariates	With covariates
WFH use (X)	−0.982*** (−1.425 to −0.343)	−0.881*** (−1.324 to −0.425)	−0.659* (−1.131 to 0.051)	−0.519* (−0.966 to 0.033)
Temporal degrees of freedom (W1)	−0.397*** (−0.607 to −0.190)	−0.380*** (−0.592 to −0.181)	−0.254* (−0.469 to −0.037)	−0.223* (−0.431 to −0.019)
Interaction	0.251*** (0.097 to 0.368)	0.212*** (0.100 to 0.237)	0.169* (0.001 to 0.289)	0.131* (0.002 to 0.248)
Extended availability[a]		−0.051 (−0.139 to 0.052)		−0.102* (−0.187 to −0.010)
Perceived job intensity		0.456*** (0.278 to 0.630)		0.525*** (0.310 to 0.740)
Age		−0.009 (−0.022 to 0.002)		0.002 (−0.012 to 0.017)
Gender		−0.204 (−0.473 to 0.054)		−0.369* (−0.694 to −0.056)
Commuting time (minutes)		0.003 (−0.012 to 0.016)		−0.001 (−0.018 to 0.017)
F	6.443***	8.166***	2.244	6.435***
R^2	0.170	0.347	0.063	0.288
$F_{(X*W2)}$	16.190***	16.331***	5.460*	4.885*
$\Delta R^2_{(X*W2)}$	0.109	0.075	0.043	0.025
W1-values defining Johnson-Neyman interval	3.491 4.479	3.618	2.567	2.551

[a]Counterintuitive scale polarity: The higher the scale value, the less risk for extended availability.
*$p < 0.05$; ***$p < 0.001$.

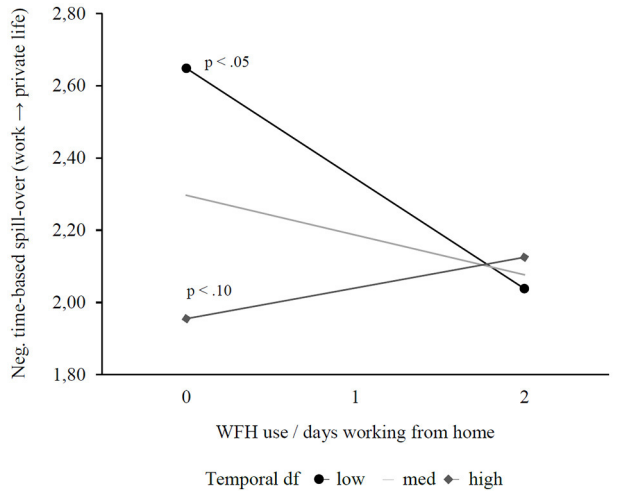

FIGURE 2
Conditional effect of working from home (WFH) use on negative time-based spillover at different values of the moderator (temporal degrees of freedom). For low df., the significant effect occurs with a moderator value ≤ 3.618. For High df., the marginally significant effect occurs with a moderator value ≥ 5.000. The addition of control variables to the model weakens the positive relationship between WFH use and negative time-based spillover at very high moderator values (only a marginally significant effect remains).

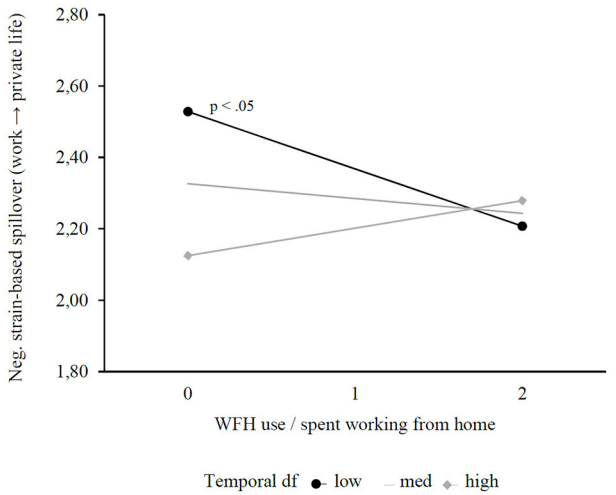

FIGURE 3
Conditional effect of working from home (WFH) use on negative strain-based spillover at different values of the moderator (temporal degrees of freedom). For Low df., the significant effect at moderator values meets below 2.550.

second overall model with negative *strain*-based spillover as the dependent variable was significant as well, $F_{(8,101)} = 6.435$, $p < 0.001$, predicting 28.76% of the variance. We found a significant negative main effect of temporal degrees of freedom on negative strain-based spillover (see Table 2). The results further show that temporal degrees of freedom moderated the effect between WFH use and negative *strain*-based spillover from work to private life, $\Delta R^2 = 2.52\%$, $F_{(1,101)} = 4.885$, $p = 0.029$, 95% CI (0.002, 0.248). There was a significant negative influence of WFH use on negative strain-based spillover at moderator values smaller than 2.55 ($p < 0.05$). At all higher moderator values, the influence was insignificant. The conditional effect of WFH use on negative strain-based spillover is visualized in Figure 3. Of all covariates, perceived job intensity, extended availability and gender occurred as additional significant model predictors (see Table 2). The *post-hoc* power analyses showed high statistical power ($1 - \beta = 0.907$) for the first moderation model (prediction of negative time-based spillover) but little power ($1 - \beta = 0.514$) for the second moderation model (prediction of negative strain-based spillover; Faul et al., 2007). There were two notable differences in results between the analyses with vs. without covariates (for further information, see Table 2). First, both simple moderation models (without covariates) naturally predicted less variance than the models with covariates. This led to the fact that the overall model predicting negative strain-based spillover was not significant anymore, although the interaction effect still was ($p < 0.05$). Second, the positive association between WFH use and negative time-based spillover at very high moderator values was still significant ($p < 0.05$; see also W1 value defining the Johnson–Neyman interval in Table 2).

3.3 Influence of content-related degrees of freedom and interaction with WFH

Another two moderation analyses were run to determine whether content-related degrees of freedom (main effect) as well as the interaction between content degrees of freedom and WFH use significantly predict negative time-based and strain-based spillover from work to private life (in reference to hypotheses 2.1a and 2.1b, as well as 2.2a and 2.2b). All relevant model coefficients can be found in Table 3. The overall model with negative time-based spillover as the outcome was significant, $F_{(8,101)} = 8.080$, $p < 0.001$, predicting 30.91% of the variance. Results show a significant negative influence of content-related degrees of freedom on negative time-based spillover from work to private life (see Table 3). Furthermore, content-related degrees of freedom moderated the effect between WFH use and negative time-based spillover from work to private life, $\Delta R^2 = 5.99\%$, $F_{(1,101)} = 14.535$, $p < 0.001$, 95% CI (0.118, 0.386). According to the Johnson–Neyman interval, WFH use reduced negative time-based spillover at moderator values smaller than 3.625 ($p < 0.05$). At all higher moderator values, the influence of WFH use on time-based spillover became insignificant. However, we again found a marginally significant reversed effect (positive association between WFH use and negative time-based spillover) at moderator values above 4.863 ($p > 0.10$). A visualization of the conditional effect of WFH use on negative time-based spillover is shown in Figure 4. Furthermore, the covariates *extended availability* and *perceived job intensity* occurred as additional significant predictors in the model (see also Table 3). The overall model of the last moderation analysis with negative *strain*-based spillover as the dependent variable was also significant $F_{(8,101)} = 5.172$, $p > 0.001$. Yet, neither the direct effect of content-related degrees of freedom nor the interaction effect was significant, showing that content-related degrees of

TABLE 3 Bootstrap model coefficients (with 95% confidence intervals), model parameters and Johnson-Neyman statistics of moderation analyses 3 and 4 with vs. without covariates.

	Moderation Analysis 3		Moderation Analysis 4	
	Neg. time-based spillover (Y1)		Neg. strain-based spillover (Y2)	
	Without covariates	With covariates	Without covariates	With covariates
WFH use (X)	−1.033** (−1.770 to −0.584)	−0.970*** (−1.590 to −0.539)	−0.620 (−1.529 to −0.106)	−0.512 (−1.199 to 0.012)
Content–related degrees of freedom (W2)	−0.211 (−0.483 to 0.025)	−0.420** (−0.719 to −0.155)	−0.028 (−0.294 to 0.212)	−0.193 (−0.488 to 0.067)
Interaction	0.257** (0.133 to 0.436)	0.234*** (0.188 to 0.386)	0.153* (0.010–0.381)	0.127 (−0.014 to 0.308)
Extended availability[a]		−0.104 (−0.190 to 0.011)		−0.132** (−0.206 to −0.041)
Perceived job intensity		0.494*** (0.300 to 0.685)		0.537*** (0.331 to 0.756)
Age		0.010 (−0.023 to 0.003)		0.002 (−0.013 to 0.016)
Gender		−0.153 (−0.462 to 0.150)		−0.360 (−0.711 to −0.017)
Commuting time (minutes)		0.002 (−0.012 to 0.017)		−0.001 (−0.018 to 0.017)
F	3.924*	8.080***	0.983	5.172***
R^2	0.083	0.309	0.032	0.268
$F_{(X*W2)}$	10.878**	14.535***	2.301	2.802
$\Delta R^2_{(X*W2)}$	0.075	0.060	0.023	0.016
W2-value defining Johnson-Neyman Interval	3.595–4.613	3.625	–	–

[a]Counterintuitive scale polarity: The higher the scale value, the less risk for extended availability.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

freedom did neither directly predict negative strain-based spillover or moderate the effect between WFH use and negative *strain*-based spillover from work to private life, $\Delta R^2 = 1.75\%$, $F_{(1,101)} = 2.802$, $p = 0.097$, 95% CI (−0.014, 0.308). Only the two covariates *extended availability* as well as *perceived job intensity* showed a significant predictive value (Table 3). Again, the *post-hoc* power analyses showed sufficient statistical power ($1 - \beta = 0.839$) for the third moderation model (prediction of time-based spillover) but little power ($1 - \beta = 0.372$) for the fourth moderation model (prediction of strain-based spillover; Faul et al., 2007). Similar differences were found between the models with vs. without covariates, as in the first two analyses: The analyses without covariates predicted less variance, again leading to the fact that the overall model predicting negative strain-based spillover was not significant anymore. Also, the positive association between WFH use and negative time-based spillover at very high moderator values was still significant ($p < 0.05$; see also W2 value defining the Johnson–Neyman interval in Table 3).

4 Discussion

4.1 Discussion of results

As predicted, degrees of freedom in terms of both time and content predict negative spillover and moderate the influence of WFH use on negative spillover from work to private life. Negative *time*-based spillover is predicted by both types of autonomy (confirming hypotheses 1.1a and 2.1a), as well as their interaction with WFH use (confirming hypotheses 1.2a and 2.2a). Both models show sufficient to high power. The effect of WFH use on negative *strain*-based spillover, by comparison, is only predicted by temporal degrees of freedom but not content-related degrees of freedom (acceptance of hypothesis 1.1b but rejection of hypothesis 2.1b). We also only find an interaction effect of WFH use with temporal degrees of freedom (acceptance of hypothesis 1.2b) but not with content-related degrees of freedom (rejection of hypothesis 2.2b). However, there is no sufficient power for either of these two moderation models. Several conclusions can be drawn from these results.

4.1.1 Autonomy and spillover (main effects)

In our study, we find that both temporal and content-related degrees of freedom are directly negatively related to negative time-based spillover. To put it simply, increasing autonomy is associated with a reduction in negative time-based spillover. On an empirical level, these results go in line with a large number of existing findings on the relationship between autonomy and WLB (e.g., Aryee, 1992; Butler et al., 2005; Grzywacz and Butler, 2005; Schuller et al., 2012). Thus, there is repeated confirmation that employees with sufficient or high autonomy at work generally seem to have better opportunities to reconcile life domains. Nevertheless, the differentiated consideration of different degrees of freedom and different types of negative spillover has added value: Contrary to expectations, we find that a negative *strain*-based spillover is only related to degrees of freedom in terms of time but not in terms of content. This finding emphasizes that scheduling options for

tasks within the working day (regarding the temporal sequence of individual activities and tasks, their duration, the pace of work, etc.) is important for balancing work and private life. So far, temporal flexibility as a whole (beginning/ending work hours) has been analyzed and rated as important when it comes to balancing work and private life (Shockley and Allen, 2007; Allen et al., 2013). Our results now provide a more precise understanding of the importance of temporal flexibility by also considering temporal degrees of freedom within the working day. Overall, based on our findings, it could be argued that temporal degrees of freedom may even be more important than content-related degrees of freedom in ensuring that no strain is transferred from work to private life. Also, when looking at the influence of other work characteristics in the model as well as a comparison of effects in the analyses with vs. without covariates, the results suggest that negative strain-based spillover is overall more strongly associated with work intensity and extended availability for work demands than with content-related autonomy (see also Schuller et al., 2012; Dettmers, 2017). However, further confirmation of these findings is needed. On a theoretical level, our findings represent both a confirmation and, to a certain extent, an extension of Bakker and Demerouti (2013) spillover–crossover model. Regarding job autonomy, the authors primarily assume that autonomy promotes positive spillover. The direct influence found in this study now further shows that autonomy is also associated with a direct reduction of negative spillover (especially time-based spillover). All in all, these results support the idea that degrees of freedom in terms of time and content as modifiable work characteristics of job autonomy not only buffer negative aspects of work but also stand for themselves as a central work characteristic that prevent spillover.

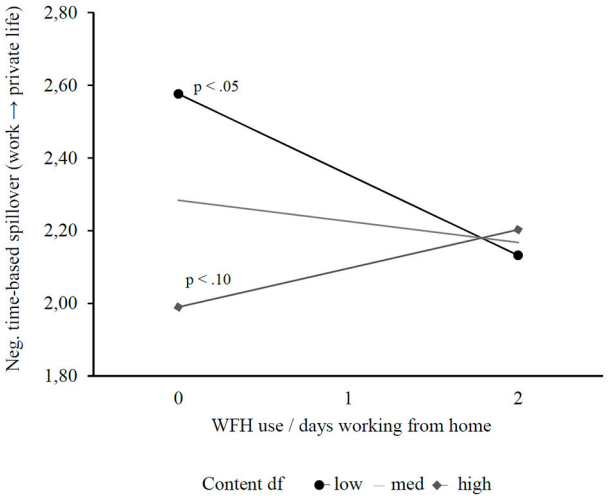

FIGURE 4
Conditional effect of working from home (WFH) use on negative time-based spillover at different values of the moderator (content-related degrees of freedom). Notice: For Low df., significant effect meets at moderator values ≤ 3.625. For High df., the marginally significant effect meets at moderator value ≥ 4.863. The addition of control variables to the model weakens the positive relationship between WFH use and negative time-based spillover at very high moderator values (only a marginally significant effect remains).

4.1.2 WFH and spillover: a question of autonomy (interaction effects)

When closer looking at the moderating effect of temporal degrees of freedom we find a significant negative association between WFH use and negative time-based spillover once people have limited temporal degrees of freedom. Specifically, this is the case when people can only plan their tasks within a few hours or, at most, until the end of the working day (values lower than 3.62). In contrast, at very high degrees of temporal freedom (temporal df = 5) that allow scheduling tasks over several days or even weeks, there is a marginally significant positive association between WFH use and negative time-based spillover. We find a similar picture with content-related degrees of freedom. A negative relationship between WFH use and negative time-based spillover occurs when the content-related degrees of freedom are limited to the discretion of the sequence of processing steps and planning within subtasks (value level below 3.63). We again find a contrary trend (marginally significant positive association between WFH and negative time-based spillover) at very high levels of content-related autonomy (if content df ≥ 4.863). Such a high degree of content-related freedom allows employees to choose between existing working methods, develop their own working methods and, at the highest level, even modify or set work goals. In a nutshell, these findings show the following trend: While WFH is associated with a decrease in negative time-based spillover when people have lower levels of job autonomy, it is associated with an increase in negative time-based spillover when people have very high levels of job autonomy. These results may seem surprising at first glance. Nevertheless, there are reasonable explanations for both of these contrasting effects. We first take a closer look at the finding that WFH only goes in line with a decrease of negative time-based spillover at lower levels of autonomy (significant effect). This association suggests that people who work in jobs with limited autonomy may actually benefit more from WFH than people who already have high or the highest degrees of autonomy in their jobs. Some of the advantages associated with WFH (e.g., the time saved on commuting as well as the reduced physical distance between life domains) may especially make a difference in managing daily demands when people otherwise have little work-related flexibility. In general, it would be conceivable that the reduced distance between work and non-work domains when working from home increases the *usability* of autonomy in favor of obligatory duties (see also Nijp et al., 2012). This increase in autonomy utility when WFH could be particularly important for individuals who otherwise have few degrees of freedom at work: Having high time commitments and strict guidelines on how to work (little autonomy) does usually not allow people to take care of any private demand within working hours, especially when working in the office/organization. When working at home, however, the coexistence of life domains allows these workers to use the little freedom they have to at least address some of their private obligations (e.g., starting the washing machine during a short break), ideally giving them more time to recover after work. In contrast, adequate levels of autonomy may enable people

to cope with private demands even without workplace flexibility (Baltes et al., 1999). The influence of WFH on the experience of spillover is therefore likely to be less salient for workers who already have sufficient autonomy at work.

The opposite trend (positive relationship between WFH use and negative time-based spillover at very high levels of autonomy) is only marginally significant in both models, which is why this association would generally not be discussed in more detail. However, if the control variables are removed from the prediction models, this positive association becomes significant. We assume that the positive association between WFH use and negative time-based spillover in jobs with high levels of autonomy may be due to a change in the utilization of work-related degrees of freedom when working from home. Very high degrees of freedom in terms of content and time occur in professions with very complex cognitive demands, especially knowledge work (Pyöriä, 2005; Rau and Hoppe, 2020). In the case of knowledge work, it is often difficult for managers and employees themselves to accurately estimate the time required for the work, as the tasks themselves often contain components of uncertainty. This problem is known as the so-called planning fallacy (e.g., Lovallo and Kahneman, 2003). As a result, the time allocated is often too short to complete the tasks within normal working hours. Because an urgent work task is often considered more important than the fulfillment of private life tasks, it is easy to "misuse" existing autonomy in order to finish a work task and work overtime (Mazmanian et al., 2013). This "paradox of autonomy" was reported as a result in different studies according to remote work or work with extended availability for work tasks (Rau and Göllner, 2019; Kost et al., 2023). Such misuse of work autonomy in the sense of extended availability for work demands may consequently be accompanied by higher conflicts between work and family and exhaustion (Golden, 2012; Dettmers, 2017; Beermann et al., 2018). The homes of employees could thereby provide a work context in which an expansion or fragmentation of working hours is more likely to occur (see also Golden, 2012). In addition, remote workers with high levels of autonomy may show greater motivation and commitment (Golden et al., 2006) as well as higher work effort (Chesley, 2010; Rupietta and Beckmann, 2016), for example, to compensate for the disadvantages of reduced visibility of their work performance (Sewell and Taskin, 2015; Cristea and Leonardi, 2019). Finally, at a very high level of autonomy, employees are responsible for setting their own work goals, going along with the need for well-thought-out work scheduling (Schweden, 2018). When WFH, there are often additional requirements for self-structuring and communication with others, which may lead to increased time expenditure (Kubicek et al., 2014, 2022; Van der Lippe and Lippényi, 2020). The distance to superiors may thereby state a risk that additional requirements are not perceived and consequently not planned for, resulting in an even higher workload and poorer WLB.

Finally, a last interaction effect that needs further discussion is that negative *strain*-based spillover from work to private life is moderated by time-related but not content-related degrees of freedom. Again, we find the tendency that WFH only reduces negative strain-based spillover, if people have very limited temporal degrees of freedom (values lower than 2.6, representing jobs where the time margin for task planning is rarely more than a few hours). In other words, only people who work in jobs with very tight temporal bindings may benefit from WFH in a way that strain-based spillover decreases. Here again, we found no effect of WFH once people had higher time-related autonomy. An explanation for this finding requires a closer look at the typical characteristics of professions with little planning autonomy. Tight time constraints that ask for an immediate or prompt completion of tasks often arise from a partialized division of labor (Hacker and Sachse, 2013) or from work in direct (face-to-face) or indirect contact (via indirect contact via information and communication technology) with customers (Richter et al., 2014). Many of these occupations (e.g., call center agents) are carried out in shared spaces (e.g., open-plan offices) with unfavorable environmental factors such as high noise levels or poor air conditions (Kaarlela-Tuomaala et al., 2009; Jahncke et al., 2011; Sander et al., 2021). For these people, WFH may reduce strain simply because it is often easier for people to adapt the working environment in their own homes to their individual needs (Xiao et al., 2021).

4.2 Theoretical implication

All in all, we found that job autonomy is not only a predictor of employees' experience of negative spillover but also a specific moderator of how WFH influences negative spillover, respectively, on the WLB experience. We see several theoretical implications. First, our findings indicate that WFH should not *per se* be judged as good or bad for people's WLB. We show that work characteristics, and in particular facets of autonomy, are important factors influencing the relationship between WFH and WLB. In further studies on the influences of WFH on health and wellbeing, it is therefore advisable to take more account of work design/specific work characteristics as potential moderators. Likewise, the moderating influence of autonomy should be considered in theoretical models of the influence of spatial flexibility/WFH on WLB (e.g., extending models such as the Boundary Management Tactics model by Kreiner et al., 2009, by including the influence of central work characteristics). Second, our results imply that autonomy is a central designable work characteristic that entails more than a buffering function for people's wellbeing (as described in the Job Demand-Ressource Model by Bakker and Demerouti, 2017). Our results underline that job autonomy is a direct influencing factor that is directly associated with a reduction in spillover effects (main effect). Nevertheless, we discuss that it may be important for future research to focus more on other work characteristics that are often "comorbid" in jobs with a very high degree of autonomy (in particular characteristics such as too little time for tasks with high complexity or high work intensity). Third, our findings suggest that it may be important to consider different facets of autonomy in order to explain differential effects on spillover or other health variables in the WFH context. Based on the considerations of Nijp et al. (2012), it would make sense to take an even closer look at the exact form of autonomy *utilization* (e.g., use of temporal degrees of freedom for work vs. break organization). Differences in access to autonomy (as

objectively assessed in this study) and the desire or utilization of this autonomy by employees could also be examined in more detail (Nijp et al., 2015).

4.3 Practical implication

As far as WLB is concerned, our results indicate that people with little professional autonomy may benefit most from WFH. Consequently, people with little autonomy in particular should be given the opportunity to WFH whenever possible. In this way, companies would support people in their life management and presumably prevent health impairments due to negative spillover effects in the long term. All in all, one could discuss that workplace flexibility compensates for a lack of other autonomy to a certain point and may therefore even be seen as an additional form of autonomy (see also De Spiegelaere et al., 2016). However, because low autonomy (regarding both time and content) still is a potential hazard to mental health (Rau and Buyken, 2015), workplace flexibility should not only be used as a substitute. Rather, the introduction of workplace flexibility should go hand in hand with ensuring sufficient degrees of freedom in terms of content and time as these types of autonomy still generally provide one of the most important resources in occupational health (e.g., Karasek, 1990; Schmidt and Hollmann, 2004; Bergmann et al., 2007; Gajendran and Harrison, 2007; Niebuhr et al., 2022). Nevertheless, our results should also draw attention to the fact that a very high degree of autonomy in combination with spatial flexibility may be accompanied by an increased risk of time-based spillover from work to private life. Still, this does not necessarily mean that people with high autonomy should no longer work remotely or that autonomy itself is harmful. Rather, it would be advisable to create organizational structures that do not restrict people in their autonomy but prevent additional demands. Above all, structures should be created that prevent an extension of working hours and availability. This could include working time regulations that protect against the dissolution of boundaries, for example, avoiding trust-based working time (Janke et al., 2014) or warnings in case of overtime. Individual solutions should be preferred to standard solutions (Roberts, 2007). Most important, however, would be the preventive avoidance of excessive work intensity through good work design (Rau and Göllner, 2019). First, realistic time margins for the completion of tasks should be developed as well as constantly reviewed and adjusted (Rau and Hoppe, 2020). As already explained, this is particularly important, but also equally challenging, in professions with very complex work tasks (knowledge work). Also, it seems important to allow enough time for the additional planning and coordination effort during remote work (Kubicek et al., 2014, 2022). Companies should thereby consider which work tasks are more and which are less suitable for WFH, for example, less cooperative work due to the increased time required (Van der Lippe and Lippényi, 2020). Supervisors should be included in this process. In general, the preservation of autonomy should not be misunderstood as a lack of supervision: Managers should maintain contact with their staff despite the physical distance (Lautsch et al., 2009). In order to reduce spillover effects, this contact should primarily serve the exchange of information as well as the promotion of work design and border compliance rather than monitoring and control (Lautsch et al., 2009). Additionally, workers in flexible work arrangements need to acquire the ability to plan and structure the demands of their work and private lives (see also Dettmers and Clauß, 2018). For example, it is known that special training on boundary management is likely to prevent health impairments and improve WLB to a certain extent (Peters et al., 2014; Gisin et al., 2016). This seems to be important not only for people with high degrees of freedom but also for people with low degrees of freedom, as they are less able to learn such skills based on their degrees of freedom at work. Above all, however, companies remain responsible for designing work in such a way that negative effects and other work-related impairments are avoided. In this way, as in the regular workplace, high levels of autonomy will remain conducive to wellbeing, health and WLB even when working remotely (see also Wieland, 1999; Kossek et al., 2006; Gajendran and Harrison, 2007; Beermann et al., 2019; Meyer et al., 2021; Becker et al., 2022).

4.4 Strengths, limitations, and future research

By using a multi-method research design and a differentiated objective measurement of autonomy, we contribute to a deeper understanding of the interaction effects of WFH on work–life management. With our approach, we overcome an often mentioned limitation as we rule out the risk of common method bias and self-report bias (Spector, 1992, 2006). We thereby show that using objective measurement methods in occupational health research contributes to a better understanding of the connections between work and strain, which is why it should be practiced more often in future research. In general, this is one of only a few studies to date that consider time planning options *during* the working day (temporal df) as an influencing factor on WLB (other studies often refer more to job autonomy as an overall construct or time flexibility regarding the start and end of working hours). We further show that strain-based spillover need not be influenced by the same work characteristics as time-based spillover. Our results therefore provide a differentiated picture of how work characteristics should be taken into account when designing flexible work arrangements. However, there are also several limitations in our study. A first and central limitation of the study can be found in the cross-sectional design. Specifically, we examine the moderating influence of work characteristics on the connection between WFH use and spillover experience at a fixed point in time. This approach offers information about relevant factors influencing WLB experience in the context of remote working, but no reliable statements can be made as to whether this influence will also be evident in the long term. Also, from a purely statistical point of view, a reverse causation of the effects could have occurred. This mainly concerns the association between WFH and spillover. However, the main effect of autonomy on spillover should not be affected due to the multimethod approach described earlier. A second limitation concerns the sample size. Due to the comparatively high time expenditure of objective analyses, as well as the need for

data linking, the sample is smaller than in most other studies. A smaller sample size deriving from only one company could affect the validity and power of the results. Sampling effects cannot be completely ruled out. We found sufficient statistical power for both models predicting time-based spillover but not for the models predicting strain-based spillover. Regarding the prediction of strain-based spillover, the results and interpretations therefore have to be treated with caution. At this point, it is important to note that *post-hoc* power analyses generally need to be examined critically and do not always reflect the true power of the analysis (Zhang et al., 2019). Furthermore, we decided to include several covariates in our models, as we considered them important in light of the existing literature and some of the particularities of our sample. Nevertheless, the integration of many covariates may involve a risk of overfitting, that is, an overestimation of effects (Zhang, 2014). All in all, further studies could start here and test the effects in a large-scale long-term study. Finally, the interaction effects of WFH with the different degrees of freedom were tested in separate models. Because both facets of autonomy are highly correlated and are likely to mutually dependent (Hacker and Sachse, 2013), it could also be interesting for future studies to test more complex models with variable combinations as moderators or test interaction effects of autonomy facets itself. As we find a significant influence of work intensity and extended availability on negative spillover, further studies should also more closely examine interactions of WFH use with objectively measured work characteristics that are associated with an expansion and intensification of work.

5 Conclusion

Our findings show that there is a differentiated relationship between WFH and negative spillover, which is partly conditional on the degree of job autonomy. Generally, we discuss that employees with little job autonomy may benefit most from WFH. We further debate that employees with very high levels of job autonomy may be at higher risk for negative time-based spillover when WFH as both high autonomy and WFH come along with additional demands. However, we argue that it is still important to promote or maintain job autonomy at work and rather to design work factors that prevent high work intensity and long working hours when working remotely.

Data availability statement

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

Ethics statement

Ethical approval was not required for the studies involving humans because the study was conducted within a single company. The main concern of the study was the analysis of work characteristics and not of humans wellbeing. The local works council (employee representatives) assessed and approved the study request. The project was also examined by the company's data protection officer. All personal data was collected anonymously. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft. RR: Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing.

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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

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/forgp.2024.1271726/full#supplementary-material

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Sometimes here, sometimes there—Differential effects of social challenge and hindrance stressors depending on the work location

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Introduction: As a result of the COVID-19 pandemic, the number of employees working from home has more than tripled in Germany from 2019 to 2022. While earlier research on remote work primarily focused on discerning variations among employee groups, this study delves into the realm of intra-individual effects. Specifically, we investigate how social stressors relate to exhaustion and positive affect at the end of the day within the context of different work settings.

Methods: This research draws insights from a sample comprising 99 employed individuals who diligently responded to surveys over a span of up to 10 working days (with an average of 6 days) after work and prior to bedtime.

Results: Although the absolute level of encountered social stressors exhibited no noteworthy difference between working at home or the premise of the employer, the relationship to exhaustion was moderated by the work location. Remarkably, the positive link between challenge-oriented social stressors and exhaustion manifested solely on days spent working from home. In contrast, social hindrance stressors exhibited a positive association with exhaustion exclusively on days when employees were operating within the organizational premise.

Discussion: These findings offer preliminary indications that the significance of specific stressors might indeed fluctuate based on the physical location of work. In essence, this study sheds light on the nuanced interplay between stressors and employee wellbeing, thereby adding depth to our comprehension of the remote work landscape.

KEYWORDS

remote work, telework, challenge stressors, social stressors, diary study

1 Introduction

The COVID-19 pandemic has accelerated the transformation of work, especially regarding the flexibility in terms of work location (e.g., Silver, 2023). While numerous studies have examined the impact of working from home on employees' work-life balance and wellbeing (e.g., Standen et al., 1999; Anderson et al., 2015), the majority of these studies compared employees who regularly work at home with employees who primarily work at the premise of their employer. As remote work before the pandemic has been mostly a privilege of highly educated employees and a free choice of those (Rigotti et al., 2021), between-person comparisons may be confounded by interindividual third variables that

account for the overall positive empirical evidence regarding higher job satisfaction (e.g., Nakrošiene et al., 2019), increased job performance (Gajendran and Harrison, 2007), and reduced exhaustion (Golden, 2006) among employees that regularly work from home. Thus, these between-person studies do not offer a comprehensive assessment of whether the work location significantly influences intraindividual experiences at the day level. In this study, we employ a within-person approach to shed light on how work-related experiences affect workers differently depending on the work location, controlling for interindividual differences, for example, in terms of flexibility preferences. This approach should contribute to a deeper understanding of how remote or hybrid work should be designed to mitigate adverse and foster positive effects.

Beyond the positive aspects of working from home (e.g., Gajendran and Harrison, 2007), research has identified certain risks, such as limited interaction with colleagues, lower frequency of social contacts, disengagement, lack of a sense of belonging, potential career growth impediments (Lim and Teo, 2000), and negative emotional impact (Mann and Holdsworth, 2003). It may also result in the blurring of boundaries between work and personal life, leading to challenges in work-life balance and increased domestic responsibilities (Hilbrecht et al., 2008; Lapierre et al., 2015). In this article, we focus on the role of work-related social interactions, as this is the most obvious proximal difference between working from home or at the office. However, social interactions can have both positive and negative effects on individuals' wellbeing (Peeters et al., 1995; Lincoln, 2000). On the one hand, positive social interactions can serve as valuable resources for employees, providing essential elements like appreciation or social support (Semmer et al., 2019), which has been linked to reduced cardiovascular stress reactivity (Baethge et al., 2020) and improved physical and mental health (Schwarzer and Leppin, 1989). Conversely, social interactions can also induce social stressors, such as interpersonal conflict or social exclusion. In this study, we focus on the effects of social stressors on employees' daily wellbeing.

Aligning with recent developments in the conceptualization of social stressors, we distinguish between social hindrance and social challenge stressors (Kern et al., 2021). Social hindrance stressors are consistent with the traditional understanding of social stressors in that they threaten an individual's social self-esteem and are therefore straining and obstructive events (e.g., Bruk-Lee et al., 2013). In contrast, social challenge stressors represent demanding social situations or requirements that involve adept social interactions. These interactions encompass high effort but are seen as integral, legitimate components of the work process and contribute to the attainment of meaningful goals. Kern et al. (2021) demonstrated that while both challenge and hindrance social stressors are positively associated with exhaustion, they exhibit differential relationships with outcomes such as professional efficacy or work engagement. Following the work of Kern et al. (2021), we likewise distinguish between social challenge and social hindrance stressors and propose that the within-person effects of these stressors on employee wellbeing vary depending on the work location. Specifically, we expect that on days working at the organization, social hindrance stressors will be more positively related to exhaustion and more negatively related to positive affect, whereas social challenge stressors will better unfold their challenging potential. We argue that challenging social interactions are related to more positive outcomes when there is more opportunity for informal feedback through face-to-face contact in the office. In contrast, the straining effect of social hindrance stressors might be diminished on days working from home, as there are more opportunities for taking a break, and distance oneself from these social interactions (for our conceptual model, see Figure 1).

This study offers several noteworthy contributions to the existing body of knowledge. First, we advance the literature on working from home by employing a within-person approach, adding evidence how the work location might be relevant for employee strain and mood in response to work stress. Second, we add further evidence to the delineation of challenge and hindrance social stressors, which has only recently been proposed by Kern et al. (2021), and add further evidence on the within-person level. Distinguishing between challenge and hindrance social stressors refines our understanding of the impact of social interactions at work. The third contribution is maybe the most crucial one. By combining the literature strands on challenge and hindrance stressors and working from home, we move beyond most studies that solely focused on main effects of work location. We rather suggest that particularly social work characteristics may show differential effects, contingent upon work location.

2 Theory

2.1 Different work locations—Different outcomes

Researchers who have previously conducted within-person studies comparing days spent working from home with those spent at the organization's office have predominantly found that remote work is associated with more favorable outcomes for employees. For instance, positive within-level effects on job performance and job satisfaction have been reported (Vega et al., 2015; Müller and Niessen, 2019), along with negative effects on daily stress levels (Delanoeije and Verbruggen, 2020) and on the need for recovery (Biron and van Veldhoven, 2016). These findings can be explained by the preservation of resources when working from home, as postulated within the conservation of resources theory (COR; Hobfoll, 1989; Hobfoll et al., 2018). At its core, COR theory postulates that people experience stress when their resources are threatened, lost, or cannot be replenished/augmented after resource investments. When employees work from home, they may have to spend fewer resources or may even succeed to gain additional resources via more efficient resource investments, which should in turn relate to higher wellbeing at the end of the workday. This may be explained by the following two aspects: First, employees can save energy resources and time which they would spend on commuting to and from work on office days. Commuting time has considerably increased over the last years (e.g., Murphy et al., 2023) and has been identified as a resource draining demand which positively relates to time-based work-family conflict (e.g., Elfering et al., 2020) and levels of exhaustion (e.g., De Reuver and Biron, 2024). Second, employees may be required to schedule tasks and meetings which they deem to be particularly important

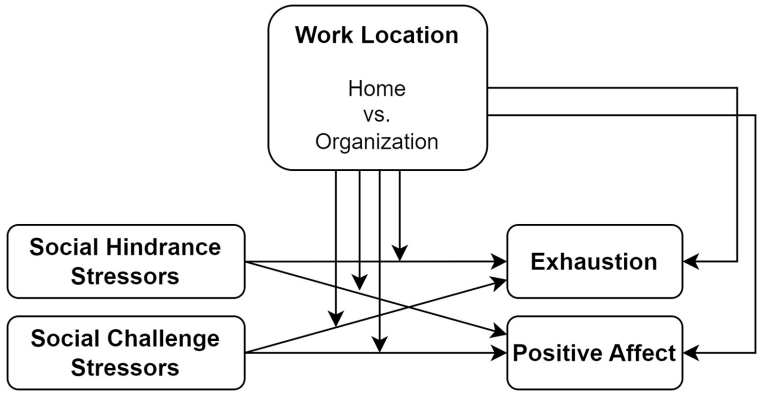

FIGURE 1
Conceptual model.

and for which they want to be most visible in the limited time available during office days. This may create additional time and performance pressures and thus, a greater expenditure of resources on office days compared to days when working from home (see also Biron and van Veldhoven, 2016). Considering these potential resource savings on days working from home, employees may opt to invest them into other work-related tasks, thereby facilitating efficient resource use and, consequently, the perception of task progress and mastery. These experiences are in turn essential to generate additional personal resources such as self-efficacy (e.g., Bandura, 1977) and therefore, to enhance wellbeing.

Empirical evidence supports this line of reasoning. For example, Biron and van Veldhoven (2016) compared diary data from employees on three home days and three office days and found that the ability to concentrate was higher on home days than on office days. In addition, Delanoeije et al. (2019) found that on days where individuals worked from home, they reported more work-to-home transitions, which were related to lower work-to-home conflict (but higher home-to-work conflict). Delanoeije and Verbruggen (2020) further reported findings of a quasi-experimental study that investigated the effects of working from home on employee stress, work-to-home conflict, work engagement, and job performance. The study was conducted in a Belgian company that implemented a pilot telework initiative, with employees in the intervention group allowed to work from home on at most two days a week, while employees in the control group were not. Data were collected before teleworking was introduced and at the end of the pilot, as well as daily on 13 consecutive workdays after the onset of the pilot. The results showed that there was no significant interaction effect between group and measurement occasion, but employees in the teleworking group had less stress at the end of the pilot compared to before teleworking was introduced. However, there were no significant differences in work-to-home conflict, work engagement, or job performance over time.

In our study, we chose exhaustion and positive affect at the end of the day as daily indicators of wellbeing because they (a) have been shown to be sensitive to daily fluctuations in numerous diary studies (e.g., Hülsheger et al., 2013; Schilbach et al., 2023c) and (b) can be positioned on different ends within the affective circumplex model (Russell, 1980). Whereas exhaustion reflects an emotional state of low activation and negative valence, positive affect is an emotional state with positive valence and characterized by high activation. By accounting for affective states of negative low and positive high activation, we are able to gain a more nuanced understanding of the daily affective experiences of employees.

Consistent with the resource-saving premise derived from COR theory and existing empirical work, we expect that employees report less exhaustion and more positive affect on days working from home as compared to days working at the office.

H1: On days when employees work from home, they report less exhaustion compared to days when they work at the organization.

H2: On days when employees work from home, they report higher positive affect compared to days when they work at the organization.

2.2 Challenge and hindrance social stressors

Stressors are typically seen as risk factors that hinder goal attainment, entail threats to the self by anticipating harm or loss of resources, and require effort to cope with (Semmer, 1996). The exclusive negative perspective on stressors has been challenged by accumulating empirical evidence indicating that certain types of stressors, while indeed straining, also present opportunities for motivational gains or enhanced performance. These observations have resulted in the development of the challenge-hindrance stressor framework and thus, a conceptual distinction between two types of stressor, namely challenge and hindrance stressors (Cavanaugh et al., 2000; LePine, 2022). The challenge-hindrance stressor framework has been a highly influential theoretical model over the past approximately 20 years and since its introduction has considerably shaped stress research in work and organizational psychology (Horan et al., 2020). Consistent with other stress-related models (e.g., the job demands-resources theory, Bakker and Demerouti, 2014), the framework proposes that both stressor types positively relate to employee strain (e.g., Cavanaugh et al., 2000; Crawford et al., 2010). However, only challenge stressors are expected to entail a potential for mastery, goal attainment and personal development (e.g., Cavanaugh et al., 2000; Kern

et al., 2021). Put differently and to use the terminology of COR theory (Hobfoll, 1989), challenge stressors are expected to result in a net gain of resources (see also Schilbach et al., 2023b). In contrast, hindrance stressors are expected to lack the potential for such personal accomplishments. They either prevent goal attainment (e.g., ambiguous tasks) or make progress toward goals unnecessarily complicated (e.g., frequent software outages), inhibit personal development, and further relate to the experience of frustration and disengagement (e.g., Cavanaugh et al., 2000; Crawford et al., 2010). Therefore, hindrance stressors should be associated only with resource loss.

Despite that an a priori categorization of stressors as either challenge or hindrance raised criticism (e.g., Mazzola and Disselhorst, 2019; Schilbach et al., 2023a), a large body of research shows that certain stressors (e.g., time pressure, work complexity) encompass a clear challenging tendency and therefore positively relate to outcomes such as thriving (Prem et al., 2017), resilience (e.g., Crane and Searle, 2016), or positive affect (Sawhney and Michel, 2022). These effects are particularly apparent when considering concurrent other stressors (Kronenwett and Rigotti, 2019; Schilbach et al., 2023a), controlling for strain (Widmer et al., 2012), or taking cognitive appraisal into account (Kronenwett and Rigotti, 2022; Kern et al., 2023). In contrast, other stressors (e.g., role ambiguity, daily hassles) seem to have a clear hindering potential, positively relating to strain and negative affect while negatively relating to work engagement (e.g., Crawford et al., 2010), resilience (Crane and Searle, 2016), or self-efficacy (e.g., Webster et al., 2010).

Social stressors have been mostly attributed a clear hindering potential (e.g., Bruk-Lee et al., 2013; Dawson et al., 2016). Drawing upon the challenge-hindrance-framework, Kern et al. (2021), however, questioned the view that social stressors at work are exclusively detrimental phenomena and thus introduced the distinction between social challenge and hindrance stressors. According to Kern et al. (2021), social challenge stressors are well perceived as stress-inducing and, consequently, are associated with strain. However, beyond their strain effect, social challenge stressors should have the potential to experience success and competence because they occur in situations that necessitate skillful social action to ensure the successful completion of collaborative tasks. Thus, they arise in situations in which discussions have to be moderated, different interests sensitively considered, or limited resources fairly distributed. These demands apply to the majority of knowledge workers, for whom collaborative tasks with high social demands are not just an occasional occurrence but rather the prevailing norm. In accordance with this rationale, Kern et al. (2021) identified positive associations between social challenge stressors and employee wellbeing across four independent samples. With respect to COR theory (Hobfoll et al., 2018), these findings suggest that social challenge stressors result in a net gain of resources subsequent to resource investment, thereby fostering wellbeing. Conversely, social hindrance stressors are either unrelated to work tasks (e.g., interpersonal conflict because colleagues dislike each other) or are perceived as illegitimate (e.g., some sorts of task conflicts and incivility; Dawson et al., 2016; Kern et al., 2021). They threaten valued resources of an individual by being demanding, frustrating, and frequently offending the self, thus exclusively triggering detrimental consequences.

Consistent with their definition as stressors, both types of social stressors were associated with increased levels of emotional exhaustion in three independent samples in the work of Kern et al. (2021). However, only between-person level associations were examined. We anticipate that these effects will also manifest at the within-person level, as supported by prior research on other challenge stressors (e.g., Baethge et al., 2019; Schilbach et al., 2023a). Thus, within-person fluctuations in social stressors are expected to correspond with concurrent intraindividual variations in strain, which can be explained by the increased effort required to cope with them and the associated emotional stress reaction associated with heightened social stressors. With respect to positive affect, it is posited that social challenge stressors, given their potential to promote goal achievement and personal development (Kern et al., 2021), should be associated with enhanced positive work experiences on days when employees encounter more social challenge stressors (see also Rodell and Judge, 2009; Tadić et al., 2015). In contrast, given their goal-preventive and illegitimate nature, we expect that being confronted with more social hindrance stressors compared to the rest of their week will more likely prevent employees from experiencing positive emotional states (see also Tadić et al., 2015). We therefore hypothesize the following:

H3: Social challenge stressors are (a) positively related to emotional exhaustion and (b) positively related to positive affect.

H4: Social hindrance stressors are (a) positively related to emotional exhaustion and (b) negatively related to positive affect.

2.3 Work location as a boundary condition

Given that work-related social interactions can also be stressful, working from home may have the potential to influence their consequences. Biron and van Veldhoven (2016), for instance, suggested that social interactions could be burdensome due to the time, attention, and effort required to establish and maintain social connections with colleagues. Windeler et al. (2017) expected that working from home serves as a strategy for individuals to manage and reduce the exhaustion caused by social interactions and provided empirical support for such a moderating effect. When working from home, individuals may have more opportunities to recover from demanding social interactions. From the perspective of COR theory, this finding suggests that when stressful social interactions are avoided, resources are less likely to be threatened, leading to higher levels of wellbeing.

However, applying this proposition to social challenge stressors may necessitate consideration of a second pathway proposed in COR theory. As outlined above, social challenge stressors should be associated with positive outcomes for the individual because there is a net gain in resources. According to Kern et al. (2021), this resource gain from social challenge stressors stems from, e.g., demonstrating competence, experiencing success, and strengthening team cohesion, which outweighs the costs in terms of effort. This net resource gain may be jeopardized when there are fewer opportunities for direct social interaction and

informal feedback, which applies to days when employees work remotely. Although there may be the same frequency of social communication when employees work from home, the quality of social interactions may suffer from the reduced richness of digital communication channels (Dennis and Kinney, 1998). Indeed, data shows that the time spent in social interactions is generally not less when working from home (van Triest, 2023). However, interactions tend to be more formal, task-related, scheduled, and of course take place via phone, e-mail, or video meetings. These interactions provide fewer social cues in terms of emotions and moods (Wang et al., 2020), especially in settings with more than two interaction partners. The reduced quality of communication may compromise one core aspect of social challenge stressors, namely the social aspect. Kern et al. (2021) defined social stressors as encompassing both an interpersonal and a task-related component. The interpersonal component involves aspects such as establishing common values, making commitments to plans, or maintaining group cohesion (Kern et al., 2021). In face-to-face interactions, these requirements are directly associated with fulfilling one's need for a sense of belonging (see also Albrecht, 2015), albeit demanding effort. In contrast, online communication when working from home can remove this challenging component of social challenge stressors, as the positive (social) events that trigger need satisfaction after successful coping may be absent (see also Schade et al., 2021). For this reason, we hypothesize that the ratio between resource investment and resource output should be less positive when working from home, so that social challenge stressors have a negative impact on wellbeing. At the same time, we posit that dealing with social challenge stressors requires more effort when working from home. Employees may have to wait for feedback, ascertain the meaning of a statement, clarify misunderstandings that arise due to technical problems in virtual communication (Lal et al., 2021; Maurer et al., 2022), all of which involve additional regulation costs that are likely to result in a negative ratio of resource investment and resource gain, leading to increased exhaustion. We therefore expect:

H5: On days when employees work from home, the relationship between social challenge stressors and (a) emotional exhaustion is stronger, (b) positive affect is weaker compared to days when they work at the organization.

Conversely, it can be argued that social hindrance stressors should be especially problematic when social interactions cannot be avoided, which is more likely the case when working in the office (see also Biron and van Veldhoven, 2016). Social hindrance stressors pose a direct threat to people's self-esteem through relational devaluation (Hershcovis, 2011; Semmer et al., 2019), and threats to the self are directly related to impaired wellbeing (Semmer, 2020; Kern et al., 2021). Thus, social hindrance stressors should have a stronger negative effect when the situation cannot easily be changed. In contrast, when employees work from home, direct confrontation with conflicting parties can be reduced to formal task coordination, and negative social behavior such as bullying become less likely (Bollestad et al., 2022). With respect to COR theory, this reasoning implies that the threat to valued resources is reduced, leading to less negative outcomes. Thus, we expect that social hindrance stressors are less straining when the social situation can easily be left.

H6: On days when employees work from home, the relationship between social hindrance stressors and (a) emotional exhaustion is weaker, (b) positive affect is stronger (i.e., less negative) compared to days when they work at the organization.

3 Method

3.1 Design and procedure

An online-based diary study was conducted in Germany over a span of ten working days with two measurement points per day, during the months of April and May 2021. During this period, Germany experienced the onset of the third wave of COVID-19, leading to the implementation of measures such as social distancing and curfews. Participants were recruited by students of a master's course using a snowball system and could choose the starting point of the diary. To enhance motivation, for each participant a donation of two euros was made to a charity organization supporting the mental health of young people. During the data collection period, the study participants received two surveys by mail every day. The first survey was sent out at 12 p.m. with the instruction to complete it directly after work. The second survey was sent to the participants at 8 p.m. with the instruction to respond to the survey before going to bed.

3.2 Sample

The initial sample comprised 99 participants. Due to missing values and participants that did not work complete days either at home or the organizational site, the final sample for data analysis included 94 employees, 49 (52.7%) of which were men and 44 (47.2%) of which were women (one response missing). Participants came from various occupational domains including health care, IT, education, industry, and trade. The age was provided by 64 individuals and ranged between 22 and 64 years with a mean age of 42.3 years (SD = 15.4 years). With an average contractual weekly working duration of 36.02 h (SD = 6.25), and regularly working from home as well as at the organizational premises, the sample exhibits a cross-section of modern workforce dynamics. Among the participants, 26 (28.0%) held leadership positions, while 67 (71.3%) did not (one response missing). Participants filled out 312 surveys (58.5%) on days they worked at home, and 221 (41.5%) surveys on days they worked in the organization.

3.3 Instruments

3.3.1 Work location

Each day, we asked participants whether they worked exclusively at home or at the organization or in both locations. As we were interested in clearly distinguishing between the work locations, we only included days on which employees worked exclusively at the employer's site (0) or at home (1).

TABLE 1 Items adapted from Kern et al. (2021) to measure social challenge and social hindrance stressors.

German	English (not validated)
Social challenge stressors	
Haben Sie heute zwischen Kollegen vermitteln müssen, um den Arbeitsablauf zu gewährleisten?	Did you have to mediate between colleagues today to keep the work flowing?
Haben Sie heute eine Diskussion moderieren müssen, da es keine klare Lösung für ein Problem gab?	Did you have to moderate a discussion today because there was no clear solution to a problem?
Haben Sie heute hitzige Diskussionen führen müssen, um ein besseres Arbeitsergebnis zu erzielen?	Did you have to lead heated discussions today to attain a better outcome of work to be done?
Haben Sie heute bei der Koordination von Arbeitsaufgaben viel Feingefühl zeigen müssen?	Did you have you to show sensitiveness and tact when coordinating tasks today?
Social hindrance stressors	
Ist es heute in Ihrem Arbeitsumfeld zu persönlichen Konflikten gekommen, weil sich jemand übergangen gefühlt hat?	Has there been any personal conflict in your work environment today because someone felt left out?
Ist es heute zu Konflikten wegen unterschiedlichen, individuellen Arbeitsauffassungen gekommen?	Did conflicts arise today because of different, individual views of work?
Haben heute sachliche Fehler im Arbeitsablauf zu Konflikten geführt?	Did factual errors in the workflow lead to conflicts today?
Ist heute Arbeitszeit wegen Auseinandersetzungen über die Aufteilung von Mitteln (finanziellen and personelle) verloren gegangen?	Was working time lost today because of disputes over the allocation of resources (financial and personnel)?

3.3.2 Social challenge and hindrance stressors

Social challenge and hindrance stressors were measured with four items each, developed by Kern et al. (2021). A sample item for social challenge stressors is "Did you have to mediate between colleagues today to keep the work flowing?", and for social hindrance stressors "Has there been any personal conflict in your work environment today because someone felt left out?" The full list of items can be seen in Table 1. Response options were provided on a five-point Likert scale from 1 = not true at all to 5 = completely true. In a multilevel confirmatory factor analysis, a two-factor model showed a better fit [$\chi 2 = 59.08$, df = 38, Comparative Fit Index (CFI) = 0.97, Tucker-Lewis Index (TLI) = 0.96, Within-level Standardized Root Mean Square Residual (SRMRw) = 0.04, Root Mean Square Error of Approximation (RMSEA) = 0.03] than a single factor model ($\chi 2 = 71.92$, df = 40, CFI = 0.96, TLI = 0.94, SRMRw = 0.04, RMSEA = 0.04). In the two-factor model, all items showed significant factor loadings on their respective latent factor with standardized values >0.40 at the within-person level, and >0.75 at the between-person level. We calculated McDonald's (1999) omega at the within- and between-person level to estimate scale reliability. Although within-person omegas of 0.64 for social challenge stressors, and of 0.67 for social hindrance stressors do not pass the common threshold of 0.70, they are still acceptable, taking into account that distinct aspects of these measures are less likely to co-occur on a daily basis (cf., Nezlek, 2017).

3.3.3 End-of-day exhaustion

To measure exhaustion before going to bed, we used three items of the Maslach Burnout Inventory (Maslach and Jackson, 1986), which have been used in numerous diary studies (e.g., Kinnunen et al., 2014; Kronenwett and Rigotti, 2019). A sample item is "I felt emotionally drained". Participants indicated their responses on a scale from 1 = *not at all* to 7 = *extremely*.

3.3.4 Positive affect

We measured positive affect at the end of the workday using ten items (e.g., interested, excited, proud, attentive) of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988; Thompson, 2007). Response options ranged from 1 = *not at all* to 5 = *extremely*. In a partially saturated multilevel confirmatory factor analysis, a one-factor model revealed acceptable fit statistics ($\chi^2 = 179.13$, df = 35, CFI = 0.93, TLI = 0.81, SRMRw = 0.06, RMSEA = 0.08).

3.4 Statistical analysis

Given the hierarchical structure of our data, with days nested within individuals, we performed multilevel analyses to examine our hypotheses. Specifically, we employed multilevel structural equation modeling (MSEM), which involved the latent decomposition of between- and within-person variance. Thus, effects could be tested simultaneously at the within-person and between-person level. To assess the proposed interactions between the within-person constructs of social stressors and location of work, we followed the guidelines provided by Preacher et al. (2016), who detailed the procedures for testing interactions across levels within an MSEM framework. The use of MSEM helps to address issues related to conflated multilevel effects and reduces bias in parameter estimates (Preacher et al., 2016). Note that social challenge, and social hindrance stressors were further centered at the grand mean to ease interpretation of the interaction plots. The syntax for the latent interaction analysis can be found via the following link on OSF: https://osf.io/ex4sz/?view_only=ec5423561f9e4c20afb6aadedf7faa18.

4 Results

Table 2 depicts the descriptive statistics, correlations among the study variables, and internal consistencies measured with McDonald's (1999) omega at the within-person and between-person level. The ICC values indicate that the total variance is more or less equally divided between and within persons, supporting the use of multilevel analysis.

Notably, work location was not significantly correlated to social challenge and social hindrance stressors at both levels of analyses, indicating that neither on days, when employees work at home, nor when working at the organization social stressors were more or less prevalent. Social challenge stressors were positively related to exhaustion as well as to positive affect, whereas social hindrance stressors were only positively correlated to exhaustion, which provides a first indication that they both match with the instrumental definition of challenge and hindrance stressors.

In support of H1 (Table 3, Model 1) participants reported less exhaustion on days working at home. However, there was no significant effect of work location on positive affect (Model 4) so that H2 was not supported. Aligning with H3 and H4, social challenge stressors were positively related to exhaustion as well as to positive affect, whereas social hindrance stressors were positively related to exhaustion, and negatively related to positive affect (Models 2, 5).

Furthermore, we proposed that work location moderates the relationship between social challenge and hindrance stressors with the two outcomes. The results provided support for H5a and H6a referring to differential effects on exhaustion. The significant interactions are shown in Figures 2, 3. For social challenge stressors, there was a positive and significant relationship with exhaustion when individuals worked from home and a non-significant relationship with exhaustion when they worked in the office. However, the moderation pattern was different than expected in that the slopes converged with increasing social stressors. Thus, when social challenge stressors were higher than usual, there was no difference in exhaustion levels by work location. Only when the social challenge stressors were less severe than usual was exhaustion higher for on-site work. Conversely, social hindrance stressors showed a strong positive relationship with exhaustion when individuals worked on site and no relationship when they worked from home. This relationship pattern is in line with our expectation. Overall, H5a, and H6a are supported.

Regarding positive affect, no interactions were identified, even though the simple slope for days working at the organization was significant ($b = -0.17$, $SE = 0.08$, $p = 0.036$), whereas it was not significant on days working at home ($b = -0.15$, $SE = 0.09$, $p = 0.085$). Thus, counter to the expectations formulated in H5b and H6b, the direct associations of social challenge and hindrance stressors with positive affect were not qualified by work location.

5 Discussion

In this study, our objective was to expand existing research on social stressors by examining the distinctions between social challenge and social hindrance stressors at a daily level. A key focus was comparing their effects on exhaustion and positive affect as a function of the work location, specifically to examine their influence when working from home vs. in the organization's office. Our findings reinforce the recently proposed differentiation between social challenge and social hindrance stressors by Kern et al. (2021). We observed that daily social challenge stressors were positively linked to both exhaustion and positive affect, whereas daily social hindrance stressors were solely associated with increased exhaustion. Notably, employees reported higher levels of exhaustion on days when they worked at the office, but there was no significant difference in positive affect between office and remote workdays. Furthermore, we discovered that social challenge and hindrance stressors had distinct relationships with exhaustion depending on the work location. Social challenge stressors were more strongly and positively related to exhaustion on days spent working from home, while social hindrance stressors exhibited a stronger positive association with exhaustion on days when employees worked at the office.

5.1 Theoretical implications

In alignment with previous studies on remote work (e.g., Sardeshmukh et al., 2012; Biron and van Veldhoven, 2016), we found evidence that employees report less exhaustion on days working at home as compared to days working at the organizational office. In contrast to Anderson et al. (2015), however, participants in our study, on average, did not report differences in their positive affect when comparing work locations. These findings do not align with the proposition maintained in this study, as well as in previous works (e.g., Golden, 2006), that resources can be conserved when working from home. Thus, our findings stress the importance of exercising caution when portraying home office work in a positive light, as benefits or resource gains might be contingent upon individual as well as contextual aspects. For example, with increasing levels of responsibility, employees working from home reported more family to work conflict in a study by Solis (2017). Another example is a study by Junça Silva et al. (2022), in which self-leadership emerged as a moderator in the telework-emotional exhaustion relationship. Specifically, it amplified the negative indirect impact of work overload, particularly for individuals with higher self-leadership scores. An important context factor to consider may be the frequency of working from home. For example, Bentley et al. (2016) found that negative effects of working from home outweighed the positive effects for employees working more than 2.5 days per week on average at home. As working from home transforms from a unique advantage into a commonplace practice, working from home normativity increases. Gajendran et al. (2015) reported a more robust connection between the frequency of working from home, task accomplishment, and autonomy when working from home was considered less common as opposed to when it was widely accepted. Based on these insights, it can be concluded that when the majority of coworkers also engage in remote work, individuals working from home might no longer perceive themselves as having a special privilege, potentially leading to a decrease in the advantages associated with working from home.

Moreover, we add to our understanding of social challenge and hindrance stressors and support the validity of the distinction

TABLE 2 Descriptives and correlations of study variables.

		M	*SD*	ICC(1)	ω_w	ω_b	1	2	3	4	5
1	Work location[a]	0.60	0.49	–			–	0.11	−0.04	−0.25*	−0.23
2	Social challenge stressors	1.82	0.87	0.45	0.64	0.91	−0.01	–	0.76***	0.18	0.12
3	Social hindrance stressors	1.62	0.81	0.46	0.67	0.95	−0.13	0.61***	–	0.30*	0.15
4	Exhaustion	2.50	1.57	0.56	0.86	0.94	−0.13*	0.24***	0.24***	–	−0.44***
5	Positive affect	2.58	0.81	0.55	0.87	0.97	−0.12	0.10*	−0.01	−0.32***	–

$N_{Day-level} = 638$, $N_{Person-level} = 99$. Standardized correlation coefficients at the within-person level are presented in the lower diagonal, at the between-person level at the upper diagonal.
[a]work location: 1 = home office, 0 = organizational premise.
*p < 0.05. ***p < 0.001 (two-tailed).

TABLE 3 Results of multilevel analyses.

	Emotional exhaustion			Positive affect		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Work location[a]	−0.45 (0.20)*	−0.36 (0.20)	−0.34 (0.15)*	−0.17 (0.12)	−0.16 (0.12)	−0.16 (0.10)
Social challenge stressors		0.21 (0.10)*	−0.11 (0.16)		0.21 (0.05)***	0.32 (0.08)***
Social hindrance stressors		0.26 (0.11)*	0.56 (0.15)***		−0.15 (0.06)*	−0.17 (0.08)*
Work location x social challenge stressors			0.56 (0.22)*			−0.16 (0.10)
Work location x social hindrance stressors			−0.56 (0.20)**			0.03 (0.12)

Unstandardized regression coefficients and standard errors in brackets, $N_{Day-level} = 555$, $N_{Person-level} = 94$.
[a]Work location: 0 = organizational premise, 1 = home office.
*p < 0.05. **p < 0.01. ***p < 0.001 (two-tailed).

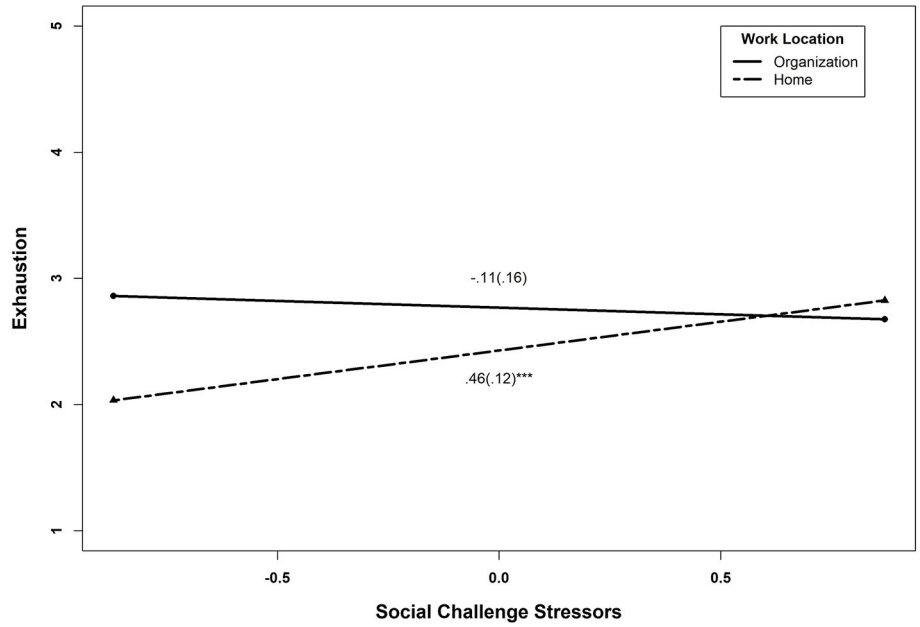

FIGURE 2
Interaction plot for the relationship of social challenge stressors with exhaustion, moderated by work location.

between the social stressor types not only at the between- (see Kern et al., 2021) but also at the within-person level: on the one hand, multilevel confirmatory factor analysis supported the two-factor structure of social stressors. On the other hand, Kern et al. (2021) showed that both social stressor types positively related to strain but exhibited differential relationships with, for example, professional efficacy or affective commitment at the between-person level. By using a daily diary design and by focusing on within-person effects, we provide further evidence that social challenge stressors and social hindrance stressors match the instrumental definitions provided in the challenge-hindrance framework (LePine, 2022). This further adds to the challenge-hindrance framework in general, emphasizing that its core assumptions can also be applied to social stressors at the day level: on days when employees experienced

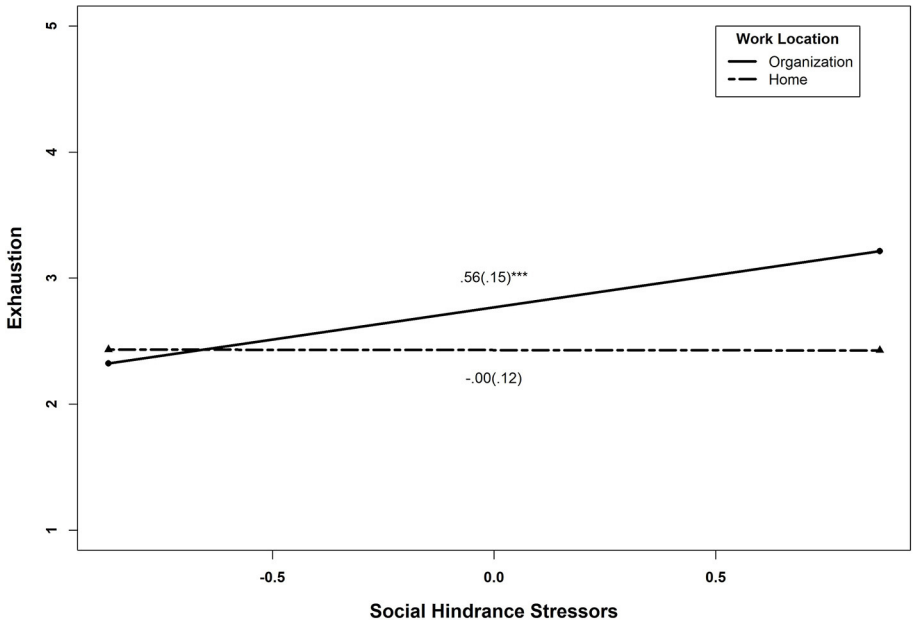

FIGURE 3
Interaction plot for the relationship of social hindrance stressors with exhaustion, moderated by work location.

more hindrance stressors than usual, they felt more exhausted and reported less positive affect. Social challenge stressors, despite showing their straining character, as indicated by a positive relationship to exhaustion, showed a positive relationship with positive affect, reflecting that they may relate to net resource gains and therefore, are worth dealing with. Thus, our findings emphasize that intraindividual variations in social challenge and hindrance stressors have timely effects on employees' daily wellbeing. At the same time, they outline the need for future research that addresses day-specific resources (e.g., autonomy and social support) or task characteristics that explain the daily positive effects of social challenge and the (strain-related) negative effects of both social challenge and hindrance stressors.

Finally, a major contribution of this study refers to the work location as a relevant contextual characteristic that determines the effects of challenge and hindrance stressors at work. We focused on social stressors because working at home restricts social interactions to be indirect via media, mostly via phone and video calls as compared to face-to-face interactions when working together with colleagues at the organizational site. Media richness theory (Dennis and Kinney, 1998) suggests that face-to-face interactions provide the richest form of communication, allowing for a wide range of subtle nonverbal cues. But there is also evidence that communication with coworkers and supervisors can be more effective in a virtual as opposed to a face-to-face setting (Ter Hoeven and van Zoonen, 2015). In line with our predictions, we found social challenge stressors to be less positively associated with exhaustion on days when employees were working at the organization. It seems to be necessary to receive immediate feedback to foster a sense of prosocial achievement that seems to help mitigating the strain effects of social challenge stressors. When working at home, social interactions tend to be more formal, usually scheduled in advance, providing less opportunities for informal feedback. Additionally, social cues may be important for tense social situations, where even subtle nuances in behavior or emotional reactions of interaction partners can be important in mastering the situation. Such social interactions are at the heart of the social challenge stressor concept (Kern et al., 2021) and, according to our results, appear to be more difficult to manage (i.e., require more effort) when communication is mediated through technology. Additional demands such as clarifying misunderstandings caused by technical problems are likely responsible for this extra effort required, leaving employees increasingly strained (e.g., Maurer et al., 2022).

Social hindrance stressors showed a different pattern, with stronger positive effects on exhaustion on days when employees worked at the organization. Social hindrance stressors are characterized by directly threatening people's need to be valued (Semmer et al., 2019), while also being perceived as an obstacle, barrier, or impediment to one's goals, wellbeing, or personal development (Kern et al., 2021). Unlike challenge stressors, which may be seen as opportunities for growth or skill development, hindrance stressors are typically viewed as threats and can hinder an individual's progress or cause distress (Dawson et al., 2016). Working at home may provide opportunities to distance oneself from such encounters, and it might be easier to more immediately talk to others about the stressful experience, seeking for emotional support, for example, from a family member or friend. This is an option which might be restricted when working in the organization due to privacy restrictions.

We did not find any significant interactions regarding positive affect. This suggests that, regardless of the location of work, social challenge stressors are (need-)satisfying, while social hindrance stressors prevent positive emotional experiences. One possible explanation for these results can be drawn from the gains that challenge stressors typically hold. Regardless of whether social

challenge stressors occur when working remotely or in the organization's office, personal accomplishments are likely when the situation is successfully met. When working from home, social challenge stressors may well be more straining, but still encompass a motivational potential because of their relationship to valued goals.

Regarding social hindrance stressors, they should be frustrating whether they occur at home or in the office. Employees can withdraw and limit themselves to formal communication when conflicts occur when working from home, which reduces the stress consequences and regulation costs, but the offense to the persons' social self remains regardless of where the employee works (see also Semmer et al., 2019). A second explanation might be that employees can still experience a sense of mastery or goal attainment despite facing these hindrance stressors. Mastery and goal attainment, in turn, are crucial predictors of positive affect and may act as buffers against the detrimental effects of hindrance stressors (Kronenwett and Rigotti, 2022). Whether other sources of mastery exist may not systematically vary depending on the location of work, and this could have affected the results of the proposed interaction.

5.2 Limitations and further research

When interpreting the findings of this study, we need to consider some limitations. First, we cannot make any causal inferences based on this study. For instance, we cannot rule out that employees deliberately chose to work at home on a specific day to avoid face-to-face interactions with colleagues and supervisors. Also, reciprocal effects between stressors and strain are likely (Guthier et al., 2020), as on days when employees feel exhausted, demanding social interactions might be perceived as more stressful, or employees simply lack resources to cope with these situations.

Second, we cannot rule out a selection bias in our sample, which consisted of mostly higher educated employees. This could be particularly relevant for the findings on social challenge stressors, where Kern et al. (2021) already pointed out that they may not have the same relevance for work in all occupations. Nevertheless, the present sample covered a wide range of occupations and sectors.

Third, data were collected between April and May 2021. During that time, Germany was hit by the third COVID-19 wave, with incidence rates of well above 100 infections per 100,000 citizens (RKI, 2021). Employers were therefore obligated to provide opportunities to work from home, although it was not mandatory to exclusively work remotely, allowing hybrid work schedules. Nevertheless, employees might have felt less discretion in deciding whether they work at home or at the office, providing a potential bias to our results.

Finally, a strict, and a priori classification of stressors into either challenge or hindrance stressors has been criticized (Mazzola and Disselhorst, 2019) based on inconsistent evidence regarding the potential positive effects of stressors, claimed to be challenging. Over the past decade, evidence has accumulated that certain stressors encompass a challenging potential by showing positive relationships with thriving, work engagement, or self-esteem particularly under the consideration of third variables, like concurrent hindrance stressors (Kronenwett and Rigotti, 2019; Schilbach et al., 2023a), the availability of resources (Tadić et al., 2015), or cognitive appraisal (Kronenwett and Rigotti, 2022). Despite adding work location as a relevant boundary condition, we did not consider any of these aspects in our study. Yet, future research might delve further in studying underlying mechanisms (e.g., cognitive appraisals or psychological detachment), as well as additional boundary conditions (e.g., occupations, illegitimacy, telework normativity) to provide more fine-grained evidence when and how challenge stressors unfold their positive potential.

5.3 Practical implications

The empirical findings provide several practical implications for both employers and employees, especially considering the growing prevalence of remote work. For organizations with both remote and in-office work options, this study suggests that the physical work location can influence how social stressors impact employee wellbeing. Employers may consider designing office spaces that mitigate the negative effects of social hindrance stressors or may provide flexible office options such that employees can choose where they work based on their preferences and stressors they may encounter. Companies can further revise their remote work policies based on our nuanced findings. If challenge-oriented stressors are more likely to lead to exhaustion when employees work from home, employers may want to provide additional resources or interventions to help remote workers manage these stressors effectively. In addition, this study highlights the importance of employee training and awareness regarding the potential stressors associated with remote work. Employees can benefit from learning how to recognize and manage stressors specific to their work location, helping them maintain a better work-life balance and overall wellbeing (Krick et al., 2024).

Parker and Grote (2022) proposed four ways of designing work in virtual work environments, which also provide good guidance in light of the present findings. Specifically, they suggest to (a) proactively design work roles when implementing technology, (b) consider human-centered principles in the development, design, and procurement of technology, (c) apply policy-level changes to support better work design, and (d) educate and train employees' digital skills and job crafting (cf. Hardwig and Boos, 2023).

Furthermore, co-working spaces close to home can help mitigate common challenges of remote work by providing a social environment to reduce isolation and foster community. They minimize distractions to enhance productivity and focus, while their proximity reduces commute times, combining the benefits of remote work with a structured, professional environment (Lara-Pulido and Martinez-Cruz, 2023). These spaces also provide flexibility and social interaction, revitalizing remote workers' energy and creativity by addressing the need for a professional routine and a positive work environment.

5.4 Conclusion

Taken together, our study shows that social challenge and hindrance stressors may affect the same individual differently on different days depending on their location of work. Specifically, social challenge stressors were more straining when employees

worked at home, whereas social hindrance stressors only related to strain when employees worked on site, at their organization. We would like to highlight that there is still much to learn about the interplay between stressors and remote work, especially at the within-person level. Therefore, we encourage researchers and organizations to conduct further studies to explore these dynamics in more detail, potentially leading to more refined and effective interventions and policies.

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 study received approval from the Ethics Committee at the Institute for Psychology at the Johannes Gutenberg-University Mainz. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

TR: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing—original draft. MS: Formal analysis, Methodology, Writing—review & editing. MK: Formal analysis, Writing—review & editing.

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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.

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Psychosocial job characteristics comparison between work from home and work in the office: a study from the pandemic onwards

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Introduction: The Covid-19 pandemic changed office workers' work situation through the widespread use of the working from home (WFH) model. It also changed the demands for, and the resources allocated to, the same tasks depending on the location of their execution. The aim of this study was to identify potential differences in the level of theoretically established job stressors between WFH and regular office work, especially with respect to working parents with childcare responsibilities.

Method: We tested the relevant working conditions by conducting repeated online surveys with three measurement times between 2020 and 2022 ($N = 1{,}144$ in total).

Results: Paired sample *t*-tests for each measurement time showed significant differences between WFH and work in the office for six out of seven psychosocial risk factors (e.g., social relationships with supervisors and colleagues). Only work intensity did not differ between WFH and work in the office. The specific challenges for WFH parents caring for children were revealed in a decreased work continuity compared to employees without childcare responsibilities. Our results suggest that job stressors are contingent on the place of work.

Discussion: In conclusion, while WFH affords the opportunity to counterbalance job stressors in the long term, it requires the support of social relationships, especially for full-time WFH employees. Parents with childcare responsibilities require assistance in addressing their individual needs amidst the challenges of WFH.

KEYWORDS

working from home (WFH), COVID-19 pandemic, job characteristics, psychosocial risk factors, childcare, hybrid work

Introduction

The COVID-19 pandemic posed significant challenges to society at the beginning of the 2020's. The first short-term lockdown in the spring of 2020 forced many workers to reduce their working hours, while office workers were often able to take their work home within a short period of time. In Germany, in particular, the percentage of people working from home (WFH) rose from 13 to 21% in 2020 and to 25% in 2021 (Statistisches Bundesamt, 2022), with the trend suggesting that, for the long term, many employees would prefer a hybrid model in which the office and home alternate as the workplace (Bruch, 2022).

In the context of widespread remote work, which is typically digital and location-independent, this study examines the psychosocial risk factors among office workers across various industries. It focuses particularly on the transition to hybrid work models, where employees alternate between office and home settings. Consistent with the findings of the ESENER-3 report (Irastorza, 2019), 24% of EU companies have been found not to undertake mandatory analyses of psychosocial risks, a trend that persists despite significant pandemic-triggered shifts toward remote work.

While previous research has addressed specific risk factors, there is a gap in comprehensive comparisons between office and home workplaces, particularly within the framework of a psychosocial risk assessment (PRA). While pre-pandemic studies often contrasted telecommuters with non-telecommuters, the current landscape reflects fluid transitions between office and home workspaces. Therefore, drawing on the Job Demands-Resources Model (JD-R, Demerouti et al., 2001), this study aims to compare psychosocial hazards within individuals across different work environments. By analyzing data from the pandemic years 2020–2022, we seek to identify potential differences in job characteristics between office and home settings, offering practical and theoretical insights for future work organization and psychological strain mitigation. Additionally, this study extends research (Pousette and Hanse, 2002) that has focused on how variations in the mean values of demands or resources can lead to different associations within generic job stress models.

Literature

To understand the distinctive challenges of the hybrid work model, it is imperative to explore the specific conditions relevant to the model and the most recent findings on the subject. It should be clarified at the outset that this investigation focuses primarily on work from home, which is not legally regulated. In contrast, teleworking is legally protected by the framework agreement of telework in the EU (European Trade Union Confederation (ETUC) et al., 2002) and was established in a few enterprises prior to the pandemic.

Psychosocial risk factors and working from home

Before the pandemic, WFH was possible only for a few employees. For instance, López-Igual and Rodríguez-Modroño (2020) observed a higher incidence of telework permissions among male managers. While the nature of the relevant tasks was often cited as a reason, the quality of trust in the employee-manager relationship and performance was particularly decisive (Beham et al., 2015). Studies prior to 2020 have consistently shown several positive outcomes associated with remote work arrangements. Employees working remotely reported higher levels of commitment, flexibility, and decision latitude (Paridon and Hupke, 2009; Biron and Van Veldhoven, 2016). Additionally, telework was associated with increased job satisfaction, effectively mitigating negative job demands and contributing to the overall wellbeing (Tavares, 2017). Moreover, telework arrangements were found to have positive impacts on individual health, promoting a better work-life balance and reducing stress levels (Tavares, 2017).

Despite its advantages, remote work also presents certain challenges and drawbacks. One of which is that remote workers frequently encounter interruptions and work-family conflicts, affecting their overall job performance and wellbeing (Fonner and Roloff, 2012; Eddleston and Mulki, 2017). Additionally, telework may lead to reduced opportunities for career advancement and blurred boundaries between work and personal life, making it difficult for employees to manage their time effectively and maintain work-life balance (Tavares, 2017). When compared with the hybrid work models that are currently being implemented, these pre-pandemic studies exhibit two noteworthy shortcomings. Generally, these studies compared the data of people who were able to work from home with others working in the office. Additionally, previous research had already examined the specific job-related stress of remote workers, or teleworkers. There is a paucity of research involving the general assessment of the psychological risk of remote work prior to the pandemic. During the pandemic, many workers were forced to work from home, leading to new studies focusing on the unique challenges of WFH during this period. The short-term changes suddenly brought about by the lockdowns posed great challenges to many employees as they were not accustomed to those changes. For many, WFH proved particularly difficult owing to the lack of equipment, performance-related limitations, and lower social support from colleagues and managers (Ipsen et al., 2021; Lee, 2021). These factors coupled with a lack of organizational support can lead to reduced wellbeing and productivity among workers (Ipsen et al., 2021; Becerra-Astudillo et al., 2022; Mihalache and Mihalache, 2022).

During the lockdowns, the paucity of social exchange due to contact restrictions in leisure time resulted in many WFH workers feeling lonely (Killgore et al., 2020). The absence of any opportunity for spontaneous conversations with colleagues proved an added disadvantage (Waizenegger et al., 2020). In addition, there was fear of contagion, uncertainty of the future, and further consequences of the pandemic (Dragano et al., 2021). These limitations resulted in increased stress levels professionally and personally (Hayes et al., 2020; Casjens et al., 2022).

However, as overwhelming as the challenges were due to the sudden switch to WFH, there were also opportunities for improved workplace characteristics. For one, the lack of on-site colleagues could potentially lead to more efficient work and the ability to more freely allocate one's time and tasks. Furthermore, with the elimination of additional trips to the office, work-life balance was strengthened, and many workers felt more comfortable at home (Abdullah et al., 2020; Aczel et al., 2021; Barrero et al., 2021; Ipsen et al., 2021).

The diverse conditions highlighted before and during the COVID-19 pandemic are reflected in recent literature. In their review, Antunes et al. (2023) have provided a summary of the psychosocial risk factors, dividing them into seven categories following the framework of Gollac and Bodier (2011). Recent studies during the pandemic have indicated that four of the factors, namely reduced work intensity and working hours,

social relationships, and fear of job insecurity, decrease in full-time telecommuting. Simultaneously, noticeable increments have been seen in emotional demands and the home/work interface, indicating a blending of the workplace with private life. According to the review, the seventh factor, conflict of values, was not examined closely. Also, as the review focused on psychosocial risks in full- and part-time WFH employees, it is not known how the risk factors affected the same (part-time tele-workers) depending on their job location during and after the pandemic. With these aspects in mind, the present study seeks to shed light on the relevant impact of these factors over the course of three consecutive years between 2020 and the end of the lockdowns.

Job Demands-Resources model

Since the pandemic, several studies have explored the theoretical models of various job characteristics of WFH, like the particularly well-known Job Demands-Resources (JD-R) model (e.g., Barbieri et al., 2021; Demerouti and Bakker, 2023; Kruyen et al., 2023), which involves the linking of workplace factors strain and motivation, and the resultant organizational outcomes.

The JD-R model illustrates the relationship between positive (resources) and negative (demands) work characteristics and their impact on occupational health (e.g., strain outcomes) and wellbeing (e.g., motivation). Demands are identified as negatively valued job characteristics that result from organizational or social factors requiring sustained mental effort, such as emotionally challenging interactions with clients or high levels of work pressure (Bakker and Demerouti, 2007). Resources, on the other hand, are characterized by factors that are positively valued, such as autonomy or helpful feedback (Bakker and Demerouti, 2007). Acting as promoters or obstructors of work activities, demands, and resources can thus determine the productivity and wellbeing of employees (Bakker and Demerouti, 2007). Past research has suggested various adjustments to evaluate the applicability of the JD-R model to emerging work paradigms. For instance, Kruyen et al. (2023) has expanded the model to include personal and home demands/resources in the WFH context, advocating for the clustering of individual demands and resources. In a similar vein, Barbieri et al. (2021) have proposed subdividing resources into organizational and individual aspects, akin to the personal factors discussed by Kruyen et al. (2023). Adding to this discourse, Demerouti and Bakker (2023) have highlighted the intricate interplay between job demands, organizational resources, and individual wellbeing during crises like the COVID-19 pandemic, enriching our understanding of the implications of remote work. Their insights contribute to the ongoing exploration of novel work paradigms, underscoring the need for adaptable frameworks to effectively address the evolving workplace dynamics.

Conventional studies involving WFH have often evaluated conditions exclusively at home or within office settings, utilizing separate cohorts. Our distinctive sample, on the other hand, enabled individuals to directly contrast their experiences in the two settings, uncovering the specific nuances of each. This methodology facilitates the identification of unique resources and demands associated with the office or the home environment. Building on past research on psychosocial risk assessment at work in general, and WFH in particular, the present study aims at analyzing relevant differences in psychosocial working conditions at home and in the office within the predictor structure of the JD-R model. Considering the review of Antunes et al. (2023), the key factors of this examination are the emotional, social, and organizational conditions, which can act as either resources or demands in the context of the JD-R model. These factors can be seamlessly integrated into the existing German occupational safety Guidelines for Psychosocial Risk Assessment at work (Beck et al., 2014).

Hypotheses

In the present study, we focus on emotional demands at the workplace as an emotional condition (see Antunes et al., 2023) according to the usual procedure in PRA. Prior studies have documented a pre-pandemic reduction in emotional demands while working from home, and an increase during the pandemic lockdown phases (see Antunes et al., 2023). However, increased emotional demands in WFH during the pandemic may have been uniquely related to concerns about infections and the pandemic's progression. In this study, the focus is on emotional demands intrinsic to job tasks, such as direct interaction with clients or customers. Consequently, with less customer contact/public interaction in WFH compared to the office, these demands are expected to be lower, leading to the first hypothesis:

Hypothesis 1: The emotional demands of the job are lower in all 3 years when working from home compared to working in the office.

As mentioned earlier, social conditions, measured here as social relationships and support, fundamentally differ between the office and home. In the office, spontaneous interactions often occur during daily commutes, fostering immediate exchange. Conversely, in the home office, deliberate efforts are required to connect with colleagues and supervisors. Various studies (Ipsen et al., 2021; Lee, 2021; Becerra-Astudillo et al., 2022; Kruyen et al., 2023) have highlighted a reduction in social resources and support during WFH. However, these studies have often compared telecommuters with office-based workers, or have linked telecommuters' experiences with only specific outcomes, thus lacking a direct comparison between participants' home and office workplaces. This leads to the following hypothesis:

Hypothesis 2: Social resources are lower when working from home compared to working in the office in all 3 study years.

The third area under consideration is organizational conditions, which can be divided into different subcategories according to the usual procedure for PRA. According to the procedure used here, these conditions include the following four factors: work intensity as a demand, and job resources like job autonomy, work continuity and task clarity. Autonomy, as per the JD-R model, is linked to increased work motivation (Demerouti et al., 2001) and is perceived to be higher in the home office due to greater opportunities to control the process involving particular tasks (Ipsen et al., 2021). Work continuity may also be better in the home office due to fewer interruptions (e.g., Abdullah et al., 2020). However, previous studies on work intensity contradict each other, with some showing a reduction in work intensity (review of

Antunes et al., 2023) and others an increase (Rebelo et al., 2024). The change in task clarity is also unclear owing to a paucity of knowledge in this respect. However, from the lack of in-person exchange and altered digital organizational structures, it can be inferred that WFH can have a negative effect (Ipsen et al., 2021; Rodríguez-Modroño and López-Igual, 2021). Existing reviews (Beckel and Fisher, 2022; Antunes et al., 2023) and studies (e.g., Ipsen et al., 2021; Kruyen et al., 2023) offer divergent results on the organizational factor. Therefore, our third hypothesis remains non-directional considering the difference in psychosocial working conditions between the office and home:

Hypothesis 3: Organizational factors, involving work intensity, job autonomy, work continuity and task clarity, differ in all 3 years between working from home and working in the office.

In addition to the three hypotheses, the present study includes three exploratory research questions. Following the initial short-term shift to WFH in the spring of 2020, this condition became normal for many workers as the pandemic continued. With periods of lockdown-like conditions persisting throughout 2021, hybrid work models alternating office work and WFH became established to help curb the COVID-19 contagion.

After 3 years of the pandemic's impact, it was possible to take stock of the situation with respect to WFH and draw conclusions about the pros and cons of a switch from office to WFH. Similarly, the fear of infection had been mitigated by the increase of vaccinated populations (DAK-Gesundheit, 2022). Therefore, for 2022, there should have been a more factual or generalizable consideration of job demands and psychosocial working conditions in the hybrid work models. It was possible to measure the concrete effects of WFH on occupational health and safety and thus arrive at relevant recommendations with respect to the work-related stress models. As illustrated, there are different and even contradictory findings regarding the levels of different job characteristics in WFH and working in the office (e.g., social relations with the supervisor) before and during the COVID-19 pandemic (Tavares, 2017; Ipsen et al., 2021; Lee, 2021). For example, while the relationship between remote workers and their leaders was markedly good before the pandemic, there was less contact during the pandemic, owing to the whole team working from home (Beham et al., 2015; Lee, 2021). That being said, the conditions have evolved throughout the pandemic, with the development of digital meeting and collaboration structures, and organizations increasingly adapting to digital formats, leading to work intensity becoming more established. The consideration of the diverse time points of data collection during the pandemic and lockdowns led to the following research question:

Research Question 1: In terms of psychosocial risk factors, does any habituation effect cause a reduction in the disparity between the two workplaces (WFH and office)?

The second and third exploratory questions involve the special situation of working parents, who faced particularly difficult challenges during the lockdowns because they had to take care of their children due to the closure of day-care facilities and schools. Having had to fulfill two roles, they reported higher stress levels as well as lower life satisfaction compared to those without children (Hübener et al., 2021; Calvano et al., 2022). In particular, WFH mothers who cared for their children took on more care tasks during the lockdowns than fathers (Kohlrausch and Zucco, 2020), thus reporting lower job-related productivity and even lower life as well as job satisfaction (Feng and Savani, 2020; Hübener et al., 2021). However, there were no data as to the exact workplace characteristics among WFH parents as a special group. Thus, a better understanding of the workplace risk factors may aid parental support. Following the JD-R model, increasing resources and reducing demands are fundamental conditions for higher motivation and reduced strain, which in turn can help augment organizational outcomes. Hence the following research questions:

Research Question 2: How do psychosocial risk factors differ between workers with and without childcare responsibilities?

Research Question 3: Is there a gender-based difference in the way psychosocial risk factors affect caregiving parents?

Materials and methods

Procedure

To test the hypotheses and the research questions, an online survey was conducted as a cross-sectional study for 3 consecutive years (2020, 2021, and 2022) in a within-subject design. Participants were approached in all 3 years via social media and distribution lists of various companies from different branches. To participate in the study, they had to work at least part of their working time from home. The participants were able to leave their email addresses of the 1st year for the follow-up survey in the 2nd and 3rd years. Each participant was asked to report on common workplace characteristics both at the office and while working from home. During the lockdowns, some participants were exclusively working from home at the time of survey participation, they were required, therefore, to provide answers based on their past experience in the office.

Since the initial survey did not anticipate future repetitions, overlapping participants could only be identified based on the question "Did you participate in the first survey last year?" For the second and third surveys, individual codes were provided as a pandemic-related precaution. While a massive mismatch of participant codes precluded a true longitudinal study, it was possible to determine that at least 29% from the 1st year participated in the second survey, and 18% from the 2nd year participated in the third measurement occasion. Consequently, we treated the three measurements as coming from three different samples. The study was approved by the local ethics committee (EK 23-006), and the participants provided informed consent before providing their responses.

Participants

After adjusting the sample to account for incomplete questionnaires or the absence of a WFH portion, a total of 1,144 participants (2020: 489; 2021: 497; 2022: 158) were included in the analysis. Demographic characteristics of the samples can be found in Table 1 for each year and overall. In addition, office workers came from various branches: 45.1% of respondents worked in the information sector, followed by 33.4% in the service sector, 15.3%

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TABLE 1 Sample description at all measurement points in percentage.

	T1	T2	T3	Overall
N	489	497	158	1,144
Age				
18–30	36.4	20.9	18.4	27.2
31–40	25.8	28.4	20.9	26.3
41–50	15.5	18.5	14.6	16.5
51–60	18.6	27.2	37.3	24.9
61–70	3.5	4.8	8.9	4.8
Gender				
Men	44.0	40.0	50.6	43.2
Women	55.4	57.9	48.7	55.6
Non-binary	0.2	1.0	0.6	0.6
No answer	0.2	1.0	0	0.5
Hours per week				
Full-time	76.8	68.8	69.0	72.2
Part-time > 19 h	16.8	25.6	23.4	21.5
Part-time < 19 h	6.4	5.6	7.6	6.2
Other factors				
Manager	12.1	12.5	13.9	12.5
% of WFH	85.0	76.0	52.8	76.6
Child care	19.8	15.9	8.2	16.5

T1 = 2020, T2 = 2021, T3 = 2022.

in industry, 9.6% in pharmaceuticals, and 0.9% in agriculture. While most participants were employees (94.8%), 3.4% were self-employed and 0.9% were freelancers. Out of the 190 (16.5%) participants who reported to have childcare responsibilities while working from home, 58.4% were women.

Measures

At all three measurement points, an online questionnaire was used to collect data on age and gender, branch, employment relationship, job scope, and extent of WFH involvement.

The study explicitly concentrated on evaluating job characteristics based on the broad categories of the JD-R model to determine the different frequencies of occurrence in demands and resources. Recent considerations regarding the categorization of demands and resources within the JD-R model, as proposed by Schaufeli and Taris (2014), suggest they may represent two sides of the same dimension (for example, a lack of resources could also be considered a type of demand). So, we selected a survey aimed at evaluating psychosocial job characteristics in a value-neutral manner, namely the PsyHealth questionnaire (Kuczynski et al., 2020). The categorization was grounded in the foundational principles of the JD-R model (see, for example, Nebel et al., 2010). A particularity of the survey is the condition-related and not person-related assessment of psychosocial work characteristics (Schneider et al., 2019). For all scales, participants had to respond on a four-point frequency scale (0 = "at no time some of the time" up to 3 = "most or all of the time"), indicating how often a specific workplace characteristic occurred in WFH or work in the office. This implies that participants responded to all items twice: once related to the demands and resources when WFH and once while in the office. A fifth response option was the option of "not applicable" in case the characteristic did not apply to their relevant activity. This option, however, was excluded from the calculations. The items for each respective subscale were calculated to form a mean value. For analyses, all categories, except emotional demands, were coded, so that a higher mean value classified the work characteristics as a resource and a lower mean value as a demand. Emotional demands were coded the other way round due to the negative orientation of the items and the term. A higher value therefore meant a higher demand.

Emotional demands were assessed using the 3-item subscale "emotional challenges" from the PsyHealth Instrument (Kuczynski et al., 2020). A sample item was: "Within the activity, it is necessary to strongly suppress one's own feelings."

Social resources were measured with two separate subscales with four items each representing social relationships with colleagues and the immediate supervisor. Participants had to indicate how often colleagues or supervisors showed a specific behavior during WFH and while working in the office. A sample item was: "Colleagues in this activity area support each other when necessary." A sample item related to the supervisor was: "Direct supervisors in this activity area help with problem situations as necessary."

Job autonomy as the first organizational job characteristic was measured with the decision latitude subscale consisting of three items. A sample item was: "Within the activity the content and scope of the tasks can be influenced."

Workload as the second organizational job characteristic was assessed with the "work intensity" subscale. On five items, participants had to report how often specific conditions had occurred, including the following: "Within the activity, regular recovery breaks are taken."

Work continuity was measured with the 3-item subscale, a sample item was: "Within the activity only one task is performed at a time."

As the last work characteristic, task clarity was assessed with the respective 3-item subscale. A sample item was: "Within the activity work orders are clearly defined." All subscales with their respective Cronbach's Alpha reliabilities are shown in Table 2. The values were calculated for all 3 years and for both work settings.

Statistical analyses

The data analysis was conducted using the SPSS statistical program version 29 (IBM Corp, 2022). To test the hypotheses, paired-samples *t*-tests were conducted for the individual years 2020–2022 by comparing the mean values of each job characteristic in the office and while WFH. According to the Intersection Union principle, the hypotheses are only fully accepted if all 3 years demonstrate a significant difference (All-or-None decision rule). This ensures that the risk of a Type I error does not increase,

TABLE 2 Job demands and resources with the range of Cronbach's Alpha between years and workplaces.

Subcategories	Cronbach's α	Number of items
Emotional demands	0.479–0.638	3
Social relationships with colleagues	0.764–0.822	4
Social relationship with supervisors	0.794–0.823	4
Decision latitude	0.677–0.750	3
Work intensity	0.605–0.747	5
Work continuity	0.516–0.618	3
Task clarity	0.677–0.789	3

The Cronbach's α was calculated for all three measurement times while working in the office and WFH.

rendering the adjustment of the significance level unnecessary (Berger, 1982; Neuhäuser, 2006). As hypotheses 1 and 2 are directional hypotheses, a one-tailed significance level is applied, while hypothesis 3 is tested using a two-tailed approach.

Research question 1 is presented descriptively, with the means of the years being exploratively examined solely due to the distinct sample compositions. Due to the small number of participants with parallel childcare in 2022, research questions 2 and 3 were calculated using paired-samples *t*-tests only in 2020 and 2021. According to the procedure described above, a two-tailed test was carried out for RQ 2 and 3 with no adjustment for the significance level. The work location served as the independent variable (office vs. WFH) and the job characteristics with their seven subcategories served as the dependent variables.

Results

The Pearson correlation coefficients of all study variable per year and work setting, are presented in the Supplementary material within the correlation tables (Supplementary Tables 1–6).

The hypotheses expected differences in job characteristics between WFH and working in the office. The results of the *t*-tests of each job characteristic are shown in Table 3.

Hypothesis 1 could be accepted based on the results of the *t*-tests presented in Table 3. The emotional challenges, conceptualized as demands according to the JD-R model, were consistently lower when working from home across all three assessments compared to the office setting. The effect sizes were considered modest (Cohen's *d*: 0.412–0.491; Cohen, 1992).

Hypothesis 2 could also be fully accepted as, across all three measurement points, social relationships with colleagues and supervisors were lower when working from home compared to the regular office workplace. The effect sizes were small (0.218–0.274; Cohen, 1992).

Since hypothesis 3 includes several constructs, the results are presented for each variable. With respect to decision latitude and task continuity, participants reported more decision latitude and better task continuity when working remotely compared to the office setting across all 3 years. Notably, task continuity exhibited substantial effect sizes (0.542–0.778; Cohen, 1992), while decision latitude displayed relatively smaller ones (0.122–0.236; Cohen, 1992). Work intensity yielded inconsistent results, with a significant difference for reduced workload in the office reported only in 2021. Compared to office work, the clarity of tasks in WFH was significantly lower during the first two assessments than reported in 2022. Accordingly, the effect sizes are small for work intensity (0.017–0.133; Cohen, 1992) and task clarity (0.012–0.254; Cohen, 1992). Thus, hypothesis 3 could only partially be supported for the constructs of decision latitude and task continuity.

To apply research question 1, the descriptive values of the 3 years in Table 3 are compared with each other. These showed a majority of the *t*-tests to be significant, but not uniformly and across all 3 years. Emotional demands and social relationships were significantly different depending on the work setting with a small effect size, and work continuity showed significant differences with a medium effect size (Cohen, 1992). Since this was not a longitudinal survey with the same sample, no appropriate inferential statistical procedures were applied.

Research question 2 looked at the difference in job demands between WFH participants who took care of children and those who did not. The results of the *t*-tests in 2020 and 2021 are shown in Table 4. As seen in Table 4, there were significant effects in work continuity, work intensity and emotional demands (only 2021) with a medium effect size (Cohen, 1992). WFH participants without childcare had higher values there.

Possible gender differences in job characteristics for WFH participants caring for children were collected in Table 5 to answer research question 3. As shown in Table 5, there were no significant differences in job characteristics between WFH men and women while caring for children.

Discussion

The present study surveyed the difference between WFH and working in the office in terms of the occurrence levels of common job characteristics at three measurement points. The aim of the study was 2-fold: On the one hand, we wanted to explore the difference between the two job settings (WFH and the office) in the context of the theoretically based job factors according to the JD-R model (Demerouti et al., 2001). On the other hand, we wanted to estimate the resources and demands with respect to WFH parents with childcare responsibilities.

Discussion of the findings

The results of the study clearly showed differences in job characteristics between WFH and working in the office, irrespective of the year of their assessment. While WFH employees reported lower levels of emotional demands, they also received lower social relationships with colleagues and managers. As expected, the organizational factors also showed different results. Decision latitude and work continuity were rated higher in WFH, while task clarity was lower, especially at the beginning of the pandemic. In line with previous literature (Antunes et al., 2023; Rebelo et al., 2024), work intensity exhibited varying directions. No

TABLE 3 Descriptive and *t*-test results comparing psychosocial job characteristics between WFH and the office.

Year	Workplace		WFH		*t*-test			
	M	*SD*	*M*	*SD*	*T*	*N*	Cohens *d*	*p*
Emotional demands								
T1	1.59	0.63	1.38	0.51	10.22***	445	0.486	<0.001
T2	1.53	0.59	1.38	0.50	8.67***	443	0.412	<0.001
T3	1.55	0.65	1.37	0.52	5.01***	148	0.434	<0.001
Social relationships with colleagues								
T1	3.67	0.46	3.59	0.51	4.97***	431	0.240	<0.001
T2	3.70	0.48	3.59	0.53	5.90***	462	0.274	<0.001
T3	3.71	0.44	3.66	0.47	2.87**	160	0.227	0.003
Social relationships with supervisors								
T1	3.43	0.63	3.31	0.68	7.73***	434	0.371	<0.001
T2	3.37	0.68	3.26	0.73	6.86***	452	0.323	<0.001
T3	3.41	0.67	3.32	0.72	2.78**	162	0.218	0.004
Decision latitude								
T1	3.18	0.69	3.24	0.68	−2.64*	466	0.122	0.006
T2	3.18	0.75	3.29	0.73	−4.77***	461	0.222	<0.001
T3	3.37	0.65	3.45	0.63	−3.01**	163	0.236	0.002
Work intensity								
T1	3.21	0.61	3.22	0.60	−0.35	449	0.017	0.441
T2	3.26	0.63	3.21	0.64	2.88**	466	0.133	0.002
T3	3.30	0.53	3.35	0.59	−1.67*	160	0.132	0.069
Work continuity								
T1	2.33	0.67	2.71	0.69	−11.90***	483	0.542	<0.001
T2	2.29	0.70	2.62	0.69	−11.98***	479	0.547	<0.001
T3	2.27	0.64	2.79	0.63	−10.03***	166	0.778	<0.001
Task clarity								
T1	3.57	0.55	3.48	0.59	5.32***	440	0.254	<0.001
T2	3.54	0.54	3.49	0.55	5.10***	437	0.244	<0.001
T3	3.65	0.51	3.64	0.50	0.15	156	0.012	0.440

Comparing the subcategories of PsyHealth in dependence of WFH or working in the office.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. T1 = 2020, T2 = 2021, T3 = 2022.

approximation of job characteristics with respect to the two work locations was shown over time.

The study suggests consistent differences in workplace characteristics over time, with potential benefits for employees in the long run. After 3 years, WFH may no longer be as unfamiliar or challenging as it was at the beginning of the pandemic. Some companies are adopting hybrid and flexible solutions, allowing employees to split their work between the office and home. This approach, leveraging the improved conditions in WFH, especially in decision-making and work continuity, can be advantageous for tasks requiring concentration. In 2022, the substantial effect of work continuity and the medium effect of reduced emotional demands supported WFH. These advantages, coupled with improved relationships and enhanced task clarity, make WFH a valuable option for specific tasks, while face-to-face interactions in the office can be reserved for constructive communication.

In tandem with numerous studies (Barbieri et al., 2021; Ipsen et al., 2021; Lee, 2021; Becerra-Astudillo et al., 2022; Antunes et al., 2023; Demerouti and Bakker, 2023; Kruyen et al., 2023), our study illuminates the enduring impact of job demands, such as increased social isolation, while emphasizing the crucial role of organizational and individual resources in alleviating stress and enhancing job satisfaction. It is also essential to consider the complex interaction between the factors of the JD-R model during crises, like the COVID-19 pandemic, as elucidated by Demerouti and Bakker (2023). Although not explicitly addressed in this synthesis, the study by Becerra-Astudillo et al. (2022) remains integral to the overall discourse. Their exploration of the influence

TABLE 4 Descriptive and *t*-test results between WFH people with and without parallel childcare roles.

Year	No childcare			Childcare			*t*-test		
	M	*SD*	*N*	*M*	*SD*	*N*	*T*	Cohens *d*	*p*
Emotional demands									
T1	1.38	0.51	350	1.40	0.51	86	−0.39	0.047	0.695
T2	1.36	0.48	375	1.49	0.57	71	−2.05	0.266	0.070
Social relationships with colleagues									
T1	3.58	0.51	343	3.65	0.49	89	−1.14	0.135	0.256
T2	3.60	0.52	390	3.55	0.54	76	0.77	0.096	0.443
Social relationships with supervisors									
T1	3.32	0.66	351	3.27	0.76	85	0.57	0.069	0.571
T2	3.27	0.72	385	3.19	0.75	73	0.82	0.105	0.411
Decision latitude									
T1	3.24	0.67	374	3.24	0.71	92	−0.05	0.006	0.961
T2	3.30	0.72	387	3.28	0.80	76	0.21	0.026	0.835
Work intensity									
T1	3.25	0.58	360	3.10	0.65	89	2.13*	0.252	0.034
T2	3.25	0.62	394	3.02	0.69	75	2.90**	0.366	0.004
Work continuity									
T1	2.77	0.68	388	2.45	0.68	95	4.08***	0.466	<0.001
T2	2.68	0.66	406	2.26	0.76	75	4.96***	0.624	<0.001
Task clarity									
T1	3.49	0.59	351	3.46	0.62	89	0.30	0.035	0.767
T2	3.50	0.55	367	3.44	0.55	71	0.84	0.109	0.401

Comparing the subcategories of PsyHealth in dependence of childcare during WFH.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. T1 = 2020, T2 = 2021.

of teleworking on job satisfaction and productivity during the pandemic aligns with the broader theme of understanding the implications of remote work. The nuanced findings from Becerra-Astudillo et al. (2022), interwoven with those of Barbieri et al. (2021), Antunes et al. (2023), and Kruyen et al. (2023), collectively enrich our understanding of the dynamic interplay between WFH, job characteristics, and employee wellbeing.

Moreover, while our study identifies stable differences in job characteristics between WFH and office work over time, insights from Barbieri et al. (2021) complement this narrative by emphasizing the mediating role of job satisfaction and stress in shaping overall wellbeing. Similarly, Becerra-Astudillo et al. (2022) provide valuable insights into the influence of teleworking on job satisfaction and productivity during the pandemic, in alignment with the broader theme of understanding remote work in terms of its implications. As outlined by the JD-R model, and underpinned by the work of Demerouti and Bakker (2023), the observed reduction in emotional demands and sustained work continuity during WFH corresponds to increased resources in the home setting, while decreased social relationships and uncertain task clarity align with increased demands in the home setting. Recognizing these nuances is imperative for the implementation of hybrid work strategies, necessitating the provision of adequate resources, fostering effective communication, and addressing emerging demands during telework to optimize benefits and mitigate the challenges identified in the JD-R model.

The examination of work characteristics among WFH parents with childcare responsibilities showed a deterioration in work continuity and intensity, indicating increased interruptions and a mismatch between workload und work time. There were no meaningful differences between men and women caring for children in WFH settings. These effects were specific to the pandemic, linked to the closing of childcare opportunities, and the analysis was limited to the first 2 years of the pandemic. With the closure of schools and day-care facilities, WFH parents were required to simultaneously manage home-schooling and work, leading to predictable consequences of lower levels of continuity and intensity in their professional duties. However, the study did not reveal any other noteworthy negative effects for WFH parents with childcare roles.

Incorporating the JD-R model, our study provides crucial insights into the unique challenges faced by WFH parents, emphasized decreased work continuity and intensity due to the dual responsibilities of home-schooling and work. This aligns with the findings of Leroy et al. (2021), highlighting greater interruptions among WFH individuals, particularly women, during

TABLE 5 Descriptive and *t*-test results examining WFH men and women with childcare duties.

Year	Men			Women			*t*-test	
	M	*SD*	*N*	*M*	*SD*	*N*	*T*	Cohens *d*
Emotional demands								
T1	1.32	0.45	37	1.46	0.55	49	−1.25	0.271
T2	1.43	0.50	31	1.54	0.63	39	−0.78	0.187
Social relationships with colleagues								
T1	3.69	0.36	39	3.62	0.57	50	0.74	0.158
T2	3.47	0.58	30	3.60	0.53	45	−1.03	0.243
Social relationships with supervisors								
T1	3.36	0.61	37	3.20	0.86	48	1.01	0.221
T2	3.16	0.80	27	3.22	0.73	45	−0.35	0.085
Decision latitude								
T1	3.33	0.67	40	3.17	0.73	52	1.12	0.236
T2	3.31	0.75	30	3.30	0.77	45	0.04	0.010
Work intensity								
T1	3.23	0.62	36	3.02	0.66	53	1.57	0.339
T2	3.01	0.64	31	3.03	0.73	44	−0.13	0.030
Work continuity								
T1	2.33	0.61	40	2.54	0.71	55	−1.47	0.306
T2	2.09	0.64	30	2.34	0.78	44	−1.46	0.345
Task clarity								
T1	3.51	0.45	38	3.43	0.73	51	0.58	0.124
T2	3.28	0.62	26	3.52	0.50	44	−1.73	0.427

Comparing the subcategories of PsyHealth in dependence of sex with childcare and WFH.
T1 = 2020, T2 = 2021.

the COVID-19 pandemic. Focusing on the impact of privacy fit on work fatigue, the study of Weber et al. (2023) offers further context to the challenges associated with the working environment at home.

Collectively, these findings underscore the intricate relationship between job demands, such as interruptions and dual responsibilities, and the necessary resources, such as privacy fit, in shaping the WFH experience. The interconnected factors influencing work continuity and intensity among WFH parents contribute to a nuanced understanding of the remote work landscape, emphasizing the relevance of the JD-R model in guiding future interventions and strategies to support employee wellbeing in hybrid work settings. Importantly, in contrast to prior studies about wellbeing, job productivity, job satisfaction, and care tasks (Feng and Savani, 2020; Kohlrausch and Zucco, 2020; Hübener et al., 2021; Bernhardt et al., 2023), no significant difference in workplace characteristics was found between WFH women and men with childcare duties. This might have been due to the small sample size and the participants' diverse WFH conditions and family demands, the data on these aspects had not been collected. Descriptively, a higher level of work continuity was found among women. A relevant question here would be whether this was due to women being generally more accustomed to WFH and caring for children, or whether some other factors were in play.

Limitations

One main limitation of the study is that the three samples of the consecutive years are not comparable. As mentioned above, the samples were composed of different participants, precluding a longitudinal inferential statistical comparability. But, given the proportional overlap in the participants, we used the propensity score matching (PSM) technique (see Supplementary material) to replicate the results of the descriptive analysis and attempt an approximation of the longitudinal data. The longitudinal comparison of the 3 years showed no effects of the workplace due to familiarization with the pandemic. Another limitation is the self-report nature of the data. However, Pauli and Lang (2024) have shown that the measure used for assessing job characteristics in this study is robust toward any subjectivity bias due to its conditional and not person-centered item wording and its frequency response scale.

Additionally, in the third assessment year, the sample was significantly smaller than the previous ones. As the closure of schools and day-care centers was sporadic in 2022, there were only 13 participants who had childcare duties while WFH. Thus, there was not enough statistical power to calculate the research questions.

Furthermore, the reliability of the subscales for at least two job characteristics (i.e., work continuity and emotional demands) can increase the measurement error in the findings, the interpretation of which, therefore, should be made with caution. The findings should also be replicated in future studies and thus corroborated.

Implications and future directions

For theoretical considerations, the present study demonstrates that the psychosocial work characteristics of a particular job can differ in the level of occurrence depending on the job setting. This finding is particularly relevant as past research (e.g., Pousette and Hanse, 2002) has shown that the association paths from established job stress models may not universally apply across occupational contexts, questioning the generalizability of these models. Therefore, future studies should consider the specificities of the samples being investigated and their respective work environments.

In a similar vein, future investigations may explore whether the adaptation proposed by recent researchers (e.g., Kruyen et al., 2023) also holds for general psychosocial risk factors. This would necessitate examining specific industries based on the nature of tasks and accordingly scrutinizing the models for their validity. While there has not been enough consistent examination of identical tasks in different locations, our study has made significant strides in this regard, which may prove crucial for the continued and successful implementation of hybrid work models in diverse countries and industries.

As a practical implication, given the durable adoption of hybrid work models, more attention needs to be paid to occupational health and safety with respect to WFH. In Germany, the rules for protecting workers are set out in the Occupational Health and Safety Act (Arbeitsschutzgesetz). This also includes the consideration and assessment of psychosocial risk factors, which represent a major challenge for employers because they, unless duly considered, can lead to mental and physical illnesses (Rosário et al., 2016). These observations can help employers to better meet the needs of their employees and ensure the maintenance of psychosocial health by considering the relevant risks and intervening accordingly.

A practical recommendation for working parents would be that, since they are frequently forced to shoulder the dual responsibilities of work and childcare, they ought to have more flexible options in terms of time allocation and place of work. Should hybrid work models become the norm, it would be interesting to examine family structures and differences in WFH behavior between men and women. Future studies with longitudinal measurements with respect to participants involved in hybrid work models may shed valuable light on the actual habituation effects and consequences of psychosocial risk factors. Effective strategies may then be adopted for work design depending on the place of work.

In addition, only general psychological risk factors were assessed in this study. Although previous research has already identified many specific psychosocial risk factors for remote workers, e.g., the physical conditions (temperature, indoor air quality, and acoustics), there are other ergonomic aspects (commuting behavior, etc.) that lead to further challenges for WFH or work in the office (Holland, 2016; Awada et al., 2021; Ahmed et al., 2022). Given these methodological shortcomings of our study, and its lack of industry specification, more research ought to be conducted in this area focusing on the practical benefits of the hybrid work model in companies. Future research should also highlight the importance of risk assessment and investigate the validity of the previous job stress models in more detail.

In a nutshell, this study gives us a clear picture of the general psychosocial challenges at office workplaces that need to be considered for both research and practice. Future research should consider the different levels of job characteristics within the same work activity depending on the setting. Past research has indicated that the absolute levels of job stressors from general job stress models may cause distinct effects. Organizations, therefore, ought to develop strategies that might allow them to effectively schedule tasks according to the job setting of hybrid work models. Leaders can use this information to guide their work design and directives. The distinct resources of the two job settings should be strategically exploited not only for greater performance efficiency, but also for the prevention of negative strain outcomes. For the society as a whole, the promotion of better working conditions is likely to lead to a healthier workforce.

It may be safe to conclude, as a first step, that a hybrid work model, allowing demanding tasks to be performed at home and social resources to take place on days in the office, may combine the advantages of both job settings, minimizing the employees' psychosocial risk factors and augmenting both their satisfaction and productivity.

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 humans were approved by the Ethikkomission of the Medicine Faculty, RWTH Aachen University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CP-R: Data curation, Formal analysis, Methodology, Writing—original draft. MS: Conceptualization, Writing—review & editing. TK: Conceptualization, Writing—review & editing. JL: Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing—review & editing.

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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.

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Supplementary material

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Leading in times of crisis and remote work: perceived consideration leadership behavior and its effect on follower work engagement

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Based on the job-demands resources theory, we examine whether leadership behavior affects followers' work engagement in the context of remote work during times of crisis, and how this effect can be explained. We focus on consideration leadership and its impact on followers' engagement under conditions of enforced remote work during the COVID-19 pandemic. Therein, we examine the role of optimism as a potential mediator. To better understand how the impact of consideration leadership behavior unfolds during crises, we examine whether being new to remote work and feeling personally impacted by COVID-19 amplified the proposed relationship between consideration leadership and followers' engagement. A sample of 729 German employees participated in a three-wave study across 6 weeks in May and June 2020. Longitudinal structural equation modeling uncovered direct positive effects of consideration leadership on changes in followers' work engagement in the second time lag (T2 to T3), while optimism did not mediate this effect. Multigroup comparisons revealed that employees who worked from home were particularly responsive to consideration leadership. No moderating effects were found for whether the COVID-19 pandemic personally impacted employees. The discussion highlights the critical role of leadership in followers' motivation and wellbeing in times of crisis and remote work.

KEYWORDS

COVID-19, crisis, work engagement, optimism, remote work, consideration, leadership, pandemic

1 Introduction

Over the past years, the prevalence of working from home has witnessed a surge, particularly driven by the health risks associated with the COVID-19 pandemic during 2020 and 2021. While some employees had worked in home office arrangements before the pandemic, enabled through technological advancements and a growing emphasis on the work-family interface (Cascio and Montealegre, 2016), the COVID-19 pandemic acted as a catalyst for the widespread adoption of telework: In Germany, for example, the percentage of employees working from home increased from 17% before the pandemic to 44% during the onset of the pandemic (Emmler and Kohlrausch, 2021). Now that remote work has

become a norm rather than the exception, many organizations and employees have come to appreciate the benefits, such as flexibility and reduced commuting time, as reflected in the fact that opportunities to work from home are continuously being offered or even expanded in the post-pandemic era (Shifrin and Michel, 2022).

However, the initial transition to remote work due to COVID-19 occurred during a period of disruption, placing employees and leaders in a situation characterized by the simultaneous presence of numerous demands, such as the loss of working routines and increased loneliness (Wood et al., 2021)—factors that might have jointly accounted for decreasing levels of work engagement during the beginning of the pandemic (Syrek et al., 2022). This disruption creates the need to examine factors that are effective in fostering work engagement in the context of remote work during crises. Work engagement is critical as it is positively associated with employee performance and wellbeing (Neuber et al., 2022; Mazzetti et al., 2023). While some antecedents to work engagement, such as organizational support or job crafting have previously been studied in the COVID-19 context (Mäkikangas et al., 2022), fewer studies focused on the effects of leadership. Nonetheless, leadership has long been recognized as a job resource according to the job demands-resources theory (JD-R Theory; Demerouti et al., 2001), demonstrated by many studies published before the pandemic (Lesener et al., 2020; Tao et al., 2022). Against this backdrop, leadership was likely a vital resource to support employees during COVID-19 (Rudolph et al., 2021). The literature proposes two overarching approaches to effective leadership during crises and remote work, one recommending an agentic, task-oriented leadership style and the other a communal, relationship-oriented approach (Demerouti and Bakker, 2022). While both styles are generally considered important, in periods of heightened insecurity and isolation such as the COVID-19 pandemic, relationship-oriented behaviors, which we operationalize through consideration leadership, might become particularly relevant to satisfy employees' increased need for leadership (Bartsch et al., 2021; Eichenauer et al., 2022; Bell et al., 2023).

In terms of explanatory mechanisms, the pandemic's uncertain trajectory and ongoing restrictions necessitate a focus on psychological constructs that enable adaptive responses by employees. Here, personal resources emerge as a critical mechanism, as conceptualized in the most recent JD-R model (Demerouti and Bakker, 2022; Bakker et al., 2023). Where future outcomes are uncertain and constantly evolving, optimism stands out as a key personal resource (Scheier and Carver, 1992). It entails a positive, forward-looking attitude that might help employees maintain their motivation and engagement in the face of adversity (Hobfoll, 2002). Such optimistic outlook can be encouraged by consideration leadership (Kim and Choi, 2023). Take, for instance, the increased challenges encountered by employees with children during the pandemic, balancing remote work and childcare. A leader who seems approachable, shows understanding, and focuses on making the work experience more pleasant (Fleishman, 1973) contributes to alleviating these challenges, perhaps by offering flexible work schedules or support for home-based work. Such practical measures by leaders may not only address immediate logistic concerns but also positively impact employees' perspective toward the future, thereby enhancing employee engagement.

The objective of the current study is to investigate the role of perceived consideration leadership behavior as a job resource for sustaining employee engagement in the context of enforced remote work and impact of COVID-19. To better understand the link between leadership and work engagement, we shed light on optimism as a potential mechanism. By doing so, we acknowledge the importance of personal resources as an antecedent to work engagement, which should be positively influenced by available job resources such as leadership, in line with JD-R theory (Demerouti and Bakker, 2022; Bakker et al., 2023) and previous research (Mäkikangas et al., 2022). In addition, we take a closer look at the remote work situation in which individuals find themselves, as we expect differentiated effects depending on whether employees had prior experience with remote work before the pandemic, were new to remote work, or continued to work at their usual workplace. Based on the boosting hypothesis of the JD-R theory, namely that increased job demands enhance the positive effects of available resources (Demerouti and Bakker, 2022), we argue that leadership should particularly affect individuals who are new to remote work. Likewise, we examine whether feeling impacted by COVID-19, for example, in terms of threatened health and social isolation, amplifies the proposed relationships between consideration leadership behavior and work engagement.

Our study contributes to research in three ways. First, it adds to the literature that explores the role of leadership during crises and remote work [see, for example, Bell et al. (2023) for an overview of virtual leadership and Riggio and Newstead (2023) for an overview of crisis leadership], whereby we focus on the importance of consideration leadership as relationship-oriented leadership behavior in a longitudinal study design. Second, while most hitherto studies have merely contrasted "employees working remotely" and "employees working on-site" (for an exception see, for example, Schulze et al., 2024) this study goes beyond the methodological status quo by examining the effects of leadership on different groups of followers, including those who were new to remote work during COVID-19. This differentiation, together with the examination of the COVID-19 impact as a proxy for crisis perception, enables us to disentangle the distinct effects of leadership on employee engagement across different contexts, thus contributing to contingency theories of leadership. Third, we add to research on the interplay between work-related resources such as leadership and personal resources in times of crises and remote work (Demerouti and Bakker, 2022; Bakker et al., 2023) by examining whether optimism as a personal resource does account for the effects of leadership on work engagement. This examination offers a refined understanding of the role of personal resources as explanatory mechanisms linking job resources and engagement. Together, we contribute to existing research on leadership in context, leadership in times of crises and remote work, and employee wellbeing. Our study model is shown in Figure 1.

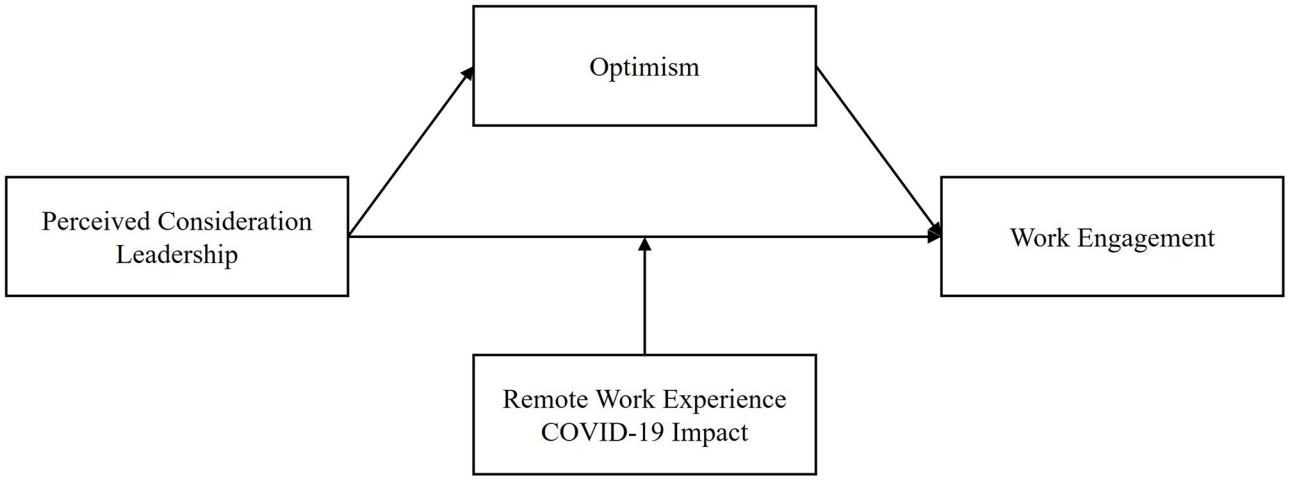

FIGURE 1
Hypothesized research model.

2 Theory

2.1 Work engagement in crisis and remote work

We use the JD-R theory as a framework to study employees' work engagement during crisis and remote work (Demerouti et al., 2001; Demerouti and Bakker, 2022; Zacher and Rudolph, 2022). JD-R theory identifies two broad categories of job characteristics: job demands and job resources. While job demands refer to aspects of an occupation that require psychological or physical effort (e.g., work pressure, conflicts), job resources such as autonomy and supervisor support enable an individual's motivation and functioning at work and foster personal development (Bakker, 2011). The presence of job demands and resources initiates two processes: the health impairment process and the motivational process. In the health impairment process, job demands deplete employees' resources, leading to strain and negative health outcomes. In the motivational process, job resources are positively associated with work engagement, which ultimately leads to improved performance (Bakker et al., 2023). The more recent JD-R framework also includes personal resources, which evidently explain the relationship between various job resources (e.g., social support, supervisory coaching) and work engagement (Xanthopoulou et al., 2007) in the motivational process.

Work engagement is described as a positive affective-motivational state in which individuals are enthusiastic about their work activities while experiencing vigor, dedication, and absorption (Schaufeli et al., 2002). Vigor refers to feeling highly energetic and remaining mentally resilient in the face of difficulties. Dedication refers to a feeling of enthusiasm, significance, pride, and inspiration at work. Absorption refers to being happily immersed and concentrated in one's work (Schaufeli et al., 2006). Previous research generally finds support for both processes as suggested in the JD-R, including the positive link between leadership as a job resource and work engagement, as suggested in the present study (Lesener et al., 2019, 2020).

The JD-R theory further states that job resources particularly gain importance when employees face increased demands (Bakker et al., 2007), which is referred to as the boosting hypothesis (Bakker et al., 2023). Prior research has demonstrated that job demands amplify the motivating effects of job resources (Bakker et al., 2007; Tadić et al., 2015; Breevaart and Bakker, 2018). For example, with a sample of teachers, Bakker et al. (2007) found that high levels of pupil misbehavior amplified the relationships between job resources (e.g., job control and supervisor support) and work engagement. Consistently, Breevaart and Bakker (2018) found that transformational leadership was particularly effective on days characterized by high challenge and hindrance demands. Following this logic, in a recent extension of the JD-R theory, Demerouti and Bakker (2022) propose that during crises such as COVID-19, employees face increased levels of job demands, thereby increasing the role of job resources. Similarly, Hobfoll (2002) argues that resource gains acquire saliency when individuals are faced with resource loss. Thus, in times of crises and remote work, an increase in work-related resources is essential for organizations and leaders to create conditions in which individuals remain satisfied and engaged in their work (Zacher and Rudolph, 2022).

In line with this rationale, we assume that the context of crisis and enforced remote work led to altered demands that increased employees' need for leadership. From a leadership perspective, crises have been defined as "events that are perceived by leaders and organizational stakeholders as unexpected, highly salient, and potentially disruptive" (Wu et al., 2021, p. 2). Crises are unanticipated and uncommon, meaning that organizations and leaders have little to no prior experience in managing such situations. Salience refers to the perceived impact and sense of urgency in terms of crisis responses. For example, the first months of COVID-19 were characterized by high ambiguity and led to sudden changes in people's lives and the loss of usual working routines (Brooks et al., 2020; Wood et al., 2021). Individuals in many occupations had to adjust their work as they were forced to work from home (Kniffin et al., 2021) with increasing role demands such as work-family conflict (Galanti et al., 2021).

While empirical work on the effects of remote work is generally inconclusive (Charalampous et al., 2018), during the pandemic, the shift happened on a large scale, unexpectedly, and with no time to prepare for a smooth transition. Finally, according to Wu et al. (2021), crises are potentially disruptive, giving rise to conflicting demands and placing leaders and employees in emotionally charged situations. However, if leaders are vigilant of their employees' concerns and needs, they might be able to buffer the negative consequences and maintain followers' engagement (Demerouti and Bakker, 2022). Accordingly, empirical evidence suggests that emotional awareness and management are critical leadership skills during such times (Wittmer and Hopkins, 2022). Therefore, we understand consideration leadership as a key resource in the context of leading remotely during a crisis.

2.2 Effective leadership behaviors in crisis and remote work

The crucial role of leadership behaviors for follower motivation and wellbeing has been recognized since the Ohio state studies of the 1950s, which identified two behaviors that established the behavior paradigm of leadership research (DeRue et al., 2011) and remain relevant for understanding leadership to this day: consideration leadership and initiating structure leadership (Fleishman, 1973). *Consideration leadership* is the degree to which leaders seem friendly and approachable, show concern for their employees' needs, express their support, and focus on making work a pleasant experience. Considerate leaders strive to build mutual trust and relationships with their followers and are committed to ensuring that followers feel comforTable around them. In contrast, leaders who *initiate structure* concentrate on the tasks at hand, clarify responsibilities and expectations, and provide clear directions to their followers. In other words, they are mainly oriented toward goal attainment. While the two concepts have become less prominent after the introduction of newer concepts, such as transformational leadership, a meta-analytic investigation indicated that the two concepts are related to work-relevant outcomes such as satisfaction, motivation, and performance (Judge et al., 2004). The meta-analysis showed that consideration leadership accounted for more than two times as much variance in employee outcomes (an R^2 of 0.23) compared to initiating structure leadership, which had an R^2 of 0.08.

In leadership research, various constructs with overlapping behaviors entail aspects of relationship-oriented leadership (DeRue et al., 2011), including consideration leadership (Fleishman, 1973) empowering leadership (Srivastava et al., 2006), transformational leadership (Bass, 1985) supportive leadership (House, 1971), and health-oriented leadership (Franke and Felfe, 2011). Based on a functional perspective of leadership, leaders are those who guide employees through difficult situations at work and ensure that their socio-emotional needs are met (Wu et al., 2021). Leaders who display relationship-oriented behaviors foster employee motivation and wellbeing because they foster personal resources such as self-efficacy and optimism (Xanthopoulou et al., 2012) and nurture employees' need for relatedness, one of the three basic needs according to self-determination theory (Ryan and Deci, 2000).

Against this backdrop, it is conceivable that in conditions of enforced remote work and crisis, due to social distancing measures as well as ambiguity and uncertainty in terms of the development of the crisis, individuals were in increased need of relationship-oriented leadership behaviors. Accordingly, using qualitative measures, Eichenauer et al. (2022) found that communal leader behaviors were more important to employees than agentic behaviors during COVID-19. Moreover, using open-ended questions, Wittmer and Hopkins (2022) identify demonstrating empathy and compassion, ensuring mutual understanding, and providing support and resources for people to work collaboratively as some of the main leadership challenges while leading during crisis and remote work.

While various leadership styles have previously been studied in crises and remote work, such as transformational leadership (Sommer et al., 2016) and health-oriented leadership (Klebe et al., 2021), we argue that consideration leadership most comprehensively and reliably represents the relationship-oriented behaviors that are needed in times of remote work and crisis such as COVID-19. For example, out of the four components of transformational leadership, namely idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Bass, 1985), only the latter refers to behaviors that are explicitly relationship-oriented, while an overall measure of transformational leadership is rather classified as change-oriented (DeRue et al., 2011). In terms of the differentiation and relative impact of leadership styles, Piccolo et al. (2012) suggest that the two-factor model of consideration leadership and initiating structure leadership has incremental validity when controlling for the effects of other behaviors such as transformational leadership. Moreover, the authors found that consideration leadership and transformational leadership are among the most important predictors of employee job satisfaction and leadership effectiveness, with each incrementally contributing to the focal outcomes.

On this basis, we hypothesize:

Hypothesis 1 (H1): *Consideration leadership is positively related to work engagement over time.*

2.3 The mediating role of optimism

Based on JD-R theory, a path through which consideration leadership may foster employees' work engagement in times of remote work and crisis is through enhancing their personal resources (Xanthopoulou et al., 2007). Personal resources are defined as developable cognitive-affective aspects that foster goal-attainment, including positive beliefs about oneself (e.g., self-efficacy) and the world [e.g., optimism, hope; van den Heuvel et al. (2010)]. Moreover, personal resources have been described as aspects associated with individuals' perceptions of their ability to successfully control and impact their environment, particularly in times of adversity (Hobfoll et al., 2003). Consequently, leaders and organizations are generally advised to put effort into strengthening employees' personal resources in times of crisis (Zacher and Rudolph, 2022).

In the present study, we focus on optimism, which is the belief that positive things will happen (Scheier and Carver,

1992). Optimism is considered one of the core components of individual adaptability (Hobfoll, 2002). Among several resilience factors, optimism proved to be the sole predictor of stress-related growth across seven time points during the COVID-19 pandemic (Schäfer et al., 2023). Furthermore, optimism is the target in training programs to foster employee resilience (Göritz et al., in press). While some studies suggest that optimism is a trait (ten Brummelhuis and Bakker, 2012), we follow the rationale of studies that have shown optimism to be malleable and fluctuate within individuals contingent on external factors (Luthans et al., 2006; Tims and Xanthopoulou, 2011). Similarly, Carver et al. (2010) suggest that optimism can temporarily shift downward regardless of individuals' dispositions. Thus, optimism is an important personal resource in times of insecurity, but it is precisely in those times that it is endangered.

We postulate that during times of remote work and crisis, leaders may enhance employees' optimism by displaying consideration leadership behaviors such as showing support and concern for employees' needs. The conservation of resources theory (Hobfoll, 2002) explains why this association is plausible: Resources tend to accumulate, entailing that employees in resource-rich environments (e.g., support, feedback) are more likely to develop further resources such as optimism. Moreover, optimism might help employees view threatening events such as COVID-19 in a more positive light and cope better with situational demands, as suggested by the transactional model of stress and coping (Lazarus and Folkman, 1984), ultimately helping employees to remain energetic and enthusiastic about their work.

Indeed, prior studies have found evidence for the links between job resources (e.g., supervisory coaching), personal resources, and work engagement (Xanthopoulou et al., 2007, 2009; Bakker et al., 2008; Mazzetti et al., 2023). In addition, there is more specific evidence regarding the mediating role of optimism in the relationship between various leadership styles and work engagement. For example, Tims and Xanthopoulou (2011) found that transformational leaders enhance their followers' daily work engagement through daily optimism. Moreover, using a cross-lagged design, Li et al. (2018) found that optimism (as part of psychological capital) partially mediates between transformational leadership and work engagement. Similar findings exist for the relationship between authentic leadership and work engagement (Du Plessis and Boshoff, 2018) as well as empowering leadership and work engagement (Gyu Park et al., 2017). This leads us to formulate our next hypothesis:

Hypothesis 2 (H2): *The relationship between consideration leadership and work engagement is mediated by optimism.*

We have postulated that remote work and crisis are contextual factors that amplify the effects of leadership; however, we have not yet included actual context-specific variables in the model. Our study is set during the initial phases of COVID-19. Although COVID-19 was a global-scale crisis that impacted most individuals, there have been differences in how people interpreted and reacted to the crisis (Morgeson et al., 2015), which might also affect the dynamics between leadership and employee engagement.

Hobfoll (1989) definition of resources as "those objects, personal characteristics, conditions, or energies that are valued by the individual" (p. 516), implies that there might be individual differences in determining the resources that employees value. Inceoglu et al. (2018), in their review on leadership and wellbeing, state that future research should choose moderator variables according to the context in which the study takes place. In response to this call, we identified personal COVID-19 impact and remote work situation as factors that should moderate the effects of leadership in our study.

2.4 The moderating role of working from home

One prominent adjustment that many individuals had to deal with in the initial phases of COVID-19 was the change to work-from-home arrangements. Compared to prior flexible work arrangements, remote work during the pandemic involved a higher share of working from home and was mostly not a free choice (Syrek et al., 2022). Nonetheless, it is important to consider that not everyone was impacted by the public health measures to the same extent: individuals who were impacted by the pandemic can be divided into those who worked from home with prior experience with working remotely, those who worked from home but were not used to it, and those who kept working at their regular workplace. Most prior studies conducted during COVID-19 differentiated between individuals who worked from home and worked on-site. For example, Lundqvist et al. (2022) found that there were few differences between both groups, with supportive leadership being effective for employees' wellbeing regardless of the workplace.

In contrast, we argue that employees who abruptly had to shift to working from home without having prior experience faced higher demands and threats to their resources (e.g., due to disrupted work routines, lower levels of social support, and improvised office environment) than the other two groups. This group, therefore, had a heightened need for leadership support, as indicated by the boost hypothesis within the JD-R theory (Bakker et al., 2023). For example, a diary study by Wood and colleagues (2021) has demonstrated that divergence from usual work and loneliness (as two factors associated with homeworking) were negatively related to wellbeing. Most employees, but particularly those who shifted to homeworking arrangements, had to develop new skills and competencies to cope with the changes in their everyday work in the context of the pandemic (Syrek et al., 2022). Becker et al. (2022) did not find the degree of working from home during the pandemic to be associated with perceived social support; however, they did not take into account whether an employee was new to remote work. Employees who had previous experience with working from home might have already developed resources that helped them navigate through the challenges of working from home. Based on this rationale, we hypothesize:

Hypothesis 3 (H3): *Experience with working from home moderates the positive relationship between consideration leadership and work engagement, such that the relationship is stronger for employees who have not had previous experience with remote work than for employees with previous experience with remote work or employees working on-site.*

2.5 The moderating role of COVID-19 impact

In line with the boost hypothesis in JD-R theory (Bakker et al., 2023) and earlier research (Klebe et al., 2021) we suggest that leadership is particularly needed in times of crisis due to increased demands. However, not everyone may be impacted by a crisis to the same extent, leading to variations in COVID-19 impact (Lin et al., 2021). For example, it is conceivable that in some branches such as hospitality (Jung et al., 2021), the impact of COVID-19 was felt more strongly than in other branches (Hoffmann et al., 2022), whereby it should be noted that the economic downturn is only one of several factors that might lead to perceptions of uncertainty and crisis (Lin et al., 2021). Other critical consequences of COVID-19 that reflect its personal impact include health anxiety and fear of COVID-19 (Mertens et al., 2020), own COVID-19 infection or infection in one's household (Kleimeier et al., 2023), social isolation and loneliness (Buecker and Horstmann, 2021) and difficulties in partnerships (Overall et al., 2021). On this basis, we define COVID-19 impact as the extent to which individuals felt personally affected by the pandemic, including adverse effects on partnerships, social contact, finances, and health. In terms of crisis perceptions and leadership during COVID-19, so far, the findings of one study indicate that health-oriented leadership mitigated employee exhaustion, especially in cases when the COVID-19 pandemic was experienced as a crisis (Klebe et al., 2021). Yet the effects of crisis perceptions on the relationship of leadership and positive wellbeing outcomes remain unexplored.

To address this, we examine whether differences in COVID-19 impact perceptions have a moderating effect on the wellbeing effects of leadership. Precisely, we expect that individuals who experience high levels of COVID-19 impact have a stronger need for consideration leadership. Thus, we hypothesize:

Hypothesis 4 (H4): *Perceived COVID-19 impact moderates the positive relationship between consideration leadership and work engagement such that the relationship is stronger for employees with a high perceived COVID-19 impact.*

3 Materials and methods

3.1 Research context

Our study focuses on the impact of leadership during the COVID-19 crisis, treating both the crisis and the shift to remote work as situational variables. The data was collected through a three-wave online study with a time lag of 2 weeks between each wave, commencing on May 11th, 2020 (subsequent waves on May 18th and May 25th), shortly after the first COVID-19 lockdown in Germany that ended on May 4th. We chose two-week time lags following recommendations by Dormann and Griffin (2015). We expected 2 weeks to be appropriate to examine the dynamics between leadership, personal resources, and wellbeing in a time of rapid changes and constant news on the development of COVID-19. The initial lockdown, which lasted for 7 weeks, involved various restrictions, including school closures, travel limitations, and the prohibition of larger social gatherings (Grote et al., 2021). At the same time, organizations were adapting to remote work arrangements. Despite the easing of restrictions in May 2020, preventive measures such as social distancing and quarantine remained in effect during the period of data collection.

In this unique context, our study reflects the challenges people faced during the first wave of COVID-19 and the lockdown, coupled with limited access to leisure activities. It also portrays the early responses of organizations to the crisis, including the transition to remote work. Albeit our study is set in this specific context, our research draws parallels to organizational crises in general, as all involve high levels of risk and ambiguity, such as financial threats (Kleimeier et al., 2023) and uncertainty regarding the future.

3.2 Participants and procedure

Participants were recruited through a non-commercial German online panel, which consists of voluntarily registered participants who agreed to participate in studies (Göritz, 2014). Participants were awarded 10 reward points for each completed timepoint in this study, which is equivalent to one euro. Those who participated in all three time points received a total of thirty reward points. In total, 729 participants provided data at T1. Of those, all took part in T2, and 719 took part in T3. We found no patterns of systematic attrition. About half of the participants were women (51.7%). The participants were on average 49.8 years old (SD = 10.7) and had a mean job tenure of 7.82 years (SD = 8.45) with their supervisor. Of these, 380 (52.1%) worked in their regular workplace, 174 (23.9%) worked from home with which they had prior experience, and 175 (24.0%) worked from home with no prior experience. Most participants were employed full-time (72.6%). In terms of educational level, 33.6% of participants reported holding a university degree, and 36% indicated having intermediate secondary school/high school diplomas. Forty-nine percent were married, with 26.5% having children.

3.3 Measures

We used a full panel design and measured the predictor, mediator, and outcome variables at all three measurement points (Taris and Kompier, 2014). Experience with working from home and demographics were assessed at Time 1. On all measurement points, participants were asked to refer to their current experience with their supervisor.

3.3.1 Consideration leadership

We measured employee perceptions of consideration leadership with four items of the shortened version of the Leadership Behavior Description Questionnaire (LBDQ; Form XII, Stogdill, 1963). All items were translated into German. An example item is "My leader is friendly and approachable." The items were rated on a 1 *(never)* to 5 *(always)* Likert scale. Cronbach's Alpha ranged between 0.88 and 0.89.

3.3.2 Work engagement

We used six items from the German Version of the Utrecht Work Engagement Scale (UWES 9; Schaufeli et al., 2006). Example items are "At my work, I feel bursting with energy" (vigor), "I am enthusiastic about my job" (dedication), and "I am immersed in my work" (absorption), with response options ranging from 1 (never) to 6 (always). In line with Schaufeli et al. (2006), we computed a mean score for engagement as a composite. Cronbach's Alpha ranged between 0.94 and 0.95.

3.3.3 Optimism

We measured optimism with six items from the Life Orientation Test [LOT; German version by Glaesmer et al. (2008), based on Scheier and Carver (1985)]. Items were adapted to represent the current state of optimism (Kluemper et al., 2009). An example item is: "Currently, I'm optimistic about my future." Response options ranged from 1 *(disagree)* to 5 *(agree)*. Cronbach's Alpha ranged between 0.81 and 0.82.

3.3.4 COVID-19 impact

We assess COVID-19 impact as a formative construct, with a scale of four items that we developed to examine the perceived impact of COVID-19 on individuals' lives. The items were: "I or a family member is infected," "I am experiencing financial difficulties," "My relationship with my partner is suffering," and "My social contacts are impaired." According to MacKenzie et al. (2005), formative measurement models comprise individual items that define their meaning and explain changes in the overall construct. However, as opposed to reflective constructs, those items do not necessarily cover a common theme or share the same antecedents and consequences. Consistently, we argue that health concerns related to COVID-19, financial threat, social isolation, and difficulties with relationships at home give meaning to the COVID-19 impact construct. All items were rated on a 7-point Likert scale, ranging from 1 (true exactly) to 7 (not true at all). We did not interpret internal consistency for COVID-19 impact since this is not recommended for formative measures (Howell et al., 2007).

3.3.5 Experience with working from home

We measured participants' experience with working from home using two items. First, participants were asked where they currently worked, with three response options: Solely at my regular workplace, partially from home, and solely from home. In cases where participants chose one of the latter two options, a follow-up item measured whether they had worked from home before the pandemic, with response options ranging from 1 (never) to 5 (always). For the analysis, participants were divided into three groups: Home office with prior experience (23.9%), home office without prior experience (24%), and work at the regular workplace (52.1%).

3.3.6 Demographics

Demographics such as sex, age, job tenure, weekly work hours, and education were assessed with one item each.

3.3.7 Controls

Age and sex were employed as control variables as suggested by previous research on work engagement (Douglas and Roberts, 2020; Rožman et al., 2021). Moreover, initiating structure leadership was a control variable so the results would not reflect an overall measure of positive leadership. Like consideration leadership, we measured initiating structure with five items of the shortened version of the Leadership Behavior Description Questionnaire (LBDQ; Form XII, Stogdill, 1963). An example item is "My leader lets group members know what is expected of them" Cronbach's Alpha ranged between 0.83 and 0.85.

3.3.8 Additional variables

We assessed the frequency of leader-follower interaction using a single item: "How often have you been in contact with your direct leader in the last 2 weeks?" The answer ranged from 1 = not at all to 5 = several times a day. The participants were instructed to refer to any type of interaction, including virtual and face-to-face interactions.

3.4 Data analysis

All analyses were conducted using Mplus Version 7 (Muthén and Muthén, 1998–2012). As a first step, we performed confirmatory factor analyses and measurement equivalence analyses to examine the appropriateness of our measurement model. Model fit was satisfactory for comparative fit index (CFI) values above 0.90, root mean square error of approximation (RMSEA) values below 0.08, and standardized root mean square residual (SRMR) values below 0.09 (Browne and Cudeck, 1993; Hu and Bentler, 1999).

In the next step, we tested for configural invariance (fixing factor structure across time), weak invariance (constraining factor loadings to be equal across time), and strong invariance (constraining factor loadings and intercepts to be equal across time) to assess the equivalence of our focal constructs across the three measurement points (Little, 2013). Following prior recommendations (Chen, 2007) changes of CFI $>$-0.010, changes smaller than 0.015 in RMSEA, and changes smaller than 0.030 in SRMR were considered as cutoff values to establish measurement invariance.

We employed structural equation modeling (SEM) to examine both the direct, mediated, and moderated lagged effects of consideration leadership on work engagement. We used the CLPM approach since we were mainly interested in examining the between-person effects, for example, whether employees who perceive their leaders to demonstrate high consideration leadership experience a subsequent increase in optimism and work engagement in comparison to employees who perceived their leaders to demonstrate low consideration leadership (Orth et al.,

TABLE 1 Means, standard deviations, and correlations among model variables.

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sex	1.48	0.50																
2. Age	49.83	10.67	0.05															
3. T1 consideration	3.46	0.95	−0.01	−0.01														
4. T2 consideration	3.49	0.94	−0.01	0.01	0.78													
5. T3 consideration	3.48	0.95	0.00	0.04	0.80	0.79												
6. T1 initiating structure	3.49	0.84	0.00	0.04	0.53	0.45	0.45											
7. T2 initiating structure	3.46	0.83	0.00	0.08	0.48	0.54	0.46	0.73										
8. T3 initiating structure	3.47	0.82	0.03	0.06	0.44	0.44	0.53	0.73	0.76									
9. T1 engagement	4.36	1.34	0.03	0.07	0.41	0.45	0.41	0.36	0.36	0.36								
10. T2 engagement	4.39	1.33	0.00	0.07	0.39	0.47	0.42	0.32	0.39	0.36	0.84							
11. T3 engagement	4.40	1.40	0.04	0.09	0.39	0.47	0.49	0.31	0.36	0.39	0.83	0.87						
12. T1 optimism	3.55	0.77	0.02	0.06	0.41	0.36	0.33	0.24	0.23	0.18	0.45	0.45	0.45					
13. T2 optimism	3.61	0.76	−0.01	0.06	0.35	0.39	0.34	0.21	0.26	0.19	0.41	0.47	0.47	0.77				
14. T3 optimism	3.65	0.79	0.03	0.05	0.34	0.35	0.37	0.21	0.21	0.25	0.41	0.45	0.52	0.72	0.78			
15. T1 COVID-19 impact	2.19	0.78	−0.01	−0.09	−0.04	−0.04	0.01	0.04	0.06	0.06	0.07	0.05	0.04	−0.19	−0.21	−0.20		
16. T2 COVID-19 impact	2.16	0.75	0.03	−0.12	−0.02	−0.01	0.02	0.06	0.08	0.08	0.05	0.08	0.05	−0.19	−0.23	−0.23	0.74	
17. T3 COVID-19 impact	2.11	0.76	0.02	−0.14	−0.03	−0.05	−0.01	0.04	0.06	0.05	0.04	0.04	0.03	−0.20	−0.24	−0.25	0.73	0.73

$N = 719–729$ (pairwise deletion). Categories for sex: 1 = male, 2 = female. All correlations |0.07–0.90| were significant at $p < 0.05$; correlations ≥ |0.12| were significant at $p < 0.01$.

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TABLE 2 Results of measurement invariance tests for consideration, optimism, and engagement.

Invariance test	χ^2 (df)	CFI	RMSEA (90% CI)	SRMR	$\Delta\chi^2$	ΔCFI	ΔRMSEA	ΔSRMR
Configural	2303.359 (861)	0.957	0.048 (0.046–0.050)	0.046	-	-	-	-
Weak	2391.812 (885)	0.955	0.048 (0.046–0.051)	0.050	88.453 (24)	0.002	<0.001	0.004
Strong	2402.576 (907)	0.955	0.048 (0.045–0.050)	0.050	10.764 (22)	<0.001	<0.001	<0.001

N = 729. CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; Δ, change.

2021). To test the mediating effect of optimism, we used a three-wave autoregressive mediation model with latent variables (Stride et al., 2015). To calculate the indirect effect, we used 10.000 bootstrap samples, as recommended by Podsakoff et al. (2003). Due to convergence issues that appeared when including the moderator in the autoregressive mediation model with latent variables, we opted for a model with reduced complexity to assess the moderating effect of COVID-19 impact. In this model, the COVID-19 impact was modeled to affect the direct effects of consideration leadership on work engagement (Stride et al., 2015). Finally, the impact of the remote work situation was tested using multigroup analyses (Muthén and Muthén, 1998–2012).

4 Results

Descriptive statistics and correlations are in Table 1.

4.1 Measurement model and measurement invariance

We ran confirmatory factor analyses (CFA) to examine the measurement quality of our study variables. First, we tested the three-factor model with consideration leadership, optimism, and work engagement. Due to its formative nature, COVID-19 impact was not included in the CFA. The CFA initially yielded an unsatisfactory fit to the T1 data (χ^2 = 664.140, df = 87, p < 0.001, CFI = 0.929, RMSEA = 0.095, and SRMR = 0.047). The modification indices suggested that model fit would be improved if error terms of the first two items of consideration leadership were allowed to correlate. This can be justified by the fact that both focus on enhancing the pleasantness of being part of a group. After including correlations between the two items, the model showed satisfactory results for T1 (χ^2 = 449.586, df = 86, p < 0.001, CFI = 0.955, RMSEA = 0.076, and SRMR = 0.049) and mediocre results for T2 (χ^2 = 514.705, df = 86, p < 0.001, CFI = 0.950, RMSEA = 0.083, and SRMR = 0.051), and T3 (χ^2 = 563.194, df = 86, p < 0.001, CFI = 0.948, RMSEA = 0.087, and SRMR = 0.053). We note that the RMSEA values for T2 and T3 are slightly over the suggested cutoff value of 0.08. However, since the model fit of the theoretical three-factor structure fits the data better than an alternative model in which all factors load on one factor (at T1: χ^2 = 3051.781, df = 90, p < 0.001, CFI = 0.580, RMSEA = 0.212, and SRMR = 0.147), we conclude that our measurements are sufficiently distinct from each other and refrain from modifying the model. The results of the measurement invariance testing (T1-T3) are in Table 2. Identical items were allowed to correlate with each other across time. The change in fit indices was below 0.005 for CFI, RMSEA, and SRMR, indicating that the measurements of the focal variables were invariant over time.

4.2 Hypothesis tests

4.2.1 Consideration leadership as a predictor of time-lagged work engagement

For all measurement points, we controlled for levels of engagement at the prior time point so that the results represent changes in work engagement from T1 to T2 and from T2 to T3. Furthermore, we controlled for the effects of initiating structure to test the incremental validity of consideration leadership behavior. Moreover, age and sex were employed as control variables. The structural model fit the data well (χ^2 = 3034.558, df = 1005, p < 0.001, CFI = 0.939, RMSEA= 0.053, SRMR = 0.056 with control variables, χ^2 = 1807.844, df = 395, p < 0.001, CFI = 0.945, RMSEA= 0.070, SRMR = 0.055 without control variables). Table 3 reports the direct effects. Overall, including control variables did not change the pattern of the results, although sex had a small significant effect on work engagement in T3. A test of a reversed model, in which engagement predicted consideration leadership did not yield a better model fit (χ^2 = 1863.312, df = 395, p < 0.001, CFI = 0.943, RMSEA= 0.071, SRMR = 0.058 without control variables) supporting our hypothesized direction of effects. Yet the analysis revealed that engagement had a significant effect on consideration leadership in the first time lag (B = 0.13, SE = 0.02, p < 0.01) as well as the second time lag (B = 0.06, SE = 0.03, p < 0.05), indicating the possibility of reciprocal effects (see additional analyses section for further exploration). Contrary to our hypotheses, consideration leadership at T1 failed to be significantly related to employee work engagement at T2 (B = 0.05, SE = 0.04, n.s.). However, the relationship reached statistical significance in the second time lag (B = 0.08, SE = 0.04, p < 0.05). Thus, H1 is partially supported.

4.2.2 Optimism as a mediator of the effect of consideration leadership on work engagement

As initiating structure leadership did not predict work engagement in the previous analysis, and the results with control variables did not differ substantially from a model without controlling for initiating structure leadership, we report the results of the three-wave autoregressive mediation model without control variables. The parameter estimates are in Figure 2. The structural model fit is good (χ^2 = 2943.552, df = 928, p < 0.001, CFI = 0.946, RMSEA= 0.055, SRMR = 0.072). The results indicate that

TABLE 3 Parameter estimates of the direct effects of consideration leadership on work engagement.

Predictor	*B*	*SE*	*p*	95% CI [LL; UL]	β
Outcome variable: T2 work engagement					
T1 consideration leadership	0.05 (0.05)	0.04 (0.03)	0.15 (0.07)	[−0.018; 0.124] ([−0.003; 0.100])	0.05 (0.04)
T1 work engagement	0.87 (0.87)	0.02 (0.02)	<0.01 (<0.01)	[0.821; 0.915] ([0.821; 0.913])	0.86 (0.86)
T1 initiating structure leadership	−0.01	0.05	0.82	[−0.115; 0.091]	−0.01
Age	0.00	0.00	0.20	[−0.002; 0.006]	0.02
Sex	−0.05	0.04	0.26	[−0.137; 0.036]	−0.02
Outcome variable: T3 work engagement					
T2 consideration leadership	0.08 (0.08)	0.04 (0.03)	0.02 (<0.01)	[0.016; 0.152] ([0.025; 0.127])	0.07 (0.07)
T2 work engagement	0.90 (0.90)	0.02 (0.02)	0.00 (0.00)	[0.851; 0.941] ([0.852; 0.941])	0.87 (0.87)
T2 initiating structure leadership	−0.02	0.05	0.73	[−0.112; 0.078]	−0.01
Age	0.00	0.00	0.20	[−0.001; 0.006]	0.02
Sex	0.09	0.04	0.03	[0.008; 0.173]	0.04

$N = 729$. Parentheses depict the estimates of the model without control variables. *B*, unstandardized estimate; *SE*, standard error; CI, confidence interval; LL, lower limit; UL, upper limit; β, standardized estimate.

consideration leadership at T1 does not contribute to optimism in T2 ($\beta = 0.0.03$, n.s.), while optimism in T2 does predict work engagement in T3 ($\beta = 0.07$, $p < 0.01$). The bootstrapped unstandardized indirect effect is not significant ($B = 0.002$), revealing that optimism does not mediate the relationship between consideration leadership and work engagement. Notably, optimism is positively related to work engagement across the two waves (T1→ T2: $\beta = 0.09$, $p < 0.01$, T2→ T3: $\beta = 0.07$, p <0.01), and consideration leadership at T2 does predict optimism at T3 ($\beta = 0.06$, $p < 0.05$).

4.2.3 Remote work experience as a moderator resulting in group differences in the effects of consideration leadership and work engagement

An analysis of group differences was performed to compare the effects of consideration leadership on the work engagement of employees who worked remotely with prior experience, without prior experience, and employees working on-site. Here, we report the results of the analysis with control variables, as results substantially differed compared to a model without control variables. The model fits the data well ($\chi^2 = 5807.705$, df = 3073, $p < 0.001$, CFI = 0.92, RMSEA = 0.061, SRMR = 0.073). The parameter estimates to predict T3 work engagement are in Table 4. As we found no group differences for the effects of consideration leadership in T1 on work engagement in T2, the parameters of the first time lag are not included in the table. Consistently with the analysis of direct effects, work engagement in T2 was not predicted by consideration leadership in T1 across all groups. However, we found group differences regarding the effects of consideration leadership in T2 on work engagement in T3. The results indicated that consideration leadership in T2 predicted work engagement in T2, but only for employees who worked remotely with experience ($B = 0.14$, $SE = 0.07$, $p < 0.05$) and without experience ($B = 0.19$, $SE = 0.08$, $p < 0.05$) and not for employees who worked on-site ($B = 0.05$, $SE = 0.06$, n.s.). Thus, H3 is partially supported.

4.2.4 COVID-19 impact as a moderator on the effects of consideration leadership and work engagement

The moderation results are in Table 5. The interactions between T1 COVID-19 impact and T1 consideration leadership ($B = 0.01$, $SE = 0.03$, n.s.) as well as T2 COVID-19 impact and T2 consideration leadership ($B = 0.00$, $SE = 0.03$, n.s.) were not significant. Moreover, COVID-19 impact did not predict work engagement (T1 → T2, $B = -0.01$, $SE = 0.03$, n.s.; T2 → T3, $B = -0.02$, SE = 0.03, n.s.). Thus, we reject H4.

4.2.5 Additional analyses

4.2.5.1 Reciprocal relationships between consideration and engagement

We conducted further analyses to explore the possibility of a reciprocal relationship between consideration and engagement, following initial findings suggesting such a relationship. The reciprocal model yielded a good fit to the data ($\chi^2 = 1882.649$, df = 395, $p < 0.001$, CFI = 0.942, RMSEA= 0.072, SRMR = 0.056). Consistent with the analysis of direct effects, consideration leadership predicted engagement in the second ($B = 0.07$, $SE = 0.03$, $p < 0.05$), but not in the first time lag ($B = 0.44$, SE = 0.03, n.s.). Moreover, engagement predicted consideration in the first time lag ($B = 0.13$, SE = 0.02, $p < 0.001$), but not the second time lag ($B = 0.05$, SE = 0.03, n.s.).

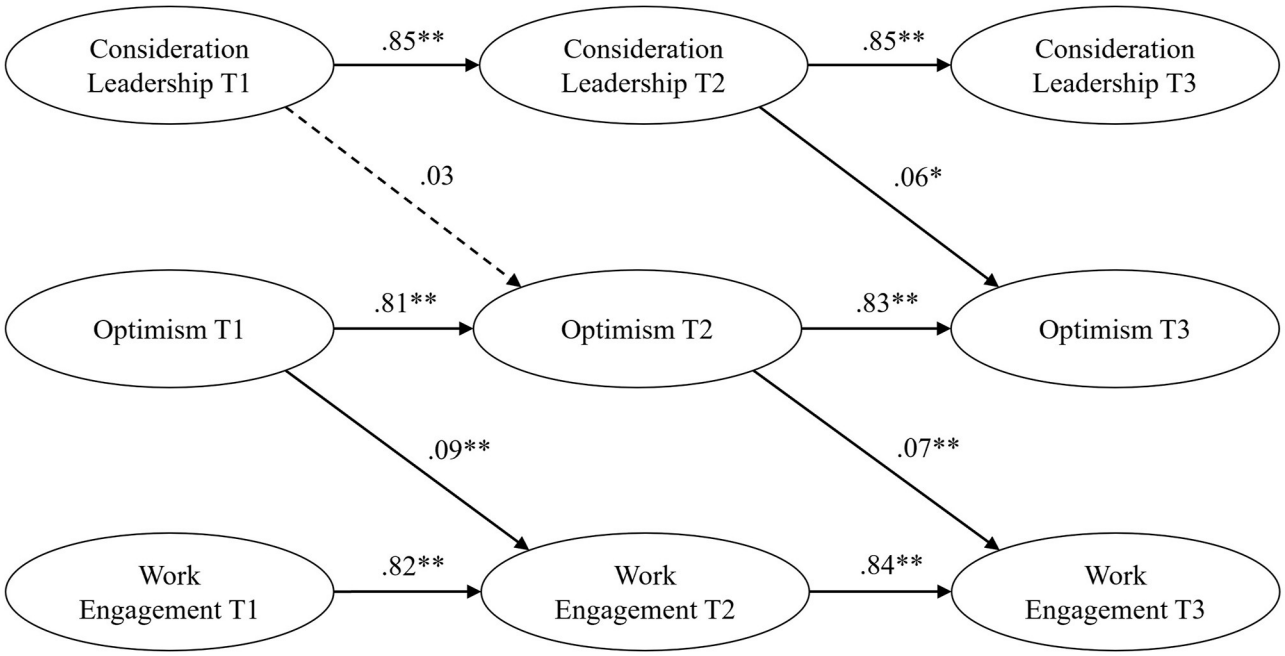

FIGURE 2
Estimated paths in the three-wave longitudinal autoregressive mediation model. $N = 729$. $^{*}p < 0.05$; $^{**}p < 0.01$. Depicted are standardized coefficients. Solid lines indicate significant relationships and dotted lines indicate non-significant relationships.

When comparing models, larger values of CFI and lower values of RMSEA suggest a better model fit (Kline, 2011). An additional criterion that is used for the comparison of competing models is the Akaike Information Criterion (AIC), whereby a lower AIC value indicates that a model is more parsimonious and superior. A comparison of the criteria reveals that our initial direct model (AIC = 49783.727, CFI = 0.945, RMSEA = 0.070) has a lower AIC value, larger CFI value and lower RMSEA value than the reverse (AIC = 49839.195, CFI = 0.943, RMSEA = 0.071) and reciprocal models (AIC = 49858.532, CFI = 0.942, RMSEA = 0.072). We conclude that the direct model is the more parsimonious and superior model compared to the reverse and reciprocal model, although all three models fit well.

4.2.5.2 Interaction frequency as a control variable

To ensure robustness, we re-analyzed the data to include interaction frequency as a control variable. The analysis was based on the premise that variations in leadership exposure could also influence work engagement levels, providing a possible explanation of why consideration leadership in T1 failed to influence work engagement in T2. The descriptive statistics revealed that there were no major changes in mean interaction frequencies over time (T1 mean = 3.15, SD = 1.17; T2 mean= 3.09, SD = 1.2; T3 mean = 3.07, SD = 1.17). On average, the participants had contact with their leader a few times per day. The inclusion of interaction frequency as a control variable in the direct model did not change the relationship between consideration leadership and work engagement, indicating that the primary findings are robust to variations of interaction frequency.

4.2.5.3 COVID-19 impact as a moderator on the effects of consideration leadership on optimism

As a moderating effect of COVID-19 impact on the path between consideration leadership and optimism is plausible, we additionally tested whether such an effect exists. The interactions between T1 COVID-19 impact and T1 optimism (B = −0.001, *SE* = 0.03, n.s.) as well as T2 COVID-19 impact and T2 optimism (*B* = −0.02, *SE* = 0.03, n.s.) were not significant. Therefore, a moderator effect on this path cannot be confirmed. However, T1 COVID-19 impact predicted T2 optimism (T1 → T2, $B = -0.04$, $SE = 0.02$ $p < 0.05$; T2 → T3, $B = 0.006$, $SE = 0.02$, n.s.).

5 Discussion

This study aimed to understand the interplay between leadership as a job resource, optimism as a personal resource, and work engagement in the context of remote work and crisis. Using JD-R theory, we predicted a positive effect of consideration leadership behavior on work engagement meditated by followers' optimism. Furthermore, we hypothesized that the remote work situation and personal COVID-19 impact would heighten the effects of leadership. The three-wave longitudinal study design enabled us to examine the hypothesized temporal precedence in our models, which is one of the conditions for establishing causality. Moreover, we were able to assess whether the relationship between consideration leadership and engagement was stable across the two time periods. Our findings partially support the idea that consideration leadership enhances work engagement over time, consistent with the JD-R Theory (Demerouti et al., 2001) and supported by meta-analytic findings (Lesener et al., 2020).

TABLE 4 Parameter estimates in the group analysis.

Predictor	Remote without experience			Remote with experience			Regular workplace		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Outcome variable: T3 work engagement									
T2 consideration leadership	0.19	0.08	0.02	0.14	0.07	0.03	0.05	0.06	0.36
T2 work engagement	0.90	0.05	<0.001	0.88	0.04	0.00	0.89	0.03	<0.01
T2 initiating structure	−0.16	0.10	0.10	−0.04	0.099	0.72	0.01	0.08	0.91
Age	0.01	0.00	0.86	0.01	0.00	0.12	0.00	0.00	0.20
Sex	−0−04	0.09	0.69	0.13	0.08	0.11	0.08	0.06	0.17

$N = 729$; *B*, unstandardized estimate; *SE*, standard error.

Specifically, consideration leadership predicted subsequent work engagement in the second, but not the first time lag. Contrary to prepositions of JDR-Theory, optimism did not mediate the effects of consideration leadership, but optimism was significantly associated with subsequent levels of work engagement in both time lags. Moreover, the analysis of group differences regarding the work situation revealed that in the second time lag, consideration leadership significantly predicted work engagement of those who worked from home (with and without prior experience), but not of those who continued to work at their regular workplace, highlighting that working from home represented an additional demand for many employees in the initial phases of COVID-19. Contrary to the boosting hypothesis of JD-R Theory (Demerouti and Bakker, 2022), in our study, the perceived personal impact of COVID-19 as a demand did not amplify the effects of leadership.

5.1 Theoretical implications

Our findings have implications for theory development on leadership and work engagement during crises and remote work: First, we made inconsistent observations regarding the effectiveness of leadership as a resource in times of remote work and COVID-19, underscoring the value of incorporating a temporal dimension in organizational and leadership research (Avey et al., 2008; Bluedorn and Jaussi, 2008). Notably, while the direction of findings was consistent across the time periods studied, consideration leadership's effect was found to be significant in the later time period of the two periods examined but failed to reach statistical significance in the first period. To shed light on this observation, we propose that consideration leadership as a resource may have been initially substituted by other resources during the COVID-19 pandemic, in line with the preposition that resources might substitute each other to cope with demands (Hobfoll et al., 1990; Demerouti and Bakker, 2022). In the early stages of the pandemic, employees may have relied more heavily on other social resources such as family and colleagues to address the immediate challenges posed by the health crisis. For example, Soncini et al. (2023) found that perceived family and colleague support promoted teachers' work engagement during the first wave of the pandemic. Consequently, the direct influence of consideration leadership as a resource may have been temporarily substituted by such unmeasured factors during the first time period. However, as the situation gradually calmed down, leadership might have gained weight as a supportive resource for employees in dealing with ongoing uncertainties and emotional wellbeing. This suggests that the role and impact of leadership as a resource might evolve over time and may be contingent on the availability and effectiveness of other resources during a prolonged crisis. Additionally, our findings indicate that consideration leadership and work engagement might have a reciprocal relationship, challenging the unidirectional view of leadership effects that were assumed in our study and other studies (Haslam et al., 2024). In light of these insights, we suggest that future research might benefit from taking a process view on the crisis (Wu et al., 2021), considering the dynamic interplay of resources, and their changing relevance over time to understand the complex

TABLE 5 Parameter estimates in the moderation model.

Predictor	*B*	*SE*	*p*	95% CI [LL; UL]
Outcome variable: T2 work engagement				
T1 consideration leadership	0.06	0.03	0.048	[0.001; 0.127]
T1 work engagement	0.87	0.02	<0.01	[0.818; 0.912]
T1 COVID-19 impact	−0.01	0.03	0.83	[−0.072; 0.045]
T1 COVID-19 impact × T1 consideration leadership	0.01	0.03	0.86	[−0.057; 0.068]
Outcome variable: T3 work engagement				
T2 consideration leadership	0.09	0.04	0.02	[0.016; 0.153]
T2 work engagement	0.90	0.02	<0.01	[0.854; 0.945]
T2 COVID-19 impact	−0.02	0.03	0.43	[−0.070; 0.030]
T2 COVID-19 impact × T2 consideration leadership	0.00	0.03	0.95	[−0.064; 0.068]

$N = 729$. *B*, unstandardized estimate; *SE*, standard error; CI, confidence interval; LL, lower limit; UL, upper limit.

relationship between leadership and employee wellbeing during extraordinary times. Second, our study provides insights into the role of optimism as a personal resource. Contrary to our expectations grounded in JD-R Theory (Bakker et al., 2023), optimism did not emerge as a significant explanatory factor in the relationship between consideration leadership and work engagement. One explanation could be the possibility of optimism to fluctuate and be influenced by leadership behaviors across shorter time lags (e.g., day-level), as suggested by Tims and Xanthopoulou (2011). Noteworthy, however, is that optimism exerted a consistent independent influence on work engagement, demonstrating its essential role in maintaining wellbeing during remote work and crises. In addition, our findings challenge previous studies that assumed optimism to have a dynamic nature (Luthans et al., 2006; Tims and Xanthopoulou, 2011), revealing that optimism remained largely stable across the three measurement points. This observation may be partially attributed to our measurement of optimism using the Life-Orientation Scale, wherein optimism is conceptualized as an abstract belief about favorable future outcomes (Scheier and Carver, 1985), raising questions about its adequacy in assessing changes in optimism over time. However, like prior studies (Tims and Xanthopoulou, 2011), we transformed the scale to a state version, which should alleviate this concern. In sum, our results underscore the need to delve into how organizations can foster optimism among their employees and to further investigate the nature of optimism in times of remote work and crises.

Third, our study illustrates the importance of distinguishing between individuals who transitioned to remote work and those who continued working at their regular workplace when investigating employee experiences during crisis and remote work. While consideration leadership affected engagement in one of the two periods, the multi-group analysis revealed that this was only the case for the two remote work groups (i.e., with and without prior experience). However, contrary to our expectations based on the boost hypothesis in JD-R, there was no notable difference between employees with prior experience with remote work and those who did not have prior experience. Yet the results indicate that place of work determined whether consideration leadership style was effective, an idea that resonates with contingency theories of leadership (House, 1971; Fiedler, 1978) and the increasing interest in organizational research that captures and considers a wider range of contextual factors (Oc, 2018). The finding that perceived consideration leadership was more effective when individuals worked remotely than on-site should be taken up in research conducted during less crisis-ridden times. As working from home is likely to stay and even expand in the post-pandemic era (Shifrin and Michel, 2022), this finding could prove to be of importance for companies to implement into action. Further research on leadership during crises can benefit from capturing as detailed a picture of the situation as possible by taking distinct situational factors into account. For our study, this meant considering whether people had shifted to remote work or worked on-site. In future studies, including different contextual conditions (e.g., socioeconomic status, occupation) may offer new insights, depending on the timing of the data collection and the background against which the study is conducted.

Finally, we did not find a moderating effect of personal COVID-19 impact in our study, which challenges the propositions of JD-R theory in times of crisis (Demerouti and Bakker, 2022). Specifically, the boost hypothesis describes that resources should have an impact on work engagement especially when demands are high, which we did not find regarding COVID-19 impact. One issue here could have been our *ad hoc* formative measure of perceived COVID-19 impact, which is going to be taken up in the limitations. However, there could also be an explanation tapping on theory, namely that employee-oriented leadership as a resource was not suited to mitigate the COVID-19 impact. This idea corresponds to the matching hypothesis (de Jonge and Dormann, 2003), according to which the effectiveness of resources in improving employee wellbeing or protecting employees from experiencing strain is contingent upon their alignment with the specific demands or stressors employees face. For example, a cross-sectional study by Ji et al. (2023) indicated that resources from the work and home domains were associated with employee health and wellbeing during COVID-19 when they matched with work

and home demands, respectively. In our study, we understood personal COVID-19's impact as a demand comprising health concerns, financial threats, social isolation, and difficulties with relationships at home. Consideration leadership involves support and a focus on the personal wellbeing of the employee, which is generally associated with indicators of employee wellbeing (Judge et al., 2004). Yet it may not be sufficient to mitigate the complexities introduced by a global crisis, which extended beyond the workplace, creating personal and home demands. Further studies might investigate which demand-leadership combinations are effective in fostering wellbeing, thereby contributing to an understanding of how specific resources can support employees in challenging situations.

5.2 Limitations and future research

Despite the strengths regarding the longitudinal research design and timely assessment of focal research variables in the early stages of the COVID-19 pandemic, this study has limitations: First, we relied on data from employees in an online panel. We compared different groups of remote and non-remote workers during COVID-19, and notably, these groups were equally reflected in our sample and were diverse in age, sex, and educational level. Online panel data is as appropriate as other samples of convenience (Walter et al., 2019), if not more appropriate (Göritz et al., 2021). However, in our sample, some segments of the German working population might be underrepresented, such as nurses or other groups who were more strongly impacted by the pandemic. Indeed, the perceived COVID-19 impact was relatively low across the three measurement points, raising concerns about the generalizability of our findings to other groups of employees. Thus, future research may consider more focused investigations and different samples to shed light on the dynamics of leadership within various demographic groups.

Second, we used self-reported questionnaires to capture individuals' experiences, which introduces concerns such as common-method bias (MacKenzie et al., 2005). Although we employed a longitudinal design with three measurement points aiming to mitigate some of the concerns associated with self-reported data, future research should take data from other sources into account (e.g., spouse or leader).

Third, we had no access to pre-crisis data, which would have been beneficial to study the effects after the onset of the crisis. We acknowledge that controlling for baseline levels of leadership and engagement would increase the informative value of the study. However, the present study was planned to study the effects of crisis and remote work during COVID-19, which is why we specifically selected all measures and introduced a formative measure of perceived COVID-19 impact. In addition, the unpredictable nature of the crisis led to our selection of two-week time lags, which were likely too short to observe major changes and shifts in individual experiences. In further research, care should be taken to select more suitable time lags to better capture the effects of crises.

Fourth, we use a self-developed formative measure of perceived COVID-19 impact. In research, there is an ongoing discourse centered around the use of formative measures. While some scholars encourage their use (Diamantopoulos et al., 2008), others argue that formative measures have several potential shortcomings, such as issues regarding their internal consistency, identification, and construct validity. Opting for a formative approach, we aimed to measure different facets to capture the personal impact of COVID-19 on individuals. While our scale was developed based on prior research on the effects of COVID-19 and thus has face validity, we recognize that it is not an empirically validated scale.

Fifth, our study used a cross-lagged panel model (CLPM) to assess the hypothesized effects of perceived consideration leadership on optimism and work engagement controlling for autoregressive effects, focusing on between-person relationships and relative changes in the constructs. However, future research could benefit from exploring alternative methods such as the random intercept cross-lagged panel model (RI-CLPM), which extends the traditional CLPM by allowing for a more detailed examination of individual trajectories (Orth et al., 2021). Using the RI-CLPM, future research could examine whether within-person deviations from their usual level of perceived consideration leadership predicts subsequent levels of optimism and work engagement, which could also bring new insights.

Finally, our study revealed a strong correlation between consideration leadership and initiating structure leadership, raising questions about a potential overlap (Fischer and Sitkin, 2023). While consideration leadership and initiating structure leadership are mildly correlated in general (Judge et al., 2004), the strong correlation at hand might have been due to the fact that we did not study leader behavior as such, but perceptions of leader behavior as experienced by the followers (Behrendt et al., 2017). These perceptions of behaviors are likely to contain evaluative components and are tinged by a halo effect. Acknowledging that incremental validity might be an issue here, we controlled for the effects of initiating structure in our analyses. The results show that the effects of consideration leadership do not change substantially when initiating structure leadership is included. We therefore conclude that the high correlation is not a critical problem, and consideration leadership has an effect independent of initiating structure. Nevertheless, in line with Fischer and Sitkin (2023), we also suggest that future research can benefit from shifting the focus on the examination of displayed leadership styles, which could be examined using experience sampling methods.

6 Conclusion

This study contributes to a better understanding of the relationships between consideration leadership, optimism, and work engagement in the context of remote work in times of crisis. The findings show that the impact of consideration leadership changes over time; in the study at hand, consideration leadership predicted work engagement in the second time lag, but not significantly in the first time lag. Moreover, optimism did not mediate the relationship between consideration leadership and work engagement, but consistently predicts work engagement independently, emphasizing its essential role as a personal resource. Contextual work variables play a role, in that consideration leadership was more effective if individuals worked remotely than on-site. Overall, this research provides insights into navigating

leadership during crisis and remote work, highlighting the importance of a temporal perspective and taking contextual variables into account.

Data availability statement

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

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

DS: Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing, Methodology. SO: Conceptualization, Investigation, Methodology, Resources, Writing – review & editing. AS: Conceptualization, Investigation, Methodology, Writing – review & editing, Validation. AG: Conceptualization, Data curation, Methodology, Resources, Writing – review & editing.

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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.

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The hidden costs of working from home: examining loneliness, role overload, and the role of social support during and beyond the COVID-19 lockdown

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Objective: This study evaluated the impact of the number of days per week working from home (WFH) on employee loneliness during and 2 years after the COVID-19 lockdown, with a focus on role overload as a mediating factor and social support from coworkers as a moderating variable.

Methods: Data were collected via self-reports from a sample of 6,918 participants during the lockdown in January 2021 and 6,576 participants 2 years post-lockdown in January 2023.

Results: Analysis using a moderated mediation model showed that increased WFH days were associated with heightened loneliness during the lockdown, a link that weakened post-lockdown. Role overload served as a mediator, intensifying loneliness during WFH but less so after the lockdown. While higher social support was generally linked to reduced role overload and loneliness, it paradoxically intensified these issues in individuals with extensive WFH days.

Conclusions: The findings suggest that the number of days WFH can exacerbate loneliness and role overload among employees, with the effect being more pronounced during the lockdown. Employees with substantial social support faced more challenges as WFH duration increased. These results underscore the complex dynamics between WFH, social support, and employee wellbeing.

KEYWORDS

loneliness, working from home, hybrid work, role overload, social support, pandemic lockdown, COVID-19, moderated mediation model

1 Introduction

The outbreak of the COVID-19-pandemic, caused by the SARS-CoV-2 virus, generated large changes in the working conditions for many people (e.g., Diab-Bahman and Al-Enzi, 2020). Isolation was used actively to combat the spread of the virus and employees were ordered to work from home (WFH) if possible. Consequently, a large part of the workforce has gained experience with accomplishing their work virtually, either from their own home or from other suitable locations (Bick et al., 2020; Wyld, 2022; Brynjolfsson et al., 2023). Although most restrictions have been removed and both work- and social life seems to recover, many workers have learned

to appreciate the increased autonomy entailed by working from home (Wang et al., 2021) and are reluctant toward a full time return to the company office (Liu et al., 2020). Thus, hybrid work (i.e., the blend of WFH and work from the company office) has been touted as the new normal in the future (Yener, 2022; Değerli, 2023).

However, WFH does not only entail positive consequences. At the individual level, increased feelings of loneliness are among the adverse effects most often discussed (Lim et al., 2020). Loneliness is an individually perceived feeling of social isolation, which is only modestly associated with the experience of actually being alone (Hawkley and Cacioppo, 2010). Feeling lonely from time to time is quite common and innocuous, but recurring and overwhelming feelings of loneliness are regarded detrimental and conducive to reduced health and wellbeing as well as reduced productivity. This applies to both general loneliness (Hawkley and Cacioppo, 2010; Lim et al., 2020) and work-related loneliness (Erdil and Ertosun, 2011; Lam and Lau, 2012; Mohapatra et al., 2023).

Reports in the popular press have repeatedly referred to an increase in loneliness during the pandemic (e.g., Horch, 2020; Knight et al., 2022; Lewitt, 2022). The main message is that WFH, or remote work in general, limits access to one's work-related social network, which can exacerbate existing feelings of loneliness and even trigger feelings of loneliness in individuals who typically do not dwell upon such feelings. This assumption are supported by some studies (Buecker et al., 2020; Koyanagi and Santini, 2021; Ernst et al., 2022), whereas others failed to find an increase in loneliness during the pandemic (Luchetti et al., 2020; Prati and Mancini, 2021). However, it is important to acknowledge that the number of days individuals spent at WFH during the pandemic varied based on factors such as the nature of the work tasks, disease prevalence, and local infection control measures. It is reasonable to assume that this variation influenced individual feelings of loneliness, potentially affecting the results observed in various studies.

Moreover, WFH during the COVID-19 lockdown may not have the same consequences as remote work after the pandemic. In many countries, WFH during the pandemic became a mandatory measure that applied to everyone irrespective of their personal preferences (Michinov et al., 2022). This may have influenced the research outcomes (Torres and Orhan, 2023). This does not imply that voluntary WFH of today is identical to remote work practices before the pandemic. Although already growing in popularity, WFH on a regular basis was not considered a viable option for most workers prior to the pandemic (e.g., Allen et al., 2015; Felstead and Henseke, 2017; Pigini and Staffolani, 2019). The COVID-19 pandemic has accelerated this development and the rise of new hybrid work models makes it even more important to investigate the assumed link between WFH and loneliness. The number of days WFH, hence understood as the number of days per week allocated to work from home, is a central element in this discussion. It has been suggested that the number of home-based workdays in a hybrid arrangement should not exceed 2 or 3 days per week to provide optimal work conditions regarding both productivity and wellbeing (Barrero et al., 2021; Criscuolo et al., 2021; Yener, 2022). However, the empirical foundation for this recommendation appears to be limited.

To enhance our understanding of this relationship, the current study aims to examine the impact of the number of days per week WFH on loneliness. The relationship will be examined both during the COVID-19 lockdown and 2 years after the lockdown.

The relation between WFH and loneliness is likely influenced also by other salient factors in the work environment. Including additional variables not only offers a more comprehensive view of factors influencing loneliness but also allows for the investigation of mechanisms likely involved in the relationship between WFH and loneliness. Drawing upon assumptions derived from the Conservation of Resources (COR) theory (Hobfoll, 1989), two prevalent factors that merit consideration are role overload and social support.

Role overload refers to a situation in which an individual is confronted with excessive work demands and responsibilities that exceed their available resources, such as time, skills, or energy. The COVID-19 lockdown introduced several new challenges related to the implementation of work tasks. If not properly managed, this may intensify the experience of role overload. Role overload is recognized as a risk factor for diminished performance, health, and wellbeing (Örtqvist and Wincent, 2006; Nixon et al., 2011; Bowling et al., 2015). Previous research has shown role overload to mediate the relationship between work-related use of information and communication technologies after hours and work family conflict (Wang et al., 2022) and the relationship between technostress and productivity (Tarafdar et al., 2007). Work overload (a component of role overload) has also been shown to mediate the relationship between work schedule flexibility (i.e., when the worker decides when to work) and mental health outcomes (Yeves et al., 2022) and technostress and perceived strain (Ayyagari et al., 2011). Although scantly studied, it may be that an increased number of days spent WFH could initially increase role overload, which in turn, amplifies feelings of loneliness. Consequently, role overload was included as a mediator in the theoretical model tested in this study.

Social support is considered a resource in the work environment (Jolly et al., 2021) and refers to the belief or actuality that one is valued and can rely on one's social network for assistance. Within the workplace, this typically encompasses backing from coworkers and management. The most prevalent conception of the advantageousness of social support is the buffer hypothesis (Helgeson, 2003). According to this hypothesis, social support primarily affects outcomes indirectly, by mitigating the adverse effects of work demands (Haly, 2009). Consistent with this perspective, the theoretical model tested in this study included social support as a potential moderator. A further aim of the present study was thus to investigate if the relationship between the number of days WFH and loneliness was mediated by role overload and moderated by perceived social support. By doing so, this study adds to the theoretical and empirical knowledge of hybrid work and work-related loneliness, a psychosocial factor often undervalued in the work environment. The study primarily draws upon assumptions from COR-theory (Hobfoll, 1989). In addition, it also utilizes the Regulatory Loop Model of Loneliness (Cacioppo and Hawkley, 2009) and elements from Social Exchange Theory (Cook et al., 2013). By integrating the explanatory power of the COR theory along with these more specific models, this study

contributes to enhanced understanding of the social dynamics inherent in hybrid work arrangements and how this influence perceived access to work related resources.

The study goes beyond the scope of cross-sectional studies by comparing the posited relationships during and after the pandemic lockdown, thus providing a more comprehensive understanding of the influence of the lockdown on the relationships under investigation.

2 Theoretical framework and hypotheses

The COR theory (Hobfoll, 1989) posits that individuals strive to acquire, retain, and protect important resources in the environment. The theory accentuates that stress occurs when an individual experience loss, or potential loss, of resources. According to the theory, resources do not only encompass material and economic factors, but also include social assets like relationships, social status, and networks of support. As inherently social beings, social relations provide us with a sense of belonging, meaning, and purpose, as well as opportunities for personal growth and shared joy. For most people, reduced social interaction over time will therefore be perceived as threatening and result in increased stress and negative emotions. Stress, in this view, is not a purely individual or internal experience, but is significantly influenced by the social context (Hobfoll, 2001). Acknowledging that individuals differ in their ability to cope with social isolation, it seems justifiable to assume that the number of days WFH influenced feelings of loneliness during the pandemic. The posited positive link is further supported by empirical evidence obtained both prior to the COVID-19 pandemic (Hoornweg et al., 2016; Tavares, 2017), as well as during the pandemic (Wang et al., 2021; Bollestad et al., 2022; Miyake et al., 2022). Thus, drawing from both theoretical perspectives and empirical evidence, we propose the following hypothesis.

> *Hypothesis 1: The number of days WFH is directly and positively associated with feelings of loneliness.*

Role overload was included as mediator in the theoretical model as a potential mechanism through which WFH affects loneliness indirectly. At the core of the COR theory (Hobfoll, 1989) is the idea of preserving resources and the adverse effects of their depletion. Depletion of resources induce feelings of stress leading to negative emotions such as tension, anger, and frustration, which makes it even more difficult to cope with a challenging situation (Spector and Goh, 2001). In cases where supportive structures, typically found in an office setting, are absent, as was often the case during pandemic-induced lockdowns, the availability of resources needed to cope with the work demands may become insufficient. Prolonged WFH may lead to depletion of resources in several ways. Factors such as heightened technostress, the requirement to adapt to new work methods, and ambiguity surrounding job expectations, all drain resources and have been shown conducive to heightened experience of role overload (Tarafdar et al., 2007; Kumar et al., 2021; Costin et al., 2023; Sommovigo et al., 2023).

Role overload may compel individuals to invest more effort into their work tasks, which in turn leads to a heightened need for recuperation (Meijman and Mulder, 1998). Unfortunately, the perceived time pressure inherent in role overload may prevent sufficient recovery. In an attempt to cope with the situation, individuals tend to invest even more effort, leading to escalating feelings of work-related fatigue (Ekstedt et al., 2006).

Just as in the development of work-related fatigue, feelings of loneliness can be a part of a negative feedback loop. Elucidated by the Regulatory Loop Model of Loneliness (Cacioppo and Hawkley, 2009), negative sentiments and thought patterns such as unhappiness, pessimism, and self-criticism lead to dysfunctional coping behaviors like reduced trust, self-protection, and social withdrawal, which reinforce the feelings of loneliness, causing emotional distress and disengagement from work. The loss spiral concept in COR theory posits that the depletion of one type of resource can lead to the subsequent depletion of other resources, creating a cascading effect (Hobfoll et al., 2018). Thus, it is reasonable to assume that if time resources are depleted due to role overload, this may trigger further depletion of socio-emotional resources. In situations where social exchange is restricted, as was evident during the pandemic lockdown, feelings of loneliness may be exacerbated. This assumption is supported by previous empirical work, which shows positive associations between loneliness and burnout (Card et al., 2022; Wood et al., 2023) as well as with both core elements of burnout, emotional exhaustion (Becker et al., 2022) and disengagement from work (Mohapatra et al., 2023). Although severely understudied, some studies have also reported positive associations between workload/job demands and loneliness (Kallioniemi et al., 2022; Lowman et al., 2023; Walz et al., 2023), as well as technostress and loneliness (Taser et al., 2022).

Based on the present discussion and the available empirical results, we propose the following hypothesis.

> *Hypothesis 2: The number of days working from home is indirectly and positively associated with loneliness through role overload.*

Social Exchange Theory posits that social interactions often involve reciprocal exchange processes, where resources such as social support and information that are provided are compensated with other resources at a later time (Cook et al., 2013). This willingness to provide resources to each other creates an exchange relationship that benefits both parties. In the context of COR-theory, this principle of reciprocity initiates what can be described as a gain spiral, contributing to an accumulation of resources for the members involved (Halbesleben and Wheeler, 2015). Social support is, consequently, an essential regulatory component of the work environment in most office settings, playing a crucial role in mitigating the depletion of resources caused by job demands and other challenges encountered at work .

Social support has consistently been linked to reduced feelings of loneliness, with individuals having easy access to support experiencing less loneliness (Wright, 2005; Wang et al., 2021; D'Oliveira and Persico, 2023; Lowman et al., 2023). It is reasonable to assume that this relationship also applies to the other associations included in the current mediation model. Findings from related research support this assumption. For example, Walz et al.

(2023) discovered that social support moderated the indirect path from job demands to loneliness through work/home interference. Similarly, Deschênes (2023) identified that perceived organizational support moderated the relationship between satisfaction with telework and professional isolation. Khedhaouria et al. (2024) demonstrated that emotional social support moderated the path from technostress to job strain. Additionally, Mohapatra et al. (2023) reported that perceived organizational support moderated the association between loneliness and work alienation. Drawing on theoretical assumptions, available empirical evidence, and the absence of indications suggesting otherwise, we propose the following hypotheses.

> *Hypothesis 3: Social support moderates both the direct relationship between the number of days working from home and loneliness, and the indirect relationship mediated by role overload, such that these effects become weaker when the level of social support is high.*

As research on hybrid work is still in its infancy, our understanding of how the relationship between WFH and loneliness changes in the context of post-pandemic normalization and employees' ability to choose between WFH and work at the office is limited. Choices about where to work are probably influenced by individual preferences and desire for social contact, ultimately leading to increased person-environment fit and thereby reduced feelings of loneliness. Nevertheless, reviews of the literature conducted before the pandemic have reported increased loneliness associated with WFH (Tavares, 2017), as well as increased risk of role overload (Demerouti et al., 2014). Additionally, studies indicate that risk factors for loneliness present prior to the pandemic persisted during the lockdown (Bu et al., 2020). Thus, it appears reasonable to expect that the same relationships exist, albeit weaker, in the post-lockdown period. Thus, based on the present discussion, the following hypotheses are proposed regarding the relationships after the pandemic lockdown.

> *Hypothesis 4: The direct association between the number of days working from home and loneliness is positive, but weaker, after the pandemic lockdown as compared to during the lockdown.*
>
> *Hypothesis 5: The indirect association between the number of days working from home and feelings of loneliness, mediated by role overload, is positive, but weaker, after the pandemic lockdown as compared to during the lockdown.*

Finally, the effect of the moderator variables in the post pandemic period were considered. Based on the logic leading to Hypotheses 4 and 5, we expect that social support will continue to moderate the associations described in the mediated model, even in the post-pandemic period. However, it remains uncertain whether this moderation will increase, decrease, or remain unchanged after the pandemic.

The lockdown altered the social context and thereby changed the rules by which social exchange unfold. Relying on electronic communication, social support from colleagues became more challenging as it must be planned ahead, making regular informal contact less convenient and less likely to happen (Collins et al., 2016; Lal et al., 2023). While some late effects may be expected, it is likely that the end of the lockdown period will bring about a resumption of social exchange in the workplace, making social support more easily available. If so, the buffering effect of social support should be expected to increase its importance after the pandemic lockdown. However, it is also possible that the pandemic lockdown and the experience of extensive WFH have permanently altered social exchange patterns at the workplace. Months WFH may have stimulated the development of new coping strategies that reduce the impact of social support as a buffer against work demands. Thus, considering the current knowledge in the field, it seems difficult to confidently predict the nature of potential post-pandemic changes in the moderator effect of social support. To acknowledge this uncertainty, it was decided to frame this part of the analysis as an exploratory research question.

3 Methods

3.1 Procedure and participants

The study was conducted as a part of a large electronic work environment survey directed toward the administration of a large public organization in Norway. The data were collected in January 2021 and January 2023.

Informed written consent was obtained from all participants and the participants were informed of the purpose of the study and their right to terminate participation without reason. The participants were allowed to answer the questionnaire during working hours. The study was approved by the Internal Ethics Committee at the Department of Psychology, University of Oslo, Norway.

The sample consisted of 6,918 participants at time 1, and 6,576 at time 2, compromising 13,494 observations. The sample also included 698 dental healthcare workers, who were unable to work remotely during the COVID-19 lockdown. Consequently, these individuals were excluded from subsequent analyses. Of the remaining 12,796 participants, 61.0 % were females. The age ranged from 19 to 75 years; 6.0% were under 30 years of age, 19.5% were between 30 and 39 years, 29.6% were between 40 and 49 years, and 31.5% were between 50 and 59 years, and 13.4% were over 60 years of age. In terms of education, 1.4 % had elementary school, 17.1 % had high school, 13.3% had until 3 years university education, and 68.2% had more than 3 years of university education. A total of 10.0% worked as leaders.

3.2 Measures

3.2.1 Number of days working from home

The participants were asked to report how many days per week they currently were working from home, on a seven-point scale from 0–7 days. Most employees work 5 days a week on the weekdays. However, some employees and leaders choose to work also in the weekends. Hence, maximum number of days' working from home per week is 7 days.

3.2.2 Role overload

Role overload were assessed by three items (Q1, Q2, and Q3) from the "job demands" section of the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS Nordic) (Pahkin et al., 2007). The three items assess the subjective perception of excessive quantitative demands, which is in alignment with the current definition of role overload and operationalizations made in previous literature (e.g., Turner et al., 2010; Adil and Kamal, 2020). The items were assessed on a five-point scale ranging from "very seldom or never" (1) to "very often or always" (5). A total score was computed, on the mean of the three items, where higher score means higher levels of role overload. Sample item: "Do you have too much to do (at work)?" Cronbach's alpha at T1 and T2, was 0.765 and 0.772, respectively.

3.2.3 Social support from co-workers

Social support from co-workers was measured by four items adapted from the Leiden Quality of Work Questionnaire (van der Doef and Maes, 1999). Each item was scored on a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). The total score was computed on the mean of the four items, where higher scores mean higher degree of perceived social support from colleagues. Sample item: "If I have problems in my job, I can ask others for help." Cronbach alpha at T1 and T2, was 0.840 and 0.846, respectively.

3.2.4 Loneliness

Loneliness was assessed by three items from Hughes et al. (2004). Each item was scored on a five-point scale ranging from "never" (1) to "very often" (5). The mean of the three items was calculated, to produce a total score, where higher scores mean higher levels of loneliness. Sample item: "How often do you feel isolated from others?" Cronbach alpha at T1 and T2 was 0.846 and 0.864, respectively.

3.3 Analyses

The sample comprised 12,796 observations across two time points. Among these, 775 observations (6.1%) had missing values for the predictor variables and were thus excluded from the analysis. Consequently, the refined sample consisted of 12,021 observations distributed over the two time points (see Table 1). These observations were nested within a cohort of 9,827 employees. Of these, 7,633 had valid scores at only one of the time points, while 2,194 had valid scores on both occasions. We conducted checks to compare participants who responded at both time points with those who responded only once and found no significant differences in mean scores on the study variables. Additionally, analyzing the moderated mediation model with only the respondent who answered on both occasions resulted in minimal differences in parameter estimates compared to the single-time respondents. The extra analyses are detailed in Supplementary Tables S1, S2.

To evaluate common method bias (CMB) in our data, we used Harman's Single-Factor Test (Fuller et al., 2016), conducting an exploratory factor analysis on the 11 items related to role overload, social support, loneliness, and days working from home. The analysis revealed three factors with eigenvalues over 1.0, with the first factor accounting for 30.2% of the variance, below the suggested 50% threshold, indicating that CMB was not a major concern in our dataset.

TABLE 1 Number of observations at each point in time.

	Valid score, one occasion	Valid score, both occasions	Total
COVID-19 Lockdown (2021)	3,977	2,194	6,171
After lockdown (2023)	3,656	2,194	5,850
Total	7,633	4,388	12,021

We utilized path analyses in Mplus Version 8.10 to examine the proposed mediation and moderated mediation effects. The nesting of 12,021 observation within 9,827 employees was accounted for by employing the "complex" and "cluster" commands in Mplus. These commands adjust for non-independence in residuals making the tests for statistical significance trustworthy. Twenty-five observations had missing data on the dependent variable, loneliness. These 25 observations were included in the model, as the Maximum Likelihood (ML) estimation method in Mplus is capable of including data that are missing at random in the outcome variable (Muthén and Muthén, 2017). Age and gender were included as covariates in the analyses.

Figure 1 illustrates the hypothesized moderated mediation model. As hypothesized in the introduction, we expect that the effect of the number of days WFH (X_1) has on the mediator role overload (M), and on loneliness (Y) is stronger during the COVID-19 lockdown compared to after the lockdown period. These moderator effects were tested by including an interaction term between days WFH (X_1) and whether the lockdown (Z) was present or not in the model ($X_1 \times Z$). Similarly, the effect of role overload on loneliness was believed to be stronger during the COVID-19 lockdown and was tested by including an interaction term between M and Z ($M \times Z$). The proposed moderator effects of social support (W) were tested in the same manner as described above.

The hypothesized moderator effects suggest that the indirect influence of days WFH on loneliness, mediated by role overload, depends on two factors: (1) the presence or absence of the COVID-19 lockdown, and (2) the level of social support. The Moderated Mediation Index quantifies this relationship (Hayes, 2022), serving as a measure of how the indirect effects of days WFH on loneliness through role overload vary at different levels of social support or whether lockdown was present or not. A significant Moderated Mediation Index indicates a variation in the strength or direction of the mediation effect, contingent on the moderator's level.

For testing the unconditional and conditional indirect effects of WFH on loneliness via role overload, as well as the Moderated Mediation Index, bootstrapping with 5000 samples was employed. We used the 95% confidence interval (CI) of the bootstrap estimates for hypothesis testing, as recommended by Hayes (2022). All predictors in the model were mean-centered before the analysis.

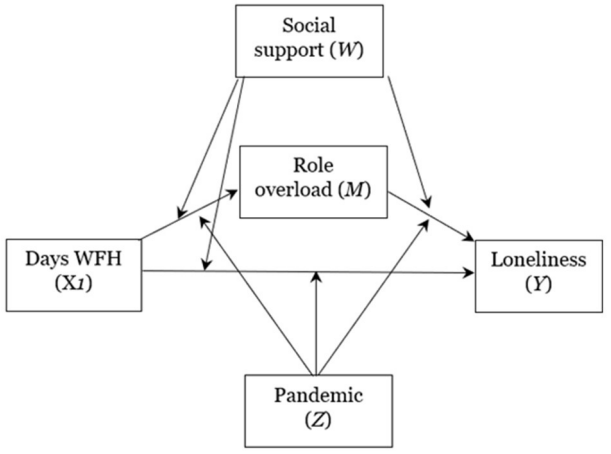

FIGURE 1
Conceptual moderated mediation model.

4 Results

4.1 Descriptive analyses

Descriptive statistics for the study variables during and after the COVID-19 lockdown are detailed in Tables 2, 3. Notably, the average number of days WFH was significantly higher ($p < 0.001$, $d = 0.79$) during the lockdown ($M = 3.16$, Median = 3) compared to the period following it ($M = 1.75$, Median = 1). Between these two periods, there was a significant reduction in the mean score for feelings of loneliness ($p < 0.001$, $d = -0.24$). In contrast, the level of role overload remained consistent across both time points. A minor, but statistically significant, increase in the level of social support was observed after the lockdown ($p < 0.001$, $d = 0.07$). Although the majority of the correlations between the study variables reached statistical significance, their magnitude was relatively modest.

4.2 Moderated mediation analysis

The results from the moderated mediation model are presented in Table 4. Increasing number of days WFH was found to be directly associated with heightened feelings of loneliness ($\beta = 0.121$, $p < 0.001$). Additionally, a greater number of days WFH was linked to an increased experience of role overload ($\beta = 0.088$, $p < 0.001$). In turn, role overload was associated with an increase in feelings of loneliness ($\beta = 0.089$, $p < 0.001$). Consequently, the number of days spent WFH was indirectly related to increased feelings of loneliness via a rise in role overload ($\beta = 0.008$, 95% CI [0.005, 0.010]; see Table 5).

Furthermore, analyses provided evidence for moderating effects of the COVID-19 lockdown period. Notably, the association between the number of days WFH and role overload was observed to be weaker in the period following the COVID-19 lockdown, compared to during the lockdown. This observation is supported by a significant interaction term between the number of days WFH and the post-lockdown period ($\beta = -0.038$, $p < 0.001$), graphically represented in Figure 2. In a similar vein, the relationship between the number of days WFH and loneliness was also found to be less pronounced post-lockdown, as evidenced by the significant interaction term ($\beta = -0.040$, $p < 0.001$), with further details depicted in Figure 2. Simple slope analysis revealed that all the slopes illustrated in Figure 2 were statistically significant ($p < 0.05$).

Moderated mediation effects were also estimated (Table 6), demonstrating that the indirect effect of days WFH on loneliness via role overload was stronger during the COVID-19 lockdown ($b = 0.006$) compared to the post-lockdown period ($b = 0.001$).

An increase in social support was significantly related to both a lower level of role overload ($\beta = -0.082$, $p < 0.001$), and, particularly, reduced loneliness ($\beta = -0.402$, $p < 0.001$). Two significant interaction effects between social support and the days WFH were observed: one on role overload ($\beta = 0.023$, $p < 0.05$), and the other on feelings of loneliness ($\beta = 0.025$, $p < 0.05$). These results suggest that individuals with higher levels of social support experience a slightly more pronounced increase in perceived role overload and feelings of loneliness as the number of days working from home increases. Both moderating effects of social support are depicted in Figure 3. Simple slope analysis showed that all the slopes illustrated in Figure 3 were statistically significant ($p < 0.05$). As depicted in Figure 3, individuals with high social support exhibit lower levels of role overload and loneliness compared to those with low social support. However, this difference diminishes with an increasing number of days WFH.

Moderated mediation effects of social support were also estimated (see Table 7), demonstrating that the indirect effect of days WFH on loneliness via role overload was stronger at high levels of social support ($b = 0.005$) as compared to low levels of social support ($b = 0.002$).

We also examined the potential variation in the moderating effects of social support during vs. after the COVID-19 lockdown. This was accomplished by incorporating three-way interaction terms into the model, as detailed in Table 4. Since none of these interaction terms reached statistical significance, no support for differential moderation effects of social support across these two time-periods was found. Finally, the possibility of non-linear effects of days WFH on both role overload and loneliness was investigated by incorporating a quadratic term for days WFH into the model. However, no evidence of such non-linear effects was found, indicating that a linear model is more suitable.

5 Discussion

The aim of the present study was to investigate how the number of days per week working from home (WFH) influence feelings of loneliness. The results affirmed Hypothesis 1, indicating a positive association between the number of days spent WFH and increased feelings of loneliness. Similarly, Hypothesis 2 was supported, revealing an indirect relationship where more days WFH led to heightened feelings of loneliness via an increase in role overload. High social support was associated with both lower levels of role overload and a significant reduction in loneliness. However, an intriguing pattern emerged for those with high social support: as the number of days WFH increased, they experienced

TABLE 2 Means scores and standard deviations on study variables during and after COVID-19 lockdown with *t*-test for mean score changes.

	During lockdown ($N = 6,171$)		After lockdown ($N = 5,850$)			
	M	*SD*	*M*	*SD*	*t*	*d*
Days working from home[a] (X_1)	3.16	(2.14)	1.75	(1.35)	−47.27***	0.79
Role overload[b] (M)	3.21	(0.82)	3.21	(0.82)	0.18	0.00
Loneliness[b] (Y)	2.26	(0.87)	2.06	(0.83)	−14.96***	0.24
Social support[b] (W)	4.15	(0.73)	4.20	(0.74)	4.13***	−0.07

[a]Range 0–7; [b]Range 1–5; ***$p < 0.001$. All p-values are adjusted for the clustering of participants within occasions. A total of 7,633 participants were measured on one occasion, and 2,194 were measured on both occasions.

TABLE 3 Zero-order correlation coefficients for study variables ($N = 12,021$).

	X_1	M	Y	W	Z	X_2
Days working from home[a] (X_1)	-					
Role overload[b] (M)	0.093***	-				
Loneliness[b] (Y)	0.186***	0.143***	-			
Social support[b] (W)	−0.049***	−0.071***	−0.409***	-		
Lockdown[c] (Z)	−0.366***	−0.004	−0.120***	0.036***	-	
Gender[d] (X_2)	−0.012	0.123***	0.039***	0.071***	0.009	-
Age (X_3)	−0.023*	−0.067***	−0.051***	−0.033***	0.017	−0.026*

[a]Range 0–7; [b]Range 1–5; [c]0 = during, 1 = after; [d]1 = male, 2 = female; *p <0.05, ***p <0.001. All p-values are adjusted for the clustering of participants within occasions. A total of 7,633 participants were measured on one occasion, and 2,194 were measured on both occasions.

a more pronounced increase in both perceived role overload and feelings of loneliness. The indirect effect of number of days WFH on loneliness, mediated by role overload, was found to be stronger at higher levels of social support than at lower levels. This moderated effect of social support was thus in the opposite direction as the prediction made in Hypothesis 3. Furthermore, the data corroborated Hypothesis 4, showing that the relationship between days WFH and loneliness was less pronounced post-lockdown. Hypothesis 5 was also supported, as the indirect effect of days WFH and loneliness, mediated by role overload, weakened after the lockdown. Regarding the proposed exploratory research question, the results showed no differential moderation effects of social support across the two time periods.

Overall, the results corroborate previous findings that the number of days WFH tends to increase loneliness. The effect may be both direct and indirect, mediated by other salient factors in the work environment. The findings are in line with the impression from previous research suggesting that the same psychosocial precursors of loneliness are active before, during (Bu et al., 2020), and after the pandemic. Thus, these results challenge the notion that work experiences from the pandemic lockdown have fundamentally altered the social exchange relationship at work. This appears to remain true even though the decision to work from home was largely based on personal preferences after the pandemic.

Following the pandemic, the levels of both loneliness and role overload were reduced compared to their levels during the pandemic lockdown. Although this study did not directly investigate the emotional challenges of social isolation and limited opportunities for social exchange, the results are consistent with tenets of COR-theory emphasizing the benefits of social interaction at the workplace (Hobfoll, 2001). In the same vein, the results support the view that the depletion of psychosocial resources may lead to elevated stress and thereby diminished wellbeing.

The obtained results may seem contrary to pre-pandemic literature showing increased feelings of job-autonomy among employees engaged in WFH and other types of telework (Gajendran and Harrison, 2007; Allen et al., 2015). Increased job-autonomy has repeatedly been linked to improved job satisfaction, productivity, and performance (Kubicek et al., 2017; Knight and Parker, 2021). WFH should, accordingly, contribute to increased productivity and performance.

This apparent paradox can be explained by two different mechanisms. One explanation may be that role overload does not always lead to reduced productivity, at least not within the relatively short timeframes used in most studies. As explicated by Meijman and Mulder (1998), the experience of time pressure associated with role overload may increase the investment of work effort and thereby contribute to increased productivity. In the long run, however, role overload, excessive workload, and time pressure can become exhausting, lead to disengagement, and contribute to the development of burnout (Örtqvist and Wincent, 2006; Lubbadeh, 2020). The positive association between role overload and feelings of loneliness does little to halt or reverse this development.

An alternative explanation suggests that employees may not always perceive autonomy as enabling. The idea, stemming from the empowerment leadership literature, is that increased autonomy comes with an inherent cost. When power and autonomy are delegated to an employee, this also transfers some leadership

TABLE 4 Moderated mediation analysis of the effect of days working from home (independent variable) on feelings of loneliness (dependent variable) with role overload as a mediator and COVID-19 lockdown and social support as moderators ($N = 12{,}021$).

	Role overload (M)		Loneliness (Y)	
	b	β	b	β
Intercept	3.019***	-	2.131***	-
Main effects				
Days WFH (X_1)	0.037***	0.088	0.053***	0.121
Social support (W)	−0.092***	−0.082	−0.468***	−0.402
Lockdown (Z) (0 = during, 1 = after)	0.051***	0.031	−0.106***	−0.062
Role overload (M)	-		0.093***	0.089
Two-way interactions				
Lockdown × Work days	−0.035***	−0.038	−0.039***	−0.040
Lockdown × Role overload	-		−0.035*	
Social sup. × Days WFH	0.013*	0.023	0.014*	0.025
Social sup. × Lockdown	0.001	0.000	0.000	0.000
Social sup. × Role overload	-		−0.023	−0.017
Three-way interactions				
D. WFH. × Social sup. × Lock.	−0.007	−0.006	−0.009	−0.008
Social sup. × Role ol. × Lock.	-		−0.033	−0.012
Covariates				
Gender (X_2) (1 = male, 2 = female)	0.213***	0.127	0.098***	0.056
Age (X_3)	−0.049***	−0.064	−0.041***	−0.053
R^2	0.037		0.216	

All predictors are grand mean centered. *$p < 0.05$, ***$p < 0.001$.

TABLE 5 The effect of days working from home (X_1) on loneliness (Y), mediated via role overload (M). $N = 12{,}021$.

	b	95%CI [a]	β	95%CI [a]
Indirect $X1->M->Y$	0.003	[0.002, 0.005]	0.008	[0.005, 0.010]
Direct $X1->Y$	0.053	[0.044, 0.063]	0.121	[0.100, 0.142]
Total effect	0.057	[0.048, 0.066]	0.128	[0.107, 0.150]

[a]Estimated from 5000 bootstrap samples.

responsibility and liabilities into their management (Langfred, 2004). Increased autonomy may thus sometimes contribute to inconsistent role expectations, uncertainty, cognitive distractions, and additional cognitive resources spent on decision-making. The burden of cognitive distraction is assumed to increase in proportion with the complexity of the task (Kim and Beehr, 2017; Cheong et al., 2019). Given the uncertainty and extraordinary conditions that prevailed in the aftermath of the COVID-19 lockdown, it seems relatively unsurprising that many workers did not experience the sudden increase in autonomy as enabling but rather as an added burden and worry. Nevertheless, this does not explain why the positive effect of autonomy was not observed after the pandemic lockdown. This implies that the benefits of job autonomy cannot be taken for granted and that increased autonomy at the workplace should be planned and supported by organizational measures.

As anticipated, the results confirm the beneficial effect of perceived access to social support during and after the pandemic lockdown. However, a surprising moderating effect emerged, indicating that workers reporting high access to social support experienced a steeper increase in role overload and feelings of loneliness with an increasing number of days WFH. This counterintuitive result seems to challenge the commonly accepted understanding of social support as a buffer against negative conditions in the work environment. Interpreted within the COR-theory (Hobfoll, 2001), one could argue that the results indicate that the employees with the most access to resources also appear to be the most depleted.

Individual differences in the desire for social interaction may be one explanation. Recent experimental research has shown that forced isolation evokes activity in the same brain regions as hunger, instigating a subjective desire or craving for social interaction (Tomova et al., 2020). Most interesting in this context is the discovery of a form of habituation effect. Although inter individual variation exists, it appears that participants who were exposed to pre-experimental isolation expressed less craving for social interaction than participants who had recently been socially active.

According to COR-theory, the experience of stress at the workplace is always perceived within a specific contextual frame, providing cues on how individuals should interpret and understands the situation (Hobfoll, 2001). Considered in the context of the Social Exchange Theory (Cook et al., 2013), participating in frequent social interactions provides more opportunities to engage in social exchange processes while at the same time also yielding contextual cues informing trust in others' willingness to provide support if needed.

Considering this, it seems likely that employees reporting high access to social support also tend to be more socially active. Consequently, individuals with high access to social support may find the reduction in social interaction, due to increased number of days WFH, more challenging than employees who are expected to be less socially active. The principle of reciprocity may contribute to refinement of this tentative explanation. In their writings Buunk et al. (1993) and Buunk and Schaufeli (1999) explicates the consequences of not experiencing reciprocity. Both providing more support than one receives and receiving more support than one provides have been shown to evoke negative emotional responses. Receiving more support than one is able or willing to reciprocate appears to be the most problematic, fostering feelings of guilt, shame, and indebtedness.

WFH during the pandemic lockdown likely made the informal provision of social support more challenging and, as a result, more evident to both the providers and the recipients. Increased visibility has been shown to heighten the emotional burden of receiving more support than one is able to reciprocate (Bolger

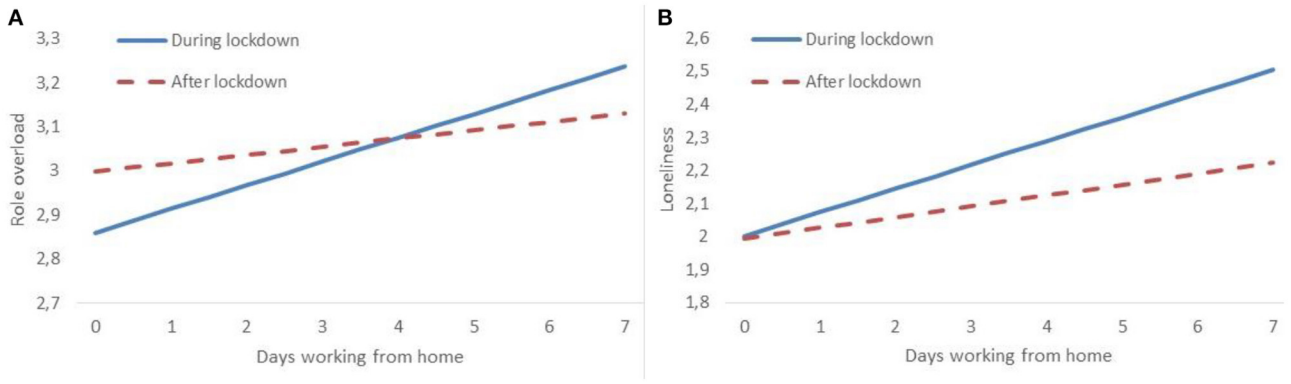

FIGURE 2
Relationships between Days working from home and **(A)** Role overload, **(B)** Loneliness, during and after the COVID-19 lockdown. Unstandardized regression coefficients.

TABLE 6 **Moderated mediation effects of days working from home on loneliness via role overload Conditional values of COVID-19 lockdown period vs post-lockdown period ($N = 12{,}021$).**

	Indirect effect	95% *CI*[a]	Standardized indirect effect
Covid-19 lockdown (2021)	0.006	[0.005, 0.008]	0.014
Post-lockdown period (2023)	0.001	[0.000, 0.003]	0.002
Moderated mediation Index	−0.003	[−0.005, −0.002]	−0.007

[a]Estimated from 5000 bootstrapped samples.

and Amarel, 2007). In an attempt to cope with this challenge, individuals may refrain from seeking help, leading to a reduction in the availability of social support that was previously offered by colleagues. This may lead to an increase in perceived role overload and feelings of loneliness, which might explain the reversed buffering effect observed in the present study. This interpretation gains some support by Nahum-Shani and Bamberger (2011), showing a reversed buffering effect of social support on the relationship between work hours and employee wellbeing when support received exceeds the support provided. However, it should be noted that this is a tentative *post-hoc* explanation that warrants further investigation in future research.

5.1 Limitations

The use of self-reported data was considered the most appropriate method for collecting data in this study, as it aimed to capture employees' personal experiences of social support, role overload, and loneliness. However, this approach may introduce Common Method Variance (CMV), potentially leading to spurious correlations between study variables due to factors such as social desirability bias or stable personality traits like negative affectivity (e.g., Chen and Spector, 1991). To address this concern, we applied Harman's Single-Factor test, which indicated that CMV did not significantly impact our findings.

Another potential limitation of this study is the absence of data on whether employees lived alone or with others during the lockdown. It could be hypothesized that the impact of working from home on feelings of loneliness would be more pronounced among those living alone, owing to their potentially reduced access to social support from partners or family members. Nonetheless, considering that 19% of the Norwegian population is living alone (SSB, 2023), the absence of household composition data is not deemed a significant drawback. Therefore, the observed association between the number of days working from home and increased feelings of loneliness is considered to be a robust finding, despite this limitation.

About one-third of participants responded on both occasions, with the rest answering just once. This discrepancy could introduce bias, yet separate analyses showed negligible differences in parameter estimates between the two groups. Therefore, the mix of single-time and dual-time respondents was not considered a significant issue.

5.2 Theoretical implications

Generally, work is seen as beneficial to both the individual and society, but it may also have repercussions that are both unforeseen and undesired. One important development the last decades is the rise of flexible work arrangements, a trend that the COVID-19 pandemic has only accelerated. The lockdown facilitated the adoption of new technologies that enabled workers to tackle complex tasks in a flexible and innovative manner (Becker et al., 2013; Thelen, 2019). However, much of the existing empirical data has been gathered from groups of employees presumed to benefit from these flexible arrangements. This study aims to fill this gap by examining how typical workers experience a workday with greater emphasis on telework and WFH.

Much of the existing literature within the field appears to rely on theories addressing specific phenomena, like technostress (e.g.,

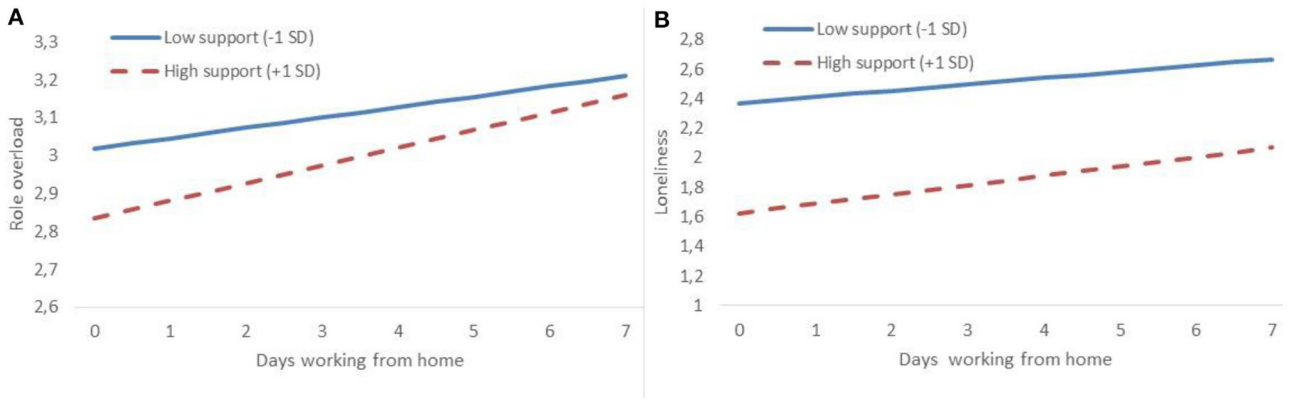

FIGURE 3
Graphical representation of the moderating effect of social support on the relationship between **(A)** number of days working from home and role overload, and on the relationship between **(B)** number of days working from home and loneliness. Unstandardized regression coefficients.

TABLE 7 **Moderated mediation effects of days working from home on loneliness via role overload at specific conditional values of social support ($N = 12{,}021$).**

	Indirect effect	95% *CI*[a]	Standardized indirect effect
Low support (-2SD)	0.002	[0.000, 0.004]	0.005
High Support (+2SD)	0.005	[0.003, 0.008]	0.011
Moderated mediation index	0.001	[0.000, 0.002]	0.002

[a]Estimated from 5000 bootstrapped samples.

Ayyagari et al., 2011; Tarafdar et al., 2015). While this approach can contribute to an in-depth understanding of the subject at hand, it may also limit the understanding of how different phenomena interact within a broader context. To address this challenge, the present study adopts the framework from COR-theory (Hobfoll, 1989) as a starting point. The study expands its conceptual basis by integrating the Regulatory Loop Model of Loneliness (Cacioppo and Hawkley, 2009) and elements from Social Exchange Theory (Cook et al., 2013) into the theoretical framework. This renders deductions from these more specific theoretical approaches applicable within the broader context of COR-theory. By expanding its theoretical basis, this study makes knowledge about the ways in which WFH affects feelings of loneliness more generally available to the scholarly discussions regarding the interplay between new ways of working, workspace design, and other elements in the work environment, and how this affects humans at work.

Traditionally, research on loneliness at work has focused on its implications for employee health and wellbeing. The present study broadens this perspective by introducing role overload as a mediator, exploring how factors typically associated with performance and productivity can affect aspects generally considered to be psychosocial. By so doing, the results suggest that role overload should be considered an important factor when evaluating the dynamics of remote work.

5.3 Practical implications

The emerging trend of combining WFH with office work is becoming recognized as the future's "new normal" (Yener, 2022; Değerli, 2023). Supervisors should note that the option to WFH might heighten employees' sense of loneliness. A practical takeaway from this study could be encouraging more in-office presence to mitigate loneliness. The findings indicate that the adverse effects of WFH are most pronounced under mandatory conditions, as seen during the pandemic. While such scenarios are exceptional, compulsory WFH could also arise from situations like office renovations or cost-saving measures. Under these circumstances, it is crucial to facilitate engagement in work-related social networks, perhaps through physical meetings at alternative venues or organizing social events that enable direct interactions among employees.

Individuals may have many reasons for wanting to work from home, some of which may only be remotely connected to the work and the tasks being conducted. The current results indicate that choosing to WFH does not necessarily protect against feelings of loneliness. With continued digitalization, the need for flexible work arrangements will likely increase in the future. Also in this scenario, it seems important to establish meeting spaces that promote social exchange, both digitally and face-to-face, regardless of whether the employees themselves prefer to WFH or not. Facilitating opportunities for informal exchange of social support between co-workers appears to be particularly important.

6 Conclusion

The past few decades have witnessed a profound reorganization of traditional work life. Jobs are being digitized, automated, outsourced, and offshored, rendering the future of work less predictable and more demanding for many employees (Fostervold et al., 2018). In our opinion, labor market developments and work organization strategies should be evidence-based. Comprehensive knowledge about the impact of new work arrangements is

fundamental for cultivating a resilient, sustainable, and high-quality labor market.

The current findings suggests that WFH has detrimental impact on employees' feelings of loneliness and perceived role overload. The results also reveal pattern regarding social support that deviates from expectations from pre-pandemic research. While social support generally continues to have a beneficial effect, individuals with high social support appear to be most bothered by intensive WFH. Additionally, the results indicate that, although the impact has diminished, the same trend persists post-pandemic as well. The insights gained from this study could influence how the adoption of WFH and remote work is considered and implemented in future work life.

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 humans were approved by the Department of Psychology's Research Ethics Committee, Faculty of Social Sciences, Department of Psychology, University of Oslo. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KF: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. PU: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. ON: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. AH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

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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.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/forgp.2024.1380051/full#supplementary-material

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Effects of teleworking on wellbeing from a gender perspective: a systematic review

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Telework has been seen as a crucial tool for enhancing work-home balance, and potentially boosting employee wellbeing. However, contradictory findings highlight the necessity of integrating a gender perspective. This study aims to find out the psychosocial effects of teleworking on wellbeing from a gender perspective through a systematic review since 2010 till 2022. We used PRISMA, SPICE and PICOS models to finally select 37 studies, considering both quantitative and qualitative design perspectives. More than half of the reviewed articles (22) found that telework has negative effects on work-family interaction and work-family balance; and, as expected, these negative effects were greater for women, such as increasing dissatisfaction with work, life and free time. Studies reviewed show that women teleworkers report increased work-family conflict and traditional gender roles relating to household and family care responsibilities. We have found also that 10 studies observed positive effects of telework for both men and women, whilst five papers report both positive and negative effects on wellbeing. Lastly, we discuss the advantages and disadvantages of teleworking from a gender perspective considering the results we have found.

KEYWORDS

systematic review, teleworking, gender, psychosocial risks, work-life balance, job satisfaction, wellbeing

1 Introduction

Telework is generally understood as a modality of work in which employees use communication technologies to perform work tasks away from the employer's facilities (Nilles, 1997). When teleworking was initially introduced, it was generally considered as a tool for improving work-life balance of employees by offering greater flexibility and autonomy and a reduction in work-family conflict (Green and Roberts, 2010). Despite teleworking experienced significant growth in several sectors before 2019, the COVID-19 global pandemic forced many companies to adapt to a necessary and accelerating implementation of teleworking for maintaining production and employee safety (Fontaneda et al., 2023). Consequently, telework has experienced significant transformations worldwide. Data reveal gender disparities in telework adoption along with variations across different sectors and age groups. During 2020, the inaugural year of the pandemic, the prevalence of telework within the European Union saw a notable increase, contrasting with the figures from 2015 where only 5.2 percent of women and 4.6 percent of men engaged in telework, to reaching 13.0 percent of women and 11.2 percent of men in 2020 (European Parliament, 2022). This surge underscores telework enhanced flexibility and autonomy, yet it also brings to light the challenges in balancing professional and family

life, and particularly impacting women's health, especially those with children who more frequently opt to telework from home (OECD, 2023).

Telework has been seen as a crucial tool for enhancing work-home balance (Marx et al., 2021). In this sense, there are several recent systematic reviews that have sought to respond to the relationship between telework and wellbeing (e.g., Charalampous et al., 2019; Oakman et al., 2020; Buomprisco et al., 2021; Chirico et al., 2021; Beckel and Fisher, 2022; Crawford, 2022). So, while many of these studies acknowledge the significance of gender considerations, they often only address it as a sociodemographic factor within the sample, rather than exploring it in depth. For example, Buomprisco et al. (2021) highlight how the underrepresentation of women in numerous professional fields might skew research outcomes. On the other hand, it is worth mentioning the study by Crawford (2022), who dedicates a section to the relationship between gender and wellbeing (in relation to Sustainable Development Goal 5: Gender equality). Stemming from 8 studies this author provides a description of wellbeing issues and the most frequent stressors by gender. For example, women perceived more advantages and disadvantages, higher workload, emotional exhaustion, workaholism, depression and stress than men, but also higher relaxation levels and lower loneliness. But working remotely entails some challenges and risks also, such as lack of social interaction, a higher difficulty when setting boundaries between work and personal life, the need for adequate technological infrastructure and remuneration, and may extend working hours longer than recommended, even working while sick, which can have cumulative negative effects on health (Ferreira et al., 2022).

Consequently, we can see that telework may be considered as a double sword in terms of wellbeing when taking gender into consideration.

1.1 Theoretical framework: telework and family balance

To analyze the relationship between telework and wellbeing from a gender perspective, it is necessary to refer to theories and concepts that analyze the relationships between work and family life (see Zhang et al., 2020). Specifically, we need to call the concept of role (Martin and Wilson, 2005), which refers to a set of duties, obligations and expectations that are related to the position and status of the individuals who in their daily life play multiple roles (mother, employee, wife...), all of them demanding them time and psychological effort, so they could become incompatible. Moreover, from the role conflict perspective, we identify time, stress and behavior as substantial aspects related to the conflict between personal and working life (e.g., Greenhaus and y Beutell, 1985). This shows us two directions of conflict: work-family conflict (WFC), in which work interferes with family roles and responsibilities, and family-work conflict (FWC), in which family life interferes with work responsibilities (Gutek et al., 1991).

Furthermore, to delve into why men and women continue to adhere to stereotypically male (productive sphere) and female (reproductive or caregiving sphere) roles even when teleworking, it is necessary to turn to gender role theory (Eagly and Wood, 2012).

1.2 Telework, wellbeing and gender

Prior to the emergence of SARS-CoV-2, many workers had already chosen to telework in the belief that better work-life balance would also improve job satisfaction and commitment to work (Felstead and Henseke, 2017); yet several studies indicated an opposite effect both prior (Sarbu, 2018; Song and Gao, 2020) and subsequent to the pandemic (Kaugars et al., 2021). However, it was the pandemic that would prove to be a turning point. Telework became an urgently necessary and even compulsory measure for most workers, which could bring to light the dark side of teleworking, as previous studies had shown that it was related to work-home conflict when it was non-voluntary, and workers perceive work and domestic pressure (Delanoeije and Verbruggen, 2019) as well. With society returning to post-pandemic normality, there is an even greater need for research that analyzes the relationship between telework and wellbeing (Anderson and Kelliher, 2020; Kniffin et al., 2021). Some studies question the advantages of teleworking (Kniffin et al., 2021; Wang et al., 2021), given the risks resulting from the changes imposed on the context and practices of family and work routine. Pandemic-era teleworking often proved counterproductive to reducing work overload. In the absence of fixed working hours, many workers reported a greater sense of availability and surveillance. The blurring of the boundaries of the working day led to long working hours that even included work at night and the weekend (Yeves et al., 2022). Studies also indicate that lower levels of wellbeing were related to social factors in the home, such as lack of space or inability to separate work from domestic tasks (Catana et al., 2022).

Focusing on potential impacts of telework on wellbeing, Hu et al. (2021) proposed ICT-related constructs that may affect occupational health strain outcomes, such as family conflict and work-life-conflict. Work-family conflict negatively affects job satisfaction and worker productivity (Becerra-Astudillo et al., 2022), and high levels of teleworking result in a significant reduction in psychological detachment from work and adverse effects on wellbeing (Cheng and Zhang, 2022). Wellbeing (WB) can be seen as a wide-ranging concept that has evolved over time, becoming the work environment an important factor, that is, teleworking in this case. The wide-ranging nature of WB may explain the lack of a single unified definition and indicator (Forgeard et al., 2011). WB at work can be defined as an affective state dependent on the degree to which individual pleasure is activated and experienced in the work environment (Wright and Doherty, 1998). This perspective highlights the close interconnection between worker WB and broader health considerations (Park et al., 2018). Work characteristics and management practices play a key role in determining WB at work, acting as risk factors that increase the likelihood of adverse health outcomes (García-Izquierdo and Castaño, 2022). Studies have shown that inadequate WB can have detrimental effects on both employees and organizations, including diminished performance, increased absenteeism, deteriorating health and the onset of long-term mental health complications (e.g Parker et al., 2017).

Recent research reviews have addressed these issues focusing on job, organizational and family conditions. Charalampous et al. (2019) concluded that the principle negative aspects of teleworking

are social isolation and hindered professional development. Buomprisco et al. (2021) highlighted unavailability of ergonomic work equipment, risk of work overload, and the psychosocial implications of working from home as the main adverse effects on teleworker health. Finally, Oakman et al. (2020) found that the degree to which telework impacts on health outcomes is strongly influenced by the degree of organizational support, colleague support, social connectedness (outside of work), and levels of work-to-family conflict.

However, only several studies focused on the consequences of teleworking on health considering the gender perspective, and when they did, they encountered with contradictory results. Allen et al. (2013) conclude that there is little evidence to suggest that gender influences the relationship between telework and different outcomes. Gajendran and Harrison (2007) found no evidence to suggest that gender plays a role in the relationship between telework and job satisfaction, job performance, work-family conflict, or work stress. However, they also conclude that remote workers may be expected to assume more household responsibilities since they are, by definition, "staying at home". This rationale affects women more than men. Hammer et al. (2005) found that flexible work arrangements (location and timing flexibility) were positively reported in wives' reports of family interferences with work one year later, but not in husbands' reports. Similarly, Rodríguez-Modroño and López-Igual (2021) found that the different way in which men and women use flexible working opportunities leads to different outcomes for wellbeing, work-life balance and work intensification. They also concluded that women teleworkers are more likely than men to perceive job insecurity, which is widely recognized as a significant cause of stress (Green, 2020). In the pandemic context of lockdowns, widespread remote work and constant coexistence of children and adults, it was foreseeable that women would assume greater responsibility for household duties, childcare and education while simultaneously carrying out their own professional activity in the same space than men (Aguado et al., 2020). We can posit two main reasons why women may report more conflict when teleworking. First, women experience more interference because they are more likely to telework at home than men (Eurofound, 2020); and second, women poorer working conditions make it more difficult to negotiate telework conditions and manage the flexibility and control that teleworking requires (Groen et al., 2018).

Thus, a key gender-related variable in teleworking is work-life balance. While work-home interference was the most common issue brought up by teleworkers during the pandemic (Wang et al., 2021), research results are contradictory. Some studies found increased work-home interference (Sousa-Uva et al., 2021), while others found the opposite (e.g., Sandoval-Reyes et al., 2021).

The results found during the COVID-19 pandemic lockdown must take into account that some advantages and positive experiences that teleworking could offer may turn into new social and family demands as the lack of school support and the need to share space in the home for both work and study among the members of the family unit were determinants factors. Family roles coexist with occupational roles in the home environment. This required every family member to adjust to sharing the same space 24 h a day, seven days a week. In some cases, spouses, or parents and children have to share equipment (i.e., computers) and rooms that were not designed for working. The most critical family variable that influences work conflict levels seems to be having children. The pandemic led to higher workloads and additional parental burdens for families with children (helping with homework, etc.) (Kaugars et al., 2021). Women were more negatively affected because they often found it more difficult to establish boundaries between work and family demands (Shockley et al., 2017). According to Eagly and Wood (2012) differing socialization processes and the assumption of gender roles help to explain why women have a more fluid perception of these boundaries and cross them more easily than men (Ashforth et al., 2000), especially if they have children (Zhang et al., 2020). Boundaries are more explicit for men, who tend to act in a more segmented way (Frone, 2003). In terms of generating conflict, the perception of blurred boundaries is more important than the amount of telework carried out (Jostell and Hemlin, 2018).

So, reviewed research raises two critical issues. First, it seems that teleworking may have a differential effect on women's wellbeing comparing to men's. Second, it seems that women take advantage of teleworking to a lesser degree than their counterparts men. However, these results have not been subject to thorough and systematic analysis.

All of the above highlights the need for research on how teleworking affects work-family conciliation as a key issue to explain men and women teleworker's wellbeing. Theoretical investigation from a gender perspective can provide data and conclusions that will assist in the future development of teleworking. Consequently, our study seeks to establish the degree to which teleworking serves to maintain or generate gender inequality, and the extent to which gender roles affect women's wellbeing.

For all that, the objective of this study is analyze how telework affect worker's wellbeing from a gender perspective, mainly considering how gender roles might affect work-home boundaries of women and men while teleworking by means of a systematic review.

2 Method

2.1 Literature research

This systematic review is performed according to standardized procedures and was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA: Page et al., 2021), formulating questions for evidence-based practice according to the Setting-Perspective-Intervention/exposure/phenomenon of interest -Comparison-Evaluation (SPICE: Booth, 2004), and the Population-Intervention-Comparision-Outcomes-Study design (PICOS: Booth, 2004). The literature search was performed using the title-keywords-abstract method (e.g., Van Essen et al., 2023).

We searched the SCOPUS, WOS, PsycINFO and PubMed databases first on 28 January 2022, and at the end of December 2022 to include all studies published in 2022. The search terms were those in the following equation: ("work-family" or "work-life") and ("conflict" or "balanc*" or "conciliation") and ("remote work*" or "telework*" or "home-based work*" or "e-work*") and ("gender" or "women") and ("effects" or "impact" or "risks" or "psychosocial

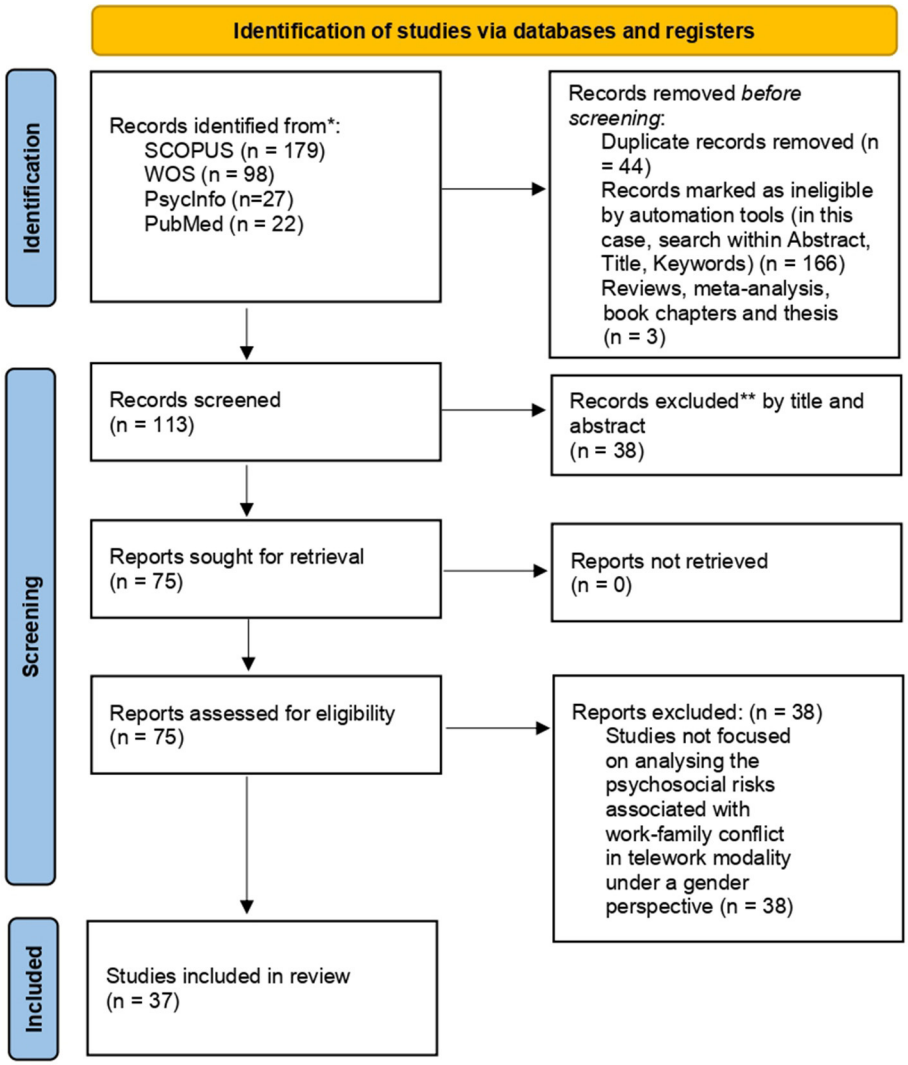

FIGURE 1
PRISMA flow diagram.

risks" or "health" or "stress*" or "technostress" or "wellbeing" or "wellness" or "burnout" or "quality of life") (Figure 1).

2.2 Inclusion and exclusion criteria

We selected studies that met the following criteria: (i) published in scientific journals, (ii) in English and Spanish, (iii) hypotheses focusing on a gender perspective and results analyzing the situation of women in telework and/or the differences between women and men, (iv) effects of telework on work-family/family-work conflict, women's health or wellbeing, or women's job, family or life satisfaction, (v) published between 2010 and 2022. We excluded studies that met the following exclusion criteria: (i) languages other than English or Spanish, (ii) reviews, meta-analyses, dissertations and book chapters (Table 1). The inclusion and exclusion criteria were very strict, in the sense that: (i) only the concept of teleworking (including remote work, home-based work, and e-work) was considered and no other forms of "flexible work arrangements," such as, for example: "flex-time," "part-time works," "compressed workweeks," which are not related to telework or work from home; (ii) the articles included women, or men and women, in the sample; and (iii) the effects were related to work- family conflict/family-work conflict. Reviews and meta-analyses were excluded because it cannot be guaranteed that the articles included in a meta-analysis or in a review meet all the inclusion criteria of the present systematic review, as, for instance, primary studies can be heterogeneous - in terms of design, study population, interventions or outcomes measured, or the information available on primary studies is insufficient or incomplete, and therefore it may be difficult or inappropriate to include them.

Finally, the main objective of the review is to summarize and synthesize the available evidence instead of combining the results quantitatively.

TABLE 1 Inclusion and exclusion criteria by SPICE and PICOS model.

Research question	Gender differences of teleworking effects on wellbeing outcomes	
	Inclusion criteria	Exclusion criteria
Setting	Telework	Other flexible work arrangements
Perspective/ population	Women in telework	Gender variable not relevant
	Women and men in telework	Workers only in non-telework
Study design	Quantitative and qualitative studies	
Intervention	Effects of telework on wellbeing outcomes for women	Effects of telework on other outcomes
Comparator	Gender Presence of children Marriage status	Other comparators
Evaluation/outcomes	Work-family conflict/Family-work conflict and wellbeing outcomes	Other outcomes

3 Results

The PRISMA flow diagram in Figure 1 shows the study selection process. Table 1 outlines the inclusion and exclusion criteria according to SPICE and PICOS models. The initial search of the databases identified 326 records. After mark as ineligible by automation tools and removing duplicates, 113 records were screened on the basis of title and abstract. The remaining 75 records were then screened on the basis of the readiness of the full text. Of these, 37 studies met our selection criteria.

3.1 Descriptive analysis

Seven of the articles included in the review were published by the International Journal of Environmental Research and Public Health, which has an impact factor of 4.614 and 4.5 in CiteScore. The rest of the journals have published only two or one articles (only four journals published two articles each) (Table 2).

3.2 Psychosocial wellbeing related outcomes

In terms of the research objectives, 35 of the 37 articles focus on the relationship between telework (considered as total or partial form of work activity on a regular or occasional basis) and some aspect of wellbeing, whether work-family conflict, satisfaction and/or health. While the two remaining articles by Cortis and Powell (2018) and by Currie and Eveline (2011) do not consider telework as such, they do consider home-based technologically assisted complementary work and its impact on work-life balance.

20 articles analyzed teleworker experiences during the COVID-19 crisis, with 16 concluding that teleworking negatively affected wellbeing during the pandemic and lockdown. Some relevant results indicate that family responsibility fell mainly on women, regardless of whether they had dependents or not, generating more stressful situations for them, especially during the COVID-19 pandemic lockdown period (Soubelet-Fagoaga et al., 2021). During this same period, the relationship between productive and care work was related to stress in both men and women, and workers with and without dependents (Soubelet-Fagoaga et al., 2022). Specifically, Lonska et al. (2021) found that women aged 18-44 and respondents with young children had difficulty maintaining work-life balance while teleworking during the COVID-19 pandemic.

We have found 35 articles where a gender perspective is shown in their theoretical approaches, objectives, hypotheses and/or discussion. Gender comparisons consider factors such as differing socialization, discrimination against women, and the way in which household responsibilities and family care are assigned to women.

Two papers (Céspedes et al., 2021; Ipsen et al., 2021) do not consider the gender perspective. While these studies do reference sex differences in their segregated results, they do not take a gender perspective into account.

The most common comparison in the papers is between men and women (31 articles). This is followed by articles differentiating outcomes for teleworkers with and without children (26 articles), and articles comparing teleworking (or working from home) with working on the organization's premises (five papers). Six studies analyze all-women samples. Two studies (Dockery and Bawa, 2018; Derndorfer et al., 2021) focus on teleworking cohabiting couples.

Four studies make specific comparisons: employed and self-employed workers (Desai et al., 2011; Reuschke, 2019); formal and informal teleworking arrangements (Troup and Rose, 2012); teleworking and teletraining (Romeo et al., 2021).

Broken down by economic sector, we found four studies on civil servants: those of Troup and Rose (2012), Bae and Kim (2016), Cortis and Powell (2018), and Thulin et al. (2019); one study on knowledge workers by Sherman (2019); one study on academic staff, that of Currie and Eveline (2011); and one study on the financial sector (Hilbrecht et al., 2013). However, 81% of our review articles considered the working population as a whole.

Five studies compared participants from two or more countries and 32 studies focused on just one individual country.

The findings of our study focus on the way in which telework affects wellbeing, with results classified on the basis positive or negative effects on work-family balance/conflict, satisfaction, health, and the extent to which these effects differ between women and men (Tables 3–7). In this sense, 22 articles find that telework has a negative impact on wellbeing. Some of them conclude that women find it more difficult to reconcile family and work than men (Currie and Eveline, 2011; Kurowska, 2020; Zhang et al., 2020; Carvalho et al., 2021; Derndorfer et al., 2021; Soubelet-Fagoaga et al., 2021; Giedrė Raišiene et al., 2022; Kuśnierz et al., 2022) devote more time to unpaid work than men (Nakrošiene et al., 2019), are more likely to do complementary work outside regular hours (Cortis and Powell, 2018), do more double shifting (Wheatley, 2012), have heavier workloads (Lonska et al., 2021). Findings also show that women teleworkers suffer from poorer mental health (Kuśnierz et al., 2022); lower levels of job satisfaction (Bae and Kim, 2016); higher levels of stress, tension and/or anxiety (Hilbrecht et al.,

TABLE 2 Journal Impact Factor (WOS), CiteScore (SCOPUS) and number of articles analyzed.

Journal	Journal impact factor (2021)	CiteScore (2021)	No. articles analyzed
International Journal of Environmental Research and Public Health	4.614	4.5	7
Frontiers in Psychology	4.232	4.0	2
New Technology, Work and Employment	4.182	7.5	2
Sustainability	3.889	5.0	2
PLoS One	3.752	5.6	2
Transportation Research Part a-Policy and Practice	6.615	10.6	1
Management Science	5.667	7.7	1
Gender Work and Organization	5.428	4.6	1
Human Resource Management Journal	5.039	7.7	1
The American Review of Public Administration	4.929	5.8	1
Group and Organization Management	4.290	6.2	1
Work, Employment and Society	4.249	6.8	1
BMC Public Health	4.135	6.1	1
Higher Education	3.947	7.2	1
Environment and Planning A: Economy and Space	3.790	6.2	1
Gender in Management	3.337	3.8	1
International Journal of Manpower	3.295	3.2	1
Personnel Review	3.228	4.6	1
Journal of Industrial Relations	3.189	3.7	1
Social Indicators Research	2.935	4.7	1
Journal of Occupational and Environmental Medicine	2,306	3.3	1
International Labour Review	1.297	2.4	1
RAE Revista de Administração de Empresas	1.100	1.4	1
Community, Work and Family	0.96	3.5	1
Problems and Perspectives in Management	-	2.2	1
Journal of International Women's Studies	-	0.5	1
Ciencia y enfermería [Science and Nursing]	-	0.4	1

2013; Céspedes et al., 2021; Parent-Lamarche and Boulet, 2021; Romeo et al., 2021; Subha et al., 2021); higher score on depressive symptoms, and lower resilience compared to fathers (Brym et al., 2022); and are less likely to pay attention to healthy habits (Giedrè Raišiene et al., 2022). Teleworking can also make women feel disengaged from professional work, make their employment situation more precarious, and consolidate their roles as traditional housewives (Çoban, 2021). In addition, three articles report a negative impact of telework on both sexes. One study describes the way in which women find it difficult to manage domestic work-life balance despite handling core household and care responsibilities (González Ramos and García-de-Diego, 2022). Strong work-family integration (i.e., lack of borders) has a particularly harmful effect on work-family conflict for male teleworkers, while a strong inability to disengage from work has an especially harmful effect on work-family conflict for female teleworkers (Eddleston and Mulki, 2017). Finally, teleworking during the COVD-19 pandemic increased perceived stress and adversely affected work-life balance and job satisfaction in both sexes (Sandoval-Reyes et al., 2021).

However, 10 articles report that telework has positive impact on work-family balance: seven on both men and women, and three articles only on women. This can be explained because teleworking more easily allows women to switch between personal and career roles while working at home (Wheatley, 2012; Rathnaweera and Jayathilaka, 2021); and especially when they have children because of caring tasks (Sherman, 2019).

Although in the other seven studies men and women both report a positive impact, for women teleworking has more drawbacks. Women perceived the limitations of the home office more than the male respondents (Ipsen et al., 2021). As Dockery and Bawa (2018) stated, telework facilitates better work-family balance but, when male employees work from home there is a tendency for their female partners to feel less satisfied with the division of household tasks. This suggests that when men work from home, they do not increase their contribution

TABLE 3 Quantitative studies on the effects of teleworking on work-family conflict or family-work conflict.

References	Country	N (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Giedrė Raišiene et al. (2022)	Lithuania	475 teleworkers (359 women and 116 men)	*Ad hoc* questionnaire	Correlational	Telework	*WFC	Women are more likely to feel exhausted ($p < 0.01$). Women are more likely than men to feel irritable ($p = 0.011$). Having children (r = 0.211, $p < 0.01$) feel more difficulties to distance themselves from personal worries at work, and more conflict with their families (r = 0.180, $p < 0.01$) Women report bad habits because of the stress of teleworking ($p = 0.009$)	Working from home increases the likelihood that women will be less concerned about healthy living habits. Having children increases WFC and FWC
Kuśnierz et al. (2022)	Poland and Ukraine	726 adults (486 women, 505 parents, 276 had children below 12 years of age)	-Six Dimensional Work-Family Conflict Scale (Carlson et al., 2000) -The satisfaction with life scale (Diener et al., 1985). -A global measure of perceived stress (Cohen et al., 1983). -A brief measure for assessing generalized anxiety disorder: The GAD-7 (Spitzer et al., 2006) -The PHQ-9: Validity of a brief depression severity measure (Kroenke et al., 2001) - Remote work assessment scale (RWAS) - General self-rated health (GSRH) (DeSalvo et al., 2005)	Cross sectional	Telework	Stress, anxiety, WFC, **FWC, depression	Women WFC ($p = 0.020$, d = −0.18), stress ($p < 0.001$, d = −0.28), anxiety ($p < 0.001$, d = −0.32), and depression ($p < 0.001$, d = −0.33) Parents caring for children under 12 WFC ($p < 0.001$, d = −0.29), FWC ($p < 0.001$, d = −0.47) stress ($p = 0.005$, d = −0.21), anxiety ($p = 0.003$, d = −0.23), and depression ($p = 0.005$, d = −0.22)	Parents of children under 12 and women are the most vulnerable groups for increased WFC, FWC, and worse mental health and wellbeing
Derndorfer et al. (2021)	Austria	1,116 workers (79.6% women)	-Multiple Burdens under COVID19 (Derndorfer et al., 2021) -Statistics on Income and Living Conditions microdata 2004–2018 (EUROSTAT. EU, 2020) -Standard-Dokumentation Metainformationen (Statistics Austria, 2016)	Correlational	Telework	WFC (domestic work and childcare tasks)	Both parents (β = 0.11, n.s.) or only mothers (β = −0.04, n.s.) working from home does not alter the probability of men taking on more childcare tasks	Mothers were more likely to find themselves stressed, working overtime, working at weekends, and with blurred boundaries between work and family time
Ipsen et al. (2021)	29 European countries	5,748 workers (59.2% women, 34.6% had children)	*Ad hoc* questionnaire	Correlational	Telework	WFC	Gender (d = 0.66231); Presence of children (d = 0.66035)	Women and men perceived the improved work–life balance in the same way

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TABLE 3 (Continued)

References	Country	N (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Rathnaweera and Jayathilaka (2021)	Sri Lanka	270 workers (51.9% women)	*Ad hoc* questionnaire	Correlational	Telework	WFC	Gender and children 0.40% effect on work- life balance ($p < 0.001$)	Gender and number of children will mainly impact the work-life balance. In telework women need to pay careful attention to childcare tasks
Soubelet-Fagoaga et al. (2021)	Spain	332 workers (178 in telework) (65% women 20.3% with children)	-WorkBAT: Spanish version (Boada-Grau et al., 2013) -A general measure of work stress: The Stress in General Scale (Stanton et al., 2001)	Correlational	Telework	WFC, job stress	WFC and gender (d = 0.278). Job stress and gender (d = 0.144)	During the lockdown period, family responsibility (with or without dependents) fell mainly on women, leading to more stressful situations for women
Kurowska (2020)	Poland and Sweden	1,358 men and 1,471 women	Generations and Gender Survey (Generations and Gender Programme, 2012–2015)	Correlational	Telework	*WFC balance	Women in Poland ($\beta = 1.36$; $p < 0.01$). Men ($\beta = 2.02$; $p < 0.01$). Women in Sweden ($\beta = 1.65$; $p < 0.01$) Men ($\beta = 1.87$; $p < 0.01$)	Teleworker mothers, above all in Poland, will have lower capability to balance *WFC with childcare and household tasks
Zhang et al. (2020)	Germany	188,081 workers (59.23% men)	German Microcensus 2010 (Statistical Offices of the Federation and the Federal States, 2018)	Correlational	Gender, marital status, presence of children, telework	*WFC	Married females with children aged 0–5 years are more likely to telework ($\beta = -0.118$ $p = 0.001$)	Female parents during intense child caring demand stages trade off career demands for their family responsibilities more often, tend to endure high family-to-work conflict over high work-to-family conflict by more telework participation
Sherman (2019)	England	187 workers (52% women, 37% had children)	-Development and validation of work-family conflict and family-work conflict scales (Netemeyer et al., 1996). -Michigan organizational assessment questionnaire (Cammann et al., 1983)	Correlational	Telework	**FWC, job satisfaction	**FWC for parents ($\beta = -0.105$; $p < 0.10$) driven by mothers (d = 0.57; $p < 0.01$). Fathers ($\beta = 0.098$, n.s.) Job satisfaction for men ($\beta = 0.203$, $p < 0.01$). Woman ($\beta = 0.0172$, n.s.)	Mothers reported reduced **FWC during remote work
Cortis and Powell (2018)	Australia	14,789 workers (54.8% men, 28% had carer responsabilities	Australian Public Service Employee Census [Australian Public Service Commission (APSC), 2014]	Correlational	Telework	*WFC	Supplementary work in women with children (***OR= 1.5; p<0.001). Men (***OR= 1.2; p<0.5)	****HbW women with caring responsibilities are more likely to carry out complementary tasks after hours
Maruyama and Tietze (2012)	United Kingdom	394 teleworkers (70% male, 52.5% with children)	Questionnaire created with Mokhtarian et al. (1998) variables	Correlational	Telework	*WFC, career visibility, cope with caring responsibilities	For female telework increased *WFC ($X^2 = 7.093$, $p = 0.029$), and reduced career visibility ($X^2 = 17.252$, $p < 0.001$)	Female teleworkers report that teleworking made it easier to cope with caring responsibilities but reduces career visibility and lack of career development opportunities

*WFC, Work-family conflict; **FWC, Family-work conflict; ***OR, Odds ratio; ****HbW, Home based Work.

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TABLE 4 Quantitative studies on effects of teleworking on satisfaction.

References	Country	*N* (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Li and Wang (2022)	United Kingdom	34,484 workers (18.904 women, 81.87% with children)	University of Essex, Institute for Social and Economic Research, NatCen Social Research, Kantar Public (2020) General Health Questionnaire (GHQ-12) (Goldberg and Williams, 1988)	Longitudinal	Telework as work-family initiatives	Job satisfaction	For women in telework ($\beta = 0.98$, $p < 0.001$). Not in telework ($\beta = 0.71$, $p < 0.001$) For men in telework (n.s.). Not in telework ($\beta = 0.39$, $p < 0.01$)	Telework increases job satisfaction for women and men, and better mental health for women
Petcu et al. (2022)	Romania	440 workers (294 women and 146 men)	*Ad hoc* questionnaire	Correlational	Wellbein telework	Job satisfaction, *WFB	Wellbeing and *WFB (for women $\beta = 0.2269$, for men $\beta = 0.0693$) job satisfaction and wellbeing for women ($\beta = 0.6659$) and for men ($\beta = 0.3661$)	There is a positive correlation between work-life balance and wellbeing at the sample level, statistically significant for women who perceive the impact more acutely. Higher incidences are generated by job satisfaction on women's wellbeing
Nakrošiene et al. (2019)	Lithuania	128 distance workers (56% women, 50.8% had children)	*Ad hoc* questionnaire	Correlational	Telework	Overall satisfaction, career opportunities, perceived advantages of teleworking	Cope with caring responsibilities effect on satisfaction with telework ($\beta = -0.25$; $p < 0.05$). Women perceive less advantages of teleworking ($\beta = 0.32$; $p < 0.101$)	Women do not value telecommuting more, since it does not really offer them real opportunities because they are dedicated to more domestic tasks than men
Reuschke (2019)	United Kingdom	15,614 men and 18,104 women	United Kingdom Household Longitudinal Study (Understanding Society, 2009–2010)	Correlational	Telework	Life and leisure time satisfaction	Life satisfaction for women ($\beta = 0.232$; $p < 0.001$), for men ($\beta = 0.036$; n.s.) Leisure time satisfaction, for women ($\beta = 0.148$; $p < 0.01$), for men ($\beta = 0.272$; $p < 0.001$)	Homeworking is positively related with leisure time satisfaction of men and women
Dockery and Bawa (2018)	Australia	26,625 women and 29,338 men	Australian Household Panel Data (Melbourne Institute, 2001–2013)	Correlational	Telework	Satisfaction with division of household tasks and with division of childcare tasks	Satisfaction with household task for women ($\beta = 7.09$; n.s). For men ($\beta = 7.94$; n.s.). Satisfaction with division of childcare tasks ($\beta = 7.84$; $p < 0.001$). For men ($\beta = 7.99$; n.s.)	With children, working from home allows equitable distribution of responsibilities associated with childcare
Wheatley (2016)	United Kingdom	5,000 households	British Household Panel Survey and Understanding Society (Institute for Social and Economic Research, 2001–2011)	Correlational	Telework	Job satisfaction	Women ($\beta = 0.429$; $p < 0.01$). Men ($\beta = -0.05$; n.s.)	Positive impacts of homeworking on job and leisure satisfaction for men and women

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TABLE 4 (Continued)

References	Country	*N* (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Bae and Kim (2016)	USA	219,450 workers (52.1% women)	Federal Employee Viewpoint Survey (U.S. Office of Personnel Management, 2013)	Correlational	Telework	Job satisfaction	Women job satisfaction ($\beta = -0.053$; $p < 0.05$, OR = 0.948). Men ($\beta = 0.093$; $p < 0.001$, OR = 1.097)	Female teleworkers have lower levels of job satisfaction
Troup and Rose (2012)	Australia	856 workers with children	Household Income and Labour Dynamics Survey in Australia (Melbourne Institute, 2009)	Correlational	Formal and informal telework arrangements	Job satisfaction and satisfaction with distribution of childcare tasks	Formal **HbW and job satisfaction for women ($\beta = 0.39$; $p < 0.001$), informal **HbW ($\beta = 0.60$; $p < 0.001$). Formal **HbW and satisfaction childcare tasks distribution, for women ($\beta = 0.23$; $p < 0.05$), informal **HbW ($\beta = 0.09$; n.s.)	Formal telework arrangements increase job satisfaction for women. Informal arrangements predicted better satisfaction with distribution of childcare for women
Wheatley (2012)	United Kingdom	1,000 people	British Household Panel Survey (Institute for Social and Economic Research, 1993–2009)	Correlational	**HbW	Satisfaction with job, leisure time and use of leisure time	Women satisfaction with job ($\beta = 0.183$; $p < 0.001$). Men ($\beta = 0.251$, $p < 0.001$). Woman satisfaction with leisure time ($\beta = 0.163$; $p < 0.05$). Men ($\beta = 0.297$; $p < 0.001$). Women satisfaction with use of leisure time ($\beta = 0.145$; $p<0.001$). Men ($\beta = -0.056$; n.s.)	For women, housework represents a particular time constraint, reflecting continued presence of the "double shift". **HbW women report greater levels of satisfaction with job, and amount and use of leisure time
Desai et al. (2011)	India	200 working women and 100 housewives	The life satisfaction scale (Andrews and Withey, 1973), Job satisfaction questionnaire (Galginaitis, 1994)	Correlational	**HbW	Job satisfaction and life satisfaction	Job satisfaction ($\beta = -0.64$; $p<0.01$). Job satisfaction and perceived self-esteem ($\beta = 0.51$; $p<0.01$)	**HbW women reported more satisfaction than working women, but less self-esteem

*WFB, Work-family balance.; **HbW, Home-based work.

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TABLE 5 Quantitative studies on effects of teleworking on health.

References	Country	*N* (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Brym et al. (2022)	Germany	Working mothers ($n = 191$) and fathers ($n = 261$)	Subscale for work-privacy conflict (WPC) of the Copenhagen Psychosocial Questionnaire (Kristensen et al., 2005). Effort-Reward Imbalance (ERI) Questionnaire (Siegrist et al., 2009). Connor-Davidson Resilience Scale (CD-RISC) (Connor and Davidson, 2003). Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1996)	Correlational	Telework	Psychosocial work stress, depressive symptoms and individual resilience	Gender interaction with work-privacy conflict and resilience ($\beta = -0.089$, $p = 0.034$, 35.1% of variance in depressive symptoms). Gender interaction with effort reward imbalance ratio and resilience explained 30.8% of variance in depressive symptoms ($\beta = -0.117$, $p = 0.007$) Depressive symptoms [$M_{mothers} = 7.03$, $M_{fathers} = 4.88$; $t_{(450)} = 4.914$, $p < 0.001$] Resilience [$M_{mothers} = 25.41$, $M_{fathers} = 27.19$; $t_{(426)} = -3.293$, $p = 0.001$]	Mothers had a higher mean of depressive symptoms compared to fathers. Fathers showing greater resilience compared to mothers. Gender was a significant confounder including the interaction term, both work-privacy conflict and resilience. Gender was a significant confounder including the interaction term, both the effort-reward imbalance ratio and resilience remained significant predictors of depressive symptoms
Soubelet-Fagoaga et al. (2022)	Spain	328 workers (54.6% were women, and 20.6% of workers had children)	A General Measure of Work Stress: The Stress in General Scale (Stanton et al., 2001)	Correlational	Telework	Job stress	Caregiving and rumination explained 18% in the variance of job stress [$R2 = 0.18$, $F_{(3,100)} = 7.37$, $p = 0.002$, $f2 = 0.22$]. In the relationship between work–family conflict and stress, caregiving and gender did not moderate this relationship in any population analyzed	During lockdown, the relationship between productive and reproductive work has predicted stress in both men and women and in those without dependents
González Ramos and García-de-Diego (2022)	European countries	92,269 workers (52.6% women)	EUROFOUND April to July 2020 survey "Living, Working and COVID-19"	Correlational	Telework	Life satisfaction	Association between the life satisfaction of workers and the gender of respondents (0.000 $F = 34.01$), where men have higher life satisfaction than women	Men self-report high life satisfaction across Europe compared to women, who were more concerned with work-life conflict. Both men and women teleworkers reported difficulties with managing work–life balance at home, despite women handling core care and household tasks
Carvalho et al. (2021)	Portugal	456 home-based workers (73.5% women, 50% workers had children)	-Boundary violations items (Hunter et al., 2019)—Boundary segmentation behavior items (Powell and Greenhaus, 2010)—Work–family balance items (Allen and Kiburz, 2012; Greenhaus et al., 2012) -Burnout Measure (SMBM) (Shirom and Melamed, 2006)	Correlational	*WFC, **FWC (boundary violation) in telework	Burnout	*WFC and burnout ($\beta = 0.62$, $p < 0.001$) **FWC and burnout ($\beta = -0.68$, $p < 0.001$) FWC and burnout ($\beta = -0.48$, $p < 0.001$)	Relationship between boundary violations from work-to-family and segmentation behavior was stronger for females than for males

(Continued)

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TABLE 5 (Continued)

References	Country	*N* (population)	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Statistical support	Results
Céspedes et al. (2021)	Chile	225 workers (76,2% women, 55,2% workers had children)	Stress from remote work, life-work balance and teleworking items from Madero Gómez et al. (2020); Madero Gómez and Flores Zambada (2009, p. 201)	Correlational	Telework	Job satisfaction, job stress, *WFC	Job satisfaction for women (r = 0.381). Job stress and *WFC for women (r = −0,408)	Teleworking in women produces stress, but they have a positive attitude toward this change in the work modality
Parent-Lamarche and Boulet (2021)	Canada	459 workers (81.9% women)	Single item (How has the COVID-19 crisis affected your stress level?)	Correlational	Telework, work-life balance	Stress	Negative contribution of work–life balance dissatisfaction (β = 0.267, $p <$ 0.01). Teleworking (β = 0.154, $p < 0.01$). Gender (woman) (β = 0.137, $p < 0.05$) to worker stress	Teleworking, work–life balance dissatisfaction and gender (women) appeared to be associated with stress
Romeo et al. (2021)	Spain	1,328 workers (69.5% women)	The Survey Work-Home Interaction–Nijmegen for Spanish Speaking Countries and the Positive and Negative Affect Schedule. Classification and Regression Trees	Correlational	Telework	Health, work-home interaction	Effects of teleworking for women's health [$t_{(1,288)} = -2.06$, $p = 0.04$] Work-home interaction for women [$t_{(1,287)} = -4.34$, $p < 0.001$]	Women exhibited more negative effects of teleworking
Sandoval-Reyes et al. (2021)	Colombia and Ecuador	1,285 workers (65.9% women, 49.3% workers had children)	-Interpersonal Conflict at Work Scale, Organizational Constraints Scale, Quantitative Workload Inventory, and Physical Symptoms Inventory (Spector and Jex, 1998). -Work Stress Questionnaire (Folkman and Lazarus, 1985)	Correlational	Telework	Stress, *WFC, job satisfaction	Stress for women (β = 0.266; $p = 0.652$), for men (β = 0.290; $p = 0.652$). *WFC for women (β = −0.217; $p =$ 0.469), for men (β = −0.261; $p = 0.469$). Job satisfaction for women (β = −0.160; $p =$ 0.112), for men (β = −0.257, p=0.112)	No significant differences between women and men
Subha et al. (2021)	India	425 women	*Ad hoc* questionnaire	Correlational	Telework	Job stress	R = −0.762	Extended period of work from home can disturb women and their mental health as they try to strike a work-life balance
Thulin et al. (2019)	Sweden	456 home workers (70.6% women, 60.5% without children)	*Ad hoc* questionnaire	Correlational	Telework	Perceived time pressure in everyday life	Women (β =-0.407; $p < 0.10$). Parents (β = 0.406; $p < 0.001$)	Women and workers with children experience the highest levels of time pressure in everyday life, regardless of telework practice
Eddleston and Mulki (2017)	USA	132 women and 167 men in telework	- WFC and FWC were assessed with measures developed by Netemeyer et al. (1996). - Work-family integration from Kreiner's (2006) measure - Job Stress was assessed with a measure created by House and Rizzo (1972) and by Netemeyer et al. (2005)	Correlational	Remote work, *WFC	Job stress Disengage from work	WFC and stress job (β = 0.54; t = 6.84). Gender moderates *WFC and disengage from work ($X^2 = 3.84$; $p = 0.05$)	Inability to disengage from work increases the *WFC of women

*WFC, Work-family conflict; **FWC, Family-work conflict.

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TABLE 6 Qualitative studies on effects of teleworking on work-family conflict or family-work conflict.

References	Country	*N (population)*	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Results
Çoban (2021)	Turkey	18 women	Semi-structured interviews	Observational	Telework	*WFC	Teleworking regulations implemented due to the pandemic risk detaching women from professional work, making their work more precarious, and consolidating their roles as traditional housewives. Having children makes teleworking preferable for women, due to traditional gender roles. Women who save time through teleworking do not transfer this time to their personal or career goals, but to childcare or sometimes household care
Lonska et al. (2021)	Latvia	204 men and 802 women, half in telework	Evaluation of Overcoming the Coronavirus Crisis in Latvia and Recommendations for Societal Resilience (CoLife), (2020)	Observational	Telework	Work lifebalance	Women in the 18–44 age group and respondents with small children were more likely to face work–life balance difficulties during COVID-19 telework
Soubelet-Fagoaga et al. (2021)	Spain	30 workers	Semi-structured interviews	Observational	Telework	*WFC, job stress	Women have had to bear the burden of double working hours. Gender roles lead to women assuming more care responsibilities compared to their male counterparts, greater experiences of guilt or assumption of responsibility in relation to leaving home. Women in telework also reported that they were particularly vulnerable to the inability to combine care with telework, which created stressful and tense situations
Da Costa et al. (2020)	Brazil	14 distance working women	Interview	Observational	Telework	*WFC	For women whose partners do not collaborate with housework, teleworking did not allow them family-work balance, and they experienced a heavy workload. For some women, teleworking during lockdown mitigated the conflict. Possibly accustomed to managing work overload, these women consider that the advantages of the proximity of the family allowed by the new routine outweighs the disadvantages resulting from increased workload
Collins et al. (2013)	United Kingdom	13 women in telework	Qualitative interview	Observational	Telework	*WFC	Woman workers with and without children used temporal flexibility to carry out domestic work at home, in line with traditional gender roles
Currie and Eveline (2011)	Australia	44 women academics	Online questionnaire and qualitative interviews	Observational	Telework	*WFC balance (privacy)	Women reported that teleworking caused an invasion and intrusion of technologies into their homes. They felt the need to set limits to separate work and family life

*WFC, Work-family conflict.

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TABLE 7 Qualitative studies on effects of teleworking on satisfaction.

Refernce	Country	*N (population)*	Instruments	Study design	Independent variable(s)	Dependent variable(s)	Results
Hilbrecht et al. (2013)	Canada	51 teleworkers (43 women, 8 men)	Semi-structured interviews	Observational	Telework	Satisfaction with leisure activities	Women teleworker's self-identify was related to normative behavior of 'good' mothers. This decreases their time for personal leisure or affect the quality of the experience and, indeed, and they reported feelings of time stress. For men, having more time with children seemed to enhance feelings of work-life balance but did not appear as closely connected to social expectations of a more intensive involvement in children's daily routines

to household chores by as much as their partners think they should.

Other studies show that telework increases satisfaction (Troup and Rose, 2012; Wheatley, 2012, 2016; Reuschke, 2019; Sherman, 2019; Li and Wang, 2022; Petcu et al., 2022). It should be noted that in the case of the study of Sherman (2019), results show that telework increases women's satisfaction since it does not penalize them at work, as other labor flexibility measures do (for example, reduction of working hours). However, Reuschke (2019) found that women do not show higher job satisfaction than men when working from home. In the case of men, the advantage of homeworking with respect to job satisfaction is associated with autonomy and control of work, while for women is related to the flexibility that allows them to combine work and private/family life. Results from Troup and Rose (2012) show that informal arrangements predicted better satisfaction with the division (between women and men) of childcare for women than formal arrangements. This finding may be related to expectations that formal telework arrangements also formalize women's greater responsibility for childcare. In contrast, such gendered expectations that formal telework arrangements entail greater responsibility for childcare might not be as strong for men who use formal telework arrangements.

Five papers found that telework has both positive and negative effect on wellbeing. Desai et al. (2011) link teleworking with lower stress and increased satisfaction, but also lower self-esteem. Although home based working ensured flexibility, it affected women's ability to work full-time, to consolidate their economic independence, and not fall behind their husbands in terms of work. Da Costa et al. (2020) report that for some women, teleworking during lockdown mitigated the conflict, but for women whose partners do not collaborate with housework, teleworking did not allow them to reach a family-work balance, so they experienced a heavy workload. Collins et al. (2013) concluded that the flexible nature of telework allows more time for leisure or training activities; but women use teleworking more to carrying out domestic work along traditional gender lines and reported that teleworking caused an invasion and intrusion of technologies into their homes, thus they felt the need to set limits to separate work and family life. Also, in deciding to work at home, the majority of women homeworkers either accepted a demotion or gave up a promotion to be able to work at home. Maruyama and Tietze (2012) found that teleworking allows women (especially those with dependent children or those who spend more than 50 per cent of their working hours at home) to cope with caring responsibilities but reduces career visibility and lack of career development opportunities. The results found in the Thulin et al. (2019) article did not correlate telework with high levels of time pressure and time use control, but the latter variable does correlated with having young children in a way that relates to less time use control. It should be noted that most studies highlight parenthood as a key factor when determining the impact of telework on wellbeing.

4 Conclusion and discussion

This review has analyzed empirical evidence of the effects of telework on wellbeing from a gender perspective. While this is

generally lacking in other studies, some research does highlight the importance of the role of variables that especially affect working women, such as social isolation and difficulties in advancing professional development (Charalampous et al., 2019), lack of autonomy (Oakman et al., 2020), and family situation (Lunde et al., 2022).

We have found 22 studies showing that telework has negative effects on work-family interaction and work conditions, which particularly affect women. However, we have found 10 studies with observed positive results of telework on satisfaction for both men and women, but only three articles show positive results specifically for women, that is, do not affect men or the results for men are not significant. Finally, five articles reported both positive and negative effects for women.

As expected, our study confirms that literature research indicates that telework has a greater negative effect on women. Also, these negative results for women have been found to be accompanied by maintenance of gender roles in the sharing of household responsibilities and family care, reduced visibility and promotion at work, and even lower self-esteem.

The results found can be explained in terms of wellbeing: work-family balance/conflict, job satisfaction (Beckel and Fisher, 2022), and health (Oakman et al., 2020; Lunde et al., 2022). Some research also suggests women working at home may be more likely to use the teleworking due to the flexibility it offers where children and significant household responsibilities are present (Sullivan and Lewis, 2001; Sullivan and Smithson, 2007). This implies the adoption and/or maintenance of stereotypical gender roles associated with household responsibilities and family care (as postulated by the gender social role theory, by Eagly and Wood, 2012), and consequent increased exposure of women to the negative effects of telework on wellbeing. Regarding work-family interaction, difficulties reconciling work and family life partly during lockdown explains lower female teleworker productivity, because they became the main responsible for household chores and caring for dependent people (King and Frederickson, 2021; Krukowski et al., 2021; Farré et al., 2022). This lack of co-responsibility was even observed in Iceland, which has had the best results in the Gender Gap Index for several years. Even in this country, it would seem that unprecedented situations like COVID-19 reveal and accentuate strong gender norms and expectations with regard to the role of mothers (Hjálmsdóttir and Bjarnadóttir, 2021).

As explained above, results indicate that teleworking serves to perpetuate the maintenance of gender stereotypes associated with domestic activities and childcare (Eagly and Wood, 2012). As women telework more than men, they assume a more significant burden of unpaid work at home. This also implies interrupted professional careers, loss of benefits and promotion, lower career visibility, and ultimately a disconnection with the employment relationship that increases gender inequality in the workplace. Following Çoban (2021), telework strengthens gender stereotypes.

Regarding wellbeing, studies showing that teleworking negatively affects women's job, life and leisure time satisfaction run contrary to the idea that teleworking leads to improved leisure time or an opportunity to spend more quality time with the family. This is clearly related to the above-mentioned difficulties that teleworking creates in connection with work-life balance and the double working day. Some recent studies have also systematically reviewed evidence on the relationship between teleworking and employee physical and mental health (Lunde et al., 2022). Focusing on mental/psychosocial health, these authors found little or very little evidence when considering gender. However, the authors did not consider the way in which teleworking may alter the work-home interface and the role that gender played in all these relationships.

In conclusion, teleworking is a double-edged sword that is particularly problematic for women's wellbeing. Considering the findings in relation to the theory of work demands and resources (Bakker and Demerouti, 2017), teleworking is presented as a type of work resource that offers greater flexibility, autonomy and work-life balance. However, by assuming traditional gender roles that are still present in our society with regard to domestic and care responsibilities (Eagly and Koenig, 2021), women perceive teleworking as a work-related and personal demand, which puts their wellbeing at risk in a more specific way. Finally, telework does not directly resolve work-family conflicts since traditional gender roles, structures and spaces related to childcare and domestic work, continue to be reproduced (Beigi and Shirmohammadi, 2017).

As a contribution, this review considers a gender perspective when analyzing the results of the studies included. It not only values the results that analyze possible differences between women and men but also applies a gender perspective to hypotheses, results and/or conclusions. As a result, we believe that differing socialization processes, stereotypes and gender roles (e.g., Castaño et al., 2019) that maintain the unequal distribution of household responsibilities and family care (Cerrato and Cifre, 2018) should be considered as one of the factors leading to differences in the effects of teleworking between women and men.

This review has shown that teleworking has led to important changes affecting the mutually related family and work environments. Future research should conduct an in-depth analysis of the sociodemographic, family and work variables that can affect the consequences of teleworking.

4.1 Limitations and future research

One of the main limitations is the disparity of the articles included in the review, especially with regard to their methodology and assessment instruments. Many of the studies used *ad hoc* questionnaires, which makes it difficult to carry out subsequent meta-analysis and ascertain their reliability and validity.

Differences have also been found in the way in which the studies define and/or classify telework. Some refer to telework within a package of measures defined as flexible work arrangements, together with other work arrangements, such as flextime and part-time work, which makes it difficult to know if the findings are more related to telework or to the other forms of flexible work included in the studies. Some studies also differentiate between formal and informal telework, making it difficult to unify these concepts. We therefore conclude that it would be valuable to carry out empirical studies to measure the effect of telework on these variables for the same type of work and the same employment status.

Given that having children has been shown to be an important variable, there is a need for in-depth research into its influence and why this has a more negative impact on women. Having children is important because it is more difficult for mothers to escape from family responsibilities and increases the number of working hours from home or outside the home. Studies should consider the number of children and their age. Looking after young children is not the same as adolescents. Older children have greater autonomy (for example, they do not need to be taken to and from school or can stay at home without the presence of an adult) and no longer require adjustments to working hours to take their needs into account.

In addition to childcare, women are also more likely to assume responsibility for caring for other adults in the family. Finally, attention should be given to the type of family: both members of the couple telework; one member of the couple teleworks; and above all, single-parent families.

Research should also consider the type of work, conditions of work, and especially work status. Differences may be found with respect to level of status, degree of supervision, the degree to which work is interesting, and levels of responsibility and autonomy.

In conclusion, this study provides information to make us aware that teleworking continues to be a double sword for women mainly due to their social role of main responsible for the household and defendant relatives. It is still needed a change in the mindset of our society, that may allow and encourage men to share these responsibilities. Only with a real co-responsibility at home can teleworking become a great arrangement for all teleworkers, regardless of gender. So, the need for policies and practices that address gender differences, working conditions, and appropriate regulations to support all workers in this changing environment becomes a must.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

NC-T: Writing – original draft, Writing – review & editing, Data curation, Formal analysis, Validation. MZ-V: Formal analysis, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AO: Funding acquisition, Supervision, Writing – original draft, Writing – review & editing. EC: Funding acquisition, Supervision, Writing – original draft, Writing – review & editing. AG-I: Conceptualization, Funding acquisition, Supervision, Writing – original draft, Writing – review & editing.

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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.

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Drawbacks of work intensification during the COVID-19 pandemic for procrastination and irritation: work from home as a further risk and social support as a potential buffer?

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The use of information and communication technologies while working from home during the COVID-19 pandemic may have increased flexibility and compatibility of different life domains, but may have also increased work intensification – which in turn may jeopardize wellbeing and task performance. While work intensification is assumed to relate positively to procrastination as well as irritation, the extent of work from home was expected to strengthen these relationships. Social support may attenuate these moderations. The assumptions were tested in two independent, comparable samples (S1, $N = 347$; S2, $N = 1{,}066$) during two stages of the COVID-19 pandemic (November 2020, 2021). Data were collected via online questionnaires using established scales (preregistered before analyses). Work intensification was significantly positively related to procrastination as well as cognitive and affective irritation in both samples. The extent of work from home strengthened the relationship between work intensification and procrastination (S2), while in S1 this held true only when persons reported not having their own study at home. Social support did not moderate the moderations. By replicating results in two different samples, this study contributes by being the first to examine the relationship between work intensification and procrastination, while further confirming the positive relationship between work intensification and irritation. The extent of work from home seems to pose an additional risk for procrastination. Our research extends the research on remote work by showing the downsides, such as work intensification, which is positively related to irritation and procrastination, which are precursors to impaired wellbeing and task performance. This highlights the different negative outcomes that can result from non-ideal working conditions when working from home during the COVID-19 pandemic. Especially given that the pandemic paved the way for a high prevalence of work from home, future research should investigate beneficial contextual factors to provide the evidence base for the design of healthy and productive working conditions.

KEYWORDS

work intensification, procrastination, irritation, work from home, social support

1 Introduction

The COVID-19 pandemic outbreak has resulted in changes in work circumstances and life including an increase in work from home (Granter et al., 2019) and the use of new technologies (De et al., 2020). These changes may increase psychosocial risks, such as work intensification, which can subsequently hamper performance (e.g., Zacher et al., 2021) and decrease wellbeing (Meyer et al., 2019; International Labour Organization, 2020; Rudolph et al., 2021; Venz and Boettcher, 2022). Furthermore, antecedents of performance such as procrastination may be relevant to consider (e.g., Ferrari, 2001; Steel et al., 2001). Procrastination is defined as voluntarily postponing an intended and necessary activity (Klingsieck, 2013), is associated with poorer academic performance (Tice and Baumeister, 1997) and is also linked to cyberslacking and reduced engagement, particularly in a work from home setting (O'Neill et al., 2014).

Work intensification is defined as "the amount of effort an employee needs to invest during the working day increases" (Kubicek et al., 2015, p. 899). It can both quantitatively and qualitatively cause employees to perceive an increased pace of work, multitasking demands, and a reduction of breaks between tasks. This can have a detrimental effect on their wellbeing and motivation, as it requires significant energy and effort on their part, which can deplete their resources and result in strain and other negative stress-related outcomes (Kubicek et al., 2015; Mauno et al., 2023). The intensification of work has been studied as a stressor in the context of remote work (e.g., Kelliher and Anderson, 2010; Venz and Boettcher, 2022); previous findings underline the risk of work intensification when working from home (e.g., Bathini and Kandathil, 2019; Meyer et al., 2019).

Studying the associations of risk factors for performance and wellbeing of employees emanating from the extent of working from home is highly relevant as the COVID-19 pandemic and its lockdowns paved the way for a higher rate of working outside of the organization's office (Statista, 2022; WFH Research, 2023). Our study has three contributions. *First*, it contributes to the knowledge regarding consequences of work intensification by examining the relationships between work intensification and negative stress-related outcomes, specifically procrastination and irritation, as irritation is the subjectively perceived cognitive and emotional strain in the work context (Mohr et al., 2006). Procrastination, that is, the irrational delay of intended actions, was identified as a major challenge during the COVID-19 pandemic in a study conducted through semi-structured interviews (Wang et al., 2021). As aversive or overtaxing tasks are common reasons for procrastination (Steel, 2007), work intensification may be one of the explanations for this increase in procrastination. This is the first study to quantitavely examine the relationship between work intensification and procrastination. Examining the relationships of work intensification is necessary because it may become more relevant even when working from home. Our study shows that it is related, among other things, to procrastination due to increased drawing on self-regulatory resources. Practical implications of our study suggest that daily goal setting can help reduce procrastination and provide a sense of achievement. This is particularly important when working from home where external task feedback is limited. The relationship between work intensification and procrastination will be explained based on the Appraisal, Attributions, and Adaption Model of Job Stress (AAA; Mackey and Perrewé, 2014; following Prem et al., 2018), which incorporates the transactional theory of stress (Lazarus and Folkman, 1984; Perrewé and Zellars, 1999) as well as self-regulation theories (Muraven and Baumeister, 2000). High job demands may also lead to irritation (e.g., Nolen-Hoeksema et al., 2008); particularly work intensification was related to cognitive and affective irritation (Scheel et al., 2023). In the long run, high demands can foster emotional exhaustion via irritation. The relationship between work intensification as a job demand and irritation will be explained through the health-impairment process of the Job-Demand Resource Model (JD-R; Demerouti et al., 2001). By incorporating the AAA and the JD-R to explain the hypotheses, the JD-R considers the broader concept of the model with the relationship of job demands in the form of work intensification and irritation as impaired mental health, while the AAA further explains the cognitive appraisal process of the proposed relationships between work intensification and procrastination as failure of self-regulation in relation to the extent of work from home and social support. Thus, we examine the relationship between work intensification and procrastination (indicating productivity loss) as well as employee irritation.

Second, our study contributes to the knowledge about the risks of working from home. We analyze the strengthening role of the extent of work from home for the links between work-intensification and procrastination as well as irritation, where the extent of work from home is defined as 1 day per week to full-time working from home (Gajendran et al., 2024). The sudden increase in mandatory work from home due to governmental regulations may be perceived as a stressor because the boundaries between life domains may become blurred and the work environment may not be as optimal as in the office. Niebuhr et al. (2022) show a positive correlation between the extent of work from home and the prevalence of stress-related symptoms during the first year of the COVID-19 pandemic (i.e., November/December 2020) in Germany. To the best of our knowledge, no prior studies have examined the moderating effect of the extent of work from home on the relationship between work intensification and procrastination as well as irritation. Working from home provides autonomy (Meyer et al., 2021), but the work environment also requires self-control (Troll et al., 2022), which is part of self-regulation (Gillebaart, 2018). This increased effort of working from home may be buffered by additional resources. *Third*, we contribute to the knowledge about resources potentially attenuating the risks of working from home with regard to detrimental consequences of work intensification. We hypothesize that moderating the extent of work from home depends on whether employees perceive social support in the form of cooperative and helpful colleagues; thus, social support is assumed to moderate the moderation by work from home. Qualitative data reported less procrastination for higher perceptions of social support for those working remotely (Wang et al., 2021), and a previous meta-analysis has shown weak moderating effects of social support on the relationship between stressors and unwell-being (Gonzalez-Mulé et al., 2021). However, the buffering role of social support for the extent of work from home as a stressor has not yet been examined. The

examination of the role of social support from colleagues reveals a potential resource that can assist in coping with job demands and, ultimately, in understanding how work can be better organized to reduce procrastination and irritation. This study contributes to the literature on remote work by showing the drawbacks, especially of work intensification, which is positively related to irritation and procrastination and it aims to inform designing work environments, both at home and in the office, to prevent procrastination and promote wellbeing. Another knowledge contribution is that the study shows possible countermeasures in the form of social support that not indirectly but directly affect irritation and procrastination. Furthermore, the study makes a significant theoretical contribution by confirming the AAA Theory and thereby demonstrating that work intensification is a threatening job demand. It fills research gaps by focusing on the situational perspective of procrastination with two samples during the COVID-19 pandemic in November 2020 and 2021, when work from home was mandatory respectively recommended for those who could do so. While this is the first study investigating the relationship between work intensification and procrastination, our results will confirm those of an earlier study (Scheel et al., 2023) that examined the relationship between work intensification and irritation. Additionally, this study examines the moderating effects of work from home as a risk factor and social support as a potential buffer in a changing work environment, which have not been previously studied.

1.1 Work intensification and procrastination

Work intensification is a job demand, which are physical, psychological, social, or organizational characteristic of the workplace (Demerouti et al., 2001). Work intensification results from accelerated changes such as an increase toward more services, globalization, and flexibility like work from home (Kubicek et al., 2015). Recent research on work intensification has broadened the scope to include all aspects of life, intending to improve efficiency, productivity, and performance (Mauno et al., 2023). In particular, the COVID-19 pandemic has further accelerated the work from home trend. When working from home, new tasks, such as more virtual meetings, generally require more coordination, which can lead to increased effort during the workday and thus to work intensification. Among other detrimental effects, work intensification may impede employee involvement in continuous improvement and job performance (Neirotti, 2018). Likewise, procrastination negatively affects performance (Tice and Baumeister, 1997; Steel, 2007), however, van den Berg and Roosen (2018) found no relationship between procrastination and performance or work engagement.

Procrastination is defined "as the voluntary delay of an intended and necessary and/or (personally) important activity, despite expecting potential negative consequences that outweigh the positive consequences of delay" (Klingsieck, 2013, p. 26); procrastination is seen as a form of self-regulatory failure (Steel, 2007). Most research on procrastination is conducted in the life domain of students, but increasing research draws on nonstudent domains such as in the workplace (e.g., Lonergan and Maher, 2000; Nguyen et al., 2013; Metin et al., 2016; Prem et al., 2018). Empirical evidence for procrastination being a personality trait covers, for instance, unfavorable employment conditions as compared to non-procrastinators (Nguyen et al., 2013). Contrary, within the situational perspective it is assumed that (state) procrastination is caused by situational features such as autonomy and task difficulty (Harris and Sutton, 1983; Klingsieck, 2013). For instance, low job demands and resources were found to be associated to procrastination at work via boredom (Metin et al., 2016). Work procrastination may be induced by situational work characteristics like work intensification, which is seen as a hindrance demand (Mauno et al., 2023). However, the empirical evidence for the distinct effects of challenge-hindrance stressors is generally not strong (Mazzola and Disselhorst, 2019).

No previous studies have examined the relationship between work intensification and procrastination, but studies showed that procrastination is positively related to time pressure and hindrance appraisal through within-person processes of cognitive appraisal and self-regulation (Prem et al., 2018). Additionally, Steel's (2007) meta-analysis found that task aversiveness is positively related to task procrastination in between-effect studies. Lack of autonomy, which is a component of task aversiveness, has also been found to be positively related to procrastination (Blunt and Pychyl, 2000). A recent study conducted during the COVID-19 pandemic found procrastination to be one of the key remote work challenges mentioned in semi-structured interviews with Chinese employees, with workload being related to lower procrastination in a subsequent cross-sectional survey study (Wang et al., 2021). However, with on average 7 daily working hours ($SD = 2$) as indicator, workload was rather moderate in this study. Accordingly, and similar to Metin et al. (2016), Wang et al. (2021) argue that boredom is the mediator between workload and procrastination. However, previous research has shown a mostly positive relationship between job demands and work procrastination from a situational perspective (e.g., Steel, 2007; Prem et al., 2018), while work intensification was likewise associated with poorer task performance (Mauno et al., 2020).

Theoretical arguments suggest an association of work intensification with procrastination. According to the transactional stress theory (Lazarus and Folkman, 1984), work intensification may be perceived as stress in the primary appraisal. Following the approach of Prem et al. (2018), this can be continued with attributions and action tendencies stated in the AAA model (Perrewé and Zellars, 1999; Mackey and Perrewé, 2014). Depending on the internal and external causes of stress, certain affective responses (emotions) lead to secondary appraisal coping choices (Perrewé and Zellars, 1999). For instance, if employees perceive work as stressful due to high work intensification (primary appraisal) and have difficulties working from home and limited social support (resources), they may withdraw (emotion-focused coping) in the secondary appraisal. The resulting action tendencies depend on the secondary appraisal and self-regulation (Mackey and

Perrewé, 2014). Procrastination may occur when self-regulation effort is high (Prem et al., 2018). Therefore, the more the work intensifies, the more likely employees procrastinate.

Taken together, based on the theory of transactional stress (Lazarus and Folkman, 1984), the AAA model (Perrewé and Zellars, 1999; Mackey and Perrewé, 2014), and the results of empirical research we hypothesize that work intensification is positively related to work procrastination.

H1: Work intensification relates positively to work procrastination.

1.2 Work intensification and irritation

The relationship between the job demand work intensification and wellbeing outcomes can be explained by the health-impairment path of the JD-R model (Demerouti et al., 2001). The health-impairment process proposed by Bakker and Demerouti (2017) posits that when job demands such as work intensification are high and resources such as social support are limited, individuals experience depleted energy levels, necessitating continuous physical and/or psychological exertion (cognitive and affective abilities). This depletion of energy results in psychological stress, leading to subsequent manifestations of impairment (Demerouti et al., 2001). Irritation, identified as a proximal mental health outcome of work-related stress, serves as a precursor to more profound impairments such as psychosomatic complaints and depression (Mohr et al., 2006). Therefore, irritation can be used as an indicator of strain, which is particularly relevant when examining the proximal effects of changing working conditions, such as work intensification during the COVID-19 pandemic. Irritation may result from a perceived goal discrepancy, with cognitive irritation or rumination being a specific subtype characterized by reinforced efforts toward goal achievement (Mohr et al., 2006). Cognitive irritation, in turn, contributes to the development of depression, as demonstrated by research such as Harrington and Blankenship (2002). Furthermore, the subcategory of affective irritation, manifested as irritability, represents a heightened state of mental strain where individuals lose the motivation to pursue specific goals (Mohr et al., 2006). In sum, the health-impairment process unfolds as high job demands such as work intensification coupled with limited resources deplete energy, leading to psychological stress and, subsequently, mental health issues such as irritation, rumination, or ultimately, depression. Previous research found support in that work intensification was related to emotional exhaustion (Fiksenbaum et al., 2010; Granter et al., 2019; Lawrence et al., 2019; Huo et al., 2022), psychosomatic complaints (Franke, 2015), stress (Blanco-Donoso et al., 2023), and irritation (Scheel et al., 2023). In summary, high job demands can lead to energy depletion, resulting in cognitive and affective irritation, which underpins the health-impairment path of the JD-R model (Demerouti et al., 2001). Thus, we postulate that work intensification is positively related to cognitive and affective irritation.

H2a-b: Work intensification relates positively to (a) cognitive and (b) affective irritation.

1.3 Moderating role of the extent of work from home

Although before the COVID-19 pandemic remote work was relevant and investigated (e.g., Kelliher and Anderson, 2010), its exploration was often motivated by employee preferences. A meta-analysis comparing studies before and during the COVID-19 pandemic showed significant differences between the pre- and the during-pandemic extent of work from home with different outcomes such as perceived isolation (Gajendran et al., 2024). During the COVID-19 pandemic, work from home became mandatory for those who could, making it difficult to generalize previous findings (Kniffin et al., 2021; Yu and Wu, 2021). Involuntarily work from home was perceived as a stressor already before the pandemic (Lapierre et al., 2016), moreover, the higher extent of work from home positively related to burnout during the pandemic, but this was not significant in the pre-pandemic data (Gajendran et al., 2024). Thus, the extent of work from home due to the COVID-19 pandemic will be considered as a potential stressor in the following. The boundaries between work and personal life may become blurred (Wang et al., 2021) and employees may struggle with self-regulation (Prem et al., 2018), especially when working from home during the COVID-19 pandemic, and thus procrastinate by, for instance, doing laundry or other household chores, answering the doorbell for neighbors' parcels, or interacting with family members.

Research on the relationship between work intensification and procrastination when work from home is limited. Previous research on trait procrastination showed that cyber slacking (involving non-work use of the internet on company time), is positively associated with procrastination and negatively affects perceived performance when working remotely (O'Neill et al., 2014). Procrastination can also impede the relationship between telework and wellbeing (Junça Silva et al., 2022). Additionally, Reinecke et al. (2018) investigated the relationship between trait procrastination and unwellbeing, which was partially mediated by insufficiently self-regulated internet use. Other causes of procrastination when working from home, such as distractions caused by the restless working environment at home, have not yet been researched. A review of procrastination and stress suggests that the risk of procrastination increases in stressful contexts, such as the COVID-19 pandemic, because procrastination is a low-resource way of avoiding aversive and difficult task-related emotions (Sirois, 2023). In line with the AAA model of job stress (Mackey and Perrewé, 2014) and the theoretical derivation of hypothesis 1, work from home may be perceived as an external source of stress in the secondary appraisal. This can lead to emotion-focused coping due to emotional withdrawal and failure of self-regulation, resulting in more procrastination (Prem et al., 2018). Therefore, we postulate that as the extent of work from home increases, the positive relationship between work intensification and procrastination becomes stronger.

H3: The extent of work from home moderates the positive relationship between work intensification and procrastination; with higher extent of work from home, the relationship becomes stronger.

When working in work from home, work intensification may spill over from one domain to another (Kelliher and Anderson, 2010), that is, work intensification might have a stronger association with mental wellbeing as compared to working in the office. Possible moderators for the relationship between work intensification and wellbeing are work-home segmentation and work-home boundary management (Kubicek and Tement, 2016). The blurred boundaries between domains could result in increased ruminating about work. Based on the transactional theory of stress (Lazarus and Folkman, 1984), work intensification may be perceived as stressful during the primary appraisal. Additionally, the increase in work from home, which can also be perceived as a stressor, may lead to strain in the form of cognitive and affective irritation during the secondary appraisal or to reappraisal. Therefore, the higher the extent of work from home, the stronger the positive relationship between work intensification and cognitive as well as affective irritation is expected to be.

H4a-b: The extent of work from home moderates the positive relationship between work intensification and (a) cognitive irritation and (b) affective irritation; with higher extent of work from home, the relationships become stronger.

1.4 Social support as moderator of the moderation

Social support includes emotional aspects, such as appreciation, and instrumental aspects, such as help with work tasks; thus, it is a fundamental resource that protects wellbeing (Sonnentag et al., 2023). Sonnentag et al. (2023) state that meta-analyses indicate a direct, positive relationship between social support and wellbeing (Viswesvaran et al., 1999). However, meta-analyses do not generally support the buffering role of social support on the relationship between job demands and wellbeing (Guthier et al., 2020; Gonzalez-Mulé et al., 2021). Based on the AAA model of job stress (Mackey and Perrewé, 2014) and the JD-R model (Demerouti et al., 2001) we propose a positive relationship between work intensification and procrastination as well as irritation, which is moderated by the extent of work from home and this in turn is buffered by social support. Social support can be perceived as a resource that reduces stress resulting from work intensification combined with work from home. Therefore, social support acts as a buffer for the extent of work from home, and the moderation by extent of work from home may be less detrimental. Previous research shows that social support aids in reducing procrastination while working from home (Wang et al., 2021); they found that closer monitoring can be a form of social support that helped individuals better cope with procrastination during the COVID-19 pandemic, although pre-pandemic research suggests that monitoring while working from home could be detrimental (Lautsch et al., 2009). In this study, social support is not defined as monitoring by a supervisor, but rather as instrumental support by colleagues. Thus, when employees perceive work as stressful due to high work intensification (primary appraisal) and have high extent of work from home, having resources like social support by colleagues (e.g., via online communications or chats) may mitigate the moderating effect of the extent of work from home. That is, the strengthening effect of the extent of work from home for the relationship between work intensification and procrastination may be attenuated due to less emotion-focused coping (due to social support) in the secondary appraisal. Likewise, social support may also attenuate the intensifying moderation of the extent of work from home of the positive relationship between work intensification and cognitive and affective irritation. Thus, social support may counter the problematic circumstances when working at home. To improve clarity and logical structure, the hypotheses are summarized in a research model, as shown in Figure 1.

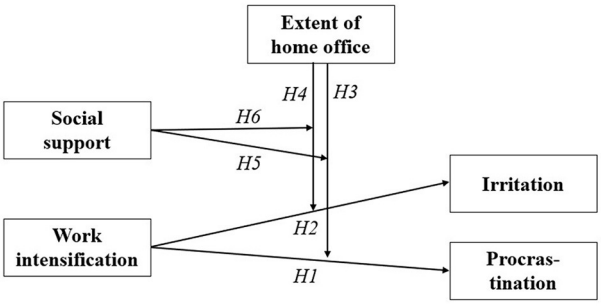

FIGURE 1
Proposed research model.

H5: Social support attenuates the intensifying moderation of the extent of work from home of the positive relationship between work intensification and procrastination.
H6a-b: Social support attenuates the intensifying moderation of the extent of work from home of the positive relationship between work intensification and (a) cognitive as well as (b) affective irritation.

2 Materials and methods

2.1 Data collection and participants

The data were collected via online questionnaires in Germany with two separate samples, 18-30 November 2020 (S1) and 18-27 November 2021 (S2). Data were collected by students as part of course requirements. To be eligible for participation in the study, participants had to be employees. Both surveys took place during the COVID-19 pandemic, with different but comparable restrictions and living conditions - lockdown (November 2020) and 3G (November 2021). In November 2020, measures were implemented in Germany to contain the pandemic, such as contact restrictions in private and public spaces, and the closure or restriction of businesses ("lockdown"). As a result, those who were able to work from home were required to do so by federal law (Bundesgesetzblatt, 2020). In November 2021, vaccines against the coronavirus became available. Employers must again offer the opportunity to work from home, and employees must accept that offer, according to federal law. However, contact restrictions in private and public spaces based on the so-called "3G"-rules remained, that is, people had to provide evidence for being either vaccinated or recovered or tested thus indicate an individual's COVID-19 status (initials "G": "geimpft,

genesen, getestet" translated to English "vaccinated, recovered, tested"; Bundesgesetzblatt, 2021). Sample S1 includes $N_{S1} = 347$ participants who mainly worked in the service sector (40.6%), in production (18.4%), and in the public sector (13.5%). Most of those surveyed were white collar (84%), only a few were blue collar workers (3%; rest mixture of both). The average age was 36.26 years ($SD = 15.6$) and 60.8% were women (39.2% men). The $N_{S2} = 1{,}066$ participants of sample S2 worked to the better part also in the service sector (42.2%) and in the public sector (23.8%), the mean age was 42.7 years ($SD = 15.32$), and 55.5% were women (44.3% men, 0.2% diverse). Most participants worked in white collar jobs (73.5%) and few in blue collar jobs (10.1%). All analyses of the studies were pre-registered (https://doi.org/10.17605/OSF.IO/4KBYV).

2.2 Operationalization

The independent variable *work intensification* was assessed with the intensification of job demands scale (IDS, Kubicek et al., 2015). The subscale work intensification includes four items such as "It is increasingly rare to have enough time for work tasks," which had to be rated for agreement on a Likert scale with anchors ranging from 1 = *not at all* to 5 = *completely*. The scale demonstrated moderate internal consistency in both samples (S1, $\alpha = 0.75$; S2, $\alpha = 0.88$).

The dependent variable *procrastination* was measured with six items such as "I postpone the start of important work until the last moment" (Höcker et al., 2017). The instruction explicitly asked for the assessment of the items with regard to work context only. The items had to be rated for agreement on a Likert scale with anchors ranging from 1 = *never* to 7 = *always*. The scale demonstrated high internal consistency in both samples (S1, $\alpha = 0.95$; S2, $\alpha = 0.95$).

The dependent variable *irritation* was measured with the two subscales of cognitive and affective irritation, indicating psychological strain in the work context (Mohr et al., 2006). *Cognitive irritation* was assessed with three items such as "I am having a hard time mentally switching off after work." which had to be rated for agreement on Likert scale anchors ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The scale demonstrated high internal consistency in both samples (S1, $\alpha = 0.86$; S2, $\alpha = 0.86$). *Affective irritation* was measured with three items such as "When someone approaches me, it happens that I react grumpily." with the same scale anchors. The scale demonstrated high internal consistency in both samples (S1, $\alpha = 0.89$; S2, $\alpha = 0.89$).

The moderator *extent of work from home* was assessed with the extent of work from home during the lockdown measures with a single item for S1 ("How often do you currently work from home, in the times of the pandemic and lockdowns?") and for S2, that is, "How often do you work from home now in the 3G time?", which was developed by the research team. The items had to be answered on a scale ranging from 0 = *not at all* to 10 = *completely*, in order to capture the extent of work from home more fine-grained as would be possible with asking for full days per week worked from home. Previous research measured extent of work from home also as a continuous variable like the percentage of week when working from home as well as days or hours per week worked from home (Gajendran et al., 2024).

The second moderator *social support* was measured with three items from Herrmann et al. (2012), an example item being "Working with my colleagues is cooperative and helpful." The rating scale ranged from 1 = *not at all* to 5 = *completely*. The scale demonstrated high internal consistency in both samples (S1, $\alpha = 0.83$; S2, $\alpha = 0.82$).

As control variables, *age*, *work context work from home*, and *gender* were included. Work intensification may be more common with increasing age (Mauno et al., 2019), which was measured continuously. Work context work from home was chosen because it is assumed that the work context may affect how easily one is distracted from work and therefore more likely to procrastinate; also, the work context at home can be perceived as another stressor. Work context was measured with one item "Where do you mainly work when you work at home?" which was developed by the research team and is comparable to Awada et al.'s (2021) operationalization of workspace context. The items had to be rated in categories ranging from 1 = *In own study*, 2 = *In a shared (e.g., partner's) study*, 3 = *In a study alcove (e.g., at a desk that is in the bedroom)*, 4 = *At the dining or kitchen table (or similar)*, 5 = *in other places (e.g., on the couch in the living room, on the floor, on the bed)*. A dummy variable was created with 1 = *in own study* and 0 = *all others*. It is expected that when employees work in their study, they can more easily avoid distractions from roommates or family members and can better ignore possible household chores, allowing for a more focused work atmosphere. Research shows that employees with their own study were less distracted (Bergefurt et al., 2023) and more productive (Awada et al., 2021). Therefore, a work from home work context in one's study does not necessarily worsen work intensification through frequent interruptions and may not imply more procrastination by, for example, doing laundry instead of finishing a project. In deviation from the preregistration, we additionally tested gender as a control variable at the suggestion of a reviewer. Gender was measured with one item, "Which gender do you feel you belong to?" The item had to be rated in the categories 1 = *female*, 2 = *male* and 3 = *diverse*. Previous research indicated an association between gender and procrastination, such that men tend to procrastinate more than women (Lu et al., 2022), and differences were also reported for gender and unwell-being, indicating that women are slightly more emotionally exhausted than men (Purvanova and Muros, 2010). However, gender was not found to be significant in any of our analyses. Furthermore, there was no change in the significance of the hypothesized relationships, with only slight changes occurring for other control variables in some analyses. Consequently, we have chosen to retain the presentation of our results as is, in accordance with our preregistration.

2.3 Statistical analyses

For the analysis, H1 and H2 were tested using linear regression with bootstrapping (1,000 iterations), and the other hypotheses were tested by means of the macro PROCESS by Hayes (2017) in SPSS (5,000 iterations), using Model 1 (H3 and H4, moderation) and Model 3 (H5 and H6, moderated moderation). Before testing the hypotheses, *t*-tests showed no significant difference between

the two samples (S1 and S2) in the sample characteristics age and gender, but a difference of small effect for the work environment when working from home, with more persons having their own study at home in 2021 as compared to 2020 {$M_{S1} = 0.29$, $SD = 0.46$; S2: $M_{S2} = 0.44$, $SD = 0.50$; $t(634) = -5.23$, $p < 0.001$, 95% CI [−0.21; −0.09], $d = -0.31$}. There was also no difference between samples for the key variables work intensification, social support and irritation, but again a small effect for the extent of work from home, with less persons working from home in 2021 as compared to 2020 [$M_{S1} = 6.51$, $SD = 3.78$; S2: $M_{S2} = 5.16$, $SD = 3.63$; $t(1411) = 5.96$, $p < 0.001$, 95% CI [0.91; 1.79], $d = 0.37$]. Also indicating a small effect, procrastination was slightly higher in 2021 as compared to 2020 {$M_{S1} = 3.11$, $SD = 1.32$; $M_{S2} = 3.40$, $SD = 1.34$; $t(2201) = -3.816$, $p < 0.001$, 95% CI [−0.44; −0.14], $d = -0.22$}. Factor analyses supported the structure of the variables, that is, according to the rotating component matrix, all scales loaded on one separate factor respectively irritation on two factors (cognitive and affective), thus confirming the original scales.

3 Results

In Table 1 the descriptives, bivariate correlations (Spearman Rho) and internal consistencies for all study variables for both samples S1 and S2 are displayed. In both samples, work intensification is significantly positively related to procrastination ($r_{S1} = 0.24$, $r_{S2} = 0.23$, both $p < 0.01$) as well as cognitive ($r_{S1} = 0.47$, $r_{S2} = 0.40$) and affective irritation ($r_{S1} = 0.32$, $r_{S2} = 0.23$, all $p < 0.01$) in both samples. Interesting on a descriptive level, while in 2020 (S1) 29% reported having their own working place at home, 1 year later (S2) 44.5% reported as such. Also, 23% were entirely working from home in 2020, but only 7.5% in 2021.

3.1 Hypotheses 1 and 2 – direct relationships

In support of H1, work intensification is significantly positively related to procrastination in both samples ($B_{S1} = 0.31$, $SE = 0.07$; $B_{S2} = 0.27$, $SE = 0.04$, both $p < 0.001$, Table 2). In both samples, work intensification is also significantly positively associated with cognitive ($B_{S1} = 0.55$, $SE = 0.06$; $B_{S2} = 0.45$, $SE = 0.03$, Table 3) and affective irritation ($B_{S1} = 0.35$, $SE = 0.06$; $B_{S2} = 0.22$, $SE = 0.03$, all $p < 0.001$, Table 4). Thus, H2a/b is also supported.

3.2 Hypotheses 3 and 4 - moderation

We tested whether the extent of work from home moderates the relationships between work intensification and procrastination (H3) as well as cognitive and affective irritation (H4a/b). The relationship between work intensification and procrastination was moderated by extent of work from home only for sample S2 (interaction coefficient $B_{S2} = 0.04$, $SE = 0.01$, $p < 0.001$, 95% CI [0.02; 0.06], Table 5), but not for S1 (see Supplementary Table 1). Figure 2 shows that, according to our expectations, the relationship between work intensification and procrastination is stronger with a higher extent of work from home (+1 *SD*) as compared to a lower

TABLE 1 Descriptive statistics and Spearman Rho correlations of all study variables.

Variables	M_{S1}	SD_{S1}	M_{S2}	SD_{S2}	Age	Gender	Work from home N	Work Intensif.	Work from home X	Social support[a]	Procrastination	Irritation Cogn.	Irritation Aff.
S1													
Age	36.26	15.64	42.7	15.33	-	0.07*	−0.002	0.21**	0.56**	−0.05	−0.20**	0.001	−0.07*
Gender	1.39	0.49	1.45	0.50	0.07	-	0.11**	−0.18**	0.03	0.04	−0.10**	−0.08*	−0.08**
Work from home N	0.29	0.46	0.44	0.50	0.25**	0.12*	-	−0.07**	0.21**	0.04	−0.13**	−0.02	−0.06*
Work Intensif.	2.84	0.92	2.74	0.97	−0.10	−0.10	−0.07	(0.75/0.80)	−0.04	−0.15**	0.23**	0.40**	0.23**
Work from home X	6.51	3.78	5.16	3.63	−0.08	−0.02	−0.008	0.07	-	0.06*	0.02	−0.05	0.04
Social support[a]	4.16	0.75	4.08	0.77	0.04	0.04	−0.07	−0.11*	0.07	(0.83/0.82)	−0.10**	−0.15**	−0.29**
Procrastination	3.06	1.30	3.09	1.24	−0.21	−0.05	−0.10	0.24**	−0.07	−0.25**	(0.95/0.95)	0.25**	0.29**
Irritation Cogn.	2.92	1.08	2.76	1.09	−0.12*	−0.08	−0.05	0.47**	0.11*	−0.17**	0.30**	(0.86/0.86)	0.42**
Irritation Aff.	2.52	1.03	2.38	0.95	−0.14*	−0.06	−0.01	0.32**	0.001	−0.35**	0.36**	0.48**	(0.89/0.89)

$N_{S1} = 347$; $N_{S2} = 1066$. S1 below diagonal; S2 above diagonal. Reliabilities Cronbachs α in the diagonal (S1/S2). Work from home X, Work from home extent; Work from home N, Work environment work from home; Work Intensif., work intensification; Irritation Cogn., cognitive; Aff., affective. Gender (1 = *women*, 2 = *men*). Work from home N (1 = *own study*. 0 = *shared workplace, work niche, dining or kitchen table, other places*). [a]At work. **p < 0.01; *p < 0.05.

TABLE 2 Regression analyses for dependent variable procrastination (H1).

Variables		B_{S1} (*SE*)	95% CI_{S1}	B_{S2} (*SE*)	95% CI_{S2}	adj. $R^2_{S1/S2}$
1	Constant	3.78 (0.19)	[3.40; 4.16]	3.94 (0.14)	[3.67; 4.23]	0.04/0.04
	Age	−0.02 (0.01)**	[−0.03; −0.01]	−0.2 (0.03)**	[−0.02; −0.01]	
	Work from home N	−0.13 (0.16)	[−0.44; 0.18]	−0.22 (0.08)*	[−0.38; −0.07]	
2	Constant	2.85 (0.29)	[2.28; 3.42]	3.19 (0.18)	[2.83; 3.56]	0.08/0.09
	Age	−0.02 (0.01)**	[−0.03; −0.01]	−0.2 (0.00)**	[−0.02; −0.01]	
	Work from home N	−0.09 (0.01)	[−0.39; 0.21]	−0.18 (0.07)*	[−0.34; −0.04]	
	Work Intensif.	0.31 (0.07)**	[0.16; 0.45]	0.27 (0.04)**	[0.19; 0.34]	
	Δadj. $R^2_{S1/S2}$					0.04/0.03

$N_{S1} = 347$; $N_{S2} = 1066$. Bootstrapping with 1,000 iterations. *CI*, Confidence Interval; Work from home N, work environment work from home; Work Intensif., work intensification. Work from home N (1 = *own study*. 0 = *shared workplace, work niche, dining or kitchen table, other places*). $^{**}p < 0.01$; $^{*}p < 0.05$.

TABLE 3 Regression analyses for dependent variable cognitive irritation (H2a).

Variables		B_{S1} (*SE*)	95% CI_{S1}	B_{S2} (*SE*)	95% CI_{S2}	adj. $R^2_{S1/S2}$
1	Constant	3.25 (0.16)**	[2.93; 3.57]	2.77 (0.12)**	[2.53; 3.02]	0.01/−0.00
	Age	−0.01 (0.00)*	[−0.02; 0.00]	0.00 (0.00)	[−0.01; 0.01]	
	Work from home N	−0.07 (0.13)	[−0.33; 0.19]	−0.06 (0.07)	[−0.19; 0.07]	
2	Constant	1.58 (0.22)**	[1.13; 2.02]	1.49 (0.14)**	[1.23; 1.76]	0.22/0.16
	Age	−0.01 (0.00)	[−0.01; 0.00]	0.00 (0.01)	[−0.01; 0.01]	
	Work from home N	0.00 (0.12)	[−0.23; 0.23]	−0.01 (0.06)	[−0.13; 0.12]	
	Work Intensif.	0.55 (0.06)**	[0.44; 0.66]	0.45 (0.03)**	[0.39; 0.51]	
	Δadj. $R^2_{S1/S2}$					0.21/0.16

$N_{S1} = 347$; $N_{S2} = 1066$. Bootstrapping with 1,000 iterations. *CI*, Confidence Interval; Work from home N, work environment work from home; Work Intensif., work intensification. Work from home N (1 = *own study*. 0 = *shared workplace, work niche, dining or kitchen table, other places*). $^{**}p < 0.01$; $^{*}p < 0.05$.

extent of work from home (-1 *SD*). Thus, H3 could only partially be support for sample S2. As an interesting addition, persons indicating to have their own study when working at home (control variable) was significantly negatively related to procrastination in S2 ($B_{S2} = -0.22$, $SE = 0.08$, $p < 0.01$, 95% CI [−0.37; −0.07]). The extent of work from home did not significantly moderate the relationship between work intensification and irritation. Thus, H4a/b could not be supported (see Supplementary Tables 2–5).

3.3 Hypotheses 5 and 6 - moderated moderation

Social support was tested as a moderator for the moderation of the relationships between procrastination (H5) and irritation (H6a/b) by the extent of work from home. However, for all proposed relationships the moderated moderation was not significant. Thus, H5 and H6 had to be rejected (see Supplementary Tables 6–11).

3.4 Explorative test

We tested exploratively whether the moderations by extent of work from home are moderated by whether persons had their own study when working from home or not. The analyzes showed that only in S1, and only for the relationship between work intensification and procrastination, the moderation by extent of work from home was moderated by work environment (moderated moderation coefficient $B_{S1} = -0.09$, $SE = 0.04$, $p < 0.05$, 95% CI [−0.17; −0.003]; see Supplementary Table 12). That is, high extent of work from home combined with having an own study even seemed to attenuate the relationship between work intensification and procrastination (see Supplementary Figure 3).

4 Discussion

Work intensification as experienced in two different phases of the COVID-19 pandemic was related to higher procrastination as well as to higher cognitive and affective irritation. While the extent of work from home strengthened the relationship between work intensification and procrastination only in the later of the two samples (i.e., S2) and not for irritation, social support was not moderating the relationships. However, an explorative analysis revealed a significant three-way interaction in S1, that is, the extent of work from home is significantly related to procrastination when not having an own study is additionally considered. The extent of work from home was not significantly directly related to neither procrastination nor irritation, but social support was directly significantly related to (lower) procrastination and irritation in both samples.

TABLE 4 Regression analyses for dependent variable affective irritation (H2b).

Variables		B_{S1} (*SE*)	95% CI_{S1}	B_{S2} (*SE*)	95% CI_{S2}	adj. $R^2_{S1/S2}$
1	Constant	2.87 (0.16)**	[2.56; 3.17]	2.57 (0.11)**	[2.36; 2.77]	0.01/0.00
	Age	−0.01 (0.00)*	[−0.02; −0.00]	0.00 (0.00)	[−0.01; 0.02]	
	Work from home N	−0.01 (0.13)	[−0.25; 0.24]	−0.12 (0.06)	[−0.23; −0.01]	
2	Constant	1.80 (0.23)**	[1.35; 2.25]	1.95 (0.13)**	[1.70; 2.20]	0.11/0.05
	Age	−0.01 (0.00)*	[−0.02; 0.00]	0.00 (0.00)	[−0.01; 0.00]	
	Work from home N	0.03 (0.12)	[−0.20; 0.27]	−0.01 (0.06)	[−0.20; 0.02]	
	Work Intensif.	0.35 (0.06)**	[0.24; 0.46]	0.22 (0.03)**	[0.17; 0.27]	
	Δadj. $R^2_{S1/S2}$					0.10/0.05

N_{S1} = 347; N_{S2} = 1066. Bootstrapping with 1,000 iterations. *CI*, Confidence Interval; Work from home N, work environment work from home; Work Intensif., work intensification. Work from home N (1 = *own study*. 0 = *shared workplace, work niche, dining or kitchen table, other places*). **p < 0.01; *p < 0.05.

TABLE 5 Work intensification and procrastination moderated by extent of work from home; sample S2 (H3).

Predictor	*B* (*SE*)	*LLCI*	*ULCI*
Constant	3.29*** (0.21)	2.87	3.71
Age	−0.01*** (0.00)	−0.01	−0.005
Work from home N	−0.22** (0.08)	−0.37	−0.07
Work Intensif.	0.08 (0.06)	−0.05	0.21
Work from home X	−0.08** (0.03)	−0.14	−0.03
Work Intensif. x Work from home X	0.04*** (0.01)	0.02	0.06
R^2	0.087***		
ΔR^2 interaction (2 way)	0.011***		

N_{S2} = 1066. Bootstrapping with 5,000 iterations. LLCI, lower limit confidence interval; ULCI, upper limit confidence interval; Work from home X = work from home extent; Work from home N = work environment work from home; Work Intensif. = work intensification. Work from home N (1 = *own study*. 0 = *shared workplace, work niche, dining or kitchen table, other places*). ***p < 0.001; **p < 0.01; *p < 0.05.

Being one of the crucial job demands when working remotely (e.g., Bathini and Kandathil, 2019; Meyer et al., 2019), work intensification seems to be related to hampered performance as well as to reduced wellbeing (Scheel et al., 2023). The latter is replicated by our results for two specific time frames of lockdown measures (lockdown vs. "3G"), with mandatory respectively desired work from home where possible, and thus reinforce the notion of risk associated with work intensification regardless of remote or office work. However, the findings for procrastination are novel. While for instance Mauno et al. (2020, 2023) found work intensification being related to decreased performance, and among others O'Neill et al. (2014) reported that remote work relates to decreased performance, procrastination was not assessed so far. The results suggest that work intensification draws on self-regulatory resources, fostering procrastination, and work from home potentially enhances the problem. The significantly positive relationship between irritation and procrastination is in line with prior research about, for instance, higher academic procrastination with higher stress (Tice and Baumeister, 1997).

Reflecting our first contribution, our findings suggest a negative relationship between work intensification, a work characteristic closely related to time pressure as in Prem et al. (2018), and procrastination. According to the AAA model and also the findings by Prem et al. (2018), we assumed a hindrance appraisal of work intensification (e.g., like Mauno et al., 2023 suggest) and a related increased drawing on self-regulatory resources, which in turn relates to higher procrastination. That is, following the transactional stress theory and the AAA model, while work intensification might be primarily appraised as a threat and the attributions would include anxiety and stress, the relation between the action tendency (to accomplish the work tasks) might be jeopardized by insufficient self-regulatory resources – and thus, procrastination of work tasks. However, we did not directly measure hindrance appraisal, attribution or self-regulation, and we assessed work intensification and procrastination at one point in time, though in two independent samples. Being generally in line with Prem et al. (2018) and their finding of a positive relationship between time pressure and procrastination, they found support for the mediation by challenge as well as hindrance appraisal - only at the within-, but not the between-person level. For the latter, occupational self-efficacy played an important role in overcoming workplace procrastination.

Complementary to the bore out hypothesis, which implies that procrastination is higher with low job demands and resources (e.g., Metin et al., 2016) respectively workload (Wang et al., 2021), the perception of increasing workload (i.e., work intensification) seems to relate to more procrastination either. The fear of being unable to cope with the amount of work might induce negative emotions, the tasks might be less likable when performing in isolation from coworkers, and both, negative emotions and task aversiveness (e.g., Steel, 2007; Tice et al., 2007), may cause procrastination.

Regarding our second contribution, while work from home seems to be a potential additional stressor, with higher work from home strengthening the detrimental relationship of work intensification and procrastination in some cases (S2), the extent of work from home was not significantly directly related to procrastination or irritation, but previous studies show a significant relationship between extent of work from home and burnout within the pandemic (Gajendran et al., 2024). The extent of work from home was also lower in the S2 sample than in the S1 sample, and either the significance of the moderation was depending on the specific COVID-situation where work from home was still

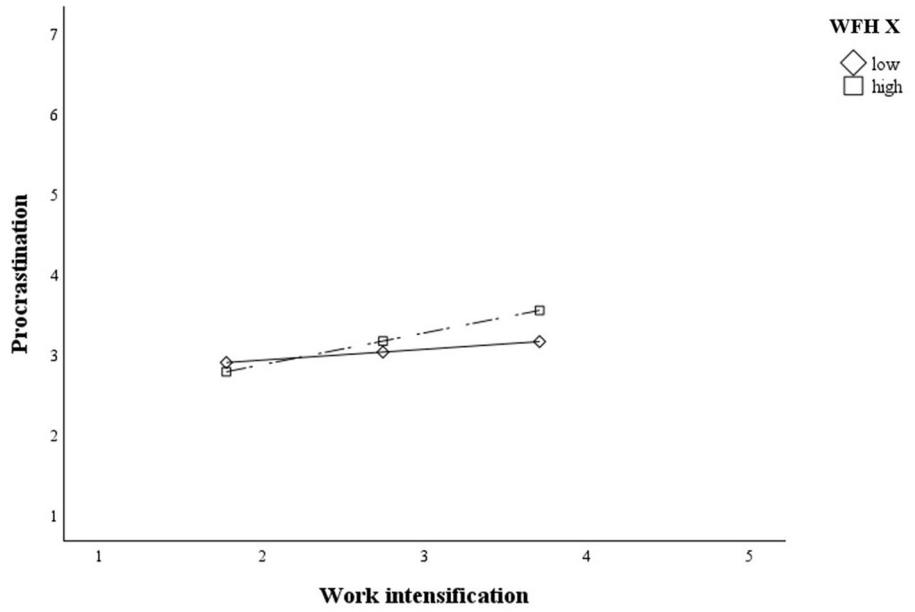

FIGURE 2
Work intensification and procrastination moderated by extent of work from home; Sample S2 (H3). N_{S2} = 1066. WFH X = Work from home extent.

rather novel in November 2020 (and mandatory where possible) as compared to 2021, with already long-term effects in 2021, or at the beginning of the COVID-19 pandemic, with half a year in S1, work from home was more seen as a protection against infection risks, while in November 2021 vaccination was available, giving back a sense of security. On the other hand, the explorative results indicate that rather than the extent of work from home, in the less voluntary work from home period in 2020 the work environment with having one's own study or not was more crucial for the work intensification–procrastination link.

Coming to our third contribution, social support was significantly directly related to procrastination as well as irritation even though social support was rated as rather high (mean above 4 given a scale maximum of 5), making a ceiling effect more likely. As procrastination is closely related to the fear of failure (Haghbin et al., 2012), social support might be an effective countermeasure for this fear. Social support is also significantly negatively related to work intensification, indicating that this resource might be closely related to the perception of work intensification – or with lower work intensification social support seems more available.

That said, given the cross-sectional design, causality claims are ruled out. With higher procrastination, the perception of work intensification may also be higher as work starts piling up. Also, with higher irritation, the work might also be experienced as more intensified, as mood is an important resource (e.g., Conservation of Resource model, Hobfoll, 1989) which may influence the evaluation of coping options.

4.1 Strength and limitations

The trend design with two independent, but comparable samples of sufficient size are among the strengths of this study. While being in part a replication study of irritation but with, given the pandemic, unique points in time, analyzing the relation between work intensification and procrastination was a first attempt. Although the situation in both points in time of the data assessment was comparable in that the COVID-19 pandemic was ongoing and salient in everyday and work life (Bundesgesetzblatt, 2020, 2021), they differed in nuances given that on the one hand the situation became more normal and the available vaccination options in fall 2021 may have decreased the perception of personal infection risk. On the other hand, the ongoing limitations of social contacts and social distancing regulations may have increasingly worn out people. However, as we had a trend but not a panel design, comparisons of the two study results remain educated guesses.

The cross-sectional design of the two studies prevents any causal conclusions. In combination with solely self-reports, this also creates the problem of common method bias. However, factor analyses clearly supported distinct concepts of the variables. To counter social desirability bias, anonymity of participants and confidentiality of the data were ensured. While online surveys where the most feasible data assessment given the pandemic, and also the gathering of subjective evaluations naturally relies on self-report, it may limit the validity of the findings in regard to objectivity. The extent of work from home was measured by a single item with eleven different ranks; though this may be less reliable in general, the lack of complexity of the phenomenon justifies single item measurement. In addition, the extent of work from home could have been measured with other continuous variables, such as the percentage of the week spent working from home and the days or hours per week spent working from home (Gajendran et al., 2024). While other studies also used single-item measures or the result of two items (e.g., weekly work hours work from home in relation to total weekly work hours), with one item and 11 ranks the calculation of extent was left to subjective perceptions of the participants. All measures have their deficits, for

instance, asking for days (per week) work from home may neglect variance across weeks or the relation to the overall working hours, our measure comes at the cost that practical recommendations cannot be concretely applied to an ideal number of days for working from home. The choice of a validated, but general scale for procrastination (Höcker et al., 2017) leaves room for interpretation. The items indicated the delaying of intended important tasks, but with no further specification as to work tasks or the work context. Although the instruction directly asked for an assessment regarding work tasks and the whole framing of the survey as work-related implied that the questions were meant to cover the work domain, it cannot be ruled out that the participants rated the items regarding other life domains than work.

The samples were acquired by Bachelor students via pyramid among their families and acquaintances for course credits (plausibility of the data was checked). Thus, the data do not claim representativity. Additionally, generalizability is limited to rather white than blue collar employees, with previous work finding white collar workers scoring higher on the three forms of chronic procrastination (i.e., decisional, arousal, avoidant) than blue collar workers (Hammer and Ferrari, 2002). Persons working in production may be less able to work from home, and thus results may be more applicable to the public and service sectors than other sectors like production. In fact, the relation between trait procrastination and actual work task procrastination was found to be stronger for office workers as compared to non-office workers (e.g., technicians) in a study by Hen et al. (2021).

On the one hand the situation was unique with mainly involuntary as a nationwide measure of containment, with results maybe generalizable to comparable situations of involuntary collective work from home due to decreased office spaces in the aftermath of the COVID-19 pandemic. On the other hand, the proposed relationships were mainly unaffected by the extent of work from home, indicating general relationships in need of further detailed research. While the study results are mainly applicable on the German context, why and whether the relationships would differ between countries remains to be tested.

4.2 Research implications

From a methodological point of view, the measurement of procrastination could be explicitly tailored to the work context in order to restrict the interpretation of the data specifically to the work domain. Also, continuing this line of research about job demands and their relations to performance and wellbeing under varying extents of work from home should adopt longitudinal or even intensive longitudinal designs such as diary studies. Beside general circumstances of work from home, diary designs would enable to analyze fluctuations in the relationships between work intensification and procrastination as well as irritation including boundary conditions like working at home or in the office, or the extent of (in)voluntarily work from home. Also, the mediating mechanisms between work intensification, whether appraised as hindrance or challenge demands, the regarding attributions and subsequent action tendencies, and the resulting handling of work tasks combined with procrastination level according to the AAA model could be investigated by means of diary designs. While time pressure leaves room for an appraisal as a challenge and as a hindrance (Prem et al., 2018), job demands like quantitative work intensification might be less ambiguous (e.g., Mauno et al., 2023). Whether for the latter the appraisal would be unequivocally as hindering needs to be demonstrated as yet. Potential differences in appraisal and coping behaviors related to short-, medium- and long-term exposure to work intensification and/or high levels of work from home are interesting with regard to interventions and thus worthwhile to investigate.

4.3 Practical implications

As causal conclusions are precluded by the cross-sectional nature of the data, practical implications may serve two perspectives. Following the direction of our theoretical arguments, decreasing work intensification by means of job design seems reasonable in order to curtail employee reactions like delaying tasks or increased irritation. This may include actually reducing workload, enforcing regular breaks during workdays, re-organizing work on team level including allowing for flexibility of work distribution among team members, or other measures closely tailored to the origins of work intensification. Following a reversed perspective, the perception of work intensification could be influenced by states of procrastination or irritation. That is, piling up work tasks due to procrastination may create actual work intensification, and being cognitively or affectively irritated may lead to perceptions of insufficient (cognitive or emotional) resources given the amount of work. While fostering recovery may be the crucial mean for decreasing irritation, measures against procrastination focus on task characteristics (e.g., autonomy and job enrichment, task aversiveness, Blunt and Pychyl, 2000; Lonergan and Maher, 2000; Van Eerde, 2000), occupational self-efficacy (e.g., Prem et al., 2018), personal resources like self-regulation (e.g., Steel, 2007; Tice et al., 2007), or attribution styles (e.g., locus of control, Lonergan and Maher, 2000). Daily goal setting, thus fostering a sense of achievement, may be especially helpful in situations lacking external task feedback like work from home contexts. A meta-analysis of studies about interventions to overcome procrastination suggests that cognitive behavioral therapy (which includes altering attributions), is superior with regard to reducing procrastination as compared to self-regulation, other therapeutic interventions, or interventions focusing on strengths and resources (Van Eerde and Klingsieck, 2018). With regard to work from home, moderating in sample S2, the work environment might indicate conditions relevant for performance and wellbeing. Actively reducing the likelihood of distractions might save self-regulatory resources; whether having a personal workplace at home is helpful in this regard remains to be investigated. In sample S1 it was unrelated to irritation, but mattered in combination with the extent of work from home for procrastination, in sample S2 having a personal study was significantly related to lower procrastination and affective, but not cognitive, irritation (though only small effects). In sum, having ones' own study when working from home seems to relate to lower procrastination. In sample S1 this was especially the case for

persons with higher extent of working from home; in sample S2 the extent itself was not crucial. While the reasons for procrastinating more if not having a separate room for working at home might be comparable (i.e., distraction, self-regulation efforts, blurred boundaries), circumstances were only to a certain degree. First, in November 2020, work from home was less voluntary and this also applied for other household members; for instance, distraction by household members might have been higher at S1 compared to S2. Thus, having ones' own study was more crucial the higher the extent of work from home. Second, at S2 fewer participants fully worked from home, which might indicate that persons with higher self-regulation problems when working from home (or less appropriate tasks for work from home) self-selected back to more often working from office. Also, distraction by household members might have been reduced at S2. Thus, the extent of (involuntarily) work from home lost relevance for procrastination, however, the context was still crucial.

However, both perspectives may not be mutually exclusive as a vicious or benign cycle of job demands and wellbeing as well as performance with mutual dependencies seems very likely. For instance, job demands are significantly related to burnout, with support for both causal directions but even higher support for the burnout → job demands link as compared to the other way around (Guthier et al., 2020). Measures like feedback by leaders, clarifying goals and goal planning (e.g., Masicampo and Baumeister, 2011, with students) even serve both directions of causality, as they may decrease both, work intensification and affective irritation by a reduction of uncertainty, and may reduce procrastination and cognitive irritation by reducing the aversity when tasks are clear (e.g., Ackerman and Gross, 2005).

Overall, work intensification is an important job demand which is related to procrastination as well as psychological strain in the work context during the COVID-19 pandemic and beyond.

Data availability statement

The datasets presented in this article are not readily available because the access to the dataset is restricted. Requests to access the datasets should be directed to lydia.bendixen@uni-flensburg.de.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the (patients/ participants OR patients/participants legal guardian/next of kin) was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

LB: Writing – original draft, Writing – review & editing. TS: Writing – original draft, Writing – review & editing.

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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

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/forgp.2024.1379782/full#supplementary-material

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Remotely engaged—The role of job crafting in the change of employees' engagement after an abrupt transition to remote work

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Introduction: Many employees perceived the move to remote work due to the COVID-19 pandemic as an abrupt organizational change. While research on work engagement has examined this construct in different contexts, it is unclear what may happen to work engagement in such an extreme context and over the course of time. In the current study, we examined the relationship between time and employees' work engagement after an abrupt change as well as the way job crafting interacts with this relationship. We hypothesized that a pre-transition high level of *approach* crafting strategies will have a negative effect, harming employees' ability to maintain their engagement over time, while a pre-transition high level of *avoidance* crafting strategies will actually have a mitigating effect, weakening the decrease in engagement.

Materials: We used a three-wave longitudinal study design, collecting data during the first 3 months of the pandemic. The sample included employees from different organizations across the U.S randomly recruited through Amazon Mechanical Turk. We utilized a multilevel repeated measures approach to analyze the data.

Results: Results supported our first hypothesis, demonstrating a negative relationship between time and engagement such that engagement declined over time. Our second hypothesis was partially supported, showing that the job crafting strategy of increasing challenging demands moderated the relationship between time and engagement, such that for employees that job craft by increasing their challenging demands, at the onset of the transition, the decrease in work engagement over time was more substantial. We did not find support for our hypothesis regarding the positive effect of avoidance crafting strategies on the decrease in work engagement.

Discussion: Our findings suggest that the tendency to job craft by pursuing more challenging demands at the onset of the pandemic, as an approach strategy of job crafting, gives employees an unnecessary added workload that requires the use of more resources. Over time, this extra load, depletes resource reservoirs and prohibits remaining engaged over time. In contrast, other types of approach crafting strategies seem to have no such harmful effect. Our findings highlight the importance of context, suggesting that under specifics conditions some job crafting strategies may be more energy draining than others.

KEYWORDS

work engagement, job crafting, job demands-resources model, COR theory, transition to remote work

1 Introduction

It has long been suggested that organizational change is associated with a reduction in employee wellbeing (Kaltiainen et al., 2020). One highly studied determinant of employee wellbeing is work engagement (i.e., a positive, fulfilling, work-related state of mind; González-Romá et al., 2006). Many organizations are concerned with boosting and upholding their employees' level of work engagement, due to its strong association with employee wellbeing and performance (Knight et al., 2017). It was also found that enhancing work engagement during organizational change is beneficial for adaptation (Hobfoll et al., 2018) and shapes employees' future expectations regarding the evolving change processes, increasing positive reactions and mitigating negative reactions (Kaltiainen et al., 2020). Yet, it is unclear whether abrupt organizational changes, i.e., sudden unexpected organizational events that require an immediate change, have a onetime effect on employee work engagement and as a result on employee wellbeing or whether they will lead to an ongoing decrease in work engagement and thus in wellbeing.

Much of the research on work engagement considers it to be a long-lasting and stable state (Seppälä et al., 2015, 2009) and research on the dynamic and temporal aspects of work engagement has mainly focused on daily (e.g., Baethge et al., 2021; Bakker and Oerlemans, 2019) and weekly fluctuations (e.g., Bakker and Bal, 2010). This research showed that despite temporary fluctuations, work engagement returns to its usual level (Lesener et al., 2020; Mäkikangas et al., 2016). Thus, if organizations want to continue to rely on work engagement as a mechanism that protects against ongoing reduction in wellbeing, it is important to understand (a) what happens to work engagement after an abrupt change over longer periods of time and (b) assuming work engagement declines, what factors might inhibit such a decrease. In an attempt to answer these questions, we took advantage of the COVID-19 pandemic and the sudden transition to remote work, to examine the dynamic change in work engagement (Adisa et al., 2023; Hajjami and Crocco, 2023), and the factors that might interfere with this change.

Though remote work has been widely investigated over the past decades (Bailey and Kurland, 2002; Spreitzer et al., 2017), most research considered this working arrangement a result of mutual choice and agreement between the employees and their employers (Spreitzer et al., 2017). However, situations such as the outbreak of the COVID-19 pandemic, caused many employees in different occupations and roles to suddenly shift to work from home (Waizenegger et al., 2020) and adjust to dramatically different working conditions regardless of any previous experience or prior preference. This shift to remote work lacked the elements of flexibility and choice that were typically characteristic of remote work arrangements (Lapierre et al., 2016) and may have had a negative effect on employees. In order to predict the manner in which engagement changes over time, in such a context of a highly demanding change event, we used the Job-Demands-Resources (JDR) model (Demerouti et al., 2001a,b) and Hobfoll's (1989) Conservation of Resources (COR) theory as our underlying theoretical framework. We hypothesized that after an abrupt transition to remote work, work engagement would decline over time. In addition, we explored how various levels of job crafting strategies, a type of proactive behavior aimed at redesigning one's job demands and resources (Tims and Bakker, 2010), are related to these changes. We used a three-wave longitudinal study design, collecting data during the first 3 months of the pandemic, and utilized a multilevel repeated measures approach to analyze the data.

This study has the potential to contribute to organizational theory. First, our study is likely to contribute to the work engagement literature by highlighting the importance of investigating work engagement as an ongoing dynamic construct. By showing that employees' work engagement drops during the first weeks of the pandemic, we have the potential to contribute to the growing understanding that a one-time assessment of engagement may provide a very partial picture. This may mean that theories of engagement should turn from explaining engagement as a stable or fluctuating phenomenon to explaining the trends and changes in engagement over longer periods of time. Second, we are likely to add to the job crafting literature by continuing the line of research showing that under some conditions, some elements of job crafting may actually be detrimental. We lean on previous work emphasizing the importance of distinguishing among the different dimensions of job crafting (e.g., Rudolph et al., 2017; Zhang and Parker, 2019) and examine the effect of different job crafting strategies setting the stage for a more comprehensive job crafting theoretical model.

2 Theory and hypotheses

2.1 Work engagement and resource based theories

Work engagement is "a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication and absorption" (González-Romá et al., 2006, p. 166). Vigor refers to high levels of energy and willingness to invest effort in one's job. Dedication refers to a strong involvement in one's work, accompanied by feelings of enthusiasm and significance. Finally, absorption refers to a state of total immersion in one's work, characterized by time passing quickly and being unable to detach oneself from the job (Maslach et al., 2001). A high level of work engagement is a desired outcome for both employees and employers. Studies have demonstrated its link with numerous outcomes such as; task performance (Neuber et al., 2022); organizational citizenship behavior (Farid et al., 2019) and innovative behavior (Kong and Li, 2018). Moreover, job engagement has been found to be negatively related to self-reported anxiety, depression (Peterson et al., 2008) and psychosomatic health complaints (Demerouti et al., 2001a,b).

Most of the engagement literature has stressed that work engagement is likely to remain relatively stable over time (Schaufeli et al., 2002a,b; Lesener et al., 2020; Mauno et al., 2007). However, an emerging body of literature has begun considering the dynamic and temporal aspects of work engagement, with some examining fluctuations in engagement from day to day and some with longer intervals (e.g.; Baethge et al., 2021; Bakker and Bal, 2010; Parent-Lamarche and Marchand, 2023; Pluut et al., 2024). To understand

these fluctuations, researchers often employ the job demands–resources (JD-R) model, which suggests that changes in job demands and job resources predict changes in work engagement (Bakker and Demerouti, 2017). For example, Bakker and Bal (2010) measured week to week fluctuations in work engagement among teachers, and found that job resources such as autonomy and exchanges with supervisors were positively related to weekly changes in engagement.

The job demands–resources (JD-R) theory (Bakker et al., 2014) has been widely used to explain wellbeing and motivation in general, and employees' engagement in particular (Saks and Gruman, 2014). The main proposition of the JD-R theory is that all work-environments or job characteristics can be classified into two categories: job demands and job resources (Demerouti et al., 2001a,b; Bakker and Demerouti, 2014) with high demands often activating a health impairment process (i.e., due to energy depletion resulting in exhaustion and burnout), and high levels of resources activating a motivational process (i.e., higher engagement; Bakker and Demerouti, 2007, 2008). Thus, according to this theory, when examining the change in engagement over time, as in the current study, it is important to understand the interplay between job resources (i.e., the physical, psychological, social, or organizational aspects of the job that help in achieving work goals and stimulate personal growth, learning, and development) and job demands (i.e., those aspects of the job that require sustained physical and/or psychological effort and are therefore associated with certain physiological and/or psychological costs). Moreover, conservation of resources (COR) theory (Hobfoll, 1989) provides a basis for hypothesizing about the dynamics of such aspects and their outcomes. More specifically, COR claims that when resources are lost (e.g., when people feel they no longer have the social support they are used to as people are struggling themselves to cope with the new consequences brought on by the pandemic) this is disproportionately more salient than resource gain and as such, tends to affect people more rapidly and at increasing speed over time often causing a loss spiral (Hobfoll et al., 2018). Accordingly, as we explain below, if the abrupt change caused by the outbreak of COVID-19 caused a loss of resources, such a spiral is likely to occur.

The outbreak of COVID-19 led organizations to alter their workforce in a way that forced employees to adapt and cope with radical and demanding changes occurring in their work and social environment (Carnevale and Hatak, 2020), with many organizations turning to home-based remote work (Spurk and Straub, 2020). More specifically, the pandemic created a situation in which many organizations had to make remote work compulsory, giving employees no choice in the matter (Waizenegger et al., 2020). Employees who used to spend all or most of their time working inside their organization's physical boundaries were forced to quickly adjust to remote work environments (Carnevale and Hatak, 2020). Such remote work lacks the elements of control and choice, i.e., resources, that are usually inherent in such arrangements (Hill et al., 2001). Not only were these resources absent, but the radical transformation in working conditions often placed greater demands on employees including; increased workload due to limited ability to rapidly delegate work between team members, in-home conflict, stress and a sense of isolation (Kniffin et al., 2021; Vaziri et al., 2020; Sinclair et al., 2020).

According to the JD-R model, when job demands exceed the resources that employees have for dealing with them, their reaction is burnout rather than engagement. In addition, dealing with change requires energetic resources from employees in order to adapt successfully (Parker et al., 2010). Furthermore, following COR theory, any pre-existing personal resources that might have helped employees in routine times maintain their level of engagement were likely to be exhausted as time went by because employees used them up, facing the changing demands. The prolonged loss of resources and increased demands was likely to lead to the depletion of more resources such as energy and a spiral loss of resources (Hobfoll et al., 1990), resulting in a situation in which engagement is likely to decline over time. Hence, we hypothesize that:

- H1: *Time will be negatively related to work engagement, such that work engagement will decline over time.*

2.2 Job crafting

One of the well-studied antecedents of work engagement has been job crafting. Job crafting is a type of proactive behavior defined as "the physical and cognitive changes individuals make in the task or relational boundaries of their work" (Wrzesniewski and Dutton, 2001, p. 179). Job crafting is aimed at redesigning one's job (Tims and Bakker, 2010) and can be seen as a set of strategies used to improve the fit between the person and his/her job. Employees who feel that they have a good fit with their jobs experience more job engagement (e.g; Bakker and Oerlemans, 2019; Chen et al., 2014; De Beer et al., 2016) hence the manner in which employees achieve such fit may be linked to changes in engagement over time. Job crafting differs from other types of proactive behaviors in that "it is about proactive changes in the job design that are not specific arrangements that are negotiated with the organization" (Tims and Bakker, 2010, p. 3). In addition, job crafting helps employees deal with increasing job demands and unpleasant conditions (Harju et al., 2016) making it a relevant strategy for coping with sudden changes such as those occurring when the working conditions dramatically change.

Tims and Bakker (2010) proposed a conceptualization of job crafting based on the job demands-resources model (Demerouti et al., 2001a,b). They stated that job crafting occurs when employees make self-initiated changes to the levels of their job demands and job resources, in order to align them with their own abilities and preferences. Employees can craft their job by increasing structural resources (e.g., seeking opportunities for professional development) or increasing social resources (e.g., asking for feedback from supervisors). Employees can also craft their job by increasing challenging demands (e.g., voluntarily taking on additional responsibilities or extra challenging tasks), or by decreasing hindering demands (e.g., avoiding contact with emotionally demanding colleagues; Tims and Bakker, 2010).

Recent literature on job crafting has built on the approach-avoidance framework (Elliot, 1999; Elliot and Thrash, 2001) to distinguish between *approach* and *avoidance* crafting. Approach

crafting refers to proactive and effortful behaviors toward problem solving and improvements (i.e., increasing social resources, increasing structural resources and increasing challenging demands), while avoidance crafting involves active efforts to avoid, reduce or eliminate negative outcomes (i.e., decreasing hindering demands) (Bruning and Campion, 2018; Zhang and Parker, 2019). Following COR theory's tenet, that individuals seek to foster their wellbeing by increasing and maintaining things that are central to their goal achievement in a given context (Hobfoll et al., 2018), approach crafting strategies may express a resource acquisition process. By approach crafting employees increase job resources and challenges (i.e., increasing social resources, increasing structural resources and increasing challenging demands) in order to enhance their wellbeing at work (Harju et al., 2021). In contrast, following COR theory's tenet that potential or actual loss of resources provokes individuals to conserve their resources (Hobfoll et al., 2018), avoidance crafting may represent a resource conservation process. By avoidance crafting employees seek to maintain their wellbeing by trying to decrease the straining effects of hindering demands (Harju et al., 2021).

Previous literature has shown that approach crafting is positively associated with employee wellbeing and with work engagement (Boehnlein and Baum, 2022; Harju et al., 2016). In contrast, avoidance crafting has been generally negatively associated with engagement and other wellbeing indicators and positively associated with burnout (Lichtenthaler and Fischbach, 2019; Rudolph et al., 2017). Despite the above-mentioned findings, recent work has suggested that under specific conditions the relationships between engagement and approach crafting or between engagement and avoidance crafting may be different. For example, Harju et al. (2021), distinguished between two types of challenging demands: *job complexity* and *workload*. They found that while approach crafting was related to an increase in work engagement through an increase in job complexity, it was also related to an increase in burnout through an increase in workload. In addition, they found that avoidance crafting was related to a decrease in work engagement and an increase in burnout, through a decrease in job complexity. They further suggested that perhaps different motivations behind approach crafting (i.e., performance goals or mastery goals), even though not tested in their study, may explain why in some situations approach crafting may increase work engagement while in others decrease work engagement.

2.3 Job crafting and the context of abrupt change

In times of change, focusing on changing the design of one's job is likely to be related to job engagement. Although it has been suggested that job crafters cope better with changes, the nature of the change matters (i.e., the extent of impact on daily life; Petrou et al., 2012). One study, for example, compared two different types of organizational changes: a major change in the form of cutbacks due to a financial recession and a regular change due to a reorganization (Petrou et al., 2017). Petrou et al. (2017) found that while most aspects of job crafting such as seeking resources and seeking challenges were associated with more engagement and less exhaustion in both contexts, there were several differences between the two conditions. For example, seeking resources was related to less exhaustion for employees in the regular change condition but not for employees in the major change condition. The authors suggested that, in the face of a major change, seeking resources might not be efficient. In addition, in the regular change condition reducing demands had a significant positive relationship with exhaustion. The more employees tried to reduce their demands, the more exhausted they felt. However, this significant correlation occurred only in the regular change condition, not in the major change one. The authors suggested that in the context of a major change, reducing demands might not have an effect, at least not a linear one (Petrou et al., 2017). Thus, it seems that different strategies of job crafting might result in different outcomes under different types of change conditions.

The above study suggests that in a major change, job crafting, in the form of seeking resources or in the form of reducing demands may not enhance work engagement. Yet, based on recent literature on the nature of the remote work transition due to the COVID-19 pandemic (e.g., van Zoonen et al., 2021), we claim that in such an abrupt, global, profound change (i.e., a change that is beyond what has previously been defined as a "major change"), these job crafting strategies may play a different role. More specifically, we claim that job crafting in the form of seeking resources (i.e., approach strategies) may not only be ineffective but may actually be detrimental for work engagement, while job crafting in the form of reducing demands (i.e., avoidance strategies) may actually be beneficial.

Beyond the impact on the working world, the outbreak of COVID-19 pandemic led to a macro crisis, which created many shifts in people's lives around the world; People felt insecurity, lost boundaries between work and home and were stressed about the health and safety of themselves and their love ones (Vaziri et al., 2020). In the organizational world, the COVID-19 pandemic was too conceptualized as a macro-level crisis, as a threatening and stressful event, causing a demanding work environment (Straus et al., 2023). In accordance to the Event Systems Theory (EST; Morgeson et al., 2015) it is characterized as a novel, disruptive and critical event that can create changes in employees' wellbeing, even within a few weeks of the crisis (Vaziri et al., 2020). Moreover, stress scholars argue that being also unpredictable and uncontrollable, the pandemic should be considered a unique stressor with severe implications for health and wellbeing (Pfeifer et al., 2021). With all this in place, we claim that the abrupt change in working conditions due to the immediate transition to remote work as part of the consequences of the COVID-19 pandemic is a special condition affecting the role of job crafting strategies play.

Hobfoll (1998) claimed that COR theory had to be viewed in context. He further suggests that resources can operate differently under different ecological contexts. In one context a resource can have a positive role and in another a negative one (Hobfoll et al., 2018). Extending this notion, we suggest that job crafting strategies, as a tendency to craft resources and demands, may also have positive or negative outcomes. Though, it is not necessarily the type of resources or demands or their valence in a specific context (i.e., structural resources, social resources, challenging demands or

hindering demands), rather it is a matter of whether this crafting strategy is draining more or less energy, under the specific context of the stress situation.

In the context of a major stress event and a sudden transition to remote work that abruptly changes the working conditions, when resources need to be preserved rather than exhausted, we claim that approach crafting may have negative consequences. While in a regular context approach crafting is seen as enhancing motivation, that in turn lead to positive outcomes (Zhang and Parker, 2019), employees' tendency at the onset of the transition to remote work, to proactively craft their jobs by approach strategies may strengthen the process of resource depletion. For example, in such context *increasing challenging demands* (e.g., by initiating and taking on extra tasks to challenge oneself) may result in an unnecessary load rather than serving as a fulfilling challenge, requiring even more resources to handle. In the same manner, *increasing structural* or *social* resources involves effortful and directed actions to seek positive aspects of work (Zhang and Parker, 2019). This investment in resource gain, that itself takes energy, may lead to depletion in resources and in turn harm employees' ability to remain engaged, since resource gain is of less magnitude and much slower than resource loss (Hobfoll et al., 2018). In the context of an abrupt change that involves a major resource loss, approach crafting may be harmful. Thus, we hypothesize that:

- **H2:** *Approach Job crafting (i.e., increasing challenging demands, increasing structural and increasing social resources) moderates the relationship between time and work engagement, such that when employees engage in a great deal of approach job crafting, the negative relationship between time and engagement will be stronger.*

Turning to avoidance crafting, previous research suggests that avoidance crafting may lead to burnout and decreased engagement, since avoiding dealing with demands may result in accumulation of demands that eventually drains employees' energy (Lichtenthaler and Fischbach, 2019). However, in the context of a major stress event in which the working conditions abruptly change, we argue that avoidance crafting may serve as a preserving mechanism that can actually mitigate the decrease in work engagement. Avoidance crafting (i.e., decreasing hindering demands) may be an effective coping strategy in the face of excessive job demands (Zhang and Parker, 2019), such as the ones brought upon by the pandemic and the sudden transition to working from home. Thus, we hypothesize that:

- **H3:** *Avoidance Job crafting (i.e., decreasing hindering demands) moderates the relationship between time and work engagement, such that when employees engage in a great deal of avoidance job crafting, the negative relationship between time and engagement will be weaker.*

3 Materials and methods

3.1 Sample and procedure

We used a sample of employees from different organizations across the U.S. randomly recruited through the Amazon Mechanical Turk platform. The data was collected from each participant at three points in time. Time 0 (T0) data were collected in April 2020, at the onset of the pandemic, approximately a month after a national health emergency was announced in the U.S., Time 1 (T1) data were collected 3 weeks later, and Time 2 (T2) data were collected 3 weeks after T1; overall, a period of 6-weeks. Hence, the study focuses on the first stages of the transition, targeting employees' initial attitudes, perceptions and adjustment responses to the abrupt transitioning to working from home. Participants received a monetary reward each time they completed the survey ($2.50–$5.00). The current research received the required ethics committee approval. Participants were included in the sample if they met all of the following criteria: (1) moved to work from home due to the pandemic, (2) worked from home at T0, (3) were 18–70 years old, (4) worked for an organization (i.e., not freelancers). In addition, following Aguinis et al. (2021) recommendation, in each wave of data collection, a different set of attention checks were implemented in the survey, to make sure participants were actually reading the items and answering accordingly. We used both open questions (e.g., "who is the current president of the U.S?", "what was the year 2 years ago?") and closed questions (e.g., "please mark the third star"). Only participants who answered correctly both questions on each survey were included in the final sample. In addition, since average time for completing the surveys was estimated to be approximately 15 min, participants who completed the survey in <5 min were also excluded from the final sample.

The final sample included 143 employees who completed the online survey at all three times (the response rate was 76% from T0 to T1, and 74% from T1 to T2). This is in accordance with previous literature examining longitudinal M-Turk data, proving its reliability and generalizability (Daly and Nataraajan, 2015). When comparing the demographic variables between those who did not continue to participate in the study and those who did, we found no significant differences between these two groups. In the final sample, the mean age was 37.36 years (SD = 9.89); 42.3% were women and 50% had children. As for workers' industry, 25.9% participants identified as working in the service sector, 24.5% in high tech, 10.5% in health care, 8.4% work in retail, 8.4% in manufacturing, 3.5% in the construction industry and 18.9% have reported working in "other" industry. 56.3% were working in an industry relatively less affected by the transition to remote work. This includes health care, hi-tech (in which remote work was relatively familiar), retail and other. 43.7% were working in an industry more affected by the transition to remote work, such as services, manufacturing and construction, in which remote work was less used prior to the pandemic. The mean of seniority in the current job was 6.37 years (ranging from 1 year to 40) and 53.5% worked from home before the pandemic.

3.2 Measures

3.2.1 Dependent variable

We assessed the dependent variable, work engagement, three times (T0, T1, T2) using the17-item Utrecht Work Engagement Scale (UWES) (Schaufeli et al., 2002b). This scale was designed to measure employees' engagement using the three-factor structure of engagement: vigor, dedication, and absorption. A sample item is

"When I am working, I feel bursting with energy." Respondents were asked to rate the frequency with which they experienced the feeling in each statement using a 7-point Likert-type scale (1 = never; 7 = always).

3.2.2 Independent variables

The first independent variable was *time*. We coded it as a categorical variable with three values based on the three points in times that data was collected (T0 = 0, T1 = 1 and T2 = 2). *Job crafting* was assessed using 20 items from the Job Crafting Scale (Tims et al., 2012). This scale was designed to measure job crafting behavior based on the four job crafting dimensions: increasing social job resources, increasing structural job resources, increasing challenging job demands, and reducing hindering job demands. A sample item for increasing social job resources dimension is "I ask others for feedback on my job performance." A sample item for increasing structural resources dimension is "I try to develop myself professionally." A sample item for reducing hindering demands dimension is "I make sure that my work is mentally less intense." A sample item for increasing challenging demands dimension is "When an interesting project comes along, I offer myself proactively as project co-worker." Respondents were asked to indicate the extent to which they engaged in each behavior or cognition using a 6-point Likert-type scale (1 = never; 6 = often). Since we examined the way a tendency for job crafting, as *a pre-change* tendency, will be related to the *post-change* decrease in engagement, we measure job crafting at T0. We also measured job crafting at T1, to make sure job crafting can be considered a stable rather than a dynamic construct. We compared the means of participant's job crafting on each sub-scale between T0 and T1 and found no significant differences [*subscale 1 (i.e., increasing social job resources*): $t_{(142)} = 1.649$, n.s; *subscale 2 (i.e., reducing hindering job demands*): $t_{(142)} = 0.223$, n.s; *subscale3 (i.e., increasing structural resources dimension*): $t_{(142)} = 0.853$, n.s; *subscale 4 (i.e., increasing challenging demands*): $t_{(142)} = 0.253$, n.s].

3.2.3 Control variables

We used previous experience with remote work as a control variable in order to examine our proposed effects above and beyond employees' current experience. Participants were asked to indicate whether they had worked from home before COVID-19, either partially or full time, or hadn't worked from home at all before COVID-19. While this variable originally had three levels (i.e., haven't worked from home before, worked partially, worked from home full time), we re-scaled it to include only two levels (i.e., worked from home before, had not worked from home) to make the model simpler, after no differences were found between the models when using either of the categorization. In addition, participants were asked to answer a few demographic questions including gender, age, seniority in their current job and the industry they worked in. We included the last variable in our measurements because in some industries such as low-tech industries, the introduction of remote work arrangements has rarely been used before the pandemic, a factor that might affect employees' experience during the transition to remote work.

3.3 Data analysis

We used a multilevel linear model (MLM) with the SAS PROC MIXED procedure (Jones and Huddleston, 2009), which takes into account a nested data structure (multiple work engagement measurements nested within each participant; see for example Azoulay and Orkibi, 2018). This analysis takes the natural hierarchical data structure into account as measurements are nested within cases. Engagement was measured at T0, T1, and T2 for each participant, representing a within-person variable. Job crafting strategies measured at T0 represented the between-person variable. Changes in engagement were represented by the inclusion of time as a predictor, indicating the extent to which engagement changed within a person over time. Interactions between time and job crafting indicated that job crafting was related to the changes in engagement over time (for SAS syntax see Appendix A). When examining the changes in engagement over time, none of the demographic variables such as gender, age, seniority and industry exhibited a significant relationship with this change. Thus, the final models included only previous home-based remote work as a control variable. In addition, we conducted an invariance analysis for work engagemen, examining configural, metric and scalar invariance analyses. The ΔCFI and ΔRMSEA between the configural and metric invariance analysis was −0.002 and 0.004 respectively and between the metric and scalar invariance analysis was 0.000 and 0.004 respectively. Thus, our measurement model shows invariance over time (see Assunção et al., 2020). Table 1 displays the means, standard deviations, Alpha Cronbach's and inter-correlations among the study's variables.

4 Results

Hypothesis 1 predicted that time would be negatively related to work engagement. To test this hypothesis, we regressed work engagement on time. Results demonstrated that engagement declined significantly over time ($\gamma = -0.1$, SE = 0.05, $p < 0.05$; see Model 1 in Table 2). Hypothesis 2 predicted that approach job crafting would be related to the changes in engagement over time such that when employees engaged in a greater deal of approach job crafting, the negative relationship between time and engagement would be stronger. Hypothesis 3 predicted that avoidance job crafting would be related to the changes in engagement over time such that when employees engaged in a greater deal of avoidance job crafting, the negative relationship between time and engagement would be weaker. To test these hypotheses, we examined the interactions between time and each of the job crafting sub-scales. As can be seen in Model 3 of Table 2, the two-way interaction between time and increasing structural resources (i.e., approach crafting strategy) was not significant ($\gamma = -0.05$, SE= 0.04, *n.s*). The two-way interaction between time and decreasing hindering job demands (i.e., avoidance crafting strategy) was not significant ($\gamma = -0.03$, SE = 0.03, *n.s*). The two-way interaction between time and increasing social job resources (i.e., approach crafting strategy) was not significant ($\gamma = 0.004$, SE = 0.03, *n.s*). The only interaction found significant, was the interaction between time and job crafting strategy of increasing challenging demands ($\gamma = -0.09$, SE = 0.03, $p <$

TABLE 1 Descriptive statistics and correlations.

Variable	Mean	SD	Alpha Cronbach	1.	2.	3.	4.	5.	6.	7.	8.
1. Age	37.28	9.89		–							
2. Seniority	6.37	5.17		0.300**	–						
3. JC ISR	4.92	0.84	0.833	0.08	0.14	–					
4. JC DHD	4.02	1.12	0.831	−0.06	−0.01	0.33**	–				
5. JC ISOR	4.02	1.18	0.839	−0.14	0.09	0.47**	0.45**	–			
6. JC ICD	4.18	1.07	0.814	0.03	0.26**	0.63**	0.26**	0.54**	–		
7. WE T0	5.02	1.1	0.942	0.12	0.15	0.71**	0.37**	0.61**	0.72**	–	
8. WE T1	4.84	1.12	0.940	0.11	0.204*	0.55**	0.203*	0.49**	0.57**	0.75**	–
9. WE T2	4.81	0.98	0.934	0.11	0.07	0.56**	0.26**	0.51**	0.500**	0.74**	0.79**

JC, job crafting; ISR, Increasing structural job resources; DHD, Decreasing hindering job demands; ISOR, Increasing social job resources; ICD, Increasing challenging job demands; WE, Work engagement.
n = 143.
*p < 0.05.
**p < 0.01.

TABLE 2 Repeated measures regression with work engagement as the dependent variable.

Effect	Model 1		Model 2		Model 3	
	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	5***	0.09	4.97***	0.13	−0.003	0.34
Time	−0.1**	0.03	−0.1*	0.05	0.68***	0.18
PHBR			0.05	0.18	−0.02	0.11
Time* PHBR			0.01	0.06	−0.02	0.06
Job crafting ISR					0.56***	0.08
Time* Job crafting ISR					−0.05	0.04
Job crafting DHD					0.05	0.05
Time* Job crafting DHD					−0.03	0.03
Job crafting ISOR					0.24***	0.06
Time* Job crafting ISOR					0.004	0.03
Job crafting ICD					0.25	0.06
Time* Job crafting ICD					−0.09**	0.03
−2 Log likelihood		992.7		992.5		840.5
Δ-2 Log likelihood				0.2		152***

ISR, Increasing structural job resources; DHD, Decreasing hindering job demands; ISOR, Increasing social job resources; ICD, Increasing challenging job demands; PHBR, Previous home-based remote work.
n = 143.
*p < 0.05.
**p < 0.01.
***p < 0.001.

0.01). As can be seen in Figure 1, a simple slopes analysis showed that high and medium levels of increasing challenging demands were significantly and negatively related to the changes in engagement over time, whereas low levels of increasing challenging demands were not. Thus, hypothesis 2 was partially supported with only one type of approach crafting (i.e., increasing challenging demands) found to be significantly related to the changes in engagement over time, indicating that indeed high levels of the use of this strategy are related to a more extreme decrease in work engagement. Avoidance crafting was not related to the changes in engagement over time, providing no support for hypothesis 3.

5 Discussion

In this research, we investigated the relationship between time and engagement in the context of an abrupt shift to remote work and the way job crafting interfere with this relationship. We found a negative relationship between time and engagement, such that

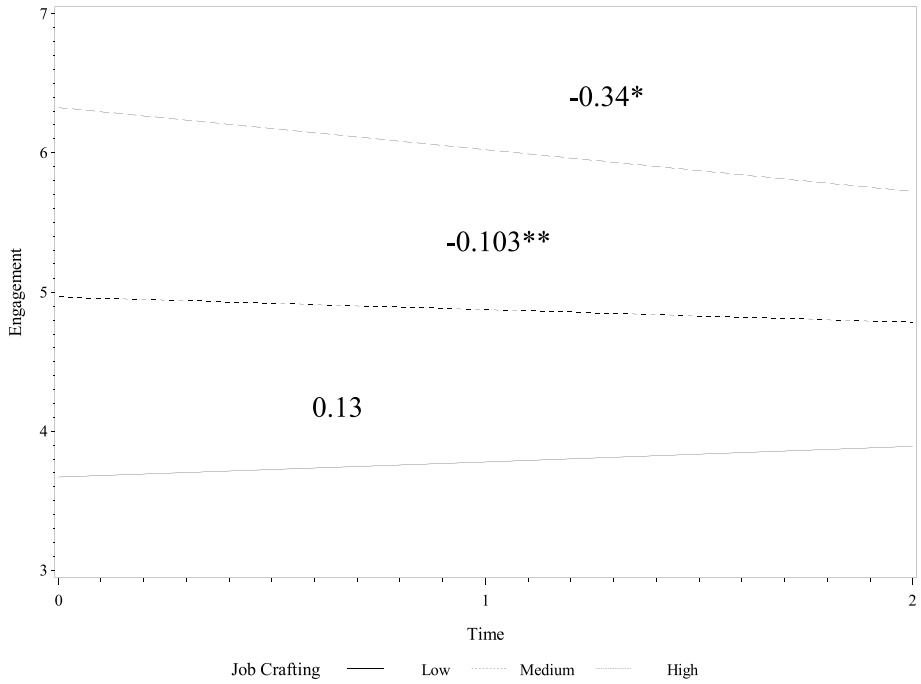

FIGURE 1
Simple slope analysis of the job crafting strategy of increasing challenging demands coefficients. * < 0.05, ** < 0.01.

engagement of employees who moved to work from home declined over time. Using a combination of the JD-R model and the COR theory as a resource based theoretical framework, the decrease in work engagement was likely to result from the ongoing imbalance between the demands of the employees' jobs and the resources they had to meet them. At the initial stage of the transitioning to remote work, employees' efforts were likely directed toward having to suddenly adjust to home-based conditions and their implications. In doing so, they exhausted any pre-existing resources. According to the JD-R model, when job demands exceed the resources that employees have for dealing with them, their reaction is burnout rather than engagement. Thus, it is reasonable to assume that the sudden transitioning to enforced remote work prompted a decline in the level of employees' engagement. In addition, as COR theory suggests, (Hobfoll et al., 1990), a continuous experience of resource loss and increased demands can lead to the depletion of more resources. Hence, it is possible that a spiral loss of resources is the basis for the continuing drop in employees' engagement. Another explanation for our finding regarding the decline in engagement is that the decline in engagement over time is actually a manifestation of disengagement. Following the conservation of resources theory that people try to minimize their net loss of resources (Hobfoll, 1989), individuals may simply withdraw from the situation to prevent further loss of resources (Whitman et al., 2014). Though we didn't measure disengagement directly, it may be that the observed decline in engagement is actually an expression of employees' disengagement from work, as a strategy to minimize further resources loss.

The most interesting finding in the current study is that the approach job crafting strategy of increasing challenging demands was related to the changes in engagement over time, such that for employees with strong tendency to craft their jobs by increasing challenging demands, the decline in work engagement over time was more substantial. As theorized, in normal circumstances, employees might be tempted to pursue more challenging demands with the goal of increasing their work engagement by enhancing their workload or choosing tasks that require acquiring new skills. Increasing challenging demands in regular times functions as a resource accumulation, as these demands motivate employees and foster their wellbeing (Hobfoll, 2011). However, pursuing this strategy at the onset of an abrupt change to remote work had the opposite effect. Having taken on extra tasks at such a time likely enhanced their workload and required even more resources to handle. Over time, this extra load seems to have depleted their resources and they were not able to remain engaged. In addition, in a unique stress context such as the one provided by the pandemic and its following transition to remote work, the motivational role of these demands may diminish as employees try to preserve resources and avoid losing more of them, differently prioritizing their use of energy.

Surprisingly, for employees with a low tendency to craft their jobs by increasing challenging demands, there was no significant relationship between time and engagement. One might expect that the decline in engagement for this group of employees would be less salient, but the results demonstrated no significant drop at all. One possible explanation is that employees who do not tend to engage in this type of job crafting rely on other strategies to maintain their fit with their job. Perhaps different forms of job crafting (e.g., role-based job crafting; Wrzesniewski and Dutton, 2001) not measured in this study, or other coping mechanisms helped them adjust more

easily to the new working conditions, helping them maintain their level of engagement. Yet, it is important to note, as we discuss later, that their level of work engagement was not very high to begin with.

In contrast to our hypothesis, the other approach job crafting strategies, i.e., increasing structural resources and increasing social resources did not impact the changes in engagement at all. Contrary to our theorizing, the pre-transition tendency to craft one's job by increasing structural and social resources did not intensify the drop in work engagement. One explanation might be that these strategies are less draining than increasing challenging demands in this specific context. Perhaps, in the context of an abrupt transition to remote work employees understand that social and structural resources will have to be changed, making their use perceived as less draining. For example, in a situation when managers have to work from home too, sharing their space with other family members, their availability to their subordinates may decrease compares to their availability prior the transition to remote work. In such a case, for employees, increasing a social resource such as supervisor support may seem more straightforward and more necessary, thus less draining (i.e., at least in comparison to increasing challenging demands which is less straight forward and more likely to feel like a burden).

Turning to our third hypothesis, that avoidance job crafting strategies (i.e., decreasing hindering demands) will result in a lower decrease in engagement, our findings show no support for such a hypothesis. Contrary to our theorizing, avoidance crafting was not found to mitigate the decline in engagement. One explanation might be that although suggested as "a health-protecting coping mechanism" (Demerouti, 2014, p. 239), decreasing hindering demands is not sufficient on its own to protect against the decline in work engagement after such an abrupt change. It is important to note that this job crafting strategy, did not have any significant effect on the decrease in work engagement indicating that after an abrupt change, this strategy neither helps nor harms the change in engagement.

5.1 Theoretical and practical contribution

Our study offers several theoretical and practical contributions. First, our findings highlight the relevance of investigating engagement as a dynamic construct rather than a stable one. By showing that employees' work engagement dropped over the first weeks after the abrupt transition to remote work, we support to the growing understanding that a onetime assessment of engagement may provide a very partial picture. In addition, daily fluctuations that tend to be stabilized over longer periods of time (Lesener et al., 2020; Mäkikangas et al., 2016) may also miss relevant dynamics of work engagement. Since previous research suggests that enhancing work engagement during organizational change may play a role in predicting its outcomes (Kaltiainen et al., 2020), examining immediate trends in work engagement after abrupt changes occur may be of high importance. Thus, we add to the emerging literature of engagement as a changing phenomenon, calling for future studies to examine trends and dynamic changes in work engagement.

Second, we lean on previous work emphasizing the importance of distinguishing among the different dimensions of job crafting (e.g., Rudolph et al., 2017; Zhang and Parker, 2019) and contribute to the job crafting literature by showing that even when distinguishing between avoidance and approach crafting strategies, under some conditions, some elements of job crafting may actually be detrimental. Our findings suggest that under extreme change conditions, increasing challenging demands as a way to craft one's job may harm employees' ability to respond to a radical organizational change such as a sudden shift to work from home and maintain their level of engagement. Though not directly measured in our study, the framing of draining vs. not draining job crafting strategies may be significant in determining the consequences of these strategies under different situations. We suggest that future models of job crafting and their predicted outcomes should include an energy draining classification and consider the context in which job crafting take place. Drawing on Zhang and Parkers' (2018) hierarchical classification of job crafting types, adding a level of classification that distinguish between low energy-draining crafting and high energy-draining crafting could end up in additional types of job crafting. Future studies could empirically test weather, under specific contexts; some job crafting strategies are more draining than in other contexts and whether differences in the level of energy-drain indeed account for perceived outcomes. This understanding would have important implications for practice as well. In face of future changes and major stress events, HRM practitioners could encourage employees to reflect on their crafting strategies and whether under the changing conditions they continue to be efficient. Managers should also take into consideration that in different situations one strategy may be more or less draining, hence more or less harmful/beneficial, allocating demands and resources accordingly.

Last, focusing on the transitioning to remote work, we contribute to the remote work literature by suggesting that special attention should be paid to the "transitioning to remote work" phase. The factors that impact employees' adjustment to abrupt remote work transitions (e.g., van Zoonen et al., 2021) may be different than those that have been found to be important when comparing people who work remotely to those who so not. We call future research to differentiate between remote work as a stable work arrangement and transitioning to remote work as a phase and to investigate the evolving consequences associated with moving from office work to remote work.

5.2 Limitations and future research

As in any study, several limitations should be taken into consideration. First, the main limitation of our study is its cross-sectional nature. While we examined work engagement at three points in time, we obtained the information on the employees' work engagement and job crafting from individuals responding to the same survey, thus enhancing the probability of same-source bias. In addition, our data come from workers recruited via MTurk. Although our sample included several industries, findings may not generalize to all occupations. In addition, despite our interest in the initial stages of moving to working from

home, perhaps over time, after the change has been understood and employees have adjusted, employees manage to adjust to the new conditions enhancing their work engagement. In that case, the role of job crafting may return to its original effect. Future studies could examine whether the decrease in engagement flattens out over time, and weather the relationships between the pre-change strategies for job crafting to changes in engagement alters as well. In the same manner, in our model job crafting was considered as a pre-change tendency to craft resources and demands, that predicts changes in engagement over time. However, recent work by Lopper et al. (2023) has suggested a reciprocal relationship between the two constructs, highlighting the importance in examining the dynamic and temporal aspects of job crafting as well. Thus, future research could continue to examine the reciprocal relationships between job crafting and engagement, taking into consideration the way external factors, such as disruptive events relate to these relationships. Another limitation may be that while we saw a link between job crafting tendencies at T0 to changes in engagement over three points of time, we did not measure actual changes in demands and resources. Selecting relevant actual demands such as workload, and cognitive and emotional demands and resources such as peer and organizational support, and measuring them as part of the research model would strengthen the results. In addition, directly measuring employees' perceptions regarding the magnitude of the transition and how demanding they perceive it to be would have helped to broaden the understanding on the mechanisms explaining the relationships found in the study. Last, though playing a major role in our theorizing, the context of the study (i.e., transitioning to remote work due to of COVID-10 pandemic) was not operationalizes as a variable rather as a constant. We did not compare between "routine" to "crisis" contexts, hence suggestions regarding the role of the context in determining job crafting strategies consequences require further empirical invitation. We also did not collect data before the outbreak of the pandemic and could not compare individuals' trends in engagement to their pre-pandemic level of engagement. Indeed, as can be seen from the simple slopes analysis in Figure 1, those with high job crafting started from a higher engagement level to begin with compared to those who were not using job crafting strategies. Having "before" data would have helped to shed light on the severity of the decline. Thus, future research should both compare different contexts and find ways to examine job crafting and engagement before the change occurs.

6 Conclusions

To conclude, our study highlights the importance in examining engagement as a dynamic construct, as well as in distinguishing among the different dimensions of job crafting under different contexts. Future disruption events (e.g., the next pandemic; Osterholm, 2020) may again lead organizations to suddenly shift to remote work or create other abrupt changes yet to be predicted. This stresses the importance in understanding the impact of transitioning from one form of working arrangement to the other, the implications of such transitions on engagement and wellbeing and factors mitigating the potential negative implications.

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 humans were approved by School of Psychology Review Board, Reichman University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

NB: Project administration, Methodology, Formal analysis, Data curation, Writing – review & editing, Writing – original draft. TK-N: Validation, Supervision, Writing – review & editing, Writing – original draft. DV: Validation, Supervision, Methodology, Formal analysis, Writing – review & editing, Writing – original draft. HH: Supervision, Writing – review & editing, Writing – original draft.

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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.

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7 Appendix A

SAS syntax for the interaction effect model predicting work engagement below:

proc mixed data = engagement method=ml covtest;
class id WorkedBefore;
model WorkEngagement_scale = time|WorkedBefore_bin time|JC0_sub1 time|JC0_sub2 time|JC0_sub3 time|JC0_sub4 /solution ;
repeated / type=un subject= id;
run;

id is the variable identifying each participant; *WorkEngagement* is the work engagement scale score measured at each point in time, time is a variable that represents the three points in time in which data was collected (i.e., 0, 1, 2) *WorkedBefore* is a binary variable indicating whether the participant worked before from home either full or part time or not. *JC0_sub1- JC0_sub4* are the sub scales for the job crafting construct measured at T0. The repeated statement allows for correlated residuals within participants.

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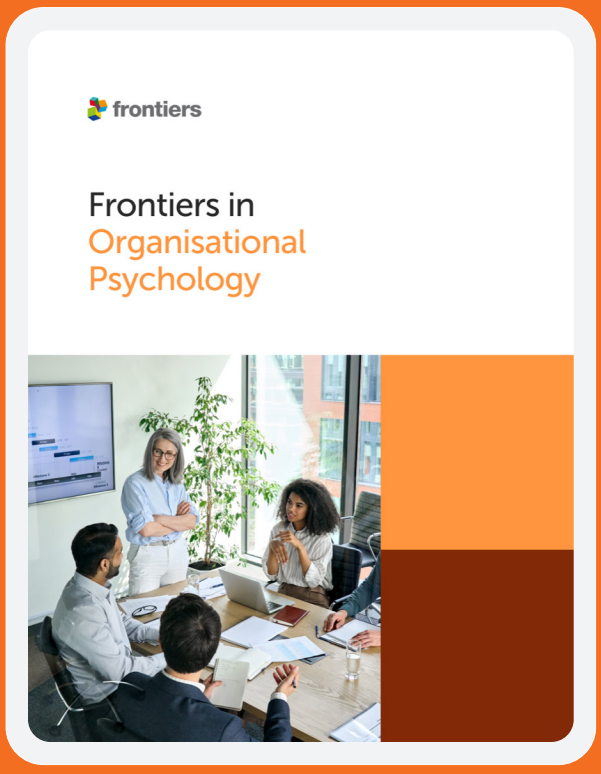

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