Violation of German rest break regulation criteria and health complaints while working in the office and from home

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Abstract

Background. Due to the ongoing COVID-19-pandemic and the need to improve health protection, companies in many countries have been encouraged to offer their employees more work-from-home (WFH) opportunities when possible, which is often the case with office work. WFH offers advantages and disadvantages in terms of work design and, as a consequence, employee health. Due to their health effects, rest breaks are a work factor that is strongly regulated by national legislation. However, their organization at different locations of work has been so far largely unclear. The aim of this study was to clarify if WFH affects employees' compliance with mandatory break regulations and if rest break behavior relates to physical and mental health complaints.

Methods. This cross-sectional study relies on survey data (10-12/2020, prior to/during the 2nd pandemic wave in Germany) from 534 office workers working in the office (n = 391) or at least partially from home (n = 143). We assessed their compliance with six mandatory rest break criteria according to German legislation (i.e., total rest break duration, single break duration, no interruptions, no skipping, scheduled/predictable, regular leaving of visual display workplaces and/or regular short rest break) and physical (muscular tension, headache) as well as mental (exhaustion, depressive mood) health complaints.

Results. Ninety-two percent reported at least one violation of these rest break principles. WFH (frequency) did not affect the (non-)compliance with these regulations but was associated with increased risk for muscular tension (OR = 1.93). Frequent break skipping increased risk of headache (OR = 2.38). After controlling for potential confounders, noncompliance with three or more of these rest break criteria related to risk of depressive mood (OR = 2.61) and headache (OR = 3.11), and noncompliance related to risk of exhaustion in a dose-response relationship (3.10 ≤ ORs ≤ 3.69).

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Discussion/Conclusion. WFH does not relate to violation of German rest break regulation criteria but is associated to musculoskeletal complaints. Moreover, our findings indicate that organizations should pay more attention to increasing employees' compliance with standards according to national break regulations since this can reduce risks for health complaints.

Keywords: COVID-19, health, home office, legislation, mental, physical, recovery, remote, rest breaks, stress, telework, work from home.

Introduction

Flexible work arrangement regarding working times (Baltes et al. 1999) or work locations (Gajendran/Harrison 2007) are not new organizational concepts but have been implemented in organizations since the early 1970s and investigated by researchers for decades. However, since the COVID-19 pandemic began in 2020 (and still continues), working from home (WFH) in particular has become a more common work location arrangement because policymakers demanded for its more intensive use in order to improve infection control and public health protection. In Germany, for example, the proportion of employees working exclusively or predominantly in offices declined from 83 to 66% between 2019 and January 2021 (Emmler/Kohlrausch 2021). This is in line with data from a German employee survey showing that about 40% reported that they could perform their work almost completely from home, and 13% say they could do so at least some of the time (Ahlers et al. 2021).

Working from home is challenging and related to many benefits but also disadvantages for employees and organizations (Allen et al. 2015). From an occupational health and safety perspective, three main issues arise when using WFH compared to traditional office work: (1) Is this work arrangement related to psychosocial and physical risks? (2) Do employees using this work arrangement comply with nationally mandatory occupational health and safety standards? (3) Do physical and mental health risks arise? (Act on the Implementation of Measures of Occupational Safety and Health to Encourage Improvements in the Safety and Health Protection of Workers at Work; ArbSchG (2013).

In our view, one work factor that has received little attention so far in this context is the organization of rest breaks. Rest break organization is highly regulated in Germany and other EU countries (Eurofound 2019). This is because there is strong empirical evidence that rest breaks have a positive impact on employees' health and occupational safety (Wendsche/Lohmann-Haislah 2016, 2018). However, we still know far too little about how employees organize their rest breaks while WFH, whether their rest break behavior at this work location complies with the legal regulations and, if not, whether health risks arise as a result. Although employers may be concerned that their employees take more time at home for rest breaks and thus possibly show lower productivity (Allen et al. 2015), one journalist describes her break behavior while WFH during the COVID-19 pandemic in just the opposite way (Sara Peschke, 23.02.2021, Süddeutsche Zeitung Magazin, authors translation).

> *Instead, I return to my 'home office' isolation with a guilty conscience, and a double one at that: That I only took such a short break, even though the weather is nice and*

> *I could really use fresh air and sunlight. And that I took a break at all–because: How are the others supposed to know that I'm really just eating something and not doing my taxes or spring cleaning? Don't the team members think I work less at home than I claim anyway?*

Therefore, our study contributes to the literature on WFH in several ways. In our view, this is the first study investigating different aspects of rest break organization (i.e., break duration, break interruptions, skipping of breaks, planning of breaks, workplace changes/short rest breaks) according to national German regulations for employees at visual display unit (VDU) workstations when working in the office compared to WFH. Therefore, this study provides important insights into the compliance with occupational health and safety standards in the organization of working time and possible challenges in the work design of employees whose work is currently suitable for WFH and will most likely continue to be so in the future. Furthermore, our study results will show if rest break behavior that does not comply with national regulation standards is associated with increased physical and mental health risks. Since we examine these aspects in the context of WFH, our results also provide evidence on whether flexible work location models can also have direct health effects for employees or whether these relationships are driven through indirect effects of work design factors such as rest break organization (Wöhrmann/Ebner 2021)

Working from home

Flexible work location arrangements are labeled with different terms in the literature (Allen et al. 2015; Vartiainen 2021): telework, telecommuting, remote work, distributed work, flexible work, flexplace, distributed work, distance work, virtual work and work from home (in German language the pseudo-anglicisms 'homeoffice' is also used).

In order to gain clarity regarding the central characteristics of these concepts and, thus, to improve their assessment in studies, the International Labour Organization (2020: 5-7) has recently proposed the following definitions for the most widely used terms telework, remote work, work from home, and home-based work.

Remote work is the most comprehensive term for work that is performed fully or partially at an alternative location to the default place of work (e.g., in the office building). Telework is a subtype of remote work in which work is performed using electronic devices (e.g., computer, tablet, and telephone). Work from home is work that takes place fully or partially within the workers own residence (i.e., at home). In contrast, home-based work means that work is performed fully at home; the home is in this case the default place of work. In our study, work from home means in general home-based remote work (i.e., partially or fully working at home but not necessarily only with electronic devices) and home-based telework (i.e., partially or fully working at home with electronic devices).

When considering the German legal context, the situation becomes even more complex because terms are used differently (Backhaus et al. 2021). The Workplace Ordinance defines telework as VDU workstations permanently set up by the employer in the private area of the employees, for which the employer has specified a weekly working time in agreement with the

employee(s) and the duration of use. The key characteristic is a fixed agreement between the employer and the employee on the alternative work location and the frequency of use. 'Mobile work' (i.e., remote work/telework) is work at an alternative location to the default place of work (i.e., work from home is on possible location) but this is more occasional and temporary and without a fixed contract for any longer periods (usually after brief consultation between supervisor and employee). From a German legal perspective, telework is the most strongly regulated case. For instance, the employer needs to provide office furniture and conduct an independent risk assessment for the work at the alternative work location.

During the COVID-19 pandemic, organizations had to implement infection control measures quickly. To avoid infection during commuting times or in open-plan offices, employees should work from home if possible. This was particularly helpful for families since schools were temporarily closed and distance learning from home was introduced. In this study, we do not distinguish the type of legal basis (in the organizations of this study, there were official agreements on these types of work), but we want to understand WFH as any work that is performed completely or temporarily from home independent of (electronic, non-electronic) work equipment.

WFH and employee health

In the literature on WFH, employee outcomes such job satisfaction, organizational commitment, turnover intention, job performance, career development, and work-to-home or home-to-work interference have been studied most frequently but less is known about potential health effects (Allen et al. 2015; Gajendran/Harrison 2007; Martin/MacDonnell 2012; Vartiainen 2021).

From a conceptual and theoretical perspective, WFH is a work context variable that affects work characteristics (e.g., job autonomy, social support, and work intensity) that, in turn, shape individual outcomes, for instance, health (Gajendran/Harrison 2007). Using the job-demands-resources approach (Bakker/Demerouti 2017), Wöhrmann and Ebner (2021) have suggested an opposing indirect effects model for relationships between telework (as type of WFH) and health. Using a cross-sectional and representative sample of German employees, they found that telework increases some job resources (e.g., working time control) and reduces specific job demands (e.g., disturbances and interruptions), which both have health protective effects. At the same time, however, WFH reduces some other job resources (e.g., coworker relations) and increases specific job demands (e.g., time pressure and long working hours) which impair health. In sum, these work-related positive and negative health effects neutralize each other and WFH is not directly but indirectly related to health (complaints).

What kind of results do systematic reviews on this topic find? Allen et al. (2015) refer to study findings showing that telecommuting relates to lower emotional exhaustion. However, they also discuss studies showing that WFH may increase risks for developing physical complaints due to poor ergonomic equipment and more prolonged sitting while working with electronic devices. They conclude that WFH might have positive health effects up to moderate WFH frequency (also referred to as intensity) but these effects can turn negative under high WFH frequency (see also Gajendran/Harrison 2007). Similarly, Tavares' (2017) review showed

positive (i.e., lower stress experience, sickness absence, and work-related impairment) and negative (i.e., more musculoskeletal problems, stronger feelings of being depressed and stressed) health effects of telework. However, the development of negative health effects was mainly driven by adverse working conditions connected to telework (e.g., long working hours, taking fewer rest breaks, isolation from colleagues, and high work intensity). Charalampous et al. (2019) draw similar conclusions from a review of 63 studies. Many studies showed positive effects on employees' well-being (indicating mental health), if adverse side effects of flexible work, for instance, social and professional isolation and career threats, are low. However, they regretted a lack of studies investigating psychosomatic complaints as outcome. Oakman et al. (2020) found inconsistent findings of WFH on physical and mental health outcomes, which might be explained by other individual and work-related moderating variables. The review of Chirico et al. (2021) draws a more negative picture of WFH. They refer to studies revealing WFH as being connected to adverse health behavior, e.g., less frequent physical activities, unhealthy food consumption, weight gain, sleep problems, and physical complaints. These findings are also supported by Di Fusco's et al. (2021) review, summarizing risks of WFH for cardiovascular health (e.g., sedentary lifestyle, nutrition behavior, stress experience, smoking, and alcohol consumption).

Recently, Shifrin and Michel (2022) presented a meta-analysis with data from 33 studies on flexible work arrangements (i.e., flextime and flexplace) and health. In general, they found small positive relationships of flexibility to physical health and small negative relationships to somatic symptoms. In a subsample of three studies, flexplace arrangements related to better physical health.

In sum, data from these reviews support the assumption of Wöhrmann and Ebner (2021) that WFH might have positive and negative health effects in parallel. The total direct WFH effect seems to be negligible or small sized and depends on the extent to which WFH influences working conditions (i.e., job demands and job resources), which then affect health. A job resource that has been widely neglected in the literature on WFH and health is employees' rest break behavior.

Rest breaks

Rest breaks are within-shift interruptions between periods of work aiming to reduce impairing consequences of physical and mental strain (e.g., physical and mental fatigue) by sufficient recovery (Graf et al. 1970).

Organizational determinants of rest breaks are manifold (Wendsche/Lohmann-Haislah 2016, 2018). These are, for instance, the specific and cumulated duration over the working period, the break intervals (i.e., time between rest breaks), their predictability, the break location (with social and physical conditions), the break activities, the occurrence of potential break hindrances (e.g., interruptions, need to skip breaks), and internal and external triggers of initiating and finishing rest breaks. Moreover, the individuals' autonomy in influencing these factors, the payment of rest break time, and organizational agreements (e.g., use of additional short rest breaks or practices regarding unauthorized rest breaks), and the rest break culture are additional influencing factors.

German rest break regulation

The European Working Time Directive (2003) calls on all European member states to implement regulations to ensure sufficient rest break times in national law (Eurofound 2019).

The German Working Hours Act (§4) therefore specifies that work must be interrupted by 30-minute rest breaks if total time on task lasts between 6 and 9 hours and by 45-minute breaks if it lasts more than 9 hours (criteria A: total break duration). Moreover, the total rest break duration can be split in two 15-minute rest breaks each (criteria B: single break duration of at least 15 min). During rest breaks, the employee is not required to remain available. Therefore, interruptions are not allowed (criteria C). Considering the first two criteria, it is also not warranted to skip rest breaks (criteria D). Moreover, rest breaks have to be planned and scheduled in advance, when the working day starts (criteria E). There are further regulations, for instance, regarding specific employee groups (e.g., breastfeeding mothers and young workers) or working conditions with elevated physical and mental risks (e.g., temperature, noise, continuous attention). In the context of office work and WFH, an additional rule from the Workplace Ordinance is important. Since these work tasks are often conducted with computers, health and safety protection for work with display screens is required. In order to reduce the workload at the display screen, this work has to be periodically interrupted by changes in activity (i.e., tasks that do not need the visual screen to be performed) or, if not possible or in addition, by additional short rest breaks (criteria F).

Two representative German surveys found that between 26% and 30% of all employees report skipping their mandatory rest breaks frequently, and about 17% reported that they are frequently interrupted during breaks (Lohmann-Haislah 2012; Vieten/Brauner 2020). Although this data already indicates that violations of these legal rest break rules (criteria C and D) are not uncommon, we do not know any statistics on the compliance with the other requirements (criteria A, B, E, F). Therefore, further studies are necessary to clarify the extent to which compliance with the other rules are also observed.

Rest breaks and health

The effort-recovery model (Meijman/Mulder 1998) proposes that rest breaks and task changes reduce adverse consequences of physical and mental strain that develop with time on task.

Several reviews have shown for many different occupations but also specifically for office workers that longer rest break duration and more frequent rest breaks are related to less physical (i.e., musculoskeletal complaints) and less mental (e.g., fatigue, exhaustion) complaints (Hoe et al. 2018; Jun et al. 2017; Luger et al. 2019; Wendsche/Lohmann-Haislah 2016; Waongenngarm et al. 2018).

Furthermore, many studies found that rest breaks might even improve job performance (Wendsche et al. 2017; Wendsche/Lohmann-Haislah 2016; Waongenngarm et al. 2018), learning behavior (Donovan/Radosevich 1999), problem solving behavior (Sio/Ormerod 2009), and reduce the risk for occupational injuries (Fischer et al. 2017).

A meta-analysis (Wendsche et al. 2016) showed that even scheduled short rest breaks (<15 min) reduce mental and physical complaints and improve employees' task performance. Such

effects are notable because employees do not have to add the time for such breaks, so they finish more work tasks of higher quality in less time.

In sum, these results on rest breaks support Steed's et al. (2021) meta-analytical findings for recovery in general: Recovery relates positively to well-being, health, and performance.

WFH and rest breaks

Prior to the COVID-19 outbreak in 2020, few studies investigated differences in rest break behavior between office work and WFH. In a cross-sectional study, there were no differences in the frequency of skipped or delayed rest breaks depending on WFH frequency (Degenhardt et al. 2014). However, employees using WFH more frequently reported more often a lack of existing organizational regulations on break times and no documentation of break times.

Data from experimental studies provide insights into the cause-effect relationship of WFH on rest break behavior. Bloom et al. (2015) conducted a field study with Chinese call center employees who were randomly assigned to WFH or working in the office for nine months. They found that employees in the WFH condition showed an increase in productivity of about 13% compared to office work. This effect was mainly driven by taking fewer breaks during working hours in the WFH condition (amongst other factors such as fewer sick days and more calls per minute). Similar effects were shown in a field experiment (Boltz et al. 2022) manipulating working time flexibility (which is also positively related to WFH). More working time flexibility increased productivity by reducing individual break duration. Such results suggest that WFH might increase the risk of reducing time for rest breaks.

Some studies did also investigate rest break behavior during the early period of the COVID-19 pandemic when employees changed from office work into WFH. Smite et al. (2023) examined these transition processes in a sample of software engineers. They found that employees that changed from office work to WFH reduced their total daily rest break duration and increased the amount of total daily working hours. Both related to feelings of exhaustion. Guler et al. (2021) surveyed employees that had recently changed from office work to WFH due to the pandemic. Participants reported reduced break times as problem of WFH. Moreover, the change into WFH increased back pain symptoms and unhealthy behavior (i.e., more junk food consumption, less physical activity, and more weight gain). Aegerter et al. (2021) surveyed Swiss office workers for two times: first, when they were working in the office in January 2020 and second, during the lockdown in April 2020 when they were fully working from home. They found a non-significant decrease in the number of daily work breaks during that time. Importantly, a higher number of daily work breaks related to lower neck pain intensity, which supports its positive effects on physical health. Another study (Leroy et al. 2021) investigated how the prevalence of work and nonwork rest breaks changed during the COVID-19 pandemic when more employees used WFH. They found that the work break frequency remained stable. However, employees reported more nonwork breaks when WFH, especially females. Surprisingly, rest breaks did not relate to lower exhaustion but more nonwork breaks predicted lower job performance. This could mean that rest break behavior under high WFH frequency and especially when being related to family issues (i.e., lunch breaks with children at home, playing with children) is not sufficient for recovery. Muniswamy et al. (2021) examined relationships between rest break behavior and health for employees completely working from home. They

found low physical activity and long sitting time – indicating fewer task changes and long hours of VDU work – relating to stronger experiences of stress, anxiety, and depression. Fewer breaks and shorter break duration related to higher anxiety and, in addition, a shorter break duration related to stronger depressive mood.

Overall, these studies provide preliminary evidence that WFH may result in increased risks for noncompliance with mandatory rest break rules and that this noncompliance might further increase risks of developing physical and mental health complaints.

Objectives

The aim of the present study was to investigate if WFH relates to an increased risk of reporting violations of six important rest break regulation criteria according to the German Working Hours Act and the German Workplace Ordinance. In line with recommendations from Gajendran and Harrison (2007) and Allen et al. (2015), we perform additional analyses for WFH frequency. For the first time, our study reports prevalence estimates of these violations in a specific group of employees that work in public administration. Moreover, we examine associations between the noncompliance with these rest break principles and potential risks for physical (i.e., muscular tension, headache) and mental (i.e., exhaustion, depressive mood) health com-plaints.

To provide clarity about these issues, we conducted a cross-sectional survey of German employees working in German public administration prior to/during the second wave of the COVID-19 pandemic in Germany since more and more employees had the opportunity to work from home during this period.

Methods

Study design and sample

This study was part of a larger and ongoing project "Recovery within and beyond the context of work: Effects and design approaches in a changing world of work". The sample consisted of office employees in knowledge intensive jobs and service jobs from five German organizations. Three organizations are from public administration (employees of the Federal Employment Agency in one federal state, employees of the German Pension Insurance in two federal states) and two from industry (two federal states). We invited all employees of these organizations to participate in a longitudinal survey study over one year (three waves after six months each, wave 2 and 3 are still ongoing). The ethics committee of the Federal Institute for Occupational Health and Safety ethically approved all different studies, taking also into account all data protection requirements.

The cross-sectional data of this paper is from the first employee survey and was collected between October to December 2020. To increase the homogeneity of the sample concerning work tasks and the organizational practices regarding recovery at work, we analyze only the data from employees working in public administration here (three organizations).

We invited 1693 employees of these three organizations to participate in a paper-pencil survey on their work characteristics, their recovery behavior, and their health. Completing the anonymous questionnaires lasted about 30 to 45 minutes. Organizations approved survey participation during official working hours. We further requested written consent from the participants. Employees received an email reminder from their organization two weeks after the start of the study asking again for participation. Participants sent the completed questionnaires to us by mail using prepaid envelopes. We received 611 questionnaires (36% response rate). We limited our analysis to the 552 employees who reported to work at least six hours a day on average since only this subsample is subject to the application of mandatory regulation criteria for rest breaks (see German Working Hours Act).

After excluding participants with missing data in the variables considered here (n = 18), the final sample consists of 534 employees. Table 1 shows the sample characteristics. Most of them were female (79%), aged between 36 and 55 years (49%), and reported daily working hours of seven to eight hours including overtime (53%). About 96% of these persons reported that they worked more than 50% of the daily working time on the computer screen. This means that the regulations of the German Workplace Ordinance regarding the design of breaks for VDU work applied to almost all of them. Moreover, most of these employees (about 76%) reported daily contacts with clients as part of their job duties and most had no supervisory role (85%). About 27% of these employees reported WFH at least one day a month (WFH frequency; "1-4 days/month": n = 69, 48%; "5-8 days/month": n = 24, 17%; "9-12 days/month": n = 18, 13%; ">12 days/month": n = 32, 22%). In this sample, employees using WFH reported more often to be "36-55 years old" and less often to be "<36 years old", having more often children living at home, and having more daily client contacts. Moreover, employees with a supervisory role reported a lower WFH frequency (r_s = -.22, p = .007).

Table 1: *Sample Characteristics and WFH*

		Total sample (n = 534)		No WFH (n = 391/ 73.2%)		With WFH (n = 143/ 26.8%)		
		n	%	n	%	n	%	X^2
Gender	female	422	79.0	312	79.8	110	76.9	0.52
	male	112	21.0	79	20.2	33	23.1	
Age (years)	<36	133	24.9	110	28.1	23	16.1	15.32***
	36-55	263	49.3	173	44.2	90	62.9	
	>55	138	25.8	108	27.6	30	21.0	
Children at home	no	403	75.5	320	81.8	83	58.0	32.03***
	yes	131	24.5	71	18.2	60	42.0	
Working hours	6-7 h/d	73	13.7	53	13.6	20	14.0	2.89
	7-8 h/d	283	53.0	214	54.7	69	48.3	
	8-9 h/d	163	30.5	112	28.6	51	35.7	
	>9 h/d	15	2.8	12	3.1	3	2.1	
VDU work (%/day)	< 50	19	3.6	11	2.8	8	5.6	2.36
	≥ 50	515	96.4	380	97.2	135	94.4	

Client contacts	no	183	34.3	157	40.2	26	18.2	27.50***
	low-moderate	222	41.6	157	40.2	65	45.5	
	high	129	24.2	77	19.7	52	36.4	
Supervisory role	no	454	85.0	336	85.90	118	82.5	0.96
	yes	80	15.0	55	14.10	25	17.5	

Note. WFH = working from home, X^2 = value of Chi-Square-test, h/d = hours per day, d/m = days per month, VDU = visual display unit (display screen work), h/d = hours per day.
** $p < .05$, *** $p < .001$*

Measures

Rest break regulation criteria

We considered six criteria (A-F) for rest break behavior according to German legislation (A-E: German Working Time Act, § 4 Rest breaks; F: Workplaces Ordinance: 6.1-2 General requirements for DSE workstations).

Total break duration (criteria A) was assessed with the item "If you add up all the breaks during an average working day (breakfast break, lunch break, coffee break, private conversations with colleagues): How many minutes is that approximately per day?" [free answer in minutes]. Depending on employees' reported daily working hours (6-9 hours/day or 9 and more hours per day), we recoded values ≥30/45min as "no violation/compliance with regulation" (= 0) and values <30/45 min as "violation/noncompliance with regulation" (= 1).

Single break duration (criteria B) was assessed from the answers to the three items "How long do you usually take a breakfast break?" [free answer in minutes], "How long do you usually take a lunch break?" [free answer in minutes], and "If you add up all the breaks during an average working day (breakfast break, lunch break, coffee break, private conversations with colleagues): How many minutes is that approximately per day?" [free answer in minutes]. We tested if employees reported at least one break of 30 minutes in duration or two breaks (e.g., breakfast or lunch) of at least 15 minutes in duration. If this was the case, we coded this as "no violation/compliance with regulation" (= 0), if not as "violation/noncompliance with regulation" (= 1).

The *frequency of break interruptions* (criteria C) was assessed with two items "How often do you find yourself interrupting your rest break due to work issues?" and "How often does it happen that you have to interrupt or shorten your rest break?" Employees responded on a 5-point-frequency scale (1 = "never" to 5 = "always"). We coded cases reporting for at least one of both items with ≥4 (often, always) as "violation/noncompliance with regulation" (= 1), all others as "no violation/compliance with regulation" (= 0).

The *frequency of skipping rest break* (criteria D) was assessed with the item "How often do you skip rest breaks on workdays with more than six hours? This refers to rest breaks of more than 15 minutes." (responses: 1 = "never" to 5 = "always"). We coded cases reporting ≥4 (often, always) as "violation/noncompliance with regulation" (= 1), all others as "no violation/compliance with regulation" (= 0).

The *organization of scheduled and predictable rest breaks* (criteria E) was assessed with two items "When I start work, I know when I will take my rest breaks." and "At the start of work, it is specified how long I will take my rest breaks." Employees responded on a 5-point-frequency scale (1 = "strongly disagree/does not apply" to 5 = "strongly agree/is completely true"). We coded cases reporting both with ≥4 (agree, strongly agree) as "no violation/compliance with regulation" (= 0), all others as "violation/noncompliance with regulation" (= 1).

In addition to these criteria according to the German Working Time Act, the Workplace Ordinance further demands that *workplace/task changes and/or additional short rest breaks* are organized regularly for employees working most of their working hours at VDU workstations. We first checked if this regulation applies to the cases (see below: daily amount of VDU work with values 1 = "≥ 50%"). Cases for which this regulation was not relevant were coded as "no violation/compliance with regulation" (= 0). Information regarding regularly leaving the VDU workstation and/or short rest breaks was assessed with the two items "How often do you switch from screen to other work activities?" and "How often do you interrupt your work with short rest breaks?" (responses: 1 = "never" to 5 = "always"). Cases reporting for at least one of both items with ≤3 (never, rarely, sometimes) were coded as "violation/noncompliance with regulation" (= 1), all others as "no violation/compliance with regulation" (= 0).

We also computed a *sum score* of all these binary variables (A-F) indicating the total amount of violations/noncompliance regarding mandatory principles of rest break behavior. For further analyses this sum score was categorized into "0 violations" (= 0), "1 violation" (= 1), "2 violations" (= 2), and "≥ 3 violation" (= 3).

Physical and mental health complaints

We assessed the frequency of muscular tension and headache as *physical health complaints* with two items from the COPSOQ III questionnaire (Burr et al. 2019). For each outcome, participants answered the question "During the past five weeks, how often did you experience … [muscular tension/headache]?" on a 5-point-frequency scale (1 = "never", 5 "always"). We recoded answers 1 to 3 ("never" to "sometimes") as "no muscular tension/headache" and 4 to 5 ("frequently" to "always") as "with muscular tension/headache".

We assessed exhaustion and depressive mood as *mental health complaints*. For the first outcome, we used the burnout-exhaustion scale with eight items (4-point agreement scale: 1 = "strongly disagree" to 4 = "strongly agree") of the Oldenburg Burnout Inventory (Halbesleben/Demerouti 2005) and computed mean scores (α = .83). Values < 2.5 were recoded as "no exhaustion" (= 0) and values ≥ 2.5 as "with exhaustion" (= 1; see Müller et al. 2018). To assess depressive mood we used the WHO-5-Well-Being Index (World Health Organization 1998). The scale was originally developed as well-being measure but has been also confirmed as valid screening tool for depression (i.e., reporting low well-being; Topp et al. 2015). Participants indicate how they had been feeling during the past two weeks on a 6-point scale ranging from "0" (at no time) to "5" (all of the time). Following the recommendations of Topp et al. (2015), we calculated a sum score of individual responses (α = .88) and categorized values ≥ 13 as "no depressive mood" (= 0) and values < 13 as "with depressive mood" (= 1).

Controls

We assessed *working from home* with the question 'How many days per month do you work from home?' [free answer]. We coded answers "0" as "no WFH" and all others as "with WFH" (= 1). WFH frequency was recoded to an ordinal scale with "1-4 days/month" (= 1), "5-8 days/month" (= 2), "9-12 days/month" (= 3), and ">12 days/month" (= 4).

We further assessed *gender* (0 = "female", 1 = "male"), *age* (1 = "<36 years", 2 = "36-55 years", 3 = ">55 years"), and *having children that are living at home* (0 = "no", 1 = "yes"). From the free answers to the questions "How many hours, including overtime, do you actually work on average per week?" and "How many days do you work each week?", we calculated its quotient; the *average number of working hours per day*. Data were recoded to 0 = "6-7 hours/day", 1 = "7-8 hours/day", 2 = "8-9 hours/day", and 3 = ">9 hours/day".

For the *daily amount* of VDU work, we classified the answer to the question "How much percent of the day do you work on a PC or screen?" [0-100%] to 0 = "<50%" and 1 = "≥ 50%". *Daily amount of client contacts* was assessed with the question "How much of your daily working time do you spend in direct contact with people who are not employed at your workplace, e.g. customers?" (0 = "1-never", 1 = "low-moderate" [2-seldom/3-about a quarter of time], and 2 = "high" [4-half/5-three quarter/all the time]). *Supervisory role* was assessed with the question "For how many employees are you the supervisor?" (0 = "no supervisory role" [answer: 0], 1 = "with supervisory role" [all others]).

Statistical analyses

We conducted all analyses with IBM SPSS Statistics 26.0. We first calculated frequencies and distributions for all variables and examined potential differences between WFH statuses (X^2-test for differences). We used Spearman's rank correlation coefficient r_s to estimate relationships between WFH frequency and other variables.

We examined relationships between WFH status (independent variable) and compliance with rest regulation criteria (dependent variables) using binary logistic regression analyses. We report odds ratios (ORs) and corresponding 95% confidence intervals (CI) as point estimates. We calculated crude estimates at first. In the following, we also adjusted these models for gender, age, children living at home, working hours, display screen work, amount of client contacts per day, and supervisory role.

We used the same analytical approach to predict health complaints (muscular tension, headache, exhaustion, depressive mood as dependent variables) from compliance/noncompliance with rest break regulation (criteria A-F, sum score) and WFH as independent variables (crude and adjusted models with confounders).

We considered parameter estimates with $p < .05$ as statistically significant (two-tailed).

Results

Frequency of noncompliance with German rest break regulation criteria depending on WFH

Table 2 shows the frequency of violated rest break regulation criteria for the total sample and for employees with and without WFH. Only 8% of all employees reported no violation, about 57% of all employees reported to be noncompliant to two or more criteria. Considering the specific criteria, noncompliance with demands of regularly changing the VDU (visual display unit) workstation and/or taking short rest break (75%) and reporting unscheduled/unpredictable rest breaks (67%) were most frequently reported. Moreover, about one out of ten employees reported rest break interruptions and frequently skipping rest breaks.

Table 2: *Frequency of Violated German Rest Break Regulation Criteria depending on WFH*

		Total sample (n = 534)		No WFH (n = 391)		With WFH (n = 143)	
Criteria		n	%	n	%	n	%
Sum score of violations (A-F)	0	40	7.5	31	7.9	9	6.3
	1	190	35.6	143	36.6	47	32.9
	2	221	41.4	159	40.7	62	43.4
	≥3	83	15.5	58	14.8	25	17.5
(A) Total break duration							
≥ 30/45 min	no	509	95.3	374	95.7	135	94.4
< 30/45 min	yes*	25	4.7	17	4.3	8	5.6
(B) Single break duration							
≥15 min	no	498	93.3	363	92.8	135	94.4
< 15 min	yes*	36	6.7	28	7.2	8	5.6
(C) No break interruptions							
no/rare interruptions	no	475	89.0	350	89.5	125	87.4
frequent interruptions	yes*	59	11.0	41	10.5	18	12.6
(D) No skipping of breaks							
no/rare skipping	no	481	90.1	357	91.3	124	86.7
frequent skipping	yes*	53	9.9	34	8.7	19	13.3
(E) Scheduled/predictable breaks							
scheduled/predictable	no	174	32.6	133	34.0	41	28.7
unscheduled/unpredictable	yes*	360	67.4	258	66.0	102	71.3
(F) Leaving VDU workstation and/or short rest breaks							
leaving and/or short rest breaks	no	135	25.3	98	25.1	37	25.9
no leaving/no short rest breaks	yes*	399	74.7	293	74.9	106	74.1

*Note. WFH = working from home, min = minutes, VDU = visual display unit (display screen work). *Violated rest break regulation criteria (for Germany).*

Table 3 shows the results of the logistic regression analyses and the correlation analyses for WFH (frequency) predicting noncompliance with mandatory rest break behavior. In sum, we found no significant relationships.

Regarding the confounders, results of the adjusted model showed that longer working hours (OR (>9h/day vs. 6-7 h/day) = 7.27, 95%CI [1.64, 32.29]) increased risks of shorter total rest break duration (noncompliance with criteria A), having children living at home increased risks of reporting rest break interruptions (criteria C; OR = 3.18, 95%CI [1.61, 6.29]), and a supervisory role increased risks of skipping rest break (criteria D; OR = 2.52, 95%CI [1.16, 5.48]). More client contacts reduced risks for noncompliance with scheduled/predictable rest breaks (criteria E; OR = 0.33, 95%CI [0.20, 0.55]) and leaving the VDU workplace/short rest break (criteria F; OR = 0.36, 95% CI [0.21, 0.64]). Lower risk for being noncompliant with criteria F were reported by male (OR = 0.57, 95%CI [0.34, 0.95] in comparison to female employees.

Table 3: *Results of Logistic Regression and Correlation Analyses with WFH (frequency) Predicting Violated German Rest Break Regulation Criteria*

				Crude	95%CI		Adjusted	95%CI	
Violated criteria (yes)	Ref.	Risk	ES	PE	LL	UL	PE	LL	UL
(A) Total break duration									
WFH	no	yes	OR	1.30	[0.55	3.09]	1.13	[0.40	3.22]
WFH frequency			r_s	-.02	[-.17	.15]	-		
(B) Single break duration									
WFH	no	yes	OR	0.77	[0.34	1.73]	0.80	[0.33	1.96]
WFH frequency			r_s	.06	[-.12	.22]	-		
(C) No break interruptions									
WFH	no	yes	OR	1.23	[0.68	2.22]	0.73	[0.37	1.41]
WFH frequency			r_s	-.15	[-.29	.01]	-		
(D) No skipping of breaks									
WFH	no	yes	OR	1.61	[0.89	2.92]	1.63	[0.83	3.18]
WFH frequency			r_s	-.02	[-.17	.12]	-		
(E) Scheduled/predictable breaks									
WFH	no	yes	OR	1.28	[0.84	1.95]	1.56	[0.98	2.49]
WFH frequency			r_s	.05	[-.11	.23]	-		
(F) Leaving VDU workstation and/or short rest breaks									
WFH	no	yes	OR	0.96	[0.62	1.49]	1.26	[0.74	2.13]
WFH frequency			r_s	.08	[-.08	.24]	-		
Sum score of violations (A-F)									
WFH	no	1	OR	1.13	[0.50	2.55]	1.76	[0.67	4.60]
		2	OR	1.34	[0.61	2.98]	1.77	[0.62	5.08]
		≥3	OR	1.49	[0.62	3.57]	1.62	[0.49	5.38]
WFH frequency			r_s	.06	[-.10	.21]	-		

Note. WFH = working from home (WFH sample: n = 534, WFH frequency sample: n = 143), 95% CI = 95% confidence interval, Ref = reference category, ES = effect size, PE = point estimate, LL/UL = lower/upper limit of 95% CI, OR = odd ratio, r_s = Spearman's rho correlation coefficient. Adjusted models include gender, age, children at home, working hours, display screen work, amount of client contacts per day, and supervisory role. 95% CIs excluding '0' for r_s and '1' for ORs are significant with p < .05.

Supplementary analyses

Our initial analyses revealed significant differences between employees reporting WFH and those reporting no WFH with regard to age, children living at home, and frequency of daily client contacts. Correlation analyses revealed that age did not relate to noncompliance with mandatory rest break behavior. However, having children living at home (r_s = .09, p = .05) was positively related and the amount of daily client contacts was negatively related to the sum score of violations/noncompliance (r_s = -.17, p < .001). Further analyses revealed employees with children living at home to be at higher risk for being noncompliant with the minimal total rest break duration (criteria A; r_s = .14, p = .001) and for reporting break interruptions (criteria C; r_s = .16, p < .001). More daily client contacts related to a lower chance of being noncompliant with scheduled/predictable rest breaks (criteria E; r_s = -.16, p < .001) and leaving the VDU workplace and/or taking short rest breaks (criteria F; r_s = -.14, p = .002).

In order to control for such a confounding between controls, WFH and rest break compliance, we conducted an additional propensity score matching analysis with SPSS. Propensity score matching is a method creating comparable groups of an independent variable (with vs. without WFH) with respect to the distribution of covariates (Rosenbaum/Rubin 1983; see Pan/Bai 2018 for an overview). We matched (no) WFH cases regarding age, children living at home, and amount of daily client contacts (caliper value was set to 0.01 tolerance of differences between propensity scores). The matched samples consisted of n = 254 employees (no WFH and WFH each with n = 127). Now, both subsamples did not differ significantly regarding gender, age, children living at home, working hours, display screen work, amount of client contacts per day, and supervisory role (all ps > .769). Thus, the matching procedure was successful. However, in the fully adjusted models ORs for WFH predicting noncompliance with German rest break regulation criteria remained insignificant (criteria in brackets; OR(A) = 1.26, 95%CI [0.38, 4.20]; OR(B) = 1.26, 95%CI [0.41, 3.86]; OR(C) = 0.63 95%CI [0.28, 1.41]; OR(D) = 1.52, 95%CI [0.62, 3.72]; OR(E) = 1.35, 95%CI [0.79, 2.31]; OR(F) = 1.16, 95%CI [0.62, 2.18]; OR(sum 0 vs. 1) = 2.20, 95%CI [0.72, 6.70], OR(sum 0 vs. 2) = 1.98, 95%CI [0.60, 6.54]; OR(sum 0 vs. ≥3) = 1.20, 95%CI [0.27, 5.38]). Moreover, there were no significant relationships between WFH frequency and noncompliant rest break behavior (.02 ≤ |rs| ≤ .14, all ps > .112).

Finally, we also checked employees' responses on a single item level with uncategorized raw data (see Appendix 1) because even if there might be no WFH effects with regard, for instance, to violations against the demanded minimal rest break duration, WFH might affect reported average rest break length. The results showed that employees using WFH reported a significantly shorter total rest break duration, reported more frequent break interruptions, and reported skipping rest breaks more frequently than employees without WFH. However, when considering the means and the 25% and 75% percentile ranks of these items, it is obvious that

the average total rest break duration was extremely long in this sample (25% percentile = 40 min) and that employees reported on average 'rarely' to 'sometimes' experiencing break interruptions or having to skip their breaks. For the WFH subsample, we further found WFH frequency to be negatively related to the frequency of leaving VDU workstation (r_s = -.22, p = .008), positively related to breakfast duration (r_s = .27, p = .001), and negatively related to break interruptions (r_s = -.18, p = .035). Following Allen's et al. (2015) recommendations, we repeated these analyses assuming possible quadratic effects. Here, we found the only significant effect to be a u-shaped relationship between WFH frequency and the scheduling of rest break time (i.e., employees with low and high WFH frequency are more likely to schedule their breaks than employees with moderate WFH frequency do).

In sum, the results of our supplementary sensitivity analyses suggest that WFH does not affect the compliance with German mandatory rest regulation criteria even when the possible effects of the confounding variables ('selection effects') are controlled more thoroughly. A further analysis revealed that under WFH employees reported a shorter total rest break duration per day and being interrupted more frequently during rest breaks or having to skip rest breaks more often than employees without WFH. However, despite these differences in rest break behavior between WFH and office work, they do not translate into increased risks for more violations of German rest break regulation criteria.

Noncompliance with German rest break regulation criteria and health complaints

Table 4 summarizes the crude and adjusted odds ratios for physical and mental health complaints.

We found that the sum score of violations against German rest break regulation criteria related to more mental health complaints, both for exhaustion and depressive mood as outcomes. For exhaustion, we found dose response relationships between the number of violated criteria ($OR_{adjusted}$ (0 vs. 1) = 3.1, $OR_{adjusted}$ (0 vs. 2) = 3.46, $OR_{adjusted}$ (0 vs. ≥3) = 3.69). For depressive mood, we found an increased risk when reporting three or more violated criteria ($OR_{adjusted}$ = 2.61).

Reporting three or more violated criteria of mandatory rest break behavior was also related to higher risk of reporting muscular tension (OR_{crude} = 2.39) but this effect dropped to insignificance when controlling for WFH and the other confounders. Reporting three or more violated criteria was not significantly related to headache in the crude model but this relationship became significant in the fully adjusted model ($OR_{adjusted}$ = 3.11).

When considering the crude relationships between violations against each of the six single criteria and physical health complaints, leaving the VDU workplace not regularly and/or not taking short rest breaks (criteria F) related to higher risk of muscular tension (OR_{crude} = 1.52) and headache (OR_{crude} = 1.92). However, both relationships were no longer significant when adjusting for violations against other criteria, WFH and the other controls. In contrast to this, we found robust relationships between skipping breaks (criteria D) and risk of headache ($OR_{adjusted}$ = 2.38).

When considering mental health complaints, reporting to take breaks that are too short (criteria A) related to higher risks reporting exhaustion (OR_{crude} = 2.39) and depressive mood

(OR_{crude} = 2.39) but these effects became insignificant in the fully adjusted model (other rest break criteria, WFH and controls). A similar pattern was found for reporting frequent break interruptions (criteria C) and risk of exhaustion (OR_{crude} = 1.73, $p < .05$; $OR_{adjusted}$ = 1.81, $p = .066$).

Moreover, we found that WFH was associated with an increased risk reporting muscular tension (OR_{crude} = 1.81/1.81, $OR_{adjusted}$ = 1.95/1.93) in both models (model using single criteria and model using the sum score).

Table 4: *Results of Logistic Regression Analyses Predicting Physical and Mental Health Complaints by Violated German Rest Break Regulation Criteria and WFH*

Violation of rest break regulation criteria	Ref.	Crude		Adjusted		Crude		Adjusted	
		OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Physical health outcomes		Muscular tension				Headache			
M1: Specific risks + WFH									
(A) Total break duration	No/yes	1.01	[0.45, 2.26]	0.87	[0.29, 2.58]	1.43	[0.56, 3.68]	1.48	[0.38, 5.77]
(B) Single break duration	No/yes	1.03	[0.52, 2.03]	1.13	[0.45, 2.81]	1.08	[0.46, 2.54]	0.66	[0.19, 2.27]
(C) Interruptions	No/yes	1.18	[0.69, 2.03]	1.11	[0.61, 2.01]	1.16	[0.59, 2.27]	1.01	[0.47, 2.14]
(D) Missing breaks	No/yes	1.20	[0.67, 2.12]	1.06	[0.57, 1.99]	**2.10**	[1.12, 3.96]	**2.38**	[1.16, 4.92]
(E) Unscheduled, unpredictable	No/yes	0.97	[0.68, 1.40]	1.02	[0.69, 1.51]	0.89	[0.56, 1.41]	0.93	[0.56, 1.52]
(F) Not leaving VDU + no short rest breaks	No/yes	**1.52**	[1.02, 2.27]	1.37	[0.90, 2.09]	**1.92**	[1.08, 3.42]	1.70	[0.93, 3.09]
WFH	No/yes	**1.81**	[1.23, 2.66]	**1.95**	[1.30, 2.91]	1.05	[0.64, 1.72]	1.13	[0.67, 1.91]
M2: Cumulated risks + WFH									
Sum score of violations (A-F)	0 vs 1	1.97	[0.95, 4.11]	1.95	[0.92, 4.16]	1.64	[0.60, 4.47]	2.00	[0.71, 5.63]
	0 vs. 2	1.70	[0.82, 3.51]	1.75	[0.83, 3.70]	1.27	[0.47, 3.48]	1.62	[0.58, 4.57]
	0 vs. ≥3	**2.39**	[1.07, 5.33]	2.16	[0.95, 4.93]	2.68	[0.94, 7.69]	**3.11**	[1.05, 9.22]
WFH	No/yes	**1.81**	[1.23, 2.66]	**1.93**	[1.29, 2.89]	1.05	[0.64, 1.72]	1.18	[0.70, 1.97]
Mental health outcomes		Exhaustion				Depressive mood			
M1: Specific risks + WFH									
(A) Total break duration	No/yes	**2.39**	[1.06, 5.34]	1.81	[0.50, 6.60]	**2.30**	[1.01, 5.22]	2.08	[0.72, 6.03]
(B) Single break duration	No/yes	1.21	[0.60, 2.44]	0.94	[0.34, 2.61]	1.52	[0.77, 2.98]	0.85	[0.35, 2.08]
(C) Interruptions	No/yes	**1.78**	[1.03, 3.08]	1.81	[0.98, 3.34]	1.49	[0.87, 2.56]	1.33	[0.74, 2.39]
(D) Missing breaks	No/yes	1.09	[0.60, 1.99]	0.76	[0.38, 1.51]	1.25	[0.70, 2.20]	1.05	[0.56, 1.96]
(E) Unscheduled, unpredictable	No/yes	1.44	[0.97, 2.14]	1.33	[0.87, 2.02]	1.35	[0.93, 1.96]	1.31	[0.89, 1.92]
(F) Not leaving VDU + no short rest breaks	No/yes	1.23	[0.80, 1.89]	1.18	[0.76, 1.83]	1.32	[0.88, 1.98]	1.25	[0.83, 1.88]
WFH	No/yes	1.04	[0.69, 1.57]	1.05	[0.68, 1.62]	0.97	[0.65, 1.43]	0.95	[0.64, 1.42]
M2: Cumulated risks + WFH									
Sum score of violations (A-F)	0 vs 1	**3.23**	[1.21, 8.66]	**3.10**	[1.15, 8.34]	1.42	[0.68, 2.98]	1.48	[0.70, 3.09]
	0 vs. 2	**3.67**	[1.38, 9.75]	**3.46**	[1.30, 9.25]	1.57	[0.76, 3.26]	1.62	[0.78, 3.36]
	0 vs. ≥3	**4.17**	[1.48, 11.77]	**3.69**	[1.28, 10.69]	**2.51**	[1.13, 5.59]	**2.61**	[1.17, 5.85]
WFH	No/yes	1.04	[0.69, 1.57]	1.05	[0.69, 1.59]	0.97	[0.65, 1.43]	0.96	[0.65, 1.43]

Note. n = 534, WFH = working from home, OR = odd ratio, 95% CI = 95% confidence interval of OR, M = model, Ref = reference category, VDU = visual display workstation. Adjusted models include gender, age, children at home, working hours, display screen work, amount of client contacts per day, supervisory role, and for specific break violation remaining criteria. 95% CIs excluding '1' are significant with p < .05 (boldface).

In sum, our results suggest that violations against mandatory German rest break regulation criteria relates to risk of reporting exhaustion in a dose-response-relationship and to risk reporting depressive mood and headache but only if noncompliance with three or more criteria is reported. Skipping breaks frequently relates to risk of headache. Moreover, WFH increases risk reporting muscular tension.

Discussion

We examined how WFH use and WFH frequency relate to violations of six criteria for rest break organization according to German regulation (German Working Hours Act and the German Workplace Ordinance). As part of these analyses, we additionally report prevalence data for noncompliance with these legal requirements. Moreover, we investigated if WFH (frequency) and noncompliance with mandatory rest break rules increase the risk for the experience of physical and mental complaints. We collected study data in a cross-sectional survey of German employees working in public administration prior to/during the second (German) wave of the COVID-19 pandemic.

Relationships between WFH and rest breaks

Ninety-two percent of the employees reported at least one violation of mandatory rest break criteria, 57% two or more. The most common problems were missing workstation changes (leaving the VDU workplace regularly), a lack of short rest breaks and rest breaks that were unpredictable regarding timing and duration. In addition, but to less extent, rest break interruptions and skipping rest breaks were reported. Surprisingly, we did not found that WFH or WFH frequency related to violations of criteria according to German rest break regulation even when controlling for confounding variables or selection effects in workplace arrangements. However, when neglecting these cutoffs according to national regulation and examining relationships using the full-scale responses, WFH related to shorter total rest break duration and a higher frequency of interrupted or skipped rest breaks. Our results are therefore consistent with what other studies found: WFH is associated with increased risks of unfavorable rest break organization (Bloom et al. 2015; Boltz et al. 2022; Guler et al. 2021; Smite et al. 2023). However, risks from WFH did not translate into more violations of occupational health and safety standards. This is in contrast to earlier study findings reported by Degenhardt et al. (2014). We think that the organizational context might explain these results. The employees in our study were all employed in public administration, whereas Degenhardt et al. (2014) surveyed employees from different sectors. Private organizations seem to violate legal occupational health and safety reg-

ulations (e.g. mandatory workplace risk assessment; Beck/Lenhardt 2019) more often than public companies and, in addition, their management practices have been described as more stressful (Bhui et al. 2016). However, giving more credit to the potential role of organizational context when analyzing WFH and rest break behavior is some avenue for further research. Moreover, our data indicated some floor and ceiling effects. For instance, rest break duration was rather long on average and other problems of rest break organization were not so common. Therefore, employees might not have changed their rest break behavior so much when starting to WFH.

In our study, we also identified some employee variables that related to poor rest break behavior. For instance, being female and having children were two relevant demographic variables relating to more VDU work, fewer short rest breaks, and more break interruptions. The literature on these factors has been inconsistent so far (Wendsche/Lohmann-Haislah 2016) but at least one study showed that females have a higher risk of skipping rest breaks compared to males (Wendsche/Lohmann-Haislah 2018). We think that the pandemic situation might have further shaped our results. In Germany, mainly female employees had to take on childcare in families during the COVID-19 pandemic (Kohlrausch 2021). An US study found female employees more frequently reporting nonwork breaks (e.g., for family responsibilities) when WFH during the pandemic (Leroy et al. 2021). Thus, independent from work location, using specific boundary management strategies might be necessary in order to balance work and nonwork (e.g., family) responsibilities (Allen et al. 2021) while reducing risks of impairing their own recovery. In addition, we found long working hours, a supervisory role, and fewer client contacts as risks for rest break behavior. This is in line with other study results (Wendsche/Lohmann-Haislah 2016, 2018). More specifically, employees who work in customer service have a highly scheduled day due to the nature of the job, as customer appointments, for example, are scheduled in advance. In contrast, office employees without client contacts have to plan the timing of their work tasks and breaks themselves to a much greater extent. In the future, it would be interesting to investigate whether electronic systems, for instance, can support the management of these requirements.

Other scholars have recommended also investigating potential effect of WFH frequency (Allen et al. 2015, Gajendran/Harrison 2007). However, the results were quite inconsistent and ranged from results showing WFH effects but no additional effects for extent (Wöhrmann/Ebner 2021) to linear and nonlinear relationships. In our study, we found no further effects of WFH frequency in relation to noncompliance with rest break regulation. However, analyses on a single item level with uncategorized raw data revealed substantial associations supporting positive, negative and level effects of WFH for rest break behavior. For instance, on the one hand, it seems that employees sit at their screens even longer when the WFH frequency is high. Organizations should therefore consider how they might better prevent prolonged sitting among individuals with high WFH doses, for example, by changing tasks or providing information on how to plan physical activity during the workday. On the other hand, higher WFH frequency also seems to be associated with benefits such as longer breakfast breaks and fewer break interruptions. In addition, employees with a low and high WFH frequency also seem to schedule their rest breaks better. In sum, these results suggest that it is useful to study WFH frequency as moderating variable of WFH effects further.

WFH and rest breaks in relation to health

We found, consistent with numerous prior studies (Hoe et al. 2018; Jun et al. 2017; Luger et al. 2019; Wendsche/Lohmann-Haislah 2016; Waongenngarm et al. 2018), that poorly designed rest breaks increase the risks of mental discomfort (i.e. exhaustion, depressive mood) and, to less extent, of physical discomfort (i.e., headache). This is also consistent with other study results involving employees who worked in the office or from home during the pandemic (Aegerter et al. 2021; Guler et al. 2021; Muniswamy et al. 2021; Smite et al. 2023). However, these other studies mainly focused on individual aspects of rest break design and neglected criterion-based measurement against legal requirements. Our results indicate that health is mainly affected by the accumulation of various violations regarding existing rest break rules. Individual aspects of break design tend to have a smaller predictive value (i.e., skipping break explained incremental variance in headache). This suggests that aspects of rest breaks organization should be analyzed comprehensively as part of the mandatory psychosocial risk assessment (Kittelmann et al. 2021), and that this should be based on minimum legal requirements.

Our results supported WFH relating to physical complaints (i.e., muscular tension) but not to mental complaints. This is consistent with findings from other studies that showed that WFH might have no, positive or negative effects on health (Allen et al. 2015; Chirico et al. 2021; Oakman et al. 2020; Tavares 2017). For our sample, we think that it was mainly the unfavorable ergonomic workplace design that caused these WFH effects. Many of the employees had to use their own work equipment at home during the pandemic. Work was often not performed with ergonomic office equipment because due to the high request, companies were not able to purchase enough of it during the pandemic. Therefore, our results support earlier assumptions that external factors (e.g., ergonomic workplace design) determine WFH effects on health. Overall, this suggests that independent of whether they have arranged WFH with the employee rather short-term by agreement or long-term by contract, organizations need to ensure that an ergonomic workplace design is made possible for WFH. In addition to providing material support (e.g. office furniture, ergonomic computer workstations), employees should also receive regular instruction on ergonomic working practices. These practices will be helpful in reducing risk of physical complaints that might develop from WFH.

Study limitations

The following limitations of our study have to be considered. Our results are cross-sectional in nature. Therefore, a causal interpretation of results and relationships between variables is not warranted. In future, longitudinal investigations might provide some more clarity here. Such studies, for instance, might use discontinuous growth modeling (Bliese et al. 2017) in order to study how changes from office work to WFH (or vice versa) or between different intensities of WFH affect rest break behavior and health.

Another limitation concerns our specific sample. The low prevalence of high frequent WFH behavior might have masked stronger effects on the outcomes because of low statistical power. However, our prevalence estimates were similar to that from a representative German survey in 2019 (Backhaus et al. 2020). One approach would be to perform our analyses again with

large-scale data from the 2017-second-wave of the BAuA-WorkingTime Survey (in extension to Wöhrmann/Ebner 2021), in which at least in some aspects of rest break behavior were assessed (e.g., rest break duration, skipping breaks, and break interruptions). Moreover, the public organizations in our sample had a well-developed health management system that was strictly compliant with the legal requirements for occupational health and safety. This explains why the prevalence of noncompliance with mandatory break behavior was relatively low. Most employees had highly routinized work tasks. Therefore, future studies on this topic should focus on employees with jobs that are more complex or that work in organizational cultures that are more competitive on costs of recovery (e.g., pressure to produce, Patterson et al. 2005; overwork climate, Mazzetti et al. 2016).

In our study, the possible moderating role of WFH experience was not investigated. For example, Gajendran and Harrison's (2007) meta-analysis showed that beneficial effects (i.e., work–family conflict and role stress) increase with WFH experience. In this line, it would be interesting to learn more about the role of transition phases to WFH and related adaptation processes on rest break behavior and health.

Finally, the type of variable assessment needs to be considered. The questionnaire design might produce a common method bias, which could have produced inflated correlations. Future studies might assess objective data (e.g., actual break behavior, physiological health outcomes) and try to disentangle the behavior and the experiences on days with and without WFH. This is also necessary because in our study we assessed general rest break behavior independent of the workplace context. In addition to the abovementioned longitudinal approaches analyzing effects of changes in WFH behavior between assessments, future studies might survey employees separately regarding their rest break behavior on WFH and office workdays (i.e., using a reference-shift approach). Moreover, data from experience sampling studies would allow investigating employees' rest break behavior on a within-person level and studying effects of daily work location use (also in relation to the development of daily health complaints).

Practical implications

In terms of practical implications, our findings suggest that, independent of office work or WFH arrangements, organizations and employees should be more sensitive and alert regarding the compliance with mandatory rest break behavior in Germany. Only few employees reported no concerns in terms of full compliance. Our results show that an accumulation of violations with respect to the design criteria rather than the violation of individual criteria leads to health risks. Therefore, it is important to optimize rest break organization from a holistic perspective.

The following points should be considered. First, employees should be educated about the regulations. Second, very common problems with break organization should be addressed first. In our study, this concerned the scheduling of breaks, the implementation of task changes (leaving VDU workplace) and short rest breaks during work, and the prevention of break interruptions or the skipping of breaks. Although studies have shown that rest break behavior and recovery behavior can be improved by trainings (Karabinski et al. 2021; Verbeek et al. 2019), it would be more sustainable to identify and eliminate the causes of problematic behavior. Work factors that impair recovery from work are high time pressure, high emotional demands, many

work interruptions, high multitasking demands, and on-call duties (Wendsche/Lohmann-Haislah 2018). The Federal Institute for Occupational Safety and Health has recently published some work redesign suggestions for improvement (Kittelmann et al. 2021). In relation to our results, it will be challenging to integrate more task changes into work. On the one hand, increasing digitization has often reduced them, but on the other hand, digital technologies enable or facilitate working from home. Therefore, employees should be encouraged to plan their rest breaks more consciously and to better monitor and control their rest break behavior. A high recovery-related self-efficacy might be a precondition here, since positive attitudes and high control regrading rest breaks as well as a strong rest break intention have been identified as drivers of break behavior (Blasche et al. 2021). Digital tools for time and rest break management (also including time monitoring) might be supportive here (Wendsche/Lohmann-Haislah 2017). Finally, we also found specific employee characteristics related to more problematic rest break behavior (i.e., gender, having children, supervisory role, long working hours, and fewer interactive tasks). Therefore, organizations might identify such risk groups and provide tailored support in helping them to get sufficient time for rest breaks (e.g., coaching, trainings, and information material).

In our study, WFH related to physical health complaints as an independent factor. We could not identify the cause of this relationship here. However, prior studies reported bad ergonomic equipment and workstation design as contributing factors (Allen et al. 2015; Vartiainen 2021). Employees therefore need support from their organization in arranging ergonomic workplaces at home (e.g., ergonomic VDU station, ergonomic chair or office table).

Conclusions

According to the results of this study, WFH is not related to a noncompliance with mandatory rest break behavior according to Germany legislation but is associated with a risk of experiencing musculoskeletal complaints. Our findings indicate that organizations should pay more attention in increasing employees' compliance with standards according to national break regulations since this can reduce risks for mental health complaints.

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Appendix

Appendix 1: *Descriptive Statistics for Single Item Responses Depending on WFH Status*

		Total sample (n = 534)					No WFH (n = 391)					With WFH (n = 143)						
					Percentile					Percentile					Percentile			
	Responses	Range	*M*	*SD*	25%	75%	Range	*M*	*SD*	25%	75%	Range	*M*	*SD*	25%	75%	t (532)	p
(A) Total break duration																		
Duration breakfast breaks [min]	free	0-30	3.79	6.57	0	10	0-30	3.86	6.56	0	10	0-30	3.50	6.50	0	5	0.57	.570
Duration lunch break [min]	free	0-70	29.44	7.95	30	30	0-60	29.53	8.21	30	30	0-70	29.23	8.1	30	30	0.38	.704
Total break duration [min]	free	0-120	49.19	16.08	40	60	5-120	49.97	16.15	40	60	0-110	46.87	15.67	40	60	**1.98**	**.049**
(C) Break interruptions																		
How often do you find yourself interrupting your rest break due to work issue?	1-5 [a]	1-5	2.33	0.89	2	3	1-5	2.27	0.91	2	3	1-4	2.50	0.82	2	3	**-2.70**	**.007**
How often does it happen that you have to interrupt or shorten your rest break?	1-5 [a]	1-5	2.25	0.79	2	3	1-5	2.20	0.81	2	3	1-4	2.38	0.73	2	3	**-2.34**	**.020**
(D) Skipping of breaks																		
How often do you miss rest breaks on workdays with more than six hours?	1-5 [a]	1-5	2.11	1.00	1	3	1-5	2.03	0.98	1	3	1-5	2.41	1.06	2	3	**-3.82**	**.001**

(Continued on the next page)

Appendix 1 (continued)

		Total sample (n = 534)					No WFH (n = 391)					With WFH (n = 143)						
					Percentile					Percentile					Percentile			
	Responses	Range	*M*	*SD*	25%	75%	Range	*M*	*SD*	25%	75%	Range	*M*	*SD*	25%	75%	t (532)	p
(E) Scheduled/predictable breaks																		
When I start work, I know when I will take my rest breaks.	1-5 [b]	1-5	2.83	1.30	2	4	1-5	2.84	1.34	2	4	1-5	2.77	1.19	2	4	0.54	.590
At the start of work, it is specified how long I will take my rest breaks.	1-5 [b]	1-5	3.22	1.33	2	4	1-5	3.27	1.35	2	4	1-5	3.06	1.27	2	4	1.60	.109
(F) Leaving VDU workstation and/or short rest breaks																		
How often do you switch from screen to other work activities?	1-5 [a]	1-5	2.42	0.86	2	3	1-5	2.43	0.86	2	3	1-5	2.38	0.86	2	3	0.51	.607
How often do you interrupt your work with short rest breaks?	1-5 [a]	1-5	2.40	0.98	2	3	1-5	2.39	0.98	2	3	1-5	2.43	1	2	3	-0.37	.714

Note. [a] 1 (never) to 5 (always), [b] 1 (strongly disagree/does not apply) to 5 (strongly agree/is completely true'). WFH = working from home. Significant mean differences ($p < .05$) between no WFH and with WFH are in boldface.