



# Remote Work and the Psychosocial Work Environment: The Role of Contact<sup>1</sup>

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## ABSTRACT

Remote work is fundamentally changing the organization of work, replacing the physical work environment of the office and creating a spatial distance between colleagues. This article investigates the relationship between remote work frequency and three aspects of the psychosocial work environment (quantitative job demands, control, and social support) and to which extent the relationship is mediated by the frequency of contact with supervisors and co-workers. The Norlife Remote Work - Longitudinal Study (NorRemo-LS) of Norwegian employees ( $n = 2553$ ) across four waves between February 2021 and September 2022 is analyzed using general structural equation modeling (GSEM).

The results show that the extent of remote work is associated with increased schedule control. Remote work may diminish employee control and increase quantitative job demands if employees have less frequent contact with their supervisor. Less frequent contact with co-workers not only entails lower job control and less social support but also lower quantitative demands.

## KEYWORDS

*autonomy / contact / control / demand / psychosocial work environment / support / telework*

## Introduction

**R**emote work, or telework, is fundamentally changing the organization of work. Remote work occurs when employees carry out paid work away from the premises of the employer, often in their own home and during regular work hours, using modern communication information technology such as asynchronous (e.g., email) and synchronous virtual communication (e.g., virtual meetings) (ILO 2020). Remote work thus replaces the shared physical work environment of the office and increases the spatial distance between co-workers and supervisors. In 2020, remote working greatly increased due to the COVID-19 pandemic social distancing measures of mandatory remote work. Post-pandemic remote work often implies employees alternating

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between working at home or another location of their own choice and their employer's office (Peters et al. 2022). The substantial pandemic-related increase in remote working, which affected half of the labor force (ILO 2020; Ingelsrud et al. 2022), is likely to have impacted the work environment of workplaces continuing to offer remote work arrangements after the pandemic. The increased remote work due to COVID-19 mandates offer a naturalistic setting to examine the consequences of remote work, which is not as affected by selection bias, as former studies might have been.

Examinations of the consequences of working remotely yield ambiguous findings in general, suggesting that remote work can have advantages, such as increasing job autonomy (Gajendran et al. 2024), job satisfaction (Bloom et al. 2024), and work-life balance (Laß & Wooden 2023), but also disadvantages, such as increasing work intensification (Kelliher & Anderson 2010) and social isolation (Charalampous et al. 2019). There is, however, limited and inconclusive evidence about *whether* and *how* the psychosocial work environment (i.e., job control, job demands, and social support) (Vleeshouwers et al. 2022) was affected during and after the pandemic. Despite strong assumptions that remote work might impact workers psychosocial work environment due to their reduced contact with co-workers and supervisors (e.g. Charalampous et al. 2019; Gajendran & Harrison 2007; Sardeshmukh et al. 2012), this has rarely been tested. Since strong evidence associates psychosocial work factors, such as high job demand, low control, and support, with health impairments, such as burnout, sickness absence, and mental health disorders (Finne et al. 2014; Leka & Jain 2016; Nieuwenhuijsen et al. 2010; Stansfeld & Candy 2006), such knowledge is crucial, as it might potentially affect a large part of the labor force.

The current study thus investigates whether employees' remote work frequency affects three aspects of their psychosocial work environment. We use the Norlife Remote Work - Longitudinal Study (NorRemo-LS) answered by Norwegian employees ( $n = 2836$ ) across four waves during and after the COVID-19 pandemic (between 2021 and 2022). Based on the demand-control-support model (Karasek & Theorell 1990), we include six measures, two for each studied aspect of the work environment: 1) *Work control* (i.e., influence at work and schedule control); 2) *Quantitative job demands* (i.e., quantitative job demands and work hours); and 3) *Social support* (i.e., co-worker and supervisor social support). Moreover, we investigate to which extent the overall (total) relationship between remote work and the psychosocial work environment can be explained (i.e., are mediated) by employees' frequency of contact with supervisors and co-workers using generalized structural equation models (GSEMs). The longitudinal design provides a more robust knowledge about the consequences of remote work for central indicators of employees' psychosocial work environment, compared to former descriptive cross-sectional descriptive studies (e.g. Gajendran et al. 2024; Vleeshouwers et al. 2022).

The theoretical framework guiding the current study stems from the socio-technical system initiative and quality of working life research. The theory emphasizes the interplay between the human, technical, and organizational aspects of work and work organizations on both efficiency and employee outcomes. The STS perspective is thus relevant for the interplay between remote work arrangements, psychosocial work environment, and work-related contact.

## Theoretical framework

*The socio-technical systems (STS) theory* sees work organizations as consisting of social and technical systems that are mutually dependent and influence each other. The perspective has been considered useful for researching remote work (Bélanger et al. 2013), as it allows researchers to study the interaction between the technical (e.g., the ICT infrastructure that allows remote work), personnel (e.g., employees' motivation to work remotely, attitudes, and beliefs about expectations), and organizational structure of work (e.g., complexity and standardization of work tasks, location and degree of formal decision making) when employees are working remotely. Following the STS perspective, remote work is not only another context in which work takes place in addition to the employers' workplace but also an aspect of work itself. As such, remote work possibly changes the way work is done and might also be a mechanism through which workers cope with work (Bélanger et al. 2013). Using the STS perspective, Bentley et al. (2016) argued that remote work efficiency is impacted by the fit between remote work, available technology, the environment, and the organization. Specifically, they found that the association between organizational social and technical support and positive outcomes was mediated by social isolation. According to STS theory (Bélanger et al. 2013), we regard remote work intensity, the frequency of remote work, as an aspect of the employees' working conditions, influencing not only the work location at given times but also employees' psychosocial work environment in general.

## Remote work and the psychosocial work environment

An important aspect of remote working is that employees are physically separated from the office space, their co-workers, supervisors, and the social setting at that workplace. Although remote work offers the possibility to communicate digitally, research suggests several disparities between physical and digital contact and shows that working remotely can lead to a feeling of isolation (Gajendran et al. 2024). It is likely that contact with the workplace is less frequent when working remotely than when working at the employer's office. As the frequency of daily contact with co-workers and supervisor is likely to be reduced, there is a high probability that remote workers will experience a changed psychosocial work environment (e.g. Charalampous et al. 2019; Gajendran & Harrison 2007; Sardeshmukh et al. 2012).

The psychosocial work environment entails essential factors involved with the psychological processes associated with the social environment of work (Stansfeld & Candy 2006). The job demand-control-support model (Karasek & Theorell 1990) focuses on three of the key aspects of the psychosocial work environment: job demands, job control, and social support. In the following, we present the relationship between remote work and these three aspects of the psychosocial work environment, and how they are mediated through contact frequency with co-workers and supervisors.

## Employees' influence at work and schedule control

Increased job autonomy, both 'influence at work' and 'schedule control', has been argued to be among the most beneficial effects of remote work (Choi et al. 2008; Gallie 2013; Guest et al. 2022). Influence at work can be defined 'the degree to which the employee can influence aspects of work itself, ranging from, e.g., planning of work to e.g., the order of tasks' (Burr et al. 2019: 15), and schedule control can be defined as 'the degree to which employees can influence 'breaks, length of the working day, or work schedules' (Burr et al. 2019: 15). Employees' control over decisions related to their work is central for job quality and work productivity (Tejero et al. 2021; Vander Elst et al. 2017).

While some research reports no significant associations between remote work working and influence at work (Sewell & Taskin 2015; Thulin & Vilhelmson 2022), studies have primarily shown an increased sense of job control when working remotely. For instance, a recent meta-analysis summarizing 35 studies with more than 15,000 individuals found a positive relationship between remote work and autonomy (Gajendran et al. 2024).

Working remotely limits supervisors' opportunity to physically monitor employees, which might give employees a heightened sense of autonomy (Allen et al. 2003; Sardeshmukh et al. 2012). Research has indeed shown that remote work increased employees' influence at work through a greater sense of prioritization ability between tasks and that employees were more compelled to take personal initiative when working from home (Dubrin 1991; Metselaar et al. 2023). Remote work might also increase employees' schedule control, especially over breaks and when to start and finish their workday (Dubrin 1991; Metselaar et al. 2023). Moreover, employees can easily transition back and forth between the work and home domains without the cost of a daily commute. Based on the arguments and studies presented above, we therefore expect that:

- H1a: *The total relationship between remote work frequency and influence at work is positive.*
- H1b: *The total relationship between remote work frequency and schedule control is positive.*

## Remote work, quantitative job demands, and work hours

Remote work has been suggested to impact quantitative job demands by intensifying work (Kelliher & Anderson 2010; Sewell & Taskin 2015). Quantitative job demands can be defined as '...how much one has to achieve in one's work. [...] assessed as an incongruity between the amount of tasks and the time available to perform these tasks in a satisfactory manner' (Burr et al. (2019: 15).

Existing quantitative studies empirically testing the relationship between remote work and perceived quantitative job demands and work hours are scarce and yield ambiguous findings. Cross-sectional studies have found lower quantitative job demands among remote workers (Eguchi et al. 2022; Rodríguez-Modroño 2022; Sardeshmukh et al. 2012), higher quantitative demands among remote workers (Knardahl & Christensen 2022; Wöhrmann & Ebner 2021), and no significant differences between

remote workers and their colleagues (Guidetti et al. 2022). Remote working is related to fewer active working hours in some findings (Giménez-Nadal et al. 2020; Restrepo & Zeballos 2020; Shimura et al. 2021), and to more active working hours in others (Hill et al. 2010; Nätti et al. 2011; Peters & van der Lippe 2007). Longitudinal studies also reveal mixed findings, with Yeves et al. (2022) reporting a positive relationship between remote work and perceived work overload six months later, and Shimura et al. (2021) reporting a negative relationship between remote work and job stressors one year later. A recent longitudinal study showed that remote work frequency was related to regularly working outside normal hours (Laß & Wooden 2023). One experimental study revealed that remote workers increased their productivity by working more minutes per shift and being more efficient in handling incoming calls (Bloom et al. 2014).

Working remotely might reduce quantitative job demands for multiple reasons. First, when employees are in a different physical location than their co-workers, they are more shielded from work-related distractions (Sardeshmukh et al. 2012). Furthermore, remote workers may be overlooked when work tasks are distributed between co-workers, or if sudden demands occur at the physical workplace. Receiving fewer unexpected tasks would decrease the quantitative demands and work hours (Sardeshmukh et al. 2012). Still, remote working may also lead to increased quantitative job demands and prolonged work hours. Employees might feel obligated to intensify their efficiency or extend their availability in exchange for the freedom to organize their own workday (Cañibano 2019). Some findings indicate that remote workers increase their work efforts by working longer hours to counter stereotypes of being less committed and devoted to their work (Kelliher & Anderson 2010; Sewell & Taskin 2015). Also, when working remotely, the time allocated to formal virtual meetings might expand, to make up for the decrease in informal ‘passing by’ communication. Still, fewer distractions and informal chats with work members might be replaced by more distractions from family members (Delanoeije et al. 2019). Additionally, research has shown that remote workers spend some of the time gained due to the reduction in commuting on extra work hours (Šmite et al. 2023).

Based on the arguments and inconclusive empirical findings presented above, we pose two competing hypotheses pointing in both directions regarding the association between quantitative job demands and work hours.

- H2a: *The total relationship between remote work frequency and quantitative job demands is positive.*
- H2ai: *The total relationship between remote work frequency and quantitative job demands is negative.*
- H2b: *The total relationship between remote work frequency and work hours is positive.*
- H2bi: *The total relationship between remote work frequency and work hours is negative.*

## Co-worker and supervisor social support

As an aspect of the psychosocial work environment, social support is beneficial for employees’ health (Taylor et al. 2002) and a significant predictor of job satisfaction

(Karasek & Theorell 1990). Social support from colleagues and supervisor, defined as the ‘employees’ impression of the possibility to obtain support from colleagues [immediate supervisor] if one should need it’, entails both emotional and instrumental support (Burr et al. 2019: 16). Social support at the workplace is likely to be affected by remote work if workplace contact is changed.

Bentley et al. (2016) showed that both technical support and organizational support, including social support, was associated with favorable employee outcomes among remote workers. One of the main concerns of remote working has been the risk of relational impoverishment (Gajendran & Harrison 2007), including social and professional isolation due to reduced contact with co-workers and supervisors (Charalampous et al. 2019; Gajendran et al. 2024). There seems to be a lack of recent studies examining the association between remote work and support from co-workers and supervisors (Vleeshouwers et al. 2022). There are some exceptions, but the field is dominated by cross-sectional studies and mixed findings. Some studies report lower levels of perceived social support (Knardahl & Christensen 2022; Sardeshmukh et al. 2012; Tejero et al. 2021; Vander Elst et al. 2017) or no significant differences (Bentley et al. 2016; Eng et al. 2010; Pulido-Martos et al. 2021) between remote workers and others. The few longitudinal studies also yield mixed findings. One longitudinal study found no significant difference in change in social support by frequency of remote work (Shimura et al. 2021). Another longitudinal study on a related topic suggested that full-time and part-time remote work increased professional isolation (de Vries et al. 2018).

The scarce evidence aside, several hypotheses about how remote work might affect perceived social support exists. First, remote work has been a trusted situation reflecting a good relationship with superiors, leading to strong associations between perceived social support and remote work. Gajendran & Harrison (2007) showed that any level of remote work intensity was associated with higher quality relationships with supervisors, but that high-intensity remote work was associated with lower quality relationships with co-workers. Supervisors may be seen as organizational agents, and support from supervisors might be interpreted as indicative of the organizations’ support for them (Rhoades & Eisenberger 2002). Still, co-workers may develop a social disconnection with their remote colleagues due to the physical distance making encounters more seldom (Collins et al. 2016). Face-to-face communication is reduced and possibly, but not necessarily, replaced with mediated communication. While formal meetings are likely to be upheld when working remotely, the support opportunities from informal encounters are likely reduced. The level of social support might be further reduced for full-time or prolonged remote work (Collins et al. 2016). The opposing findings regarding supervisor and colleague support in earlier cross-sectional research may have been indicative of a social selection into remote work. Considering that the widespread remote work due to the COVID-19 pandemic reduced selection, we find it likely that remote work has the same relation to supervisor and co-worker support:

*H3a: The total relationship between remote work frequency and social support from co-workers is negative.*

*H3b: The total relationship between remote work frequency and social support from supervisors is negative.*

## Can the relationship between remote work and psychosocial work environment factors be explained by the frequency of contact?

According to the STS framework, the interaction between the personnel, technical, and organizational substructures influence outcomes at the individual and organizational level (Bélanger et al. 2013). For instance, communication patterns may be influenced by colleagues alternating between remote and office-based work, influencing the psychosocial work environment. Sardeshmukh et al. (2012) argued that alterations in the psychosocial work environment due to remote work stems from the separation from others. Many of the arguments for why remote working might affect the psychosocial work environment presented in earlier research relates to the physical distance reducing or deteriorating the interaction with co-workers and supervisors. While formal interactions and meetings might be upheld or even increased for remote employees through ICT, informal and unplanned interactions are likely to decrease (Charalampous et al. 2019), potentially reducing the total frequency of interactions employees have with co-workers and supervisors. We define contact as interactions, formal and informal synchronous communication both in person and digitally (video, audio, or chatting/writing).

In earlier research, influence at work is argued to increase due to less contact with, and thus less opportunity for direct monitoring from supervisors (Allen et al. 2003; Kelliher & Anderson 2010; Sardeshmukh et al. 2012). Quantitative job demands are argued to decrease, as employees working remotely are not present to take on ad hoc tasks when they are distributed by supervisors or co-workers (Sardeshmukh et al. 2012). Moreover, remote workers likely have a lower frequency of contact with co-workers, contributing to reduced stress from physical meetings and interruptions (Fonner & Roloff 2010). The lack of contact with supervisor or colleagues is argued to increase work hours through increased availability to counteract any negative stereotypes regarding slacking of (Sewell & Taskin 2015). Considering social support, contact is pivotal in the argumentation that reduced face-to-face contact and interaction weaken the relational bonds that the employee has to co-workers and the workplace (Charalampous et al. 2019; Gajendran & Harrison 2007).

The reduced interaction with co-workers and supervisors is central in many of the arguments for why remote work might change the psychosocial work environment. Yet to our knowledge, none of the studies investigating the impact of remote work on the psychosocial work environment have empirically tested the importance of contact frequency with co-workers and supervisors for this relationship. Our hypothesis is that:

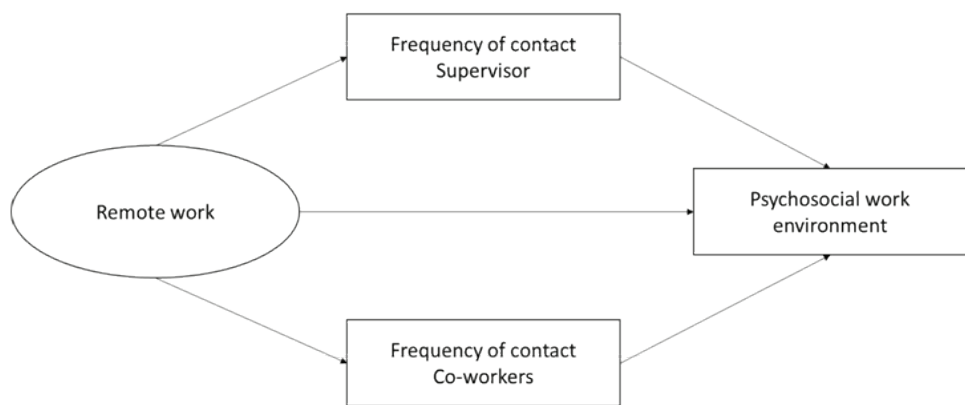
*H4: Frequency of contact with co-workers and supervisors mediates the relationship between remote work frequency and the psychosocial work environment factors.*

Figure 1 presents the full conceptual model.





**Figure 1** Conceptual model of the mediation of frequency of workplace contact (supervisor and co-worker) on the relationship between remote work frequency and psychosocial work environment.



The context

The current study is conducted in Norway, where working life is highly legislated with regards to workers’ rights, working conditions, and working time (Heiret 2012). Employees have the opportunity to utilize flexible arrangements (Nergaard et al. 2018) and family-friendly policies (Håpnes & Rasmussen 2011), and the Norwegian Work Environment Act (WEA) (Arbeidsmiljøloven) states that employers are responsible for ensuring a healthy physical and psychosocial work environment of their employees, also when they are working remotely. The work environment is characterized as open and trustful (Dølvik 2013), and Norwegian employees score high levels on autonomy and job satisfaction, as compared to other European countries (Aagestad et al. 2017).

Method

Design and procedure

This study was part of a larger project in which a representative sample of Norwegian employees were recruited from a national web panel provider, the Kantar web panel (not self-recruited). This resulted in the Norlife Remote Work - Longitudinal Study (NorRemo-LS). Employees were invited to answer a 20-minute survey about work with three follow-up surveys collected at six-month intervals from February 2021 to September 2022. After providing informed consent, respondents could opt-in to answer three follow-up surveys allowing researchers to combine the data from each wave. Respondents were matched by Kantar who handled all personal information. Respondents were included in the study if they (1) had the possibility to work remotely



and (2) worked remotely one full day or after working hours at least once every month. The questionnaire was held constant across all waves.

The four survey waves had different contexts regarding COVID-19 restrictions. In Norway, as in many other countries, remote work surged following the COVID-19 lockdown in March 2020 when the government issued a mandate requiring all employees with the opportunity for working remotely to do so. During the first survey wave in February 2021, most office workers had been working from home for extended periods since March 2020. The government still encouraged remote work, and many did, although it was not mandatory. During the second study wave, in August 2021, most adults were vaccinated, and society was re-opening. Remote work was still widespread, but companies were talking about bringing employees back to the office. However, following an upsurge of contagion, society was yet again locked down in January 2022 and remote work was mandated for those who could during the third study wave. The fourth wave of data was collected in September 2022 when COVID-19 was no longer declared a threat to society, and the level of remote work was considered normalized.

## Sample

The data collected comprised 5038 employees. Among these, 2041 (41%) responded to all four waves, 970 (19%) to three, 729 (14%) to two, and 1298 (26%) to one wave. In our analyses, we only included respondents who worked remotely at least monthly in each wave. This population comprised about half of the Norwegian working population at the time of the study, with little variation between survey waves. The analytical sample consists of 2553 employees included in at least two survey waves, contributing a total of 6270–6566 observations depending on the outcome variable analyzed.

## Measurements

**Remote work frequency** was measured with a single item: ‘How often do you work from home for the whole workday?’. The response scale had six points: ‘Every day’ (6), ‘Several days per week’, ‘One day per week’, ‘Monthly’, ‘More seldom’ to ‘Never’ (1).

Several measures of the psychosocial work environment: job autonomy, quantitative demands, and social support from co-workers and supervisor, were assessed using items from COPSOQ III (Burr et al. 2019; Llorens et al. 2019). These variables were computed as means, and respondents who had answered all the items of each variable received a valid score.

**Influence at work** was assessed with four statements on a 5-point scale (1 = ‘Never/hardly ever’ to 5 = ‘Always’) asking: (1) ‘Do you have a large degree of influence on the decisions concerning your work?’, (2) ‘Can you influence the amount of work assigned to you?’, (3) ‘Do you have any influence on what you do at work?’, and (4) ‘Do you have any influence on how you do your work?’. The Cronbach’s alpha in each wave ranged from 0.80 to 0.81.

**Schedule control** was measured by four out of five original statements used by Valcour (2007), who adapted the scale from Thomas & Ganster (1995). Four statements on a 5-point scale (1 = ‘None’, 5 = ‘A great deal’) asked ‘How much control do you have



over...': (1) 'when you begin and end each workday'; (2) 'the number of hours you work each week'; (3) 'when you can take a few hours off'; and (4); 'when you take vacations or days off'. The Cronbach's alpha in each wave ranged from 0.82 to 0.85.

**Quantitative job demands** were assessed by three statements on a 5-point scale (1 = 'Never/hardly ever' to 5 = 'Always') asking: (1) 'Is your workload unevenly distributed so it piles up?'; (2) 'How often do you not have time to complete all your work tasks?'; and (3) 'Do you get behind with your work?'. The Cronbach's alpha in each wave ranged from 0.80 to 0.83. Work hours was the second measure of job demands. The respondents reported their total weekly working hours including any paid or unpaid overtime. Work hours was included as a scale variable.

**Social support from co-workers and supervisor.** Respondents assessed two statements regarding co-worker and supervisor social support on a 5-point scale (1 = 'Never/hardly ever' to 5 = 'Always') asking: (1) 'How often do you get help and support from your co-workers (immediate supervisor), if needed?'; (2) 'How often are your co-workers (immediate supervisor) willing to listen to your problems at work, if needed'. The Cronbach's alpha in each wave ranged from 0.86 to 0.88 for support from co-workers. The corresponding numbers for support from supervisor were 0.82 to 0.83.

To assess the **frequency of contact with supervisor and colleagues**, respondents were asked to rate: 'How often during the workday do you talk to your supervisor/employer' and '... colleagues' on a 7-point scale: from 'Never' (1) to 'Several times a day' (7).

**Control variables.** Employees' socioeconomic position is related to psychosocial work environment factors (Stansfeld & Candy 2006) and the access to telework (Ingelsrud et al. 2022). To control for selection, we therefore include the following variables as controls in the analyses: educational level, age category ('below 30', '30–44', '45–59', '60+'), household composition (e.g., living with partner, children), having a leadership position, working fulltime vs. part-time, and a variable for industry with 21 categories.

## Analytical strategy

We examined direct and indirect paths between remote work frequency and psychosocial work environment indicators using the GSEM command of STATA<sup>1</sup>. All variables were measured in all waves. All included variables were constructed prior to analyses as a mean of the included items.

In the longitudinal panel data, time (survey waves) is nested within individuals. All models include a random intercept at the employee level. The GSEM utilizes variation both within and between respondents, which makes it an efficient model. The models analyze the association between remote work and the work environment at time *t* (e.g., remote work at wave 1 is compared to the work environment at wave 1), while the random intercept allows us to utilize the longitudinal data by accounting for time-constant individual differences between the participants. The models analyze each psychosocial work environment factor separately. The coefficient and confidence interval for the indirect and total relationships were calculated using the *nlcom* command in STATA.

As a first robustness check, for all models, we estimated each path separately using fixed effects (FE) OLS regression. We ran two separate analyses for the relationship between remote work and frequency of contact with (1) supervisors and (2) colleagues.

We then ran separate analyses for the relationship between each of the two frequency of contact variables and each of the six outcome variables (2 x 6 analyses), while controlling for remote work. Collectively, these 14 separate analyses replicate the SEM analyses with FE instead of random effects. The FE analyses only rely on within-person variance; each employee is only compared to themselves. We thus have control over any stable characteristics that affect both remote work frequency and psychosocial work environment factors (e.g., personality traits, stable quality of relationship with supervisor or co-workers).

As a second robustness check, we estimated cross-sectional SEM analyses, including only wave four, collected in September 2022, to investigate the associations using only post-COVID-19 data. We thereby investigate the probability that the results were unduly influenced by other aspects of the pandemic impacting both remote work frequency, the corresponding contact frequency and the psychosocial work environment factors.

Results

Table 1 provides descriptive statistics of the full study sample, remote sample, and the analysis sample at wave 1. Compared to the general employed population, the study sample was somewhat older and more educated. The attrition rate between the survey waves was also somewhat larger among the younger employees (Ingelsrud et al. 2022). In the analysis sample, the mean age was 46.8 years and 51% were male. The large majority (74%) had completed tertiary education. One-third had a management position, while 83% work full-time, 6% work part-time, and with missing information about work time for 12%. Remote work for full days was frequent, and 68% of the sample worked remotely several days per week or more often. At wave 4, the corresponding share was 35% (not shown), showing that remote work was still pronounced also after the COVID-19 lockdown. The analysis sample was similar to the full remote worker sample at wave 1, except that a higher share of the analysis sample had completed long tertiary education. The analysis sample worked remotely more often than the full remote sample at wave one.

**Table 1** Characteristics of the analysis sample, full remote worker sample, and full employee sample at wave 1.

	Analysis sample	Full remote sample	Full employee sample
Variable	Percent	Percent	Percent
N observations	2553	2930	5038
Remote work freq.			
Never	2%	5%	
More seldom	11%	18%	
Monthly	11%	10%	
One day per week	9%	8%	

(Continued)



Table 1 (Continued)

	Analysis sample	Full remote sample	Full employee sample
Several days per week	30%	26%	
Every day	38%	33%	
Gender			
Male	51%	51%	49%
Female	49%	49%	51%
Educational level			
Primary	2%	2%	4%
Secondary, general	8%	9%	10%
Secondary, vocational	8%	9%	16%
Higher vocational education	8%	9%	11%
Tertiary, up to four years	35%	35%	30%
Tertiary, more than four years	39%	36%	27%
Age group			
Below 30	7%	7%	8%
30-44	34%	33%	32%
45-59	43%	43%	43%
60+	16%	17%	17%
Household			
Partner, no children	35%	36%	
Partner and children	37%	37%	
Children	6%	6%	
Alone	19%	19%	
Other	2%	2%	
Management position			
Full time	83%	73%	
Part time	6%	5%	
Missing	12%	23%	

**Table 2** Means, standard deviations, and correlations among the study's main variables at wave 1

Variables	Mean	SD	1	2	3	4	5	6	7	8
1. Remote work freq.	4.67	1.44								
2. Influence at work	3.64	0.69	-0.03							
3. Schedule control	3.94	0.82	0.16***	0.43***						
4. Quantitative job demands	2.96	0.71	-0.03	-0.13***	-0.13***					
5. Work hours	39.68	8.11	-0.06**	0.06**	-0.05*	0.23***				
6. Supervisor support	3.79	0.91	0.03	0.42***	0.22***	-0.17***	-0.01			
7. Co-worker support	3.96	0.82	0.04	0.33***	0.13***	-0.13***	-0.02	0.55***		
8. Supervisor contact	4.84	1.23	-0.18***	0.14***	-0.01	-0.02	0.08***	0.33***	0.14***	
9. Co-worker contact	5.86	1.03	-0.26***	0.17***	-0.04*	0.09***	0.17***	0.16***	0.30***	0.39***

As Table 2 shows, the scores on the work environment factors are quite high, indicating a generally preferable psychosocial work environment among employees with the possibility of remote work. The intercorrelations between the study variables are reasonable and no hinder for a SEM analysis (Kline 2016: 71).

Table 3 shows the direct relationship between remote work and psychosocial work environment factors when the mediation through contact frequency with co-workers and supervisor was accounted for. A higher remote work frequency was associated with higher influence at work, more schedule control, and higher levels of supervisor and co-worker support. There was no direct association between remote work and quantitative job demands or work hours. A higher frequency of remote work was associated with less frequent contact with supervisors and co-workers. More frequent contact with supervisor was associated with higher influence at work, lower quantitative demands, and higher supervisor and co-worker support. More frequent contact with co-workers was associated with higher influence at work, higher quantitative job demands, more hours worked, and higher levels of supervisor and co-worker support.



**Table 3** The direct relationship between remote work, contact, and psychosocial work environment factors. GSEM analysis

Independent variable			Mediator		Dependent variable				
	M1: Supervisor contact	M2: Co-worker contact	Model 1: Influence at work	Model 2: Schedule control	Model 3: Quantitative job demands	Model 4: Work hours	Model 5: Supervisor support	Model 6: Co-worker support	
Remote work freq.	-0.17***	-0.214***	0.014*	0.026***	0.003	0.016	0.045***	0.043***	
M1: Supervisor contact			0.037***	0.011	-0.017*	-0.015	0.211***	0.037***	
M2: Co-worker contact			0.053***	-0.008	0.049***	0.681***	0.026*	0.202***	
Control variables									
Educational level (ref. Master's degree)									
Primary			-0.107	-0.090	-0.216**	-2.735**	0.105	-0.035	
Secondary, general			-0.178***	-0.040	-0.218***	-1.911***	-0.042	-0.050	
Secondary, vocational			-0.132**	-0.009	-0.271***	-2.232***	-0.028	-0.044	
Higher vocational education			-0.143***	-0.070	-0.169***	-1.358**	-0.099	-0.128**	
Tertiary, up to four years			-0.063*	-0.048	-0.134***	-1.383***	-0.036	-0.021	
Age group (ref. 45–59)									
Below 30			-0.072	-0.229***	-0.068	-1.036*	0.083	0.077	
30–44			-0.119***	-0.178***	0.048	-0.561*	0.001	0.050	
60+			0.045	0.115**	-0.12***	-0.964**	-0.061	-0.026	
Household (ref. Partner, no children)									
Partner and children			-0.023	0.033	0.001	0.450	-0.017	-0.022	
Children			-0.025	-0.045	-0.077	-0.114	-0.066	-0.129*	
Alone			-0.036	0.019	0.032	0.223	-0.062	-0.033	
Other			-0.157*	0.051	-0.065	-0.595	-0.098	0.030	

Table 3 (Continued)

	Model 1:	Model 2:	Model 3:	Model 4:	Model 5:	Model 6:
Management position (ref. other)	0.159***	0.062**	0.075***	2.033***	-0.088**	-0.101***
Part time (ref. full time)	0.032	0.022	-0.141***	-13.282***	0.092	0.0140
Missing	0.117***	0.101**	-0.036	-0.657*	0.008	0.069*
Industry (ref. Public central admin.)						
Childcare/education	-0.071	-0.701***	0.106*	1.28**	-0.096	-0.003
Health services	-0.072	-0.315***	0.078	0.382	-0.033	-0.080
Social services	0.130	-0.046	0.095	0.317	0.046	0.204*
Health care	0.134	-0.120	0.201	-1.23	-0.134	0.147
Defense/police/justice	0.086	-0.061	-0.017	1.684	0.082	0.034
Primary industries	0.035	0.193	0.296*	2.304	-0.002	-0.252
Manufacturing	0.089	0.041	0.059	1.087*	-0.001	-0.072
Building/construction	0.115*	-0.029	0.036	1.745**	-0.074	-0.107
Wholesale/retail	0.080	0.008	0.021	2.325***	-0.066	-0.001
Transportation	-0.057	0.005	0.012	2.614***	-0.054	-0.022
Culture/sports/org.	0.108*	-0.076	0.037	-0.415	-0.046	-0.025
Media/PR	0.102	-0.181**	-0.092	0.862	-0.154*	-0.264***
Research/analysis	0.259***	0.050	0.064	0.99	0.014	-0.082
Travel and hotel	0.046	-0.211	-0.184	1.783	-0.185	0.099
Restaurant/barns	0.142	0.378	0.119	0.092	-0.237	-0.458*
Telecom/IT	0.221***	0.103*	-0.105*	1.406**	0.198**	0.028
Finance/Insurance	0.053	-0.049	0.011	1.755**	0.032	0.012
Business services	0.185***	0.020	0.020	1.611**	-0.035	-0.006
Oil/ gas/energy	-0.043	-0.021	-0.017	0.815	-0.065	-0.023
Other	0.028	-0.094*	0.052	1.267***	-0.066	-0.069
N obs.	6539	6566	6563	6635	6290	6270

Note: Unstandardized coefficients. \*p < .05, \*\*p < .01, \*\*\*p < .001.



**Table 4** Structural model with direct, indirect, and total effects

Independent Mediator variable		Dependent variable					
		Model 1: Influence at work	Model 2: Sched- ule control	Model 3: Quantita- tive job demands	Model 4: Work hours	Model 5: Supervi- sor sup- port	Model 6: Co- worker support
Remote work							
Indirect relationship	M1: Supervisor contact	-0.006***	-0.002	0.003*	0.003	-0.036***	-0.006***
	M2: Co-worker contact	-0.011***	0.002	-0.010***	-0.146***	-0.006*	-0.043***
Direct relationship		0.014*	0.026***	0.003	0.016	0.045***	0.043***
Total relationship		-0.003	0.026***	-0.004	-0.127	0.003	-0.006

Note: Analyses are adjusted for educational level, age, household composition, leadership position, full-time/parttime position, and industry. Unstandardized coefficients. \*p < .05, \*\*p < .01, \*\*\*p < .001.

**Figure 2** Direct and indirect effects of remote work on psychosocial work environment indicators. Results from SEM analysis. Analyses are adjusted for educational level, age, household composition, leadership position, fulltime/parttime position, and industry. Unstandardized coefficients. \*p < .05, \*\*p < .01, \*\*\*p < .001

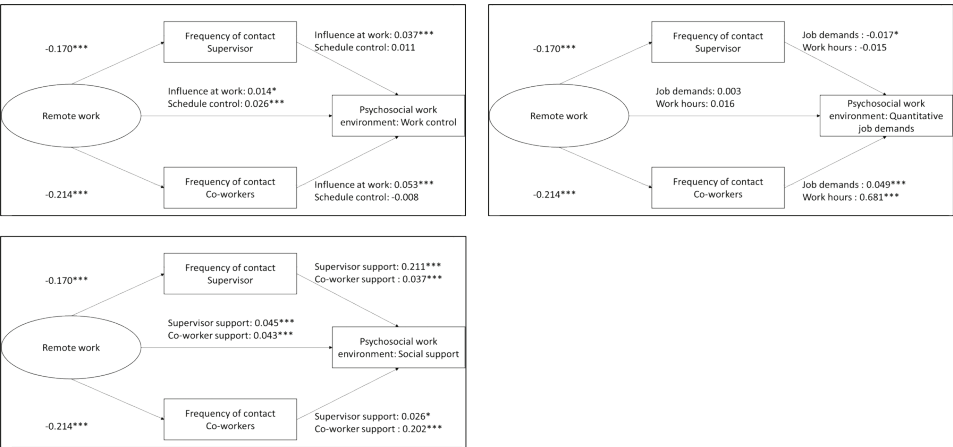


Table 4 shows the magnitude of the total (H1-H3), direct, and indirect (mediated) relationships between remote work and the psychosocial work environment variables via supervisor and co-worker contact (H4). Figure 2 shows all relationships. Hypotheses 1a and b stated that the total relationship between remote work and influence at work

(H1a) and schedule control (H1b) is positive. The results did not support H1a (model 1), as the total relationship was not significant. However, the results supported hypothesis 4 (mediation) for influence at work. Remote work had a negative indirect relationship with influence at work mediated through supervisor and co-worker contact. As remote work frequency increased, contact decreased. However, higher contact frequency was related to more influence at work, not less, as expected. The remaining direct association between remote work and influence was positive, indicating that the non-significant relationship between remote work and influence consist of multiple relationships pulling in different directions. The results support H1b (model 2), showing a significant positive total relationship between remote work and schedule control. However, we found no support for an indirect relationship via contact (H4).

Hypotheses 2a and b stated that the total relationship between working remotely and job demands (H2a) and work hours (H2b) is positive. Hypotheses 2ai and 2bi stated a negative relationship. There was no significant total relationship between remote working and quantitative job demands or work hours (model 3 and 4). Hypotheses H2a, 2ai, H2b, and 2bi were thus all rejected. However, for both relationships, there was support for mediation via contact (H4). The results of model 3 regarding quantitative job demands displayed a slight positive indirect path from remote work to increased demands through supervisor contact, but a negative path through co-worker contact. As remote work frequency increased, contact with co-workers and supervisors decreased. Decreased supervisor contact was related to higher quantitative job demands. Contrary, decreased co-worker contact was related to lower perceived demands. The remaining direct relationship between remote work and quantitative job demands was not significant. Similarly, there was a negative indirect path from remote work to work hours through co-worker contact. The remaining direct relationship was not significant.

Hypotheses 3a and b stated that the total relationship between working remotely, and co-worker and supervisor support was negative. The results of models 5 and 6 showed that, as expected, there was a negative indirect path from remote working to lower co-worker and supervisor social support mediated through contact frequency. When the negative mediation was considered, the remaining direct relationships between remote working and social support were positive. The total relationships between working remotely and co-worker and supervisor support, respectively, were not significant. The results weakened hypotheses 3a and b but strengthened hypothesis 4 regarding the mediation of frequency of contact.

Results from the robustness check using FE OLS regression (presented in supplementary table 1) supported the overall results of the GSEM analyses. Each of the individual analyses were similar in coefficient size, direction, and significance, with only a few exceptions. In the FE results, there was no significant direct effect of remote working on schedule control or influence at work. Also, the negative association between supervisor contact and quantitative job demands, and between colleague contact and support from supervisors were not significant in the FE analyses. The FE results did support a direct relationship between remote working and work hours.

The robustness check using only wave four, from post COVID-19 (supplementary tables 2 and 3), showed the same direction of associations regarding total relationships and the indirect relationships through frequency of contact as the analyses presented in this study, although there were some variations in significance.

## Discussion

We investigated the relationship between remote work and three psychosocial work environment factors, and to what extent the frequency of contact between employees, co-workers, and supervisors might explain these relationships. The findings showed that remote work intensity did not have an overall association with the psychosocial work environment factors, except for schedule control. However, when examining contact frequency, we found that working remotely decreased influence at work and social support, increased and decreased quantitative demands, and increased work hours, through reduced contact. After accounting for contact frequency, we found remaining direct relationships between remote work frequency and schedule control, influence at work, and social support from co-workers and supervisors. These results highlight changes in workplace contact frequency as one of the central mechanisms through which remote work influences employees' psychosocial work environment.

## Theoretical implications

The findings have theoretical implications for our understanding of the importance of workplace relations for the psychosocial work environment, of job autonomy and demands as relational aspects, and the potential for employee emancipation that we attribute to flexibility. Our research finding that influence at work was lower when employees had less frequent contact with supervisor and co-workers due to remote work is in contrast to the theorizing in earlier research (Gajendran & Harrison 2007; Hall & Atkinson 2006; Kelliher & Anderson 2008). Our findings indicate that employees' influence on decisions concerning work, what, how, and the amount of it, may be more easily attainable in situations where there is close contact between supervisors and employees. However, remote work implies a larger influence on where employees do their work and, in line with expectations and earlier research (e.g. Dubrin 1991; Gajendran & Harrison 2007; Metselaar et al. 2023), when they do their work. Working remotely thus influences employees' control over some aspects of work, but not all. Our finding that high influence at work requires interaction with co-workers and supervisors even when not working from the same location indicates that job control or autonomy has a relational and organizational aspect. This is in line with the STS theory (Bélanger et al. 2013; Guest et al. 2022). While working remotely and the often-accompanying flexibility have the potential to improve the quality of work by increasing autonomy; *how* remote work is organized and *the relations* at the workplace (in person and virtual) are of great consequence. Employees working remotely are still bound up in an employment relationship, and the emancipatory potential of remote work might easily be overestimated, as also pointed out by Sewell & Taskin (2015) and Thulin & Vilhelmson (2022).

Our results showed that the association between remote work frequency and quantitative job demands was complex. First, through the pathway of reduced colleague contact, we found that higher remote work intensity reduced work hours and work demands. A potential explanation is that employees who work on-site are more available for ad hoc tasks and questions from colleagues, than those working remotely. Accordingly, remote work increases possibilities for concentration because of fewer

interruptions (Sardeshmukh et al. 2012), allowing workers to finish their work faster and thus work shorter hours. This contrasts with studies suggesting that remote workers work longer hours due to loyalty or to combat stereotypes concerning slacking (Kelliher & Anderson 2010; Sewell & Taskin 2015). Still, when remote employees are sheltered from ad-hoc tasks and unplanned communication with colleagues, they are also less a part of the social work environment (Sewell & Taskin 2015). This might show itself in the finding that less frequent contact also leads to lower levels of social support from co-workers and supervisors, in line with earlier research (Knardahl & Christensen 2022; Sardeshmukh et al. 2012; Tejero et al. 2021; Vander Elst et al. 2017).

Second, in our study, supervisor contact was negatively related to quantitative job demands. Reduced supervisor contact due to remote work was related to increasing job demands, but unrelated to work hours. This might be interpreted as the supervisors having a role as job demands calibrators. That the level of social support from supervisors also increased with frequency of contact points to the positive aspect of supervisor contact in this context. Indeed, Taskin et al. (2024) show that managers used virtual co-presence as a way to show caring and create meaning for their employees, in effect re-humanizing management. Another explanation is offered by the psychological contract theory; that employees view flexibility both as a contribution and an inducement from the employer, and thus exchange additional freedom to control their work day with increased availability or intensity of work (Cañibano 2019). A similar explanation might be that additional days of remote work are allowed workers under the assumption that they can manage their own workload and thus will receive less supervisor resources or assistance. As Thulin & Vilhelmson (2022) show, managing incoming work and work-time is work in itself, largely informally delegated to individual employees. Remote workers might be left to handle more of their work alone, possibly increasing their perceived job demands. The psychological contract regarding remote work might entail that if employees cannot handle the accompanying independence, they may return to the office.

Our study suggests that employees drive themselves harder in the absence of the eye of their supervisor. The neoliberal advocacy of work as a site of freedom and employees as entrepreneurs who see their own capabilities as a form of capital to be developed and invested in (Lindebaum et al. 2022) might offer an interpretation of this finding. The employees who are offered the possibility to work remotely are predominantly highly educated professionals. As argued by Fleming (2022), these professionals are subjected to a ‘responsibilization’ whereby managerial control is pivoted through employee agency. On a slightly different note, technological surveillance and self-surveillance might substitute supervisor contact for remote workers such that they increase their efforts in order to fulfil their perceived duties (Sewell & Taskin 2015).

## Practical implications

The findings have practical implications for stakeholders such as employees, unions, employers, and policy makers. First, this study does not indicate any net negative or positive consequences of the frequency of remote work for central work environment factors. Although remote work does not seem to threaten employees’ psychosocial work environment, neither should it be seen as entirely advantageous. Second, remote work yields positive *and* negative consequences through the mechanism of less frequent



contact with co-workers and supervisors. Both employers, co-workers and remote workers, should be aware that *how* remote work and *workplace contact* is organized has consequences for remote workers' psychosocial work environment. Third, work organizations and communities should discuss how they organize remote work, the distribution of job demands and social support at their workplace so that they can keep the positive aspects and diminish the negative effects of remote work.

## Strengths and limitations

The current longitudinal study has strengths such as utilizing four waves across a two-year period with a largely representative sample. Nevertheless, there are limitations that need to be accounted for. First, there is a risk for selection bias. Employees who work from home have generally been highly trusted professionals or have other characteristics associated with their person or work that influence both remote work frequency and psychosocial work environment factors. The longitudinal design reduces bias due to selection into remote work of employees with certain stable traits (Cameron & Trivedi 2005: 697). The GSEM random intercept model is efficient, as it utilizes both variation within and between employees. The results from robustness checks using FE OLS regression, utilizing only within-person variation, are in line with the results from the GSEM, strengthening the claim that the results are not caused by selection. Moreover, the mandatory remote work policies during the pandemic opened remote work for a wider population of employees, also reducing selection.

Second, the current study cannot rule out reversed causation, for instance if employees choose to alter their remote work intensity as a response to changes in psychosocial work environment factors; for instance, if employees in a work conflict experience low social support and therefore limits contact and increases their remote work frequency. Although the longitudinal design accounts for time-stable reporting bias, time-varying reporting bias could affect the results, for example, if employees rate, for example, job demands higher when they are working remotely to signal busyness.

Third, the representative sample for Norwegian employees with the possibility to work remotely is a strength. However, the Norwegian case with high autonomy and non-hierarchical organizations, as well as the Work Environment Act's law-regulated focus on health enhancing work might offer a special case. Further research should investigate the role of supervisor and co-worker contact in various work life contexts. Possibly, the association between supervisor contact frequency and supervisor control and surveillance is more pronounced and remote work more autonomy inducing in more hierarchical contexts. The same may be said regarding supervisors' effect on job demands.

Fourth, the data collection was done during and after the COVID-19 pandemic, with mandated remote work in two of four waves. Thus, caution must be made when generalizing the findings to contemporary work life. The findings show that employees' remote work frequency largely followed COVID-19 restrictions, with higher frequencies at waves one and three. Our sample acts as an important methodological case, likely reducing the probability of reversed causality where changes in the psychosocial work environment cause changes in remote work frequencies. Simultaneously, other aspects of the COVID-19 pandemic can diminish the findings' generalizability. For instance, the positive direct effect between remote work and social support might be a result of the

emphasis on social support during the COVID-19 pandemic. Employers and co-workers were 'in it together' and had a heightened awareness of the possibly precarious situation. Analyses of the fourth wave (autumn 2022) when COVID-19 remote work mandates were lifted give similar results. This suggests that the findings are valid also for post-COVID 'normal' remote work. Still, remote work policies and other factors may have evolved in recent years, and we recommend future research to examine the relationship between contemporary remote work and psychosocial work environment factors.

Fifth, the current study has the remote workers' perspective. Research is lacking on how remote work impacts the psychosocial work environment of employees who remain at the office. Furthermore, differences in availability, frequency, and consequences of remote work for various categories of employees according to gender, tenure, and life and career situation should be further investigated.

Last, although the data provided the opportunity to account for industry, we have no information about the organizational circumstances at the respondents' workplace. An interesting direction for future research would be to investigate how the organizational structure of work interplays with remote work and its consequences for the psychosocial work environment.

## Conclusion

The current study shows that remote work had an impact on several psychosocial work environment factors, through reduced contact with supervisors and colleagues during and after the COVID-19 pandemic. Our findings suggest that psychosocial work environment factors should be studied as relational concepts, as they are dependent on relationships with co-workers and supervisors. Specifically, the findings show that remote work reduces influence at work and increases job demands if employees have less frequent contact with their supervisor. Less frequent contact with co-workers reduces influence at work and social support and also reduces job demands. Furthermore, the study challenges the view of the supervisor as a limiter of employees' autonomy. Remote work as a technologically enabled new way of organizing work has consequences past liberation of the employee from time and place constraints, including the paradoxical possible reduction of autonomy and increase in job demands. Although flexibility enabled by remote work involves promising aspects with regards to enhancing employee well-being, there are paradoxical tensions that need to be monitored as remote working is normalized for even larger shares of the working population.

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## Endnote

<sup>1</sup><https://www.stata.com/features/overview/generalized-sem/>