Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Full length article

COVID-19 crisis and digital stressors at work: A longitudinal study on the Finnish working population

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ABSTRACT

The global crisis caused by the outbreak of a novel coronavirus and the associated disease (COVID-19) has changed working conditions due to social-distancing policies. Many workers started to use new technologies at work, including social media applications. In this longitudinal study, we investigated the potential stress effects of social media communication (SMC) at work. Based on our integrative theoretical model, we expected that SMC at work would burden some workers, but those who were accustomed to SMC at work would be better off when the crisis started. We collected a nationally representative sample of Finnish workers before ($N = 1308$) and during ($N = 1081$) the COVID-19 crisis. Outcome measures included technostress and work exhaustion. Multilevel linear mixed-effects regression models investigated formal and informal SMC at work. Covariates included cyberbullying at work, social media usage, personality, occupational status, and sociodemographic factors. Results showed that formal SMC increased and predicted higher technostress. However, technostress and work exhaustion decreased among workers already accustomed to using SMC at work before the crisis. The results indicate a disparity in workers' resilience during remote work and highlight a need for organizational level support.

1. Introduction

The outbreak of a novel coronavirus (SARS-CoV-2) and the associated disease (COVID-19) began a global crisis in early 2020. COVID-19 was first reported in December 2019 in Wuhan, the capital of Hubei province, China (Bogoch et al., 2020; Zhao et al., 2020). In January 2020, the disease was also reported in Europe (Lescure et al., 2020; Rothan & Byrareddy, 2020). National policies on social distancing were placed in most European countries in March 2020, including Finland (Oksanen, Kaakinen, et al., 2020).

As a consequence of the COVID-19 pandemic and social-distancing policies, remote working has increased in Europe (Eurofound, 2020a). Many organizations were forced to start using new digital technologies and social media applications as their primary modes of communication and collaboration. The crisis became a massive natural experiment in using technologies that enable social distancing and remote work. This mainly applied to office and knowledge workers, but other sectors were impacted as well. Many workers and companies were unprepared for the sudden change, and it is likely that workers' technology-related stress and exhaustion might have increased.

We investigated the potential stress effects of social media communication (SMC) at work during the COVID-19 crisis. Our theoretical approach integrates work–family border theory, conservation of resources (COR) theory, and the resilience framework. This SMC at work during crises model advances our theoretical understanding of the impact of the COVID-19 crisis on workers and working life. The model can be also applied to similar large-scale crises taking place in a digitalized world. However, the COVID-19 crisis is the first of its kind due to its scale, the measures used to control it, and the current technological context. We use nationally representative longitudinal survey data to track the changes resulting from the COVID-19 crisis, which began in Finland in March 2020.

1.1. Balance and conflict between work and private life

The COVID-19 crisis has forced many to work from home. Remote

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working is not a new phenomenon, but the extensity due to the COVID-19 pandemic is novel. Transitioning to home offices and using social media applications to interact with colleagues may challenge workers' abilities to set borders between their work and private lives. Private life may be interrupted by work tasks and meetings, whereas work meetings are disturbed by family life. Blurred boundaries between home and work can also lengthen employees' working hours without additional compensation (Adisa et al., 2017).

Work–life and work–family balance refer to the harmonious division of time and attention between work and private life (Allen et al., 2000; Burke & Vinnicombe, 2005; Greenhaus et al., 2003). This harmony might be threatened in numerous ways. Expectations from work and private life might cause negative intrusion or spillover from one domain to the other (Byron, 2005; Staines, 1980). In other words, there is work interference with family (WIF) and family interference with work (FIW; Amstad et al., 2011; Byron, 2005). Spillover occurring in either direction can cause conflict.

Meta-analytic reviews of work–family conflict have shown a multitude of antecedents predicting WIF and FIW. Nonpsychological stressors, such as time demands, have been identified as significant predictors of WIF, whereas having many children has been associated with FIW (Byron, 2005; Michel et al., 2011). Psychological stressors, such as role overload (i.e., the perception of having too many tasks in a family or work role and too little time to complete the tasks), predict the overall work–family conflict. However, past researchers have recognized that the impacts of WIF and FIW are mostly domain specific (Amstad et al., 2011). In other words, WIF is mostly associated with work-related problems, such as lower well-being at work, and FIW with family-related problems, such as lower family satisfaction. WIF and FIW are both negatively associated with well-being and performance at work (Amstad et al., 2011).

However, spillovers are not only negative. Positive spillovers include experience, skills, knowledge, and networks gained at home becoming useful at work, and vice versa (Andreassi & Thompson, 2007). Compensation theory proposes a contrary view and suggests that people search for what they are missing in one domain from other domains (Staines, 1980). Negative experiences in one domain may incite a search for positive experiences in the other domains. For example, a person lacking creative activities at work might fulfil that side of themselves at home, whereas marital disputes might encourage more investment in the quality of relationships at work.

Clark's (2000) work–family border theory extends the discussions of spillovers and compensation onto border management between the types of work and types of work–life boundaries. Work and personal life are seen as two life domains separated by borders. The domains may be close or distant. Typical ends that people aim for at work include money and sense of accomplishment, whereas at home, people value close relationships and personal happiness. When domains of work and home are similar, the ends, as well as the types of behaviors and the ways of thinking encouraged to achieve them, are similar. When domains are distant, the work self and private self are also experienced as different. Domains are separated by strong or weak borders. A border is strong when it is made inflexible by set working hours, a separate place of work physically distant from home, and different rules for patterns of thinking, feeling, and behaving that the individual has adopted for each domain. According to Clarck (2000), weak borders facilitate work–life balance when domains are close, and strong borders maintain the balance when the domains are distant. The strength of the border can be impacted by workers to varying degrees, depending on the centrality of their roles in each domain. Usually, a border's strength is also largely controlled by border keepers, such as colleagues, supervisors, and family members at home.

Remote workers have weaker work–life borders and often need to be especially skillful in managing their work–life balance (Fonner & Stache, 2012). Employees can alleviate the negative consequences of domain conflicts by consciously segmenting their professional and private identities (Rothbard & Ramarajan, 2009). Hence, identity negotiation in an online context is vital, and employees need guidance and support (Ollier-Malaterre et al., 2013). Utilizing SMC can enhance employees' abilities to combine work and their personal lives, as completing work does not depend on time and space (Gerdenitsch et al., 2015). SMC at work can also have other positive effects, for example, on employees' work engagement, which translates to family life and increases enrichment from work to family life (Hakanen et al., 2016). In addition, employees' relatedness to the organization and work community can be higher if they are able to combine private and professional domains and identities (Fieseler et al., 2015; Leonardi et al., 2013). Work–family border theory and previous studies on remote work have shown reasons to hypothesize that those who have intertwined their work and family domains (e.g., by remote work and flexible borders between the domains) are the most equipped to face the challenges caused by the COVID-19 crisis at work.

1.2. Impacts of technology use on stress and work exhaustion

In recent years, organizations have recognized the potential of social media at work (Leidner et al., 2018; Leonardi et al., 2013; Leonardi & Vaast, 2017; Oksa et al., 2020; Yu et al., 2018). Social media applications, such as Workplace by Facebook, Yammer, and Microsoft Teams, allow employees to communicate and share work issues (Leonardi et al., 2013; Treem & Leonardi, 2012). Social media applications enable versatile functionalities from user-generated content creation and exchange (Kaplan & Haenlein, 2010; Krämer et al., 2017) to collaboration using textual elements, file sharing, simultaneous document editing and video meetings (Oksa et al., 2020).

Social media is utilized for internal and external purposes, from organizing work to employer branding (Huang et al., 2013; Tsimonis & Dimitriadis, 2014). Thus, the technology enables organizational communication practices and knowledge sharing and advances external networking with stakeholders (Leonardi & Meyer, 2015; Waters et al., 2009). Formal and informal discussions take place on social media platforms that are quick, effortless, and accessible 24/7 (Leonardi et al., 2013). Formal communication means using social media platforms strictly for work, but those same platforms could be used for more informal purposes as well, for example, talking about leisure activities with colleagues. The omnipresence of social media can, however, cause exhaustion with push notifications, messages, and the possibility for constant connectivity, thus blurring the boundaries of work and private life (Ollier-Malaterre et al., 2013; van Zoonen et al., 2016).

The invasive nature of technology and social media can induce technostress in workers (Bucher et al., 2013; Tarafdar & Ragu-Nathan, 2010). Technostress refers to the stress people experience due to the use of technology and the demands related to technology's use (Ayyagari et al., 2011; Pirkkalainen et al., 2019; Suh & Lee, 2017; Tarafdar et al., 2019). Technostress can occur in relation to any technology, old or new, but it is more common with new technologies or situations (Shu et al., 2011; Tarafdar et al., 2007). Even an accustomed technology user could face stress caused by software updates or new tools. Various studies have shown that, in recent years, technostress has become a persistent challenge in organizations (Pirkkalainen et al., 2019; Tarafdar et al., 2019, 2020).

The conservation of resources (COR) theory implies that people most often seek to maintain their resources and possible threats to important resources can stimulate psychological stress (Hobfoll, 1989). These resources could be, for example autonomy, feedback on work performance, and support from supervisor and colleagues, which can foster work and employees' engagement and well-being (Demerouti et al., 2001; Schaufeli & Bakker, 2004). The COR theory highlights that the stress process includes individual and social factors (Hobfoll, 2001). Psychological stress is reaction to an evident threat of losing one's potential or actual resources (Hobfoll, 1989). Employees with fewer resources are at risk of experiencing resource loss compared to those who

have more resources and more likely to gain additional resources (Hobfoll, 2001, 2002).

The use of technology and social media can threaten employees' resources and well-being. For instance, shifting to remote work and using digital communication methods may reduce the social support received from the workplace. In addition, continuous online meetings can be exhausting, and multitasking and concentration problems can occur, which can lead to fatigue, exhaustion, stress, and burnout (Leonardi, 2020; Ter Hoeven et al., 2016; Waizenegger et al, 2020; van Zoonen et al., 2016). Work can easily spill over into free time at home and have negative consequences, such as decreased productivity, reduced well-being, and work–family conflicts (Cao & Yu, 2019; Eurofound, 2020b). These issues and a lack of adequate job resources, in turn, can result in exhaustion and burnout (Bakker, Demerouti, & Euwema, 2005; Demerouti, Bakker, & Bulters, 2004; Hakanen, Schaufeli, & Ahola, 2008). Burnout is described as a psychological state in which an employee experiences emotional exhaustion, cynicism, and inefficacy (Maslach et al., 2001). Burnout has been associated with decreased work autonomy and resources (Alarcon, 2011; Aronsson et al., 2017; Hakanen et al., 2006), which can lead to long sick leaves and depression (Hakanen et al., 2008; Schaufeli et al., 2009).

The impact of social media use on work exhaustion is yet to be explored even under normal circumstances. Unusual crisis situations, such as the COVID-19 pandemic, make it even more difficult to predict outcomes of social media use at work. Currently there is a lack of evidence on the direct impacts of the COVID-19 crisis on work exhaustion and the eventual burnout. Some of the effects can only be observed later. Inevitably the COVID-19 crisis and its economic consequences will change the working conditions for many.

1.3. Coping with the COVID-19 crisis

Crisis situations can evoke vast psychological consequences and lead to reduced well-being (Heymann et al., 2015; Wahlbeck & McDaid, 2012). However as shown in the resilience framework, people are remarkably resilient psychologically and they can cope with even extreme stressors, such as war or natural and man-made disasters (Bonanno, 2004; Bonanno et al., 2015; Chen & Bonanno, 2020). During a crisis social cooperation and solidarity typically increase and help people overcome the situation (Hawdon & Ryan, 2011; Norris et al., 2008). However there are also social and individual differences in resilience and coping with crisis situations (Bonanno, 2004; Waugh et al., 2008). Any societal crisis is often easier for those in better socioeconomic positions (Bonanno et al., 2007; McLeod & Kessler, 1990). Coping is also easier for those with available social support (Cohen & Wills, 1985; Dalgard et al., 1995). Other relevant factors include family background, psychiatric history, and personality (Bonanno, 2004). Of the personality traits, neuroticism is found to correlate negatively with resilience (Oshio et al., 2018).

The COVID-19 crisis has directly and economically impacted millions of people across the world. The pandemic has put enormous pressure on handling things in a new way, especially technologically. During the COVID-19 crisis, new and more efficient ways of working and communicating have been explored. This was an urgent need because work meetings and information sharing primarily began taking place online amid the new situation imposed on employees and organizations (Oksa et al., 2020). Hence the COVID-19 crisis forced workers in different fields to take a sudden digital leap and adapt to working remotely from home or other locations rather than the physical workplace. Europe changed the most, with more than a third of workers transitioning to teleworking due to the pandemic (Eurofound, 2020a). Attitudes toward technology and prior user-experiences of technologies play a role in accepting and implementing new technologies (Savela et al., 2018; Taylor & Todd, 1995; Venkatesh & Davis, 2000). Therefore, employees with prior remote-working experience and technological skills may have an advantage over those with less experience.

The digital leap and remote work may have also had consequences for other domains. The COVID-19 crisis has caused work–life conflicts, especially for families with young children (Eurofound, 2020a, b). The pandemic has also put pressure on organizations and managers to maintain stable standards of well-being at work. One such challenge is posed by cyberbullying at work (Oksanen, Oksa, et al., 2020; Snyman & Loh, 2015; Vranjes et al., 2018). As work has become more digitalized, so has workplace harassment. Crises put vulnerable individuals and groups at risk. Moreover, the COVID-19 crisis has meant that a lot of people have started to work remotely without direct supervision and guidance. Hence, research information about how workers are coping during the crisis is needed.

1.4. The present research

The starting point for this study was recognizing the COVID-19 crisis as a natural experiment that forced people to work remotely and to take a digital leap in the use of new technologies, especially social media applications designed for work. In Finland, 60% of workers switched to remote working, representing the highest proportion of remote working in Europe due to the COVID-19 crisis (Eurofound, 2020a). The National Institute for Health and Welfare provided social distancing recommendations on March 12, 2020, and the recommendations were soon followed by the government's declaration of a state of emergency. Enacting state of emergency laws ultimately changed people's work–life balances and created new digital stressors and conflicts for those working from home.

Our study is theoretically grounded on work–family border theory and research on work–family conflict (Amstad, 2011; Byron, 2005; Clark, 2000; Ford et al., 2007), COR theory (Hobfoll, 2001, 2002), and the resilience framework (Bonanno et al., 2015; Chen & Bonanno, 2020). We also acknowledge the recent work done on technostress (Pirkkalainen et al., 2019; Suh & Lee, 2017; Tarafdar et al., 2019, 2020), work exhaustion, and burnout (Alarcon, 2011; Aronsson et al., 2017; Schaufeli et al., 2009). These theories are integrated into the model for SMC at work during a crisis.

According to this integrative model, technology-mediated remote work during the COVID-19 pandemic can cause technostress and work exhaustion by inducing increased conflict between work and personal life and by threatening job-related resources. Individuals vary in their acquirements to cope with these problems. Hence, our integrative theoretical model covers different risk factors for technostress and work exhaustion during the COVID-19 crisis, as well as advances theoretical understanding of potential stressors in crisis situations in a digitalized world.

Our first starting point to analyze whether there are increases in technostress and work exhaustion due to the COVID-19 crisis. Our aim was to analyze SMC at work as a digital stressor. We investigated formal and informal SMC at work to analyze two previously recognized user patters that were potentially linked to well-being at work (Oksa et al., 2020). We expected the following.

- **H1: social media burden hypothesis:** The impacts of the COVID-19 crisis on technostress and work exhaustion are strongest among those who are most active in communicating via social media at work during the crisis.
- **H2: well-prepared hypothesis:** The impacts of the COVID-19 crisis on technostress and work exhaustion are weakest among those who were already active in communicating via social media at work before the crisis.

We tested the hypotheses for formal and informal SMC at work. Covariates included personality factors, cyberbullying at work, social media usage, occupational status, and sociodemographic factors.

2. Methods

2.1. Sample

Participants of this study were part of the longitudinal *Social Media at Work in Finland Survey*, which targeted Finnish workers aged 18 years and older. A pre-COVID-19 crisis survey was collected from September 16 through October 15, 2019 ($N = 1318$). All participants taking part in the 2019 autumn survey were recontacted during the COVID-19 crisis in spring 2020, and we collected the follow-up survey between March 16 and April 8, 2020. The response rate was 82.02% ($N = 1081$), and there was no bias due to nonresponse. Participants of both surveys were 53.93% male and aged 18–66 ($M = 44.14$, $SD = 11.58$). We used population weights to correct minor biases of age and gender in the sample. We removed from the analysis respondents who were retired, unemployed, or temporarily not working ($n = 79$) to measure changes in the working population.

In December 2018, the Academic Ethics Committee of the Tampere region stated that the study did not pose any ethical problems. All participants agreed to voluntarily participate in the online surveys, and they were informed about the purpose of the study. The survey was in Finnish and was designed by the research group. Data collection was carried out by Norstat, whose panel was also used to recruit the participants. The dataset only includes those respondents who filled out the entire survey.

2.2. Measures

2.2.1. Technostress

To measure technostress, we used six items on techno overload and techno invasion (Ragu-Nathan et al., 2008) as a starting point and adapted these items for social media. The items included the following: (a) "I am forced to do more work than I can handle due to social media"; (b) "I am forced to work with tight time schedules due to social media"; (c) "I am forced to change my habits to adapt to new social media services"; (d) "I have to be always available due to social media"; (e) "I feel my personal life is being invaded by social media"; and (f) "I have to sacrifice my time to keep current on new social media services." For all items, the scale ranged from 1 (*disagree completely*) to 7 (*agree completely*). The scale showed an excellent interitem reliability (T1: $\alpha = 0.89$, T2: $\alpha = 0.90$). The scale ranged from 6 to 42 (see Table 1 for details).

2.2.2. Work exhaustion

To measure work exhaustion, we used five items from the Maslach Burnout Indicator (Maslach et al., 2018). Previous researchers have widely used, applied, and validated this measure (Golden, 2006; Hakanen et al., 2006). The five items included the following: (a) "I feel emotionally drained from my work"; (b) "I feel used up at the end of the workday"; (c) "I feel tired when I get up in the morning and have to face another day on the job"; (d) "Working all day is really a strain for me"; (e) and "I feel burned out from my work." The provided answer options were *never, a few times a year or less, once a month or less, a few times a month, once a week, a few times a week,* and *every day,* and answers were given numerical values of 0–6, respectively. The internal consistency of the scale was excellent in Time Points 1 and 2 (T1 and T2; T1: $\alpha = 0.92$, T2: $\alpha = 0.92$). The scale ranged from 0 to 30. Work exhaustion is the only measure that includes missing observations ($n = 18$ in T1, and $n = 13$ in T2).

2.2.3. Social media communication

SMC is a complex phenomenon and encompasses multiple functionalities and platforms, but for the objective of this study, we focused on the frequency of using SMC for two distinctive purposes: formal and informal matters regardless of the platform used (e.g., enterprise social media or public social media). We measured the frequency of formal SMC at work with the following question: "How often do you use social media to keep in touch with your colleagues or work community regarding work-related matters (e.g., on information sharing or agreeing timetables)?" In addition, we measured the frequency of informal SMC at work with the following question: "How often do you use social media to keep in touch with your colleagues or work community regarding nonwork-related matters?" The answer options for both measures were *I don't use it*, *less than weekly*, *weekly*, *daily*, and *many times a day*, with answers given numerical values of 0–4, respectively. These measures have been previously used and validated in two Finnish cross-sectional samples (Oksa et al., 2020).

2.2.4. Social media covariates

Our models included cyberbullying at work as a time-varying measure. Cyberbullying at work was measured with 10 questions adapted from the *Cyberbullying Behavior Questionnaire* (Forssell, 2016; Oksanen, Oksa, et al., 2020). For example, items included questions on whether they had been targeted with insulting or harassing comments, such as "rude messages have been sent to you via social media," "offensive photos/videos of you have been posted on social media," and "colleagues have excluded you from the social community on social media (e.g., Facebook, Twitter, and Instagram)." We created a dummy variable from the options and analyzed those who had been victims of cyberbullying at least on a weekly basis. The internal consistency of the scale was excellent in both time points (T1: $\alpha = 0.94$, T2: $\alpha = 0.93$; see Table 2 for details).

Our models controlled for the use of social media and social networking applications for personal purposes during the COVID-19 crisis. We used 16 items on the private-use sites and applications, such as Facebook, Twitter, Instagram, and YouTube. The answer options were *I don't use it*, *less than weekly*, *weekly*, *daily*, and *many times a day*. We created a dummy variable and categorized those using at least one application or site many times a day as active private social media users.

Table 1
Correlations and descriptive statistics of main variables.

Continuous variables	Range	M	SD	1	2	3	4	5	6	7
Technostress										
1. T1: before COVID-19 crisis	6–42	13.43	7.58	1						
2. T2: during COVID-19 crisis	6–42	13.75	7.51	0.69***	1					
Work exhaustion										
3. T1: before COVID-19 crisis	0–30	14.42	7.64	0.20***	0.18***	1				
4. T2: during COVID-19 crisis	0–30	13.75	7.32	0.22***	0.23***	0.68***	1			
Formal SMC at work										
5. T1: before COVID-19 crisis	0–4	1.33	1.18	0.26***	0.25***	0.04	−0.003	1		
6. T2: during COVID-19 crisis	0–4	1.54	1.17	0.15***	0.22***	0.06	0.09**	0.56***	1	
Informal SMC at work										
7. T1: before COVID-19 crisis	0–4	1.10	1.00	0.23***	0.24***	0.02	0.02	0.54***	0.36***	1
8. T2: during COVID-19 crisis	0–4	1.21	1.06	0.17***	0.23***	0.04	0.06*	0.44***	0.56***	0.57***

*$p < .05$; **$p < .01$; ***$p < .001$.

Table 2
Descriptive statistics of covariates.

Continuous variables	Range	*M*	*SD*
Age	18–65	41.09	13.51
Neuroticism	3–21	12.04	3.71
Extroversion	3–21	13.41	4.30
Income (1 = lowest, 8 = highest)	1–8	3.45	1.56
Categorical variables	**n**	**%**	
Cyberbullying at work victimization (weekly)			
T1: before COVID-19 crisis	85	8.46	
T2: during COVID-19 crisis	80	7.99	
Active private social media use	637	63.66	
Working hours per week			
T1: 1–34 h	220	21.93	
T1: 35–40 h	584	58.28	
T1: >40 h	198	19.79	
T2: 1–34 h	250	24.94	
T2: 35–40 h	587	58.65	
T2: >40 h	164	16.41	
Occupational area			
Industrial sector	286	28.55	
Service	185	18.50	
Business, communication, and technology	166	16.61	
Public administration	69	6.88	
Education	87	8.68	
Health and welfare	150	15.03	
Unknown	58	5.75	
Remote work at least 2 days/week	78	7.77	
Managerial position	194	19.62	
Female gender	483	48.22	
Married or in close relationship	587	58.59	
Under-aged children at home	280	27.96	
Education			
Primary/secondary degree	576	57.57	
University of applied science degree	210	20.99	
University degree	215	21.44	

2.2.5. Individual, occupational, and sociodemographic characteristics

Personality traits neuroticism and extroversion were measured with items included in the 15-item Big Five Inventory (Hahn et al., 2012). For both traits, we created a 3-item sum variable ranging from 3 to 21. Interitem reliability ranged from acceptable to good: neuroticism (α = 0.72) and extroversion (α = 0.87).

Occupational information included the number of working hours per week and the occupational area. We determined working hours with a question on how many hours per week respondents worked in their primary occupations. Answer options included *1–34 h*, *35–40 h*, *41–50 h*, *51–60 h*, and *over 60 h*. We reclassified the options into three categories: *1–34 h*, *35–40 h*, and *over 40 h*. Models include measures from both time points. We requested information on participants' occupational fields using the list of International Standard Industrial Classification of All Economic Activities. Then, we categorized responses into seven broader categories. We used remote work before the COVID-19 crisis as the control. In this study, we considered those working remotely at least 2 days a week to be remote workers. We also asked whether they were in managerial positions.

We determined sociodemographic background through questions of age, gender, relationship status, number of underage children at home, education, and income. Gender options were male, female, and other. Only one participant reported other. For the analysis, we used a dummy-coded variable (0 = *male*, 1 = *female/other*). Relationship status referred to whether respondents were married or in another type of close relationship during the crisis (0 = *no*, 1 = *yes*). We requested information on education, with seven categories that we recategorized into three for study purposes: *primary/secondary degree*, *degree from the university of applied science (usually bachelor level)*, and *university degree (usually master's level or higher)*. We requested information about the participants' monthly gross incomes, with options ranging from 1 (*less than 1000 €*) to 8 (*more than 7000 €*).

2.3. Statistical techniques

We conducted the analyses using Stata16 software. We first ran descriptive statistics on technostress, work exhaustion, and SMC at work. We then conducted multilevel linear mixed-effects regression models to analyze the between-person differences and within-person changes in technostress and work exhaustion before and after the COVID-19 crisis. Modelling was theoretically based on our integrative approach that considers a number of confounding factors.

In our models, we predicted technostress and exhaustion using within- and between-person predictors and cross-level interactions. Within-person predictors in our models included time (the within-person change in technostress and exhaustion), weekly working hours, and cyberbullying at work. As between-person predictors, our models included the use of social media for formal and informal communication with colleagues and the work community at T1 and T2. To analyze between-person differences in the effect of COVID-19 on technostress and exhaustion, we added the cross-level interaction between time and formal and informal SMC (at T1 and T2) into our models. Our between-person covariates included social media use and measures on personality, occupational situation, and sociodemographic factors.

We estimated the models using probability weights and robust Huber-White standard errors. For the fixed parts of our models, we report unstandardized regression coefficients and their standard errors and the statistical significance of the estimates. Our models included random intercepts and random slopes for time with an unstructured covariance structure. For the random parts of our models, we report standard deviations and 95% confidence intervals. To elaborate on our cross-level interactions, we present plotted predictive margins—that is, the estimated values of technostress and exhaustion at T1 and T2 for different levels of SMC (see Figs. 1–4). Overall, the models are robust to potential confounding factors and main results remained statistically significant although number of covariates were included in the model.

3. Results

3.1. Changes in well-being and social media communication

Comparison of situations before the COVID-19 crisis (T1: September–October 2019) and during the COVID-19 crisis (T2: March–April 2020) showed a 0.32 increase in technostress among our sample of the

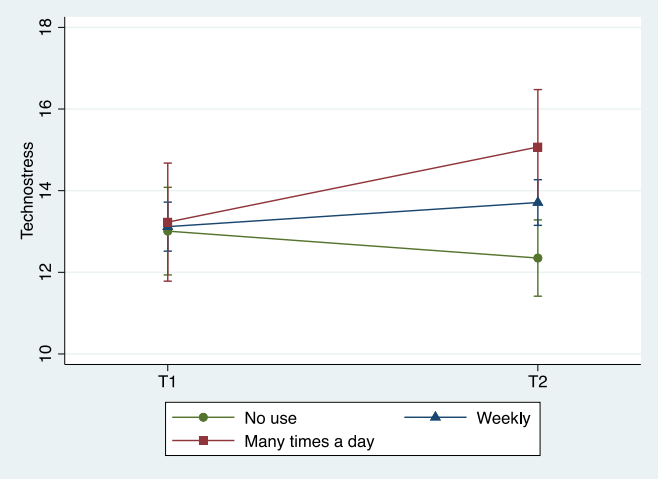

Fig. 1. Development of technostress by the formal SMC at work during the COVID-19 crisis.

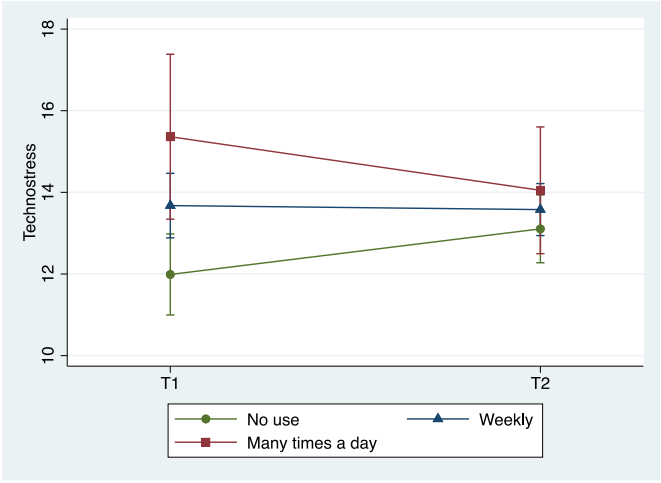

Fig. 2. Development of technostress by the formal SMC at work before the COVID-19 crisis.

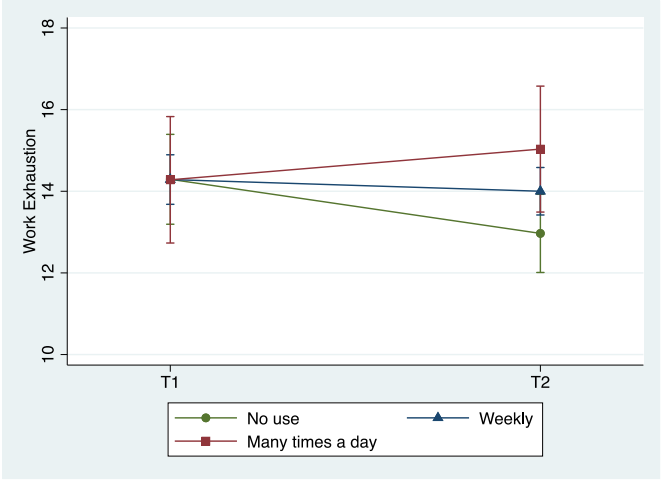

Fig. 3. Development of work exhaustion by the formal SMC at work during the COVID-19 crisis.

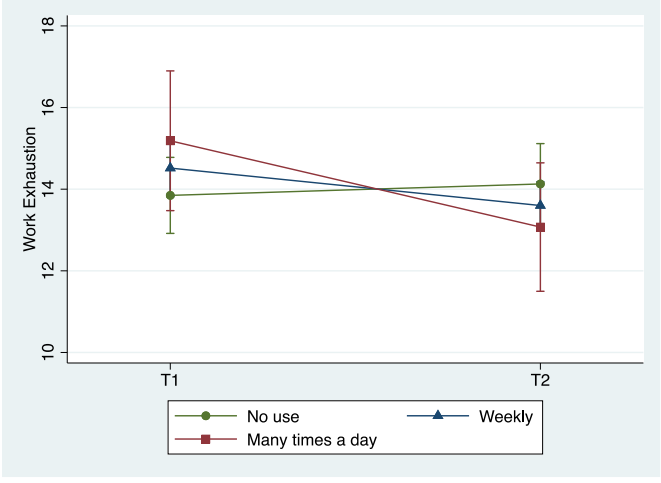

Fig. 4. Development of work exhaustion by the formal SMC at work before the COVID-19 crisis.

Finnish working population, using a 6-item scale from 6 to 42 (see Table 1). This change was not statistically significant, however. Of all the participants, 17.09% reported a substantial increase (+6 points at least) in technostress, whereas 69.72% reported little or no change at all, and 13.19% reported a significant decrease (−6 points at least) in technostress. Substantial increases in technostress were reported in service and education sectors, in which 24.33% and 22.02%, respectively, reported substantially higher technostress scores.

Work exhaustion decreased by 0.67 points on a 5-item scale from 0 to 30. This change was also statistically significant in the multilevel linear mixed-effects regression model, which only included time as an independent variable ($b = -0.55$, $p = .040$). Only the health and welfare field saw a slight, yet statistically insignificant, increase in work exhaustion ($b = 0.52$, $p = .216$). On average, workers from the remaining fields reported lower work exhaustion scores. Of all the participants, 16.95% reported a substantial increase (+5 points at least) in work exhaustion, whereas 61.22% reported little or no change at all, and 21.83% reported a substantial decrease (−5 at least) in work exhaustion. Substantial increases in exhaustion scores were specifically reported in industry (14.11%) and health and welfare sectors (15.64%).

Due to the crisis, formal and informal SMC at work increased among the Finnish working population. The proportion of nonusers' formal SMC at work dropped from 31.67% to 23.85%. The proportion of nonusers of informal SMC at work dropped from 34.03% to 30.88%. The number of nonusers of formal SMC at work decreased in all fields. The smallest change (4.84% decrease) was in the education sector, which already had the smallest number of nonusers. The biggest change was in the business, communication, and technology sectors, where the number of nonusers decreased by 14.47%. The number of nonusers of informal SMC at work decreased in all fields except in education. Biggest decrease was in the service sector where number of nonusers of informal SMC at work dropped by 8.23%.

3.2. Social media communication predicts technostress and work exhaustion

Results based on multilevel linear mixed-effects regression are reported in Table 3, which shows models for technostress and work exhaustion. Our results first showed that there was a significant cross-level interaction effect between time and formal SMC at work at T2 for technostress ($b = 0.63$, $p = .011$). Fig. 1 shows that technostress specifically increased among those individuals who communicated formally via social media at work many times a day during the COVID-19 crisis.

There was also significant cross-level interaction between time and formal SMC at T1 ($b = -0.61$, $p = .047$). Fig. 2 shows that technostress increased among those individuals who were nonusers of formal SMC before the COVID-19 crisis (T1), and there was a decrease in technostress among those users who had already used formal SMC at work many times a day. After considering the cross-level interactions, the main effect of formal SMC at T1 remained significant ($b = 0.84$, $p = .017$), meaning that formal SMC at T1 predicted higher technostress at that time. Informal SMC did not predict technostress. Of the covariates, victimization from cyberbullying at work ($b = 2.20$, $p = .004$), young age ($b = -0.11$, $p < .001$), and neuroticism ($b = 0.32$, $p < .001$) predicted technostress.

Results on work exhaustion were similar to technostress. Results showed a cross-level interaction effect between time and formal SMC at work at T2 on work exhaustion, with a significance level of $p < .1$ ($b = 0.52$, $p = .068$). Fig. 3 shows that work exhaustion decreased specifically among nonusers of formal SMC at work and that there was a slight increase in work exhaustion among those using formal SMC at work many times a day during the COVID-19 crisis. We also found a significant cross-level interaction between time and formal SMC at T1 ($b = -0.60$, $p = .031$). Fig. 4 shows that work exhaustion decreased among those who had used formal SMC before the COVID-19 crisis. This decrease in work

Table 3
Multilevel Linear mixed-effects Regression Models Predicting Technostress and Work Exhaustion.

	Technostress			Work exhaustion		
Fixed part	*b*	*SE*	*p*	*b*	*SE*	*p*
Constant	9.47	1.96	<.001	5.87	1.96	.003
Within-person variables						
Time	−0.35	0.51	.492	−0.84	0.44	.056
Cyberbullying at work	2.20	0.76	.004	3.47	0.89	<.001
Working hours per week (ref. 35–40 h)						
1–34 h	0.77	0.54	.154	−1.25	0.48	.008
>40 h	0.49	0.48	.306	−0.02	0.55	.969
Between-person variables						
T1: Formal SMC at work	0.84	0.35	.017	0.33	0.30	.268
T2: Formal SMC at work	0.05	0.29	.848	0.00	0.31	.992
T1: Informal SMC at work	0.28	0.37	.442	−0.32	0.44	.460
T2: Informal SMC at work	0.54	0.39	.166	0.00	0.42	.991
Time x T1: Formal SMC at work	−0.61	0.31	.047	−0.60	0.28	.031
Time x T2: Formal SMC at work	0.63	0.25	.011	0.52	0.28	.068
Time x T1: informal SMC at work	0.08	0.29	.778	0.11	0.41	.796
Time x T2: informal SMC at work	0.33	0.33	.315	0.16	0.40	.694
Active private social media use	0.28	0.49	.569	0.98	0.51	.054
Neuroticism	0.32	0.07	<.001	0.63	0.06	<.001
Extraversion	0.04	0.06	.554	0.00	0.07	.999
Female gender	−0.61	0.52	.244	0.24	0.54	.657
Age	−0.11	0.02	<.001	0.00	0.02	.938
Married or in close relationship	−0.29	0.49	.559	−0.39	0.50	.433
Underaged children at home	−0.11	0.47	.818	0.02	0.49	.974
Education (ref. prim./sec. degree)						
University of applied science degree	0.60	0.54	.266	1.02	0.58	.079
University degree	−0.05	0.58	.927	0.92	0.61	.132
Income	0.17	0.18	.343	0.04	0.21	.831
Occupational area (ref. Industrial sector)						
Service	0.89	0.71	.213	−1.03	0.75	.170
Business, communication and, technology	0.97	0.74	.190	−1.31	0.67	.052
Public administration	0.01	0.76	.991	−0.27	0.91	.768
Education	1.12	0.90	.214	1.29	0.85	.131
Health and welfare	0.50	0.63	.432	0.53	0.76	.485
Unknown	−0.64	1.22	.597	−2.03	1.44	.157
Remote work at least 2 days/week	0.45	0.79	.567	0.24	0.82	.767
Managerial position	0.59	0.61	.334	−0.45	0.65	.488
Random part	**SD**	**95% *CI*]**		**SD**	**95% *CI*]**	
Constant	6.07	5.66	6.51	6.58	6.28	6.89
Time	4.64	4.32	4.99	4.44	4.11	4.80

exhaustion was largest among those who had used formal SMC at work many times a day.

Of the covariates, victimization to cyberbullying at work ($b = 3.47$, $p < .001$) and neuroticism ($b = 0.63$, $p < .001$) predicted higher technostress. Those working only 1–34 h per week reported less work exhaustion ($b = -1.25$, $p = .002$). We also discovered that those working in the education sector reported the highest exhaustion scores (adjusted $M = 15.61$, 95% *CI* 14.12, 17.05). The difference between the education sector and the business, communication, and technology sector (adjusted $M = 13.00$, 95% *CI* 11.95, 14.06) was statistically significant.

4. Discussion

4.1. Main findings

In this longitudinal study based on an integrative model of SMC at work during a crisis, we investigated SMC at work and the potential impacts on technostress and work exhaustion during the COVID-19 crisis, which has been a major natural experiment and has forced many people to work from home and learn new digital tools. With the COVID-19 crisis, the border between work and home has become more ambiguous, and there is a potential for conflicts due to spillover from work to family and vice versa. Finding balance between work and family is expected to be a challenge (Amstad et al., 2011; Byron, 2005; Clark, 2000), but those workers who had previous knowledge and better resources were more apt to cope with the crisis (Hobfoll, 2001, 2002). As the COVID-19 crisis has been rather unique, it was important to understand the factors explaining resilience and vulnerability under such circumstances (Chen & Bonanno, 2020).

Our starting point was to describe the general changes in technostress, work exhaustion, and SMC at work. We considered workers as border crossers who made transitions between the domains of work and family (Clark, 2000). We expected the impact of the crisis to be greatest among those people who were communicating extensively through social media at work (H1: social media burden hypothesis). However, some people had used social media at work prior to the crisis and, hence, were more prepared for the sudden change to remote work and working online via social media. We expected the impact of the crisis to be weaker among those individuals (H2: well-prepared hypothesis). Both formal and informal SMC at work were analyzed.

Results showed that technostress had slightly increased but that work exhaustion had decreased in all fields, except health and welfare. This is understandable in the context of a pandemic that particularly burdened healthcare workers (Lancet, 2020). Furthermore, in industry sectors, there was a relatively high proportion of those who reported a substantial increase in work exhaustion. Changes in working conditions and working time are likely explanations for the lower work exhaustion scores of other Finnish workers. For remote workers, working at home might have given them more autonomy and control over their jobs, and these factors have been associated with lower work exhaustion (Alarcon, 2011; Aronsson et al., 2017). People have also saved time in transitioning to and from work, leaving more time for leisure. However, potential stressors exist when partners are also working at home and when children have online schooling due to school closures. Our results on technostress point to the fact that the change brought by COVID-19 has not been easy.

SMC at work increased in all occupational fields, which was indicated by the decreasing number of nonusers and the increasing number of active users. Our results underline that formal SMC at work is a main stressor. These findings are not surprising because the role of social media use at work has been discussed as a stress factor in previous research literature (Bucher et al., 2013; Tarafdar & Ragu-Nathan, 2010; Zoonen et al., 2016). The findings confirmed H1 and H2. Heavy use of social media at work is a stressor, and we saw higher scores of technostress and work exhaustion among this heavy social media user group. Those workers who had used social media at work before the crisis were better off. Figs. 2 and 4 showed decreases in technostress and work exhaustion among these groups. These results generally fit the research evidence, pointing out major differences between accustomed technology users and others (Kim et al., 2009; Taylor & Todd, 1995; Venkatesh & Davis, 2000).

Of our covariates, cyberbullying at work predicted technostress and work exhaustion. This is in line with previous cross-sectional results about the potential negative impacts of cyberbullying at work in general (Oksanen, Oksa, et al., 2020; Vranjes et al., 2018). Although there was no increase in cyberbullying at work, it remains a major stressor at work. It is important to continue analyzing the resilience and vulnerability

among workers facing different types of crises. As expected from previous literature (Armon et al., 2012; Srivastava et al., 2015), in our results, neuroticism predicted technostress and work exhaustion. Differences between the fields were ultimately quite small in the models. Furthermore, we did not find evidence that the situation would have been difficult for families or those in close relationships. This is also understandable because family and close relationships are likely to be major social support resources during the crisis when other social contacts are limited.

4.2. Theoretical implications

Our integrative model of SMC at work during a crisis was grounded on the work–family border theory, COR theory, and the resilience framework. This merger advances our understanding of employees' experiences during a crisis in the digital age when knowledge work especially can be done flexibly and collaborative tools and information are at hand. The sudden digital leap and changes in work settings have demanded resilience (Chen & Bonanno, 2020) and might have decreased employees' resources to cope and contributed to their stress (Hobfoll, 1989). Considering that people can have their spouses and children at home when concurrently working remotely, drawing the boundaries between private and professional life can be challenging.

From a theoretical perspective, our study showed, that those experienced in using SMC at work are probably accustomed to negotiating the border between work and family and combining their professional and private identities more efficiently. In addition, those individuals had used the necessary technologies before the COVID-19 pandemic. Hence, there was less struggle within work issues and the management of work within the family context. This finding fits generally well with the work–family border theory (Clark, 2000) and theories on boundary management and identity negotiation (Fieseler et al., 2015; Ollier-Malaterre et al., 2013. At the same time, the crisis was challenging for those who wanted to keep their work and family lives strictly separated for a variety of reasons. As there is no return after a digital leap, a longer perspective on how these people are coping is possibly important. The potential impacts on work exhaustion and burnout are likely to come later.

We believe that our integrative model of SMC at work during a crisis is important for future studies investigating the on-going COVID-19 crisis and any forthcoming societal and global crises. This model is able to map dimensions of work–family boundary management, resources, and support gained from work and personal resilience under crisis. As such, the model is not limited to crises such as COVID-19, but it could be applied to other types of societal, local, or organizational crises. These could be, for example, man-made environmental disasters, violent events, economic crises, or unusual circumstances taking place within organizations and forcing workers to rearrange their work. In all types of crises, boundary management, resources, and resilience are imperative for workers to continue their tasks.

4.3. Practical implications

The results provide important information about working styles and the professional and private domains. Thus, essential potential actions include providing autonomy and flexibility in completion of the work and helping employees in managing and combining their professional and private domains and identities. Furthermore, aspects regarding well-being at work, especially exhaustion and technostress, are crucial to consider in organizations. Endorsing employees' technological skills, especially among those individuals with limited experience, can be one way to mitigate the negative implications of copious technology use. Notably, people have diverse personality traits and neurotic people might experience more exhaustion. Hence, recognizing employees' individual characteristics and providing support for those with neurotic personality characteristics are important actions. For policymakers as well as for organizations, regulations and guidance on handling cyberbullying at work need to be considered.

4.4. Strengths and limitations

One strength of our study was the use of a longitudinal nationally representative sample that enables the analysis of impacts brought by the COVID-19 crisis. The response rate was also high, and our survey includes a limited number of missing observations. The perspective on SMC at work was novel, and a similar study has not been conducted before. Prior studies have been limited by cross-sectional designs and small samples.

Our study was limited by self-reported information. Following the objective of this study, we focused on the frequency of using SMC for formal and informal purposes. Hence, our study does not cover the full complexity of SMC, its multiple functionalities, and different platform usage. Although our measurement of SMC has been used in previous research (Oksa et al., 2020), single-item measures have their limitations. In addition, we investigated the beginning of a long crisis. Hence, some of the effects might only become evident later, depending on the development of the crisis. Future research should investigate, for example, the development of work exhaustion over time.

4.5. Conclusion

The COVID-19 crisis has been a major natural experiment and has led to increases in remote working and intensive use of social media applications designed to facilitate work. This was the first study to investigate longitudinally the impacts of the COVID-19 crisis on the working population. We were able to demonstrate that technostress increased during the crisis and that excess use of social media at work strains people. However, this effect is not shown on those people who were already accustomed to using social media at work. Those used to digital technologies and remote working adjusted better to the COVID-19 crisis than others did. The COVID-19 crisis has provided an important lesson for many organizations on the general variance of skills in using digital technologies.

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Credit author statement

Atte Oksanen: Conceptualization, Investigation, Methodology, Data curation, Formal analysis, Resources, Writing – original draft, Supervision, Funding acquisition; Reetta Oksa: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing; Nina Savela: Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing; Eerik Mantere: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. Iina Savolainen: Investigation, Writing – original draft, Writing – review & editing., Markus Kaakinen: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing.

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Declaration of competing interest

None of the authors have a conflict of interest to declare.

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