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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. Multi-level 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
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 (Andreasii & 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 fulfill 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, or strict 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 & Raghu-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 (Demouroti 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 (Leondardis, 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, & Ewema, 2005; Demerouti, Bakker, & Bulers, 2004; Hakonen, 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; Hakonen et al., 2006), which can lead to long sick leaves and depression (Hakonen 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; Vaugh 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 working online amid the new situation imposed on employees and organizations during the crisis. 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, 2006; 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 acquisitions 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 patterns 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 conducted 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.” The scale ranged from 1 (disagree completely) to 7 (agree completely). The scale showed an excellent interitem reliability (T1: α = 0.89, T2: α = 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, 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”; and (e) “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 both time points (T1: α = 0.92, T2: α = 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 (Forsell, 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: α = 0.94, T2: α = 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 | | | | | | | | | | |
| T1: before COVID-19 crisis | 6–42 | 13.43 | 7.58 | 1 | | | | | |
| 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.
Interitem reliability ranged from acceptable to good: neuroticism (α = 0.87) and extroversion (α = 0.87).

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—i.e., the estimated values of technostress and exhaustion 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 conducted the analyses using Stata16 software. We first ran descriptive statistics on technostress, work exhaustion, and SMC at work. Then we 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.

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### 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 reclassified 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 €).

### 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.](image-url)
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 except in education. Biggest decrease 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...
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Table 3
Multilevel Linear mixed-effects Regression Models Predicting Technostress and Work Exhaustion.

|                     | Technostress | Work exhaustion |
|---------------------|--------------|-----------------|
|                     | b  | SE | p   | b  | SE | p   |
| Fixed part          |    |    |     |    |    |     |
| 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 | 0.97 | 0.74 | .190 | -1.31 | 0.67 | .052 |
| Commercial and technology | 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 |
| 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 |

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 (Hofstätter, 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-Ma laterre 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

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Srivastava, S. C., Chandra, S., & Shirish, A. (2015). Technostress creators and job outcomes: Theorising the moderating influence of personality traits. *Information Systems Journal, 25*(4), 355–401. https://doi.org/10.1007/s10200-013-0225-1

Staines, G. L. (1980). Spillover versus compensation: A review of the literature on the relationship between work and nonwork. *Human Relations, 33*(2), 111–129. https://doi.org/10.1177/001872678003300201

Suh, A., & Lee, J. (2017). Understanding teleworkers’ technostress and its influence on job satisfaction. *Internet Research, 27*(1), 140–159. https://doi.org/10.1108/IR-06-2015-0181

Tarafdar, M., Cooper, C. L., & Stich, J. F. (2019). The technostress triffica-technostress, technostress and design: Theoretical directions and an agenda for research. *Information Systems Journal, 29*(1), 6–42. https://doi.org/10.1111/isj.12169

Tarafdar, M., Pirklalainen, H., Salo, M., & Makkonen, M. (2020). Taking on the “dark side” – coping with technostress. *IT Professional, 22*(6), 82–89. https://doi.org/10.1109/MITP.2020.2977343

Tarafdar, M., Tu, Q., & Raghu-Nathan, T. S. (2010). Impact of technostress on end-user satisfaction and performance. *Journal of Management Information Systems, 27*(3), 303–334. https://doi.org/10.2753/MIJIS742-122270311

Tarafdar, M., Tu, Q., Raghu-Nathan, B. S., & Raghu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. *Journal of Management Information Systems, 24*(1), 301–328. https://doi.org/10.2753/MIS0742-122240109

Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. * MIS Quarterly, 19*(4), 561–570. https://doi.org/10.2307/249633

Ter Hoeven, C. L., van Zoonen, W., & Fonner, K. L. (2016). The practical paradox of technology: The influence of communication technology use on employee burnout and engagement. *Communication Monographs, 83*(2), 239–263. https://doi.org/10.1080/03637751.2015.1133920

Tremm, J. W., & Leonard, P. M. (2013). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Annals of the International Communication Association, 36*(1), 143–189. https://doi.org/10.1080/23809895.2011.679130

Tsimonis, G., & Dimitriadis, S. (2014). Brand strategies in social media. *Marketing Intelligence & Planning, 32*(3), 328–344. https://doi.org/10.1108/MIP-04-2013-0056

Venkatsh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186

Vranjes, I., Baillien, E., Vandebosch, H., Erreygers, S., & De Witte, H. (2018). Kicking someone in cyberspace when they are down: Testing the role of stressor evoked emotions on exposure to workplace cyberbullying. *Work & Stress, 32*(4), 379–399. https://doi.org/10.1080/02678375.2018.1437255

Wahlbeck, K., & McIaid, D. (2012). Actions to alleviate the mental health impact of the economic crisis. *World Psychiatry, 11*(3), 139–145. https://doi.org/10.1002/wps.20151–5545.2012b00114.x

Waters, R. D., Burnett, E., Lamm, A., & Lucas, J. (2009). Engaging stakeholders through social networking: How nonprofit organizations are using Facebook. *Public Relations Review, 35*(2), 102–106. https://doi.org/10.1016/j.pubrev.2009.01.006

Waugh, C. E., Fredrickson, B. L., & Taylor, S. F. (2008). Adapting to life’s slings and arrows: Individual differences in resilience when recovering from an anticipated threat. *Journal of Research in Personality, 42*(4), 1031–1046. https://doi.org/10.1016/j.jrp.2008.02.005

Yu, L., Cao, X., Liu, Z., & Wang, J. (2018). Excessive social media use at work exploring the effects of social media overload on job performance. *Information Technology & People, 31*(3), 1091–1112. https://doi.org/10.1108/MITP-10-2016-0237

Zhao, S., Lin, Q., Ran, J., Musa, S. S., Yang, G., Wang, W., Los, Y., Gao, D., Yang, L., He, D., & Wang, M. H. (2020). Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *International Journal of Infectious Diseases, 92*, 214–217. https://doi.org/10.1016/j.ijid.2020.01.050

van Zoonen, W., Verhoeven, J. W. M., & Vliegenthart, R. (2016). Social media’s darkside: Including boundary conflicts. *Journal of Managerial Psychology, 31*(8), 1297–1311. https://doi.org/10.1108/JMP-2015-0388

Waizenegger, L., McKenna, B., Cai, W., & Bendz, T. (2020). An affordance perspective of team collaboration and enforced working from home during COVID-19. *European Journal of Information Systems, 4*, 429–442. https://doi.org/10.1080/0960085X.2020.1800417