

# Is there a fit between PhD candidates' and their supervisors' perceptions on the impact of COVID-19 on doctoral education?

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## Abstract

**Purpose** – The COVID-19 pandemic has had its impact on research and researchers, potentially influencing the future of academia. Yet, to the best of the authors' knowledge, there are no empirical studies on the alignment between supervisors' and supervisees' estimates of the impact of COVID-19. This study aims to contribute to bridging this gap by exploring PhD candidates' and supervisors' perceptions of the impact of COVID-19 on candidates' study progress and study well-being, and whether the estimates were related to supervisors' and supervisees' well-being.

**Design/methodology/approach** – A total of 768 PhD candidates and 561 doctoral supervisors from a large multifield research-intensive university in Finland participated in this quantitative study. Data were collected with the doctoral experience survey and the supervisory experience survey.

**Findings** – In general, the results show that both supervisors and supervisees recognised the negative impact of the pandemic on candidates' well-being and progress, and their perceptions were quite well aligned. However, supervisors estimated that the impact had been more detrimental than the supervisees did. The results also show that the supervisors' perceptions of the negative impact of COVID-19 on candidates' progress and well-being were related to reduced levels of their own well-being.

**Originality/value** – Results can be used in developing effective support means for both the supervisors and supervisees to overcome the hardships caused by the COVID-19 pandemic and to avoid long-term negative consequences for the candidates in degree completion, career trajectories and the future of the academy.

**Keywords** COVID-19 pandemic, PhD candidates, Doctoral supervisors, Doctoral study progress, Study well-being, Engagement, Stress, Burnout

**Paper type** Research paper



## Introduction

There is growing body of evidence that the COVID-19 pandemic has had its toll on research and researchers. Most of the reported pandemic influences have been negative, though a few positive ones have been described (review by [Lokhtina et al., 2022](#)). The effects of COVID-19 have not been evenly distributed across the disciplines nor researchers at different stages of their careers ([Lee and Haupt, 2021](#)). In particular, PhD candidates have been found to suffer from negative pandemic effects ([Andersen et al., 2021](#); [Donohue et al., 2021](#); [Krukowski et al., 2021](#); [Viglione, 2020](#); [Lokhtina et al., 2022](#)). Among the influences detected are reduced productivity ([Cui, Ding, and Zhu, 2021](#)), delays in timelines ([Adarmouch et al., 2020](#); [Atkinson et al., 2021](#); [Ramvilas et al., 2021](#)), expiry of research funding ([Stamp et al., 2021](#)), lack of or limited access to the data and participants ([Pyhältö et al., 2022](#)), erosion of research support networks ([Guintivano et al., 2021](#)), restrained access to the resources provided by the institution and a reduction in well-being ([Atkinson et al., 2021](#); [Donohue et al., 2021](#)). Based on the limited empirical evidence, doctoral supervisors have also been influenced by the pandemic. This includes increased pressure to obtain funding for doctoral candidates ([Guintivano et al., 2021](#)), in supervisory responsibilities ([UK Council for Graduate Education, 2021](#)) and lower productivity ([Myers et al., 2020](#)). However, results concerning the impact of COVID-19 on supervisors' well-being are mixed: in some studies, a decline in supervisors' well-being has been reported ([Betts, 2021](#); [Camerlink et al., 2021](#)), whereas in other studies, lower levels of performance demands and stress, and higher levels of well-being among the supervisors during the pandemic have been detected ([Eringfeld, 2021](#)). However, there have not been any studies on the alignment between supervisors' and supervisees' estimates on the impact of COVID-19. This has resulted in a lack of shared grounding for developing pertinent and effective research-informed strategies to overcoming the hardships caused by the COVID-19 pandemic for PhD candidates. Our aim with this paper was to contribute to bridging the gap in the literature on the impact of COVID-19 on research education by exploiting a large-scale quantitative data set collected from both supervisors and doctoral candidates from one multi-field and research-intensive university. Furthermore, the aim is to explore the alignment between PhD supervisors' and supervisees' perceptions of the impact on candidates' study progress and study well-being, and whether the estimates were associated with their experiences of stress, burnout symptoms and engagement.

### *Doctoral supervisors' and supervisees' experiences of the impact of COVID-19*

There is strong evidence that supervisory relationships play a key role in successful PhD degree completion ([Lovitts, 2001](#); [Peltonen et al., 2017](#); [Pyhältö et al., 2015](#)). Accordingly, supervisory relationships potentially offer a central resource for overcoming the challenges caused by the COVID-19 pandemic for PhD candidates. Yet, harnessing the potential and building a grounding for offering well-fitted supervisory support for the PhD candidates to overcome the challenges caused by the pandemic requires shared understanding of the influences. This cannot be taken for granted, but typically calls for shared sensemaking about the influences ([Janssen et al., 2021](#)).

Based on the restricted empirical evidence, it seems that the COVID-19 pandemic has predominantly had a negative impact on PhD candidates ([Atkinson et al., 2021](#); [Aubry et al., 2021](#); [Camerlink et al., 2021](#); [Donohue et al., 2021](#); [Myers et al., 2020](#)). For instance, we recently showed that PhD candidates typically estimated the COVID-19 pandemic as having a negative impact on their study progress and study well-being ([Pyhältö et al., 2022](#)). The negative influences reported by the candidates were related to impaired access to the data, erosion of scholarly support networks, reduced access to institutional resources, poor work-life balance and reduced well-being ([Pyhältö et al., 2022](#)). The destructive COVID-19

effects for PhD candidates have also been shown to include a decline in the weekly working hours devoted to research (Myers *et al.*, 2020), delays in thesis submission (Stamp *et al.*, 2021), reduced opportunities for networking (Guintivano *et al.*, 2021) and professional development (Kappel *et al.*, 2021), as well as reduced involvement and experienced usefulness of online events attended (Raby and Madden, 2021). There is also tentative evidence that frequency of supervision may have declined during the pandemic (Pyhältö *et al.*, 2022). A reason for this might be fewer informal meetings such as coffee break meetings with the supervisors due to the lockdowns. In addition, reduced levels of well-being due to the COVID-19 pandemic have been detected (Atkinson *et al.*, 2021; Donohue *et al.*, 2021), including increased stress levels (Camerlink *et al.*, 2021; Guintivano *et al.*, 2021), mental and physical fatigue (Adarmouch *et al.*, 2020; Stamp *et al.*, 2021) and poorer work–life balance (Aubry *et al.*, 2021).

It also appears that the impacts of the pandemic have not been evenly distributed across PhD candidates (Minello *et al.*, 2020; Myers *et al.*, 2020; Staniscuaski *et al.*, 2021; Vincent-Lamarre *et al.*, 2020), potentially contributing to further inequalities and hence varied support needs between them. For example, during the first 10 weeks of lockdown in the USA, women’s research productivity measured in the number of publications decreased by 14% relative to men (Cui *et al.*, 2021). A similar decline has also been detected in Australia, China, Italy, Japan, The Netherlands and the UK (Cui *et al.*, 2021; Guintivano *et al.*, 2021). Moreover, we recently showed that international candidates, those at the mid phase of their studies, candidates studying full time, engaging in research teams and those from natural sciences had an increased risk of suffering from more severe COVID-19 influences compared to their peers (Pyhältö *et al.*, 2022). The results imply that PhD candidates are likely to need a range of types of support, including but not limited to supervisory support, to overcome the hardship caused by the pandemic.

Empirical evidence on the impact of COVID-19 on doctoral supervisors and supervision is even more limited. Results on the few studies on COVID-19 influences on supervision are mixed: some studies have reported a decline in supervisors’ stress (Betts, 2021; Else, 2021), reduced productivity particularly among those with teaching duties (Myers *et al.*, 2020; Watermeyer *et al.*, 2021), blurring of boundaries between the personal and the professional (Lasater *et al.*, 2021) and an increase in workload due to additional tasks and responsibilities that have resulted from the pandemic (Le, 2021). However, in other studies, no such effects or even opposite influences have been detected (Eringfeld, 2021). For instance, in our recent study on Finnish doctoral supervisors, two-thirds of the supervisors (66%) reported that their supervisory responsibilities had not changed because of the outbreak of COVID-19, whereas a quarter of the supervisors (24%) reported that the pandemic had increased their supervisory responsibilities, and 10% estimated that their supervisory responsibilities had declined (Löfström *et al.*, submitted). Those reporting changes in supervision estimated that the challenges of supervisory responsibilities caused by COVID-19 were primarily related to recognising when doctoral candidates needed help and supporting the candidates (Jung *et al.*, 2021). Similarly, Eringfeld (2021) showed that supervisors experienced reduced levels of performance demands and stress, and higher levels of well-being during the pandemic. Supervisors’ experiences on the impact of COVID-19 has also been reported as varying according to seniority, whether they supervise full-time or part-time candidates, and depending on the scholarly field (Gill *et al.*, 2020; Lambrechts and Smith, 2020; Löfström *et al.*, submitted).

Overall, the limited evidence on the impact of COVID-19 on doctoral supervisors and supervisees implies that they might have had varied experiences, and hence perceive influences of COVID-19 on PhD experience differently. Also, variation across the disciplines

and study status (full-time versus part-time) might occur regarding the alignment between the supervisors' and supervisees' estimates of the pandemic influences, considering that the differences detected across the varied groups of PhD candidates. Yet, there have been no empirical studies on the topic.

### *Doctoral education at the research-intensive university in Finland*

Finland has one of the highest rates of doctoral degree holders per capita (OECD, 2014), and has adopted a system nationwide graduate school relatively recently. At the research-intensive university, all doctoral candidates have belonged to one of the four doctoral schools, and to one of the university's 33 doctoral programmes since 2014. Studying for a doctorate (a total of 240 ECTS) involves conducting doctoral research (80%; i.e. 200 ECTS) that is launched from the beginning, and complementary coursework (20%; i.e. 40 ECTS) based on a personal study plan (Andres *et al.*, 2015). Doctoral candidates write their dissertation as either a monograph or as a set of articles. Most doctoral candidates write an article-based doctoral dissertation (Pyhältö *et al.*, 2022), typically including three or four peer-reviewed published articles and a summary. Doctoral candidates are typically supervised by at least two supervisors, with the main supervisor usually being a full professor holding a permanent position at the university. The thesis examination proceeds in three stages: firstly, two external examiners appointed by the faculty pre-examine the dissertation; secondly, if approved, a public defence follows the pre-examination; and finally, the faculty grants the PhD degree. The target time for completing the doctorate is four years studying full time; however, the average time for degree completion is five or six years (Pyhältö *et al.*, 2022). There are no tuition fees, but the universities, projects or foundations do not automatically provide funding for the doctoral candidate.

### **Aim of the study**

The aim of the study was to understand the alignment between the PhD candidates' and their supervisors' perceptions of the impact of COVID-19 on studying and well-being. In addition, the interrelation between the perceived COVID-19 influences and the candidates' and the supervisors' well-being was explored.

The following research questions were addressed:

- RQ1. What alignment there is between the PhD candidates' and supervisors' perceptions on the impact of COVID-19 on study progress and candidates' well-being?
- RQ2. What variations can be detected in PhD candidates' and supervisors' perceptions on the impact of COVID-19 across
  - RQ2a. the disciplines, and
  - RQ2b. the candidates with varied study status (i.e. full-time/part-time)?
- RQ3. Was the perceived impact on study progress and candidates' well-being related to
  - RQ3a. candidates' experiences of study burnout and engagement, and
  - RQ3b. supervisors' experiences of burnout and work engagement?

Methods

Participants

The participants in the study comprised 561 doctoral supervisors (275 women, 50%; 266 men, 49%; and 6 non-binary, 1%) and 768 PhD candidates (502 women, 67%; 234 men, 31%; and 18 non-binary, 2%) from a large multi-field research-intensive university in Finland. The response rate of the supervisors was 16%, and 17% for PhD candidates. The typical age of the participating PhD candidates was 30–34 years, and 40–44 years for supervisors. In terms of disciplinary distribution, the participants represented PhD candidate and doctoral supervisor populations in the case university well. Also, in terms of gender distribution, the supervisor data represented the population well, but women were slightly overrepresented in the PhD candidate data. Of the candidates, 62% reported studying full time and 38% part time. Similarly, about a third of the supervisors reported supervising part-time candidates (see [Table 1](#)).

Data

In this study, we used a large-scale quantitative approach with two separate data sets collected in 2021. The data sets were combined to compare the supervisors’ and PhD candidates’ perceptions of the impact of COVID-19 on candidates’ progress and well-being, and how the perceptions were related to supervisors’ and supervisees’ experiences of engagement, stress, exhaustion and cynicism in their work. The data from PhD candidates were collected between April and May 2021 using a modified version of the cross-cultural doctoral experience survey (C-DES) validated in previous studies ([Pyhältö et al., 2016](#); see also C-DES manual: [Pyhältö et al., 2018](#)). The DES has been originally developed and validated among Finnish PhD candidates with various data sets since 2007. The survey was developed based on the series of qualitative studies and literature on the main determinants of doctoral experience ([Stubb et al., 2014](#); [Vekkaila et al., 2013, 2014](#)). Since 2008, the survey has been validated with data collected from nine countries, and it has been translated into several languages (see details in the cross-country doctoral experience manual 2018: [Pyhältö et al., 2018](#)). The validation procedures have included translation back procedures, several pilots with thinking aloud procedure and series of confirmatory analysis. Also, researcher teams from each country have been involved in the survey validation to ensure proper contextual adaptation. The supervisory experience survey was first developed in 2010 by the first author and her team. The development and further adaptations involve piloting with supervisors, and series of quantitative analysis. Recently, cross-country data have been also collected using supervisory experience survey. The data from doctoral supervisors for this study were collected between August and September 2021 using a modified version of

**Table 1.**  
Background  
information about  
the participants

Background variables	PhD candidates		Supervisors	
	<i>n</i>	%	<i>n</i>	%
<i>Discipline</i>				
Humanities and social sciences	370	49	180	38
Natural sciences	106	14	85	18
Health sciences	209	28	129	27
Environmental, food and biological sciences	64	9	77	16
<i>Candidates'/supervisees' study status</i>				
Full-time	467	62	372	68
Part-time	286	38	179	32

supervisory experience survey validated in previous studies (Pyhältö *et al.*, 2015). Both data sets were collected via online surveys available in Finnish, Swedish and English. The links to the surveys were sent via e-mail to the participants by using the Doctoral Schools' PhD candidates' and supervisors' mailing lists. All the participants were informed about the study before the data collection. No identifying information or incentives were used. Participation in the study was voluntary.

The following measures were used to examine the PhD candidates' perceptions of COVID-19 and their study well-being:

- one item on the COVID-19 pandemic impact on PhD candidates' study well-being scale;
- one item on the COVID-19 pandemic impact of doctoral study progress scale;
- one item stress scale (Elo *et al.*, 2003);
- study burnout scale comprising exhaustion (five items) and cynicism scales (six items) (adapted from Schaufeli *et al.*, 2002a); and
- study engagement scale (nine items) (adapted from Schaufeli *et al.*, 2002b; Salmela-Aro and Upadaya, 2012).

For measuring doctoral supervisors' perceptions of the same themes, the following scales were used:

- one item on the COVID-19 pandemic impact on PhD candidates' study well-being scale;
- one item on the COVID-19 pandemic impact of doctoral study progress scale;
- one item stress scale (Elo *et al.*, 2003);
- burnout scale comprising exhaustion (five items), cynicism (three items) and sense of inadequacy scales (three items) (Pyhältö *et al.*, 2018 adapted from Maslach Burnout Inventory); and
- work engagement scale (nine items) (Schaufeli *et al.*, 2006).

All the scales were one- to seven-point Likert scales. For the items, see [Appendix](#).

In Finland, an ethics review is required when research involves intervention in the physical integrity of research participants; deviates from the principle of informed consent; involves participants under the age of 15 being studied without parental consent; exposes participants to exceptionally strong stimuli; risks causing long-term mental harm beyond that encountered in normal life; or signifies a security risk to subjects (Finnish National Board on Research Integrity, 2019). None of these conditions affected this study.

### Analysis

To get the overall view of the PhD candidates' and supervisors' perceptions of the impact of the COVID-19 pandemic on candidates' study progress and study well-being, the means and standard deviations were calculated. To further analyse the fit between the PhD candidates' and supervisors' perceptions, the independent samples *t*-test was used. Variation across the disciplines in PhD candidates' and supervisors' perceptions of the impact of COVID-19 were explored with one-way analysis of variance and differences based on candidates' study status with the independent samples *t*-test. For pairwise comparisons of the disciplinary differences, Tukey's HSD test was used. Independent samples *t*-test was also used to analyse differences in supervisors' and candidates' perceptions of impact of COVID-19



within the disciplines. Bonferroni correction was applied when multiple *t*-tests were conducted to same groups. Finally, to analyse the associations between the perceptions of the impact of COVID-19 on PhD candidates' and supervisors' well-being, Pearson's correlation coefficients between the study variables were calculated.

## Results

### *PhD candidates' and supervisors' perceptions of the impact of COVID-19 on study progress and candidates' well-being*

Candidates reported that the pandemic had hindered their study progress ( $M = 4.12$ ,  $SD = 2.14$ ) and reduced their doctoral study related well-being ( $M = 4.39$ ,  $SD = 2.01$ ). Similarly, doctoral supervisors often estimated the pandemic as having a negative impact on doctoral candidates' progress ( $M = 4.60$ ,  $SD = 1.82$ ) and well-being ( $M = 4.87$ ,  $SD = 1.57$ ). Further investigation showed that the supervisors estimated the negative impact of COVID-19 on the supervisees' progress to be higher [ $t(1,274) = -4.34$ ,  $p < 0.001$ ] and the decrease in their study well-being to be more severe [ $t(1,292) = -4.82$ ,  $p < 0.001$ ] than the candidates themselves did. Accordingly, in general, the supervisors estimated the impact of COVID-19 on supervisees' progress and well-being to have been more detrimental than the supervisees did.

### *Variation in PhD candidates' and supervisors' perceptions of the impact of COVID-19 across and within the disciplines and candidates' study status*

Some disciplinary differences in the impact of the COVID-19 pandemic were detected among the candidates [ $F(3, 740) = 4.96$ ,  $p < 0.01$ ]. The candidates in the natural sciences estimated that the COVID-19 pandemic had reduced their study-related well-being more severely than their peers in the health sciences (see Table 2). No such disciplinary differences in the estimated impact of COVID-19 on candidates' well-being were detected among the supervisors. There were no disciplinary differences in PhD candidates' estimates on COVID-19 impact on study progress. However, some disciplinary differences were detected among the supervisors: supervisors in health sciences estimated COVID-19 influences on study progress to be more detrimental than supervisors in humanities and social sciences [ $F(3, 463) = 2.770$ ,  $p < 0.05$ ].

Some disciplinary differences in the fit between candidates' and supervisors' perceptions of the impact of COVID-19 were also detected: In the health sciences, the supervisors assessed the impact of COVID-19 on the study progress [ $t(292) = -5.51$ ,  $p < 0.001$ ] and study well-being [ $t(306) = -4.03$ ,  $p < 0.001$ ] more negatively, than the supervisees themselves did. In the humanities and social sciences, the supervisors estimated the negative pandemic influence on the candidates' well-being [ $t(438) = -2.93$ ,  $p < 0.01$ ] to be higher than the candidates themselves did, but, there was no difference between the candidates' and the supervisors' perceptions of the impact of COVID-19 on the study progress. In the natural sciences and in the environmental, food and biological sciences, no differences were detected in the supervisors' and candidates' perceptions of the impact of COVID-19.

The candidates who were conducting their doctoral research full time reported that the COVID-19 pandemic had both decreased their study-related well-being [ $t(580) = 8.56$ ,  $p < 0.001$ ] and hindered their study progress [ $t(554) = 5.55$ ,  $p < 0.001$ ] more often than those studying part time. Similarly, the doctoral supervisors, whose supervisees were typically studying full time, perceived more often that the pandemic had influenced negatively the progress [ $t(545) = 2.55$ ,  $p < 0.05$ ] and well-being of their candidates [ $t(307) = 4.92$ ,  $p < 0.001$ ] than supervisors supervising mostly part-time candidates.

Background variables	PhD candidates		Supervisors	
	Impact on progress of doctoral studying <i>m (sd)</i>	Impact on study well-being <i>m (sd)</i>	Impact on progress of supervisees' doctoral studying <i>m (sd)</i>	Impact on supervisees' study well-being <i>m (sd)</i>
<i>Discipline</i>				
Humanities and social sciences	4.24 (2.14)	4.40 (2.00)	4.41 (1.84)	4.86 (1.55)
Natural sciences	4.35 (2.16)	4.94 (1.86)	4.37 (1.79)	4.99 (1.43)
Health sciences	3.76 (2.07)	4.04 (2.00)	4.96 (1.85)	4.85 (1.65)
Environmental, food and biological sciences	4.34 (2.28)	4.53 (2.16)	4.66 (1.83)	4.87 (1.66)
<i>Candidates' /supervisees' study status</i>				
Full-time	4.48 (2.01)	4.88 (1.89)	4.74 (1.78)	5.10 (1.47)
Part-time	3.58 (2.24)	3.63 (1.97)	4.32 (1.88)	4.38 (1.68)

**Table 2.**  
PhD candidates' and supervisors' perceptions of the impact of COVID-19 according to discipline and candidates' study status



*Association between well-being and the perceptions of COVID-19 influence on candidates*

Further investigation showed that the supervisors' perceptions of the negative impact of COVID-19 on candidates' progress and well-being were also related to their own well-being (see [Table 4](#)). More specifically, the supervisors' negative estimates of the impact of COVID-19 on their supervisees were related to experiencing elevated levels of stress, exhaustion, cynicism and inadequacy in their work. However, the perceptions of negative impact of COVID-19 on their supervisees were not related to work engagement among the supervisors.

### *Findings in the light of previous research*

We set out to investigate the alignment between PhD candidates' and supervisors' estimates of the impact of COVID-19 on study progress and the candidates' study well-being, and whether the estimates were related to supervisors' and supervisees' well-being. Results showed that, in general, the supervisors estimated that the impact of COVID-19 on supervisees' progress and well-being had been more detrimental than the supervisees did. This implies that supervisors do recognise and are sensitive to the challenges faced by the PhD candidates resulting from the pandemic. Accordingly, although earlier studies suggest that the impact of the pandemic on the supervisors tended to be less severe and to some extent varied (Betts, 2021; Camerlink *et al.*, 2021; Eringfeld, 2021) compared to supervisees,

	1	2	3	4	5	6
1. COVID-19 pandemic impact on doctoral study progress						
2. COVID-19 pandemic impact on PhD candidate's study well-being	0.606**					
3. Stress	0.208**	0.295**				
4. Exhaustion	0.169**	0.288**	0.706**			
5. Cynicism	0.195**	0.245**	0.514**	0.672**		
6. Research engagement	-0.087*	-0.131**	-0.312**	-0.387**	-0.685**	
<i>N</i>	756	755	761	763	763	762
Cronbach's $\alpha$	—	—	—	0.839	0.869	0.950
Mean	4.12	4.39	4.61	3.68	3.60	4.84
SD	2.14	2.01	1.75	1.48	1.48	1.35
Min/Max	1/7	1/7	1/7	1/7	1/7	1/7

**Notes:** \*\* $p < 0.001$ ; \* $p < 0.05$

**Table 4.**Correlations between  
doctoral supervisors'  
perceptions of the  
impact of COVID-19  
on supervisees' study  
progress and well-  
being, and their own  
burnout and work  
engagement

	1	2	3	4	5	6	7
1. COVID-19 pandemic impact on supervisees' study progress							
2. COVID-19 pandemic impact on PhD supervisees' study well-being	0.652**						
3. Stress	0.214**	0.238**					
4. Exhaustion	0.247**	0.270**	0.791**				
5. Cynicism	0.116**	0.164**	0.354**	0.438**			
6. Sense of inadequacy	0.189**	0.219**	0.535**	0.582**	0.676**		
7. Research engagement	-0.020	-0.069	-0.260**	-0.276**	-0.629**	-0.488**	
N	551	547	547	546	546	546	552
Cronbach's $\alpha$				0.817	0.798	0.705	0.905
Mean	4.60	4.87	3.97	3.36	2.52	3.25	5.63
SD	1.82	1.57	1.77	1.33	1.32	1.40	0.87
Min/Max	1/7	1/7	1/7	1/7	1/7	1/7	2/7

**Note:** \*\* $p < 0.001$ 

the supervisors' estimates of the impact on supervisees matched well with those of the supervisees. Further investigation showed that supervisors' and supervisees' estimates about the impact of COVID-19 were also well aligned regarding study status: PhD candidates who studied full time considered the impact of COVID-19 to be more detrimental compared to the candidates studying part time, as did the supervisors who primarily supervised full-time candidates. In general, supervisors estimated that the impact of COVID-19 on candidates' progress and well-being to be more negative than the candidates themselves did. This implies a certain degree of mismatch between the supervisees' and supervisors' estimates on the impact of COVID-19. A reason for this might be that because of their experience, supervisors are able to make more accurate estimations, for example, about the long-term consequences of data collection delays for the study progress. Moreover, supervisors may worry about the supervisees' future study trajectories, and consider that providing extra-support to be their responsibility, even though they are also facing a pandemic crisis for the first time in their careers (Lasater *et al.*, 2021). Some disciplinary differences regarding supervisors' and supervisees' estimates of the impact of COVID-19 were identified: while supervisors' estimates of the impact in health sciences exceeded the estimates of the supervisees, in humanities and social sciences such a difference was only detected regarding candidates' well-being. In natural sciences and in environmental, food and bio sciences, no such differences between the supervisors' and supervisees' estimates about COVID-19 were detected, implying a better understanding of the impact. A reason for this might be that the number of full-time students was highest within these disciplines, which potentially allows more frequent interaction and hence shared sensemaking about COVID-19 between the supervisors and supervisees, which is reflected in a better alignment between the perceived impact.

Both supervisors' and supervisees' negative estimates of the impact of COVID-19 on PhD candidates were related to reduced levels of well-being: increased levels of stress and burnout symptoms. In this regard, our results support the findings of previous studies suggesting that COVID-19 pandemic increases stress and the risk of developing burnout symptoms among both the supervisees and supervisors (Atkinson *et al.*, 2021; Donohue

*et al.*, 2021; Betts, 2021; Camerlink *et al.*, 2021). The results further extend the findings of previous studies by showing that hardships caused by the pandemic for PhD candidates reflect negatively on both supervisors' and supervisees' well-being. The finding implies that as an intensive long-term professional relationship, supervisory interaction is challenged by the pandemic, resulting in a decline in supervisors' and supervisees' well-being. However, while the reported negative influences were related to the reduced levels of research engagement among the PhD candidates, no such relationship were detected regarding supervisors' work engagement. A reason for this may be that though potentially aligned, supervisors' research is not dependent on their supervisees' research and their work is more varied compared to the PhD candidates, whose primary task is to promote their doctoral research. On the contrary, the findings may indicate that the core resource of supervisors' work contributing to their work engagement does not stem from supervisory relationship, and hence are not affected by the problems faced in this domain. Moreover, because of being less experienced in research and having more limited access to institutional resources, the supervisees might be more emotionally vulnerable and less resilient in facing hardships caused by the pandemic. Accordingly, our paper contributes to the new understanding on interrelation between the supervisors' and supervisees' well-being under particular circumstance, i.e. during the COVID-19 pandemic. However, the results concerning the interrelation between supervisors and supervisees have potentially more general implications: firstly, supervisors' well-being is likely to reflect on the kind of supervisory practices applied, and secondly, the experienced quality of supervisory relationship is likely to have impact not only on supervisee's well-being but also on supervisor's occupational well-being. The hypothesis is supported by our recent results on supervisors' well-being suggesting that the supervisors' perceptions of quality of supervisory relationship was related to higher levels of work engagement, and decreased levels of burnout symptoms, especially cynicism. The satisfaction with supervisory competences was also positively associated with work engagement and negatively with stress and burnout symptoms. Furthermore, receiving support from the scholarly community was related to increase in work engagement, and decrease in stress and burnout symptom (Tikkanen *et al.*, forthcoming). Similarly, a recent study on UK research supervisors showed that despite a high proportion reporting supervisory responsibilities, only half of the supervisors suggested their workplace formally recognised their supervision in workload allocation models, and that a third of them have experienced stress caused by the concern related to supervision that have kept them awake at night over the past 12 months (UK Council for Graduate Education, 2021). However, further studies are needed to test the hypothesis.

### *Implications*

Our results suggested that COVID-19 pandemic has had a negative impact on the PhD candidates' well-being and progress across the disciplines and that both supervisors and supervisees recognise it. This calls for developing effective means of support to overcome the hardships to avoid long-term negative consequences for the candidates' degree completion, career trajectories and the future of the academy. Because supervision is repeatedly shown to be one of the main determinants of doctoral experience and degree completion (Cornér *et al.*, 2017; Ives and Rowley, 2005; Lovitts, 2001; Peltonen *et al.*, 2017; Pyhältö *et al.*, 2012, 2015), supervisors' understanding of the impact of the COVID-19 pandemic on the candidates provides a reason for providing support for the candidates to stay resilient in facing the challenges and overcome the hardships. Accordingly, the fact that supervisors acknowledged the impacts and were sensitive to them implies that supervisors are in general well tuned with the supervisees' experiences. This would suggest that the

shared sensemaking is needed more in co-creating means to overcome the challenges rather than just building an understanding of whether the PhD candidates are influenced by the pandemic or not. However, it is important to note that measures taken to overcome the hardships cannot be limited only to supervision, but calls for efforts at all levels of doctoral education ranging from policies and funding instruments to institutional support tools and individual actions. Our results further suggest that the negative COVID-19 influences are related to an increased risk of suffering from stress and burnout symptoms among both the supervisors and supervisees. This suggests that the pandemic can compromise the well-being of both supervisors and supervisees via having a negative impact on the latter. Accordingly, actions on overcoming the influences should consider the supervisors' support needs that would allow them to be responsive to their supervisees' needs, without compromising their own occupational well-being.

### *Methodological limitations*

The study has some methodological strengths and limitations that should be considered in drawing a conclusion. A major strength of the study is that it explored the fit in supervisors' and supervisees' views of the COVID-19 pandemic with comparable measures by using data collected from both groups from the same institution. The response rates for both groups of participants were somewhat low. However, regardless of the low response rate, in terms of age and disciplinary distribution, the PhD candidates were a good representation of the whole PhD candidate population at the case university. Women were slightly over presented in the data. The distribution of men and women was a good representation of doctoral supervisors at the university, and they were from all four doctoral schools. However, we were not able to match the supervisors with their own supervisees because we wanted to protect the anonymity of the respondents. Therefore, one should be cautious in making conclusions about the supervisory relationship between the participants. Instead, the results reflect the fit in the perceptions concerning the impact of COVID-19 at the more general institutional level. Measures used in the study can be considered reliable. We used a cross-sectional design in this study, and hence, causal conclusions or conclusions about development of the perceptions cannot be drawn.

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## Appendix. Scales and items

### PhD candidate data

- (1) COVID-19 pandemic impact on PhD candidates' study well-being
  - COVID-19 pandemic has decreased my doctoral study-related well-being.
- (2) COVID-19 pandemic impact of doctoral study progress
  - COVID-19 pandemic has hindered the progress of my doctoral studies.

- (3) Stress
  - Stress means feeling nervous, uneasy, distressed or having difficulties sleeping because of things that are bothering you. Do you have such feelings?
- (4) Exhaustion
  - I often sleep badly because of matters related to my doctoral research.
  - The pressure of my doctoral dissertation causes me problems in my close relationships with others.
  - I feel burned out.
  - I brood over matters related to doctoral research a lot during my free time.
  - I feel overwhelmed by the workload of my doctoral research.
- (5) Cynicism
  - I have difficulties in finding any meaning to my doctoral dissertation.
  - I feel that I am losing interest in my doctoral research.
  - I feel my doctoral dissertation is useless.
  - I used to have higher expectations of my doctoral research than I do now.
  - I often feel that I fail at my doctoral research.
  - I often have feelings of inadequacy in my doctoral research.
- (6) Study engagement
  - When I conduct my doctoral research, I feel that I am bursting with energy.
  - I find the doctoral research that I do full of meaning.
  - Time flies when I'm doing my doctoral research.
  - When doing my doctoral research, I feel vigorous.
  - I am enthusiastic about my doctoral research.
  - When I am doing my doctoral research, I forget everything else around me.
  - I feel happy when I start working on my doctoral research.
  - My doctoral research inspires me.
  - I am immersed in my doctoral research.

*Doctoral supervisor data*

- (1) COVID-19 pandemic impact on PhD candidates' study well-being
  - The Covid-19 pandemic has impacted negatively on the well-being of my doctoral candidates.
- (2) COVID-19 pandemic impact of doctoral study progress
  - The Covid-19 pandemic has hindered the progress of my doctoral candidates.
- (3) Stress
  - Stress means feeling nervous, uneasy, distressed or having difficulties sleeping because of things that are bothering you. Do you have such feelings?
- (4) Exhaustion
  - I feel overwhelmed by my workload.
  - I often sleep badly because of matters related to my work.
  - I feel burned out.
  - I brood over matters related to work a lot during my free time.

- The pressure of my work causes me problems in my close relationships with others.
- (5) Cynicism
  - I often feel that my work has very little value.
  - I feel that I am losing interest in my work.
  - I have difficulties in finding any meaning to my work.
- (6) Inadequacy
  - I often have feelings of inadequacy in my work.
  - I used to have higher expectations of my work than I do now.
  - I often feel that I fail at my work.
- (7) Work engagement
  - At my work, I feel bursting with energy.
  - At my work, I feel strong and vigorous.
  - When I get up in the morning, I feel like going to work.
  - I am enthusiastic about my work.
  - I am proud of the work that I do.
  - My work inspires me.
  - I am immersed in my work.
  - I get carried away when I'm working.
  - I feel happy when I am working intensely.

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