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Title: A positive impact of crisis? A longitudinal study on the impact of the Covid-19 pandemic on physicians' work experiences and employability

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Abstract

Objective – The Covid-19 pandemic places an enormous demand on physicians around the world. The aim of this study was to examine the impact of a crisis on physicians' work experiences and their ability and willingness to continue working in their profession until retirement (i.e. their employability). Attention for this is important to maintain a healthy and sustainable workforce.

Design - A longitudinal approach was used. Survey data were collected on three moments: before (May 2019), in the early phase (May 2020) and in a later phase (November 2020) of the Covid-19 pandemic in The Netherlands. Data were compared in repeated-measures analyses of variance (RM ANOVA).

Setting – This study took place among physicians of two hospitals in a large city in the Netherlands.

Participants – 165 hospital physicians with surgical, medical and other specialties participated in this study.

Results – Physicians' employability significantly increased from the time prior to the crisis, the Covid-19 pandemic, compared to the period during the crisis. Employability differs among physicians with surgical, medical and other specialties. Furthermore, physicians experienced a lower emotional, physical and quantitative workload in the first peak of the Covid-19 pandemic compared to the time before. Moreover, physicians experienced the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Conclusions – This study shows that physicians' employability and work experiences are affected by a crisis, the Covid-19 pandemic specifically. Work experiences vary for physicians with different specialties. These varieties stress the importance of attention for physicians' individual needs and challenges regarding working during a crisis and the possibility of continuing work in the aftermath of a crisis. Based on this, tailor-made solutions can be offered to physicians. This is important to maintain a healthy and employable workforce which is essential for a sustainable health care system.

Strengths and limitations of this study

- The study captured the work experiences of physicians prior to and during a crisis, the Covid-19 pandemic specifically, allowing for within-person comparisons

- The study used a longitudinal study approach with data collected at three moments in time
- Despite the highly relevant longitudinal study approach, this has also resulted in participants dropout

Introduction

Emerging crises, such as infectious pandemic diseases, place an enormous strain on health care workers [1]. They are especially vulnerable during pandemics, given the risk of exposure to the virus, concerns about infecting their loved ones, shortages of personal protective equipment, extended workload, and involvement in emotional and ethical decision making [2,3]. Crises, such as the recent Covid-19 pandemic, are likely to have implications for health care workers' ability and willingness to work in the short-run and to continue their essential work on the frontlines in the long-run [4]. Crises may for instance result in stress [5], illness, insomnia [6], fear for becoming infected [7], hesitation to work [8] or a lack of motivation to work [9] in the short-run. From previous research on crises we know that a pandemic may even result in more adverse consequences for physicians in the long-run, such as developing burn-out, psychological distress, and post-traumatic stress-disorder [10,11].

The possible consequences of crises for physicians make it important to monitor physicians' work experiences (i.e. their perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability). It is important to prevent adverse consequences, because health care workers' well-being might be at stake. Studying physicians' work experiences helps to monitor their ability to work in the short-term. Especially job demands, such as workload, and job resources such as job autonomy have been shown to be important factors that affect well-being, stress and performance [12–14]. Furthermore, employability provides an indication of physicians' ability and willingness to continue working in their profession. Research has shown that employability positively affects well-being and performance [15,16]. Research has shown that a crisis, such as the Covid-19 pandemic, is a "career shock" referring to a disruptive and extraordinary event that is caused by factors outside an individual's control and triggers a deliberate thought process concerning ones' career [17]. This may result in people reconsidering their position, leaving their

profession or lower job or career satisfaction [18]. This challenges employability which is especially problematic in a health crisis as employable physicians are necessary to handle the high demands for health care, and in the aftermath of the health crisis due to delayed operations and treatments for instance.

Despite the relevance of focusing on employability and work experiences, a search on Google Scholar shows that research on this is lacking behind, both in quantity as well as in timing, in contrast to the large number of research examining the medical consequences of the Covid-19 pandemic. In this study we examine the impact of a health crisis on physicians' work experiences and employability, by addressing the following research question in the context of a three-wave prospective study: "What is the impact of a health crisis on physicians' work experiences (i.e. perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability)?" The Covid-19 pandemic is examined as a case to study this question. Understanding the impact of a health crisis on physicians' work is important to be prepared for future outbreaks of health crises as maintaining a healthy and employable workforce is essential for a sustainable health care system. These themes, and topics related to this, receive little attention, especially in a medical setting. Physicians tend to self-ignore attention for their well-being and health systems poorly support this [19] emphasizing the importance of this research.

This study examines the impact of a health crisis on physicians with varying specialties. Previous studies have shown that the impact of pandemics varies for health care workers working in different departments [20,21]. For instance, those who work in emergency departments, intensive care units, and isolation wards have a greater risk of developing adverse psychiatric outcomes than those working in other departments [21]. Despite differences between physicians, it is likely that pandemics, such as the Covid-19 pandemic, affect them all to some extent as their work has suddenly changed, both in terms of content (e.g. change in cases, increase in the use of video consults) and location (e.g. working from home or in different departments), and due to an uncertain future. These changes may result in various job demands such as a high (emotional) workload or stress [1,22] which may vary between

groups of physicians. More research is needed to understand the impact of pandemics on physicians with different specialties. This study examines physicians with surgical, medical, and other specialties to examine the impact on their work and possible differences between specialties.

Studies examining the psychological effects of pandemics (e.g. SARS, H1N1 influenza and avian influenza H5N1) often use cross-sectional methods [6,9–11,23]. Also recent studies into the Covid-19 pandemic mainly rely on cross-sectional methods [6,23]. A disadvantage of using cross-sectional methods is that the dynamics of pandemics cannot be captured with this approach. The impact of pandemics on health care workers has been shown to vary in different phases of a crisis. During initial outbreak health care workers perceive feelings of extreme vulnerability, uncertainty, anxiety and threat while mental health problems such as depression are more likely to develop in a later phase [24]. For this reason, a longitudinal approach where experiences are measured at multiple points in time is more appropriate to study the impact of a pandemic. In this study we use a longitudinal approach by examining physicians experiences at three moments in time.

In addition, a meta-analysis shows that these studies often use retrospective questions where respondents are asked for their past experiences [25]. This approach is problematic as psychologists and survey methodologists have shown that subjective experiences are poorly represented in memory. Retrospective questions often ask respondents for information that they cannot provide with any validity [26]. Therefore, examining behaviour and experiences by using real-time data is highly preferable [26]. This is done in this study by asking for physicians' current behaviour, at the three moments of taking the surveys.

Method

Three surveys were sent to physicians in two hospitals in a large Dutch city, an academic hospital and a general hospital. One survey was sent as part of another study [27]. This survey was sent in May 2019 (T1), prior to the Covid-19 outbreak. A second survey was sent in May 2020, in an early phase of the Covid-19 pandemic. This was one month after the first peak of Covid-19 infections in the Netherlands (RIVM, 2020). The long period in which the Covid-19 pandemic dominates the world, made it relevant to add a measurement in a later phase of the pandemic to examine the longer-term consequences of working during a crisis. Therefore, a third survey was sent in November 2020 (T3), one month after the second peak of Covid-19 in the Netherlands. When the surveys were sent at T2 and T3, many countries, including the Netherlands, were still partly or fully in lockdown, social distancing was required and the number of patients infected with Covid-19 was high.

Participants were recruited through promotional presentations and through an internal mailing list. 165 physicians participated in this study at T1. These 165 physicians were invited by e-mail to complete a second and third survey. 93 physicians completed the survey at T2, 98 physicians at T3. We compared participants who completed all three surveys (T1, T2 and T3) (n=75) with participants who only completed the survey sent at T1 (n=72). Multivariate analysis of variance indicated that there were no significant differences between these participants in terms of age (F(1,124)=0.037, p=0.849), hours worked according to contract (F(1,135)=0.555, p=0.458), functional tenure (F(1,133)=0.591, p=0.443), and organisational tenure (F(1,129)=0.804, p=0.371). For the dichotomous variables gender, hospital type (general vs. academic), type of specialism (surgical, medical vs. other, following the categorization of [28]) and type of employment contract (employed by the hospital vs. independently established) we conducted chi-square tests, again showing that there were no significant differences between participants that dropped out of this study and the participants that completed all three surveys (all p's>0.452).

Physicians provided several reasons for not completing the surveys sent at T2 and/or T3. At T2, 1 physician left the hospital, and 10 physicians were on a leave (either a pregnancy leave, holiday leave

or were abroad). At T3, 2 physicians left the hospital, 10 physicians were on a leave, and 1 physician was too busy to complete the survey. These reasons, apart from the latter, are unlikely to result in biased outcomes. This, together with the non-significant results for the non-response analysis, show that there are no significant differences between the participants who dropped out of this study and the participants who completed all three surveys. The result section reports on the results of the analyses based on the data from participants who completed the surveys on T1, T2 and T3 (*n*=75). Table 1 presents the demographics of the respondents.

Table 1: Demographics of participants (n=75)

Gender	Male: *n*=28 (37%) Female: *n*=47 (63%)
Age	*M*=44.9, *SD*=7.8
Work hours according to contract	*M*=41.4, *SD*=11.12
Functional tenure (years)	*M*=11.6, *SD*=8.4
Organizational tenure (years)	*M*=9.6, *SD*=8.0
Type of employment contract	Self-employed: *n*=10 (13%) Contracted: *n*=65 (87%)
Specialty	Surgical: *n*=14 (19%) Medical: *n*=35 (47%) Other: *n*=26 (35%)
Involved in care for Covid-19 patients at T2	Yes: *n*=24 (32%) No: *n*=51 (68%)
Involved in care for Covid-19 patients at T3	Yes: *n*=19 (25%) No: *n*=56 (75%)

Participants provided informed consent at the start of each survey stating that participation is voluntary, outcomes are held confidential, participants can withdraw from the study at any time, and all study material was anonymized and saved on a protected server. The questions addressed sociodemographic characteristics (gender, age), job characteristics (specialism, occupational and

organizational tenure, autonomy and workload) and involvement with care for patients with the Covid-19 virus. Further, physicians were asked to rate their emotional workload (5 items: *"Is your job emotionally demanding?", "Are you confronted in your work with things that affect you personally?", "Are you in your work in contact with difficult patients or their relatives?", "Do you have to convince or persuade people for your job?" and "Do you encounter emotionally demanding events in your work?"*, [29]), quantitative workload (3 items: "*Do you have too much work to do?", "Do you have to put in extra effort to finish your work?" and "Do you have to hurry?"*, [29]), physical workload (1 item: "*My job is physically demanding"*, [30]), and job autonomy (3 items: "*The job allows me to decide on my own how to go about doing my work", "The job provides me with significant autonomy in making decisions" and "The job gives me a chance to use my personal initiative or judgment in carrying out the work"*, [31]). Answers were given on a 5-point Likert scale (1=never, 5=very often).

Other questions asked for physicians' perceptions on their own employability (2 items measured ability: *"I am [physically (item 1)/ mentally (item 2)] able to continue to work until the age of 67 in my current profession"*; 1 item measured willingness: *"I am willing to continue to work until the age of 67 in my current profession"*, [32]), job satisfaction (1 item: "*Generally speaking, I am very satisfied with my job",* [33]) and career satisfaction (1 item: "*Generally speaking, I am very satisfied with my career*", [34]). Answers were given on a 5-point Likert scale (1=totally disagree, 5=totally agree).

The surveys sent on T2 and T3 additionally asked for perceived stress associated with the Covid-19 situation. This was measured with items that are relevant for employees working during the Covid-19 pandemic. Some are specifically related to the work of health care workers as they may experience stress for the health of their patients or colleagues who have a higher risk of infection (10 newly-developed items: "*How often do you experience stress caused by Covid-19 [for work* (item 1)/ *about the measures taken against Covid-19* (item 2)/ *for your work-life balance* (item 3)/ *messages in the media* (item 4)/ *yourself* (item 5)/ *love ones* (item 6)/ *your patients* (item 7)/ *your colleagues* (item 8)/

the hospital where you work (item 9)/ *the profession of physicians*" (item 10)] rated on a 5-point Likert scale (1=never, 5=very often).

The University Medical Center Utrecht confirmed that this study fell outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 19/109).

Data analysis

A series of 3 (Time: T1 vs. T2 vs. T3) × 3 (Group: surgical, medical or other specialty) repeated-measures analyses of variance (RM ANOVA) was performed with planned contrasts on Time (Helmert contrasts T1 vs. T2/T3) and with Time as a within-subject factor and Group as a between-subject factor.

Results

Employability is higher during the Covid-19 pandemic than before

RM ANOVAs show that physicians' perceived employability significantly increases over time (Figure 1). In specific, physicians mental and physical ability to work and to continue working in their current profession significantly increase from the time before the Covid-19 pandemic (T1) compared to the period during the Covid-19 pandemic (T2 and T3) (F (1,67)=4.954, p=0.029*, *partial* η^2=0.069). Similarly, physicians' willingness to work and to continue to work significantly increases from the time before the pandemic compared to the period during the pandemic (F (1,65)=11.125, p=0.001**, *partial* η^2=0.146).

Please insert: Figure 1: Mean scores for employability on T1, T2 and T3

We observe a similar significant increase in physicians' career satisfaction from prior to the Covid-19 pandemic (T1) to during the Covid-19 pandemic (T2 and T3) (F (1,72)=6.294, p=0.014*, *partial* η^2=0.080). No significant change was found for physicians' job satisfaction in this period.

Employability differs between specialties

Further analyses show that employability differs among physicians with surgical, medical and other specialties (Figure 2). At T1, surgical doctors are significantly less positive about their employability than physicians with medical or other specialties (ability: F (2,71)=6.412, p=0.003**, partial η^2=0.153; willingness F (2,68)=4.200, p=0.019*, partial η^2=0.110). Further, during the first phase of the Covid-19 pandemic (T2), the employability of surgical doctors is still significantly lower than that of physicians with medical or other specialties (ability: F (2,70)=6.492, p=0.003**, partial η^2=0.156; willingness: F (2,71)=5.941, p=0.004**, partial η^2=0.143). At T3 there are no significant differences anymore between the employability of the three groups of medical specialties. Table 2 summarizes the differences in employability over time among physicians with surgical, medical, and other specialties.

Please insert: Figure 2: Mean scores for employability on T1, T2 and T3 for physicians with surgical, medical and other specialties

Table 2: Results RM ANOVAs employability on T1, T2 and T3 for physicians with surgical, medical and other specialties (n=75)

		Surgical		**Medical**		**Other**			
Variable	**Time**	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F-values***	**Partial *η2***
Ability to continue working	T1	3.00	1.22	3.83	0.79	3.96	0.64	F (2,71)=6.412, p=0.003**	0.153
	T2	3.18	1.05	3.88	0.81	4.10	0.52	F (2,70)=6.492, p=0.003**	0.156
	T3	3.64	1.08	3.91	0.96	4.13	0.71	F (2,69)=1.256, p=0.291	X
Willingness to continue	T1	2.08	1.26	3.17	1.22	3.00	1.04	F (2,68)=4.200, p=0.019*	0.110

working	T2	2.29	1.07	3.38	0.99	3.12	0.99	*F* (2,71)=5.941, *p*=0.004**	0.143
	T3	3.00	1.24	3.39	1.20	3.42	1.06	*F* (2,70)=0.700, *p*=0.500	X

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Physicians' work experiences during the Covid-19 pandemic

We have further examined how physicians experience their work during the Covid-19 pandemic. Table 3 shows that physicians experience a significant lower emotional workload ($F(2,70)=10.579$, $p<0.001$**), physical workload ($F(2,72)=5.159$, $p=0.008$**), and quantitative workload ($F(2,62)=5.702$, $p=0.005$**) during an early phase of the Covid-19 pandemic (T2), compared to the time before the pandemic (T1). In a later phase of the pandemic (T3), the experience of workload showed a tendency to return to the pre-pandemic levels (T1) (figure 3).

Please insert: Figure 3: Mean scores for work characteristics on T1, T2 and T3

Table 3: Experience of work characteristics on T1, T2 and T3 (n=75)

	T1		**T2**		**T3**			
Work characteristics	**M**	**SD**	**M**	**SD**	**M**	***SD***	***F-values***	***η2***
Emotional workload	2.70	0.67	2.45	0.63	2.51	0.67	*F*(2,70)=10.579, *p*<0.001**	0.232
Physical workload	2.61	0.98	2.34	0.93	2.65	0.99	*F*(2,72)=5.159, *p*=0.008**	0.125
Quantitative workload	3.45	1.11	2.99	1.03	3.22	1.11	*F*(2,62)=5.702, *p*=0.005**	0.155
Job autonomy	3.82	0.80	3.64	0.54	3.76	0.60	*F*(2,63)=2.417, *p*=0.097	x

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Stress factors during the Covid-19 pandemic

Physicians have further reported to what extent they experience stress in several areas because of the Covid-19 pandemic (Figure 4). During an early phase of the crisis (T2), physicians experienced the most stress from combining work and private life (*M*=2.63; *SD*=1.27), from work in general (*M*=2.49; *SD*=0.95) and for the possible impact of Covid-19 on their loved ones' health (*M*=2.33; *SD*=0.93). They experienced the least stress for the possible consequences of Covid-19 on themselves (*M*=1.85; *SD*=0.85). During a later phase of the Covid-19 pandemic (T3), physicians reported to experience the most stress from their work in general (*M*=2.55; *SD*=1.00), from combining work and private life (*M*=2.47; *SD*=1.12), and for the health of their patients (*M*=2.38; *SD*=0.98). Again, they reported to experience the least stress for the possible impact of Covid-19 on themselves (M=2.03; SD=0.72).

Please insert: Figure 4: Mean scores on how often physicians experience stress in several areas on T2 and T3 caused by Covid-19

Discussion

The aim of this study was to provide insight into the impact of a crisis, the Covid-19 pandemic specifically, on physicians' employability and work experiences. A longitudinal approach was used, which allowed us to compare physicians work experiences during the Covid-19 pandemic with the situation prior to the pandemic.

Perhaps the most interesting finding of the present study was the fact that the perceived employability of physicians was significantly *higher* during the pandemic than it was before. Specifically, the results show that physicians' employability increases in the time prior to the Covid-19 pandemic to the early phase of the Covid-19 pandemic and continues to increase in a later phase of the Covid-19 pandemic. This goes contrary to our expectations since other studies found that physicians work motivation decreases [9] and stress and burn-out increase during previous pandemics [10,11]. These different conclusions may be the result of a different approach taken in our study compared to these past

studies. Earlier studies draw conclusions from cross-sectional, retrospective data. Recall biases are inherent to cross-sectional studies using retrospective techniques to understand a change in experience over time [26]. Studies have shown that when respondents have reason to believe in change, they will report change when they are asked to reflect on the past. Even when no change has occurred [26]. In a crisis situation, such as a pandemic, respondents may believe that they were more positive before the outbreak of a pandemic than during the pandemic. This perspective is likely to be strengthened by the public debate where the negative impact of the pandemic on health care workers has been frequently emphasized. This study used real-time data collection, instead of using retrospective methods. It asked physicians about things that they *can* report, namely their current experiences at the moment of taking the survey, i.e. they reported on their current feelings, not on their perceptions of their feelings in the past. This approach allows to draw considerably more reliable conclusions about physicians work experiences prior to the crisis and during the crisis than is possible using non-longitudinal methodologies.

There are various substantive explanations for the increase in employability. It could be related to a change in physicians' work characteristics, or an increase in societal appreciation during the pandemic. This study shows that physicians experienced a lower workload during an early phase of the Covid-19 pandemic compared to the time prior to the pandemic. Workload has also been shown to correlate with employability. Therefore, a lower workload at this time could possibly explain why physicians perceive to be better able to continue working until their retirement. This is in line with research showing that job demands, such as workload, positively relate to concepts related to well-being and self-reported health [e.g. 14]. This suggests that a period of lower job demands may be beneficial for an individuals' well-being or related concepts such as employability. More research is needed to examine this further.

More appreciation for physicians work by society [8] may provide an alternative explanation for the increase in physicians' employability. Physicians and other health care workers have been portrayed as 'heroes' [35], and citizens have expressed their support through a public applause and by placing white t-shirts with red hearts in front of their windows. Physicians are on the short-list of 'vital

professions', which gives them certain privileges during the pandemic compared to people with other professions (e.g. they may use public transport and their children can still go to daycare and school). They are further given a prominent role in dealing with the crisis. Many physicians are members of expert bodies that advise on the course of governmental action. These examples might have resulted in physicians feeling highly appreciated during the Covid-19 crisis, which may have boosted their ability and willingness to work and to continue their essential and meaningful work.

Physicians employability differed across surgical, medical and other specialties. This difference is also apparent before the Covid-19 pandemic. This is in line with previous studies showing that physicians with different specialties experience their work differently. There are for instance significant differences in job stressors, demands and resources among medical specialties [e.g. 36]. Another interesting finding is that the employability of physicians with surgical specialties increased stronger from the time prior to the Covid-19 pandemic to the time during the Covid-19 pandemic compared to physicians with medical or other specialties. We tested whether this difference is caused by the degree of involvement with care for Covid-19 patients, but this was not the case. Other factors might explain this difference. Physicians with different specialties had very diverse roles during the Covid-19 pandemic. While some physicians were directly involved in taking care for Covid-19 patients, or were part of crisis teams, making very long workdays, other physicians work was significantly reduced due to postponed or cancelled non-Covid related care [37]. Therefore, the job demands of physicians with different specialties varied during the Covid-19 pandemic. For example, job demands for physicians with surgical specialties could be lower during the Covid-19 pandemic as they saw their work being reduced due to the cancellations of operations. This could have reduced their (physical) workload more strongly than the workload of physicians with medical or other specialties which could explain the rise in their employability.

Limitations

This study has some limitations. First, although a longitudinal approach is highly relevant to understand the impact of a crisis over time, the disadvantage of this approach is the drop-out of participants. In this study, around one third of the participants did not complete all three surveys and were therefore excluded from the analyses. It is possible that nonresponders differed from responders, for example in terms of workload. However, non-significant non-response analyses show that it is unlikely that this has biased our results.

Second, this study is based on a sample of Dutch physicians limiting the generalizability of our findings to other countries. The Covid-19 pandemic is a global crisis that affected countries differently. Early evidence shows that health care workers experiences vary based on the country where they work [38,39]. Health care workers have dealt with a different proportion of Covid-19 infections and also the national differences in the organization of health care may have affected physicians work differently across countries.

Study implications

This study contributes to the body of knowledge about the psychological impact of a crisis on health care workers. It shows that crisis, specifically the Covid-19 pandemic, do not necessarily negatively affect health care workers but may also result in positive outcomes (i.e. increasing employability). As physicians work experiences are dynamic, a longitudinal approach is necessary to capture the dynamics of a pandemic on physicians work experiences. Furthermore, this study is valuable to practice as the healthcare system's ability to cope during an influenza pandemic will depend, to a large extent, on the number of health care workers, including physicians, who are able and willing to work through the crisis [7]. This study can inform global health actors that develop human resource strategies for dealing with the aftermath of the Covid-19 outbreak on health care workers. This study shows that physicians with surgical, medical and other specialties experience the Covid-19 pandemic differently. Therefore, tailor-made human resource strategies seem appropriate that pay attention to the specific needs of individual physicians.

Conclusion

This is the first study to provide evidence on the effects of the Covid-19 pandemic on physicians' employability and work experience, using a longitudinal approach with real-time data at three moments in time. We found evidence that physicians' employability significantly increased from the time prior to the pandemic to the period during the Covid-19 pandemic. Also, physicians experience a lower workload during the first peak of the Covid-19 pandemic compared to the time before the pandemic. At a later phase in the pandemic, their experiences of workload bounce back to initial levels. These results show that employability and work experiences vary, not only over time, but also in different phases of the crisis. Physicians further experience the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Footnotes

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Competing interests: None declared.

Patient and public involvement: Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. The survey was co-constructed with the authors, some of them work within the hospital. The survey was also pilot tested with physicians who gave feedback on it.

Patient consent for publication: Not required.

Ethics approval: The Ethical Committee of the University Medical Center Utrecht confirmed that this study falls outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 19/109).

Data availability statement: Raw data are available upon reasonable request. Ethical restrictions related to participant confidentiality prohibit the authors from making the dataset publicly available.

Authors' contributions: All authors conceptualized the research project. EvL coordinated the study and gathered participants. EvL analyzed the data and drafted the manuscript. All authors reviewed and

provided comments and revisions. TT, EvR, JWL and EK secured funding for the project. All authors read and approved the final manuscript.

References

1 Ripp J, Peccoralo L, Charney D. Attending to the emotional well-being of the health care workforce in a New York city health system during the Covid-19 pandemic. *Acad Med* 2020;**64**:1–4. doi:10.1097/ACM.0000000000003414

2 Smith CC. The structural vulnerability of healthcare workers during COVID-19: Observations on the social context of risk and the equitable distribution of resources. *Soc Sci Med* 2020;**258**:1–4. doi:10.1016/j.socscimed.2020.113119

3 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *N Engl J Med* Published Online First: 2020. doi:10.1056/NEJMp2008017

4 Cooch N. The psychological impact of Covid-19 on physicians: Lessons from previous outbreaks. 02-06-2020. 2020.https://www.practiceupdate.com/content/the-psychological-impact-of-covid-19-on-physicians-lessons-from-previous-outbreaks/100995/45?trendmd-shared=0 (accessed 9 Jul 2020).

5 Fargen KM, Leslie-Mazwi TM, Klucznik RP, *et al.* The professional and personal impact of the coronavirus pandemic on US neurointerventional practices: a nationwide survey The Pandemic and Neurointervention. *J Neurointerv Surg* 2020;**12**. doi:10.1136/neurintsurg-2020-016513

6 Lai J, Ma S, Wang Y, *et al.* Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open* 2020;**3**:1–12. doi:10.1001/jamanetworkopen.2020.3976

7 Ives J, Greenfield S, Parry JM, *et al.* Healthcare workers' attitudes to working during pandemic influenza: a qualitative study. *BMC Public Health* 2009;**9**:1–13. doi:10.1186/1471-2458-9-56

8 Vindrola-Padros C, Andrews L, Dowrick A, *et al.* Perceptions and experiences of healthcare workers during the COVID-19 pandemic in the UK. *BMJ Open* 2020;**10**:1–

8. doi:10.1136/BMJOPEN-2020-040503

9 Imai H, Matsuishi K, Ito A, *et al.* Factors associated with motivation and hesitation to work among health professionals during a public crisis: a cross sectional study of hospital workers in Japan during the pandemic (H1N1) 2009. *BMC Public Health* 2010;**10**:1–8. doi:10.1186/1471-2458-10-672

10 Liu X, Kakade M, Fuller CJ, *et al.* Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr Psychiatry* 2012;**53**. doi:10.1016/j.comppsych.2011.02.003

11 Maunder RG, Lancee WJ, Balderson KE, *et al.* Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Eerging Infect Dis* 2006;**12**:1924–32. doi:10.3201/eid1212.060584

12 Bakker AB, Van Veldhoven M, Xanthopoulou D. Beyond the demand-control model. *J Pers Psychol* 2010;**9**:3–16. doi:10.1027/1866-5888/a000006

13 Karasek RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Adm Sci Q* 1979;**24**:285–308.https://www.jstor.org/stable/pdf/2392498.pdf?casa_token=Lv7e61ddZFkAAAAA:cDIPyGRTkgjcINSmVlIVUYGHt0E2srz5VXhjl3ak28KDkdFVZRDUx-g9yeZF8Vm3XAAdRPJQ5z3Mh-opCYGqlqZlK-GjAajHupaW4G1TQUayGhs9IIua (accessed 15 Feb 2021).

14 De Lange AH, Taris TW, Kompier MAJ, *et al.* The very best of the millennium: longitudinal research and the Demand-Control-(Support) Model. *J Occup Health Psychol* 2003;**8**:282–305. doi:10.1037/1076-8998.8.4.282

15 De Cuyper N, Sulea C, Philippaers K, *et al.* Perceived employability and performance: moderation by felt job insecurity. *Pers Rev* 2014;**43**:536–52. doi:10.1108/PR-03-2013-0050

16 Kirves K, Kinnunen U, De Cuyper N, *et al.* Trajectories of perceived employability and their associations with well-being at work. *J Pers Psychol* 2014;**13**:46–57. doi:10.1027/1866-5888/a000103

17 Akkermans J, Seibert SE, Mol ST. Tales of the unexpected. Integrating career shocks in the contemporary career literature. *SA J Ind Psychol* 2018;**44**:1–10. doi:10.4102/sajip.v44i0.1503

18 Akkermans J, Richardson J, Kraimer ML. The Covid-19 crisis as a career shock: Implications for careers and vocational behavior. *J Vocat Behav* 2020;**119**:1–5. doi:10.1016/J.JVB.2020.103434

19 Wallace JE, Lemaire JB, Ghali WA. Physician wellness: A missing quality indicator. *Lancet* 2009;**374**:1714–21. doi:10.1016/S0140-6736(09)61424-0

20 Maunder R. The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. *Philos Trans R Soc London* 2004;**359**:1117–25. doi:10.1098/rstb.2004.1483

21 Naushad VA, Bierens JJ, Nishan KP, *et al.* A systematic review of the impact of disaster on the mental health of medical responders. *Prehosp Disaster Med* 2019;**34**:632–43. doi:10.1017/S1049023X19004874

22 Willan J, King AJ, Jeffery K, *et al.* Challenges for NHS hospitals during Covid-19 epidemic. *BMJ* 2020;**368**:1–2. doi:10.1136/bmj.m1117

23 Tan, B. Y., Chew, N. W., Lee, G. K., Jing, M., Goh, Y., Yeo, L. L., ... & Shanmugam GN. Psychological impact of the Covid-19 pandemic on health care workers in Singapore. *Ann Intern Med* 2020;:1–3. doi:10.7326/M20-1083

24 Chong MY, Wang WC, Hsieh WC, *et al.* Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry* 2004;**185**:127–33.

25 Preti E, Di Mattei V, Perego G, *et al.* The psychological impact of epidemic and pandemic outbreaks on healthcare workers: rapid review of the evidence. *Curr Psychiatry Rep* 2020;**22**:1–22. doi:10.1007/s11920-020-01166-z

26 Schwarz N. Retrospective and concurrent self-reports: The rationale for real-time data capture. In: Stone A, Shiffman SS, Atienza A, *et al.*, eds. *The science of real-time data capture: Self-reports in health research*. New York: : Oxford University Press 2007. 11–26.https://dornsife.usc.edu/assets/sites/780/docs/schwarz_retrospective_self-reports_mdc_2007.pdf

27 Van Leeuwen, E. H., Knies, E., Van Rensen, E. L. J., Taris TW. Stimulating perceived ability and willingness to continue working and job crafting behaviour of physicians: An intervention study. In: *Dutch HRM Network Conference*. Tilburg: 2019.

28 Blank, J. L. T., Niaounakis TK. Productiviteitsontwikkelingen bij medisch specialisten: Resultaten en technische rapportage. Delft: 2019.

29 Van Veldhoven, M., Prins, J., Van der Laken, P., Dijkstra L. *VBBA 2.0: Update van de standaard voor vragenlijstonderzoek naar werk, welbevinden en prestaties*. Enschede: : Gildeprint 2014.

30 Demerouti E, Le Blanc PM, Bakker AB, *et al.* Present but sick: a three-wave study on job demands, presenteeism and burnout. *Career Dev Int* 2009;**14**:50–68. doi:10.1108/13620430910933574

31 Morgeson FP, Humphrey SE. The work design questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *J Appl Psychol* 2006;**91**:1321–39. doi:10.1037/0021-9010.91.6.1321

32 Oude Hengel KM, Blatter BM, Geuskens GA, *et al.* Factors associated with the ability and willingness to continue working until the age of 65 in construction workers. *Int Arch Occup Environ Health* 2012;**85**:783–90. doi:10.1007/s00420-011-0719-3

33 Wanous JP, Reichers AE, Hudy MJ. Overall job satisfaction: How good are single-item measures? *J Appl Psychol* 1997;**82**:247–52. doi:10.1037/0021-9010.82.2.247

34 Martins LL, Eddleston KA, Veiga JF. Moderators of the relationship between work-family conflict and career satisfaction. *Acad Manag J* 2002;**45**:399–409. doi:10.5465/3069354

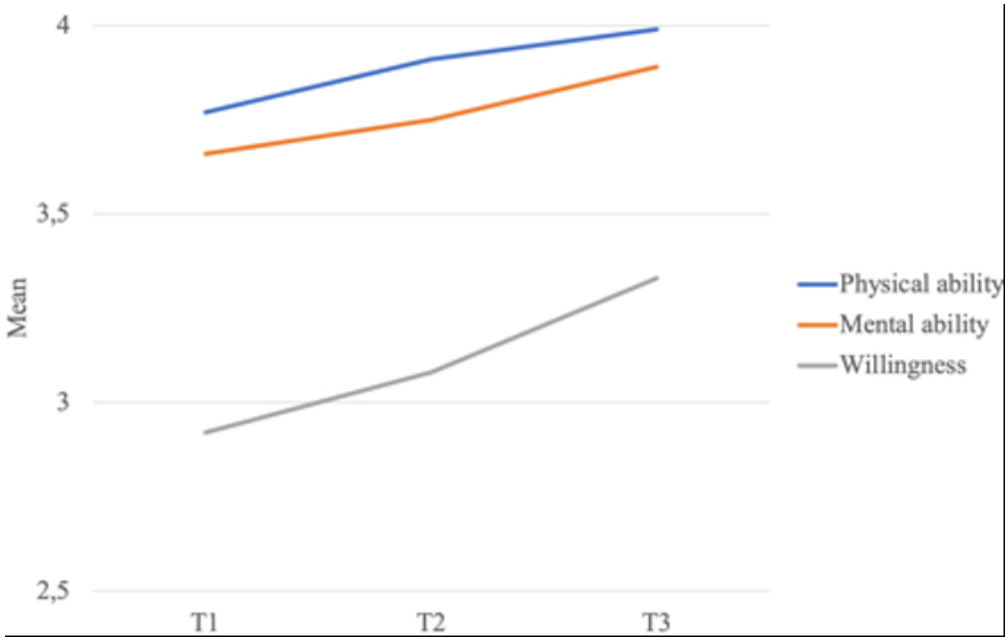
35 Van Dooren W, Noordegraaf M. Staging science: Authoritativeness and fragility of models and measurement in the Covid-19 crisis. *Public Adm Rev* 2020;**80**:610–5. doi:10.1111/puar.13219

36 Bernburg M, Vitzthum K, Groneberg DA, *et al.* Physicians' occupational stress, depressive symptoms and work ability in relation to their working environment: a cross-sectional study of differences among medical residents with various specialties working in German hospitals. *BMJ Open* 2016;**6**:1–9. doi:10.1136/BMJOPEN-2016-011369

37 Fowler A, Abbott TEF, Pearse RM. Can we safely continue to offer surgical treatments during the COVID-19 pandemic? *BMJ Qual Saf* Published Online First: 20 November 2020. doi:10.1136/BMJQS-2020-012544

38 Elhadi M, Msherghi A, Elgzairi M, *et al.* Psychological status of healthcare workers during the civil war and COVID-19 pandemic: A cross-sectional study. *J Psychosom Res* 2020;**137**:1–6. doi:10.1016/j.jpsychores.2020.110221

39 Luo M, Guo L, Yu M, *et al.* The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. *Psychiatry Res* 2020;**291**:1–9. doi:10.1016/j.psychres.2020.113190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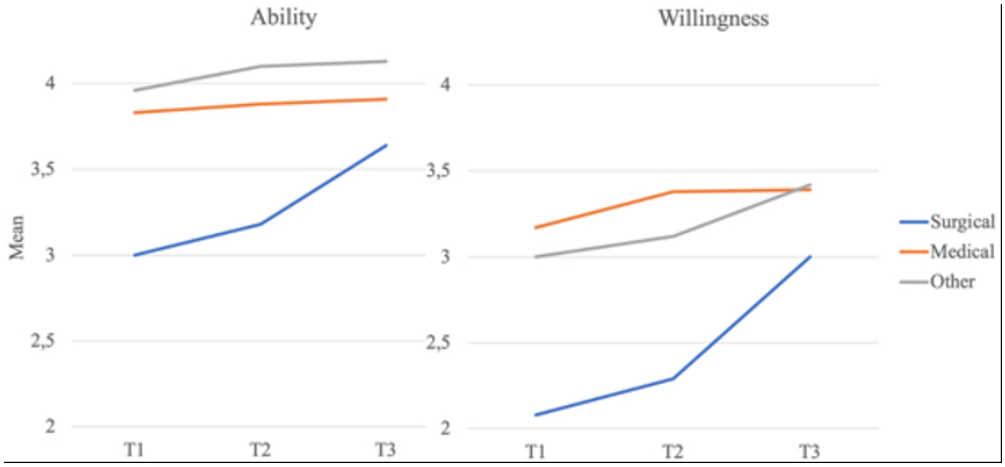
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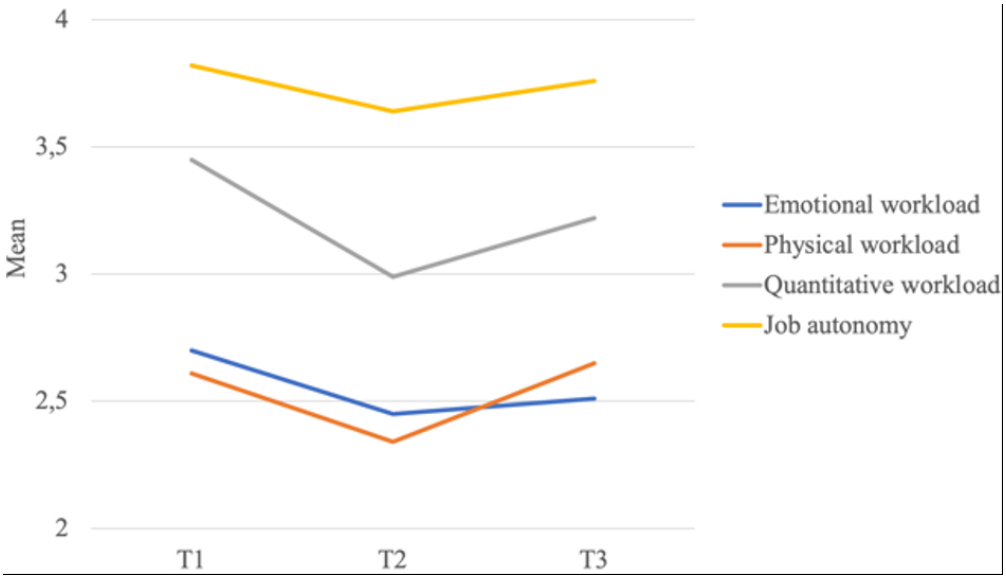
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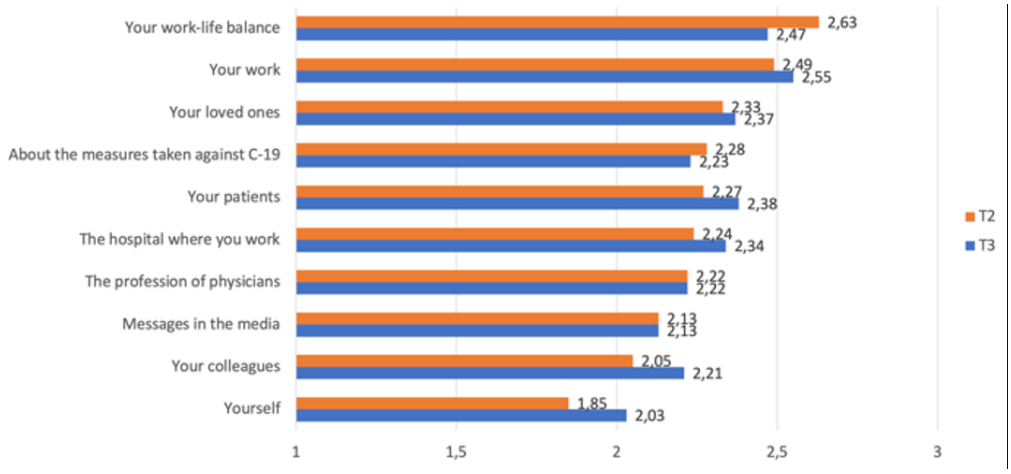
Your work-life balance
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About the measures taken against C-19
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Your patients
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The hospital where you work
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The profession of physicians
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Messages in the media
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Your colleagues
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Yourself
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STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed (NA)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable (NA)
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, explain how loss to follow-up was addressed
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram (not included yet, could still be included but I think it is clear from the text and I am not sure whether it increases the readability)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount)
Outcome data	15*	Report numbers of outcome events or summary measures over time
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a

		meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

BMJ Open

A positive impact of the Covid-19 pandemic? A longitudinal study on the impact of the Covid-19 pandemic on physicians' work experiences and employability

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Title: A positive impact of the Covid-19 pandemic? A longitudinal study on the impact of the Covid-19 pandemic on physicians' work experiences and employability

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Abstract

Objective – The Covid-19 pandemic places an enormous demand on physicians around the world. The aim of this study was to examine the impact of the Covid-19 pandemic on physicians' work experiences and their ability and willingness to continue working in their profession until retirement (i.e. their employability).

Design - A longitudinal comparative design was used. Survey data were collected on three moments: before (May 2019), in the early phase (May 2020) and in a later phase (November 2020) of the Covid-19 pandemic. Time effects were tested using repeated-measures analyses of variance (RM ANOVA) and one-way analyses of variance (one-way ANOVA).

Setting – This study took place among physicians of two hospitals in a large city in the Netherlands.

Participants – 165 hospital physicians with surgical, medical and other specialties participated in this study.

Results – Physicians' employability significantly increased from the time prior to the Covid-19 pandemic, compared to the period during this pandemic. Employability differs among physicians with surgical, medical and other specialties. Furthermore, physicians experienced a lower emotional, physical and quantitative workload during the first peak of the Covid-19 pandemic, compared to before the pandemic. Moreover, physicians experienced the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Conclusions – This study shows that physicians' employability and work experiences are affected by the Covid-19 pandemic. Work experiences vary for physicians with different specialties. These varieties stress the importance of attention for physicians' individual needs and challenges regarding working during the Covid-19 pandemic, and the possibility of continuing work in the aftermath of this crisis. Based on this, physicians can be offered tailor-made solutions. This is important to maintain a healthy and employable workforce which is essential for a sustainable health care system.

Strengths and limitations of this study

- The study captured the work experiences of physicians prior to and during the Covid-19 pandemic, allowing for within-person comparisons

- The study used a longitudinal study approach with data collected at three moments in time
- Despite the highly relevant longitudinal study approach, this has also resulted in participants dropout

Introduction

Health care workers stand in the frontline of health care pandemics [1]. They are highly vulnerable during these pandemics, given the risk of exposure to the virus, concerns about infecting their loved ones, shortages of personal protective equipment, extended workload, and involvement in emotional and ethical decision making [2,3,4]. The Covid-19 pandemic is likely to have implications for health care workers' ability and willingness to work in the short-run and to continue their essential work on the frontlines in the long-run [5]. Evidence from earlier studies on the impact of the Covid-19 pandemic on health care workers, including meta-analyses and systematic reviews, show that the Covid-19 pandemic results in stress [6], illness, insomnia [1,7], fear for becoming infected [8], hesitation to work [9] or a lack of motivation to work [10] in the short-run. From previous research on crises we know that a pandemic may even result in more adverse consequences for physicians in the long-run, such as developing burn-out, psychological distress, and post-traumatic stress-disorder [11,12].

The possible consequences of crises for physicians make it important to monitor physicians' work experiences (i.e. their perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability). It is important to prevent adverse consequences, because health care workers' well-being might be at stake. Studying physicians' work experiences helps to monitor their ability to work in the short-term. Especially job demands (such as workload) and job resources (such as job autonomy) have been shown to be important factors that affect well-being, stress and performance [13–15]. Furthermore, employability provides an indication of physicians' ability and willingness to continue working in their profession. Research has shown that employability positively affects well-being and performance [16,17]. Research has shown that crises, such as the Covid-19 pandemic, are so-called "career shocks" referring to disruptive and extraordinary

events caused by factors outside an individual's control, triggering a deliberate thought process concerning ones' career [18]. This may result in people reconsidering their position, leaving their profession or lower job or career satisfaction [19]. This challenges their employability, which is especially problematic in a health crisis as employable physicians are needed to handle the high demands for health care, and in the aftermath of the health crisis due to delayed operations and other treatments for instance.

In this study we examine the impact of the Covid-19 pandemic on physicians' work experiences and employability, by addressing the following research question in the context of a three-wave prospective study: "What is the impact of the Covid-19 pandemic on physicians' work experiences (i.e. perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability)?" Understanding the impact of the Covid-19 pandemic on physicians' work is important to be prepared for future outbreaks of health crises, as maintaining a healthy and employable workforce is essential for a sustainable health care system. These themes, and topics related to this, have to date received little attention, especially in a medical setting. Physicians tend to self-ignore attention for their well-being and health systems poorly support this [20], emphasizing the importance of this research.

This study examines the impact of the Covid-19 pandemic on physicians with varying specialties. Previous studies have found mixed outcomes for the impact of the Covid-19 pandemic on health care workers working in different departments [21,22,23]. Some studies have shown that the impact of pandemics varies for health care workers working in different departments [22,23]. For instance, one study found that those who work in emergency departments, intensive care units, and isolation wards have a greater risk of developing adverse psychiatric outcomes than those working in other departments [22]. Another study found the opposite, physicians and nurses who worked in the frontline had a lower frequency of burn-out and were less worried about being infected with the Covid-19 virus compared to those working in usual wards [23]. Yet another study found no differences in mental health outcomes for physicians and nurses working in Covid-19 care units, non

Covid-19 care units or in both units [24]. Despite possible differences between physicians working in different departments, it is likely that pandemics, such as the Covid-19 pandemic, affects them all to some extent as their work has suddenly changed, both in terms of content (e.g. change in cases, increase in the use of video consults) and location (e.g. working from home or in different departments), and due to an uncertain future. These changes may result in various job demands such as a high (emotional) workload or stress [1,25] which may vary between groups of physicians. More research is needed to understand the impact of pandemics on physicians with different specialties. This study examines physicians with surgical, medical, and other specialties to examine the impact on their work and possible differences between specialties.

Studies examining the psychological effects of pandemics (e.g. SARS, H1N1 influenza and avian influenza H5N1), including recent studies into the Covid-19 pandemic, often use cross-sectional methods [7,10–12,26]. A disadvantage of this approach is that it cannot capture the dynamics of pandemics. The impact of pandemics on health care workers has been shown to vary in different phases of the pandemic. During the initial outbreak health care workers perceive feelings of extreme vulnerability, uncertainty, anxiety and threat while mental health problems such as depression are more likely to develop in a later phase [27]. For this reason, a longitudinal approach where experiences are measured at multiple points in time is more appropriate to study the impact of a pandemic. In this study we use a longitudinal approach by examining physicians experiences at three moments in time.

In addition, a meta-analysis shows that these studies often use retrospective questions where respondents are asked for their past experiences [28]. This approach is problematic as psychologists and survey methodologists have shown that subjective experiences are poorly represented in memory. Retrospective questions often ask respondents for information that they cannot provide with any validity [29]. Therefore, examining behaviour and experiences by using real-time data is highly preferable [29]. This is done in this study by asking for physicians' current behaviour, at the three moments of taking the surveys.

Based on prior studies into the impact of health crises on health care workers, together with early evidence on the impact of the Covid-19 pandemic on health care workers, we expect that physicians experience their work more negatively during the Covid-19 pandemic compared to the situation prior to this pandemic, which will be reflected in a higher emotional, physical and quantitative workload. Furthermore, we expect that physicians are more negative about their employability during the pandemic, compared to the situation prior to the Covid-19 pandemic, and have a lower job and career satisfaction during the pandemic compared to the time prior to the pandemic.

Method

Three surveys were sent to physicians in two hospitals in a large Dutch city, an academic hospital and a general hospital. The first survey was sent as part of another study [30]. The sample size of this study was therefore predetermined by the sample of the prior study that was calculated according to a power analysis. The first survey was sent in May 2019 (T1), prior to the Covid-19 outbreak. A second survey was sent in May 2020, in an early phase of the Covid-19 pandemic. This was one month after the first peak of Covid-19 infections in the Netherlands [31]. At this time, both hospitals had established a Covid-19 clinic and an Covid-19 intensive care unit which were separated from other departments in the hospital. Furthermore, in both hospitals non-emergent care and surgeries were postponed. Physicians and health care workers from different departments were requested to support on the Covid-19 departments. Health care professionals were supported with volunteers from "outside" who were not employed by the hospitals. The long period in which the Covid-19 pandemic dominates the world, made it relevant to add a study wave in a later phase of the pandemic to examine its longer-term consequences. Therefore, a third survey was sent in November 2020 (T3), one month after the second peak of Covid-19 in the Netherlands. During the first and second peak of the number of Covid-19 infections, there were 60 patients infected with the Covid-19 virus in the academic hospital (20 on the intensive care and 40 in the Covid-19 clinic) and 30 in the general hospital (8 on the intensive care and 22 in the Covid-19 clinic). When the surveys were sent at T2 and T3, many countries, including the Netherlands, were partly or fully in lockdown, social distancing was required

and the number of patients infected with Covid-19 was high. In the two hospitals where this study took place, waiting lists for patients were higher at T3 than at T2 due to non-emergent care that was still being postponed.

Participants were recruited through promotional presentations and through an internal mailing list. Participants provided informed consent at the start of each survey stating that participation is voluntary, outcomes are held confidential, participants can withdraw from the study at any time, and all study material was anonymized and saved on a protected server. 165 physicians participated in this study at T1. These 165 physicians were invited by e-mail to complete a second and a third survey. 93 physicians completed the survey at T2 (response rate: 56%), and 75 physicians completed all three surveys (response rate: 45%). A flowchart of the participants in this study is presented in figure 1. We compared participants who completed all three surveys (T1, T2 and T3) (n=75) with participants who only completed the survey sent at T1 (n=72). Multivariate analysis of variance indicated that there were no significant differences between these participants in terms of age (F(1,124)=0.037, p=0.849), hours worked according to contract (F(1,135)=0.555, p=0.458), occupational tenure (F(1,133)=0.591, p=0.443), and organisational tenure (F(1,129)=0.804, p=0.371). For the dichotomous variables gender, hospital type (general vs. academic), type of specialism (surgical, medical vs. other, following the categorization of [32]) and type of employment contract (employed by the hospital vs. independently established) we conducted chi-square tests, again showing that there were no significant differences between participants who dropped out of this study and the participants who completed all three surveys (all p's>0.452).

Please insert: Figure 1: Flow chart of participants at T1, T2 and T3

Physicians provided several reasons for not completing the surveys sent at T2 and/or T3. At T2, 1 physician had left the hospital, and 10 physicians were on leave (either a pregnancy leave, holiday leave or were abroad). At T3, 2 physicians had left the hospital, 10 physicians were on leave, and 1 physician was "too busy" to complete the survey. These reasons, apart from the latter, are unlikely to

result in biased outcomes. This, together with the non-significant results for the non-response analysis, show that there are no significant differences between the participants who dropped out of this study and the participants who completed all three surveys. The result section reports on the results of the analyses based on the data from participants who completed the surveys on T1, T2 and T3 (n=75).

The questions addressed sociodemographic characteristics (gender, age), job characteristics (specialism, autonomy, workload, occupational tenure referring to the time working as a medical specialist and organizational tenure referring to the time working in their current hospital) and involvement with care for patients with the Covid-19 virus. Further, physicians were asked to rate their emotional workload (5 items: *"Is your job emotionally demanding?", "Are you confronted in your work with things that affect you personally?", "Are you in your work in contact with difficult patients or their relatives?", "Do you have to convince or persuade people for your job?" and "Do you encounter emotionally demanding events in your work?"*, α_{T1}=0.96; α_{T2}=0.82; α_{T3}=0.82, [33]), quantitative workload (3 items: "*Do you have too much work to do?", "Do you have to put in extra effort to finish your work?" and "Do you have to hurry?"*, α_{T1}=0.90; α_{T2}=0.91; α_{T3}=0.93, [33]), physical workload (1 item: "*My job is physically demanding"*, [34]), and job autonomy (3 items: "*The job allows me to decide on my own how to go about doing my work", "The job provides me with significant autonomy in making decisions" and "The job gives me a chance to use my personal initiative or judgment in carrying out the work"*, α_{T1}=0.80; α_{T2}=0.72; α_{T3}=0.79, [35]). Answers were given on a 5-point Likert scale (1=never, 5=very often).

Other questions asked for physicians' perceptions of their own employability (2 items measured ability: *"I am [physically (item 1)/ mentally (item 2)] able to continue to work until the age of 67 in my current profession"*; 1 item measured willingness: *"I am willing to continue to work until the age of 67 in my current profession"*, [36]), job satisfaction (1 item: "*Generally speaking, I am very satisfied with my job"* [37]), and career satisfaction (1 item: "*Generally speaking, I am very satisfied*

with my career" [38]). Answers were given on a 5-point Likert scale (1=totally disagree, 5=totally agree).

The surveys sent on T2 and T3 additionally asked for perceived stress associated with the Covid-19 situation. This was measured with items that are relevant for employees working during the Covid-19 pandemic. Some specifically related to the work of health care workers as they may experience stress due to the health of their patients or colleagues who have a higher risk of infection (10 newly-developed items: "*How often do you experience stress caused by Covid-19 [for work* (item 1)/ *about the measures taken against Covid-19* (item 2)/ *for your work-life balance* (item 3)/ *messages in the media* (item 4)/ *yourself* (item 5)/ *love ones* (item 6)/ *your patients* (item 7)/ *your colleagues* (item 8)/ *the hospital where you work* (item 9)/ *the profession of physicians*" (item 10)], that were all rated on a 5-point Likert scale (1=never, 5=very often)).

The University Medical Center Utrecht confirmed that this study fell outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 20/328).

Patient and public involvement

This study was conducted among physicians; patients were not involved in this study. Physicians were involved in developing the surveys that were used in this study. The survey was pilot-tested among five physicians. They were interviewed about the content, wording, and style of addressing physicians in the survey. If needed, the content and the item wordings were adapted. Furthermore, the researchers of this study developed the surveys and interpreted results with the support of a senior board member, and two physicians, one from the academic and one from the general hospital. The outcomes of this study are discussed in both hospitals in a group of representative physicians from all departments.

Data analysis

To examine physicians' employability, a repeated measures analyses of variance (RM ANOVA) was performed with planned contrasts on Time (Helmert contrasts T1 vs. T2/T3) and with Time as a within-subject factor and Group as a between-subject factor.

Furthermore, one-way ANOVAs were performed to compare groups (physicians with surgical, medical or another specialty) and work experiences over time (T1, T2 and T3).

Results

Table 1 presents the demographics of the respondents.

Table 1: Demographics of participants (n=75)

Gender	Male: *n*=28 (37%) Female: *n*=47 (63%)
Age	*M*=44.9, *SD*=7.8
Work hours according to contract	*M*=41.4, *SD*=11.12
Occupational tenure (years)	*M*=11.6, *SD*=8.4
Organizational tenure (years)	*M*=9.6, *SD*=8.0
Type of employment contract	Self-employed: *n*=10 (13%) Contracted: *n*=65 (87%)
Specialty	Surgical: *n*=14 (19%) Medical: *n*=35 (47%) Other: *n*=26 (35%)
Involved in care for Covid-19 patients at T2	Yes: *n*=24 (32%), of which *n*=6 (25%) had a surgical specialty, *n*=13 (54%) had a medical specialty and *n*=5 (21%) had another specialty No: *n*=51 (68%)
Involved in care for Covid-19 patients at T3	Yes: *n*=19 (25%), of which *n*=4 (21%) had a surgical specialty, *n*=10 (53%) had a medical specialty and *n*=5 (26%) had another specialty No: *n*=56 (75%)

Employability is higher during the Covid-19 pandemic than before

RM ANOVAs show that physicians' perceived employability significantly increased over time (Figure 2). Specifically, physicians' mental and physical ability to work and to continue working in their current profession significantly increased from the time before the Covid-19 pandemic (T1) compared to the period during the Covid-19 pandemic (T2 and T3) (F (1,67)=4.954, p=0.029*, *partial* η^2=0.069). Similarly, physicians' willingness to work and to continue to work significantly increases from the time before the pandemic compared to the period during the pandemic (F (1,65)=11.125, p=0.001**, *partial* η^2=0.146).

Please insert: Figure 2: Mean scores for employability on T1, T2 and T3

We observe a similar significant increase in physicians' career satisfaction from prior to the Covid-19 pandemic (T1) to during the Covid-19 pandemic (T2 and T3) (F (1,72)=6.294, p=0.014*, *partial* η^2=0.080). No significant change was found for physicians' job satisfaction in this period. Moreover, no significant differences were found in the employability, job and career satisfaction for physicians who were involved in taking care for patients infected with the Covid-19 virus and physicians that were not involved in Covid-19 related care.

Employability differs between specialties

Further analyses show that employability differs among physicians with surgical, medical and other specialties (Figure 3). At T1, surgical doctors are significantly less positive about their employability than physicians with medical or other specialties (ability: F (2,71)=6.412, p=0.003**, partial η^2=0.153; willingness F (2,68)=4.200, p=0.019*, partial η^2=0.110). Further, during the first phase of the Covid-19 pandemic (T2), the employability of surgical doctors is still significantly lower than that of physicians with medical or other specialties (ability: F (2,70)=6.492, p=0.003**, partial η^2=0.156; willingness: F (2,71)=5.941, p=0.004**, partial η^2=0.143). At T3 there are no significant differences anymore between the employability of the three groups of medical specialties. Table 2 summarizes the differences in employability over time among physicians with surgical, medical, and other specialties.

Please insert: Figure 3: Mean scores for employability on T1, T2 and T3 for physicians with surgical, medical and other specialties

Table 2: Results one-way ANOVAs employability on T1, T2 and T3 for physicians with surgical, medical and other specialties (n=75)

		Surgical		Medical		Other			
Variable	**Time**	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F-values***	**Partial *η2***
Ability to continue working	T1	3.00	1.22	3.83	0.79	3.96	0.64	*F* (2,71)=6.412, *p*=0.003**	0.153
	T2	3.18	1.05	3.88	0.81	4.10	0.52	*F* (2,70)=6.492, *p*=0.003**	0.156
	T3	3.64	1.08	3.91	0.96	4.13	0.71	*F* (2,69)=1.256, *p*=0.291	X
Willingness to continue working	T1	2.08	1.26	3.17	1.22	3.00	1.04	*F* (2,68)=4.200, *p*=0.019*	0.110
	T2	2.29	1.07	3.38	0.99	3.12	0.99	*F* (2,71)=5.941, *p*=0.004**	0.143
	T3	3.00	1.24	3.39	1.20	3.42	1.06	*F* (2,70)=0.700, *p*=0.500	X

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Physicians' work experiences during the Covid-19 pandemic

We further examined how physicians experience their work during the Covid-19 pandemic. Table 3 shows that physicians experience a significant lower emotional workload ($F(2,70)=10.579$, $p<0.001$**, physical workload ($F(2,72)=5.159$, $p=0.008$**, and quantitative workload ($F(2,62)=5.702$, $p=0.005$** during an early phase of the Covid-19 pandemic (T2), compared to the time before the pandemic (T1). In a later phase of the pandemic (T3), the experience of workload showed a tendency to return to the pre-pandemic levels (T1) (Figure 4). There were no significant differences in the

experiences of these work characteristics for physicians who were involved in Covid-19 related care and physicians who were not.

Please insert: Figure 4: Mean scores for work characteristics on T1, T2 and T3

Table 3: Results one-way ANOVAs experience of work characteristics on T1, T2 and T3 (n=75)

	T1		**T2**		**T3**			
Work characteristics	**M**	**SD**	**M**	**SD**	**M**	***SD***	***F-values***	***η2***
Emotional workload	2.70	0.67	2.45	0.63	2.51	0.67	$F(2,70)=10.579$, $p<0.001$**	0.232
Physical workload	2.61	0.98	2.34	0.93	2.65	0.99	$F(2,72)=5.159$, $p=0.008$**	0.125
Quantitative workload	3.45	1.11	2.99	1.03	3.22	1.11	$F(2,62)=5.702$, $p=0.005$**	0.155
Job autonomy	3.82	0.80	3.64	0.54	3.76	0.60	$F(2,63)=2.417$, $p=0.097$	x

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Stress factors during the Covid-19 pandemic

Physicians further reported to what extent they experience stress in several areas because of the Covid-19 pandemic (Figure 5). During an early phase of this pandemic (T2), physicians experienced the most stress from combining work and private life (*M*=2.63; *SD*=1.27), from work in general (*M*=2.49; *SD*=0.95) and due to the possible impact of Covid-19 on their loved ones' health (*M*=2.33; *SD*=0.93). They experienced the least stress for the possible consequences of Covid-19 for themselves (*M*=1.85; *SD*=0.85). During a later phase of the Covid-19 pandemic (T3), physicians reported to experience the most stress from their work in general (*M*=2.55; *SD*=1.00), from combining work and private life (*M*=2.47; *SD*=1.12), and due to the health of their patients (*M*=2.38; *SD*=0.98). Again, they reported to experience the least stress for the possible impact of Covid-19 on themselves (M=2.03; SD=0.72).

Please insert: Figure 5: Mean scores on how often physicians experience stress in several areas on T2 and T3 caused by Covid-19

Discussion

The aim of this study was to provide insight into the impact of the Covid-19 pandemic on physicians' employability and work experiences. A longitudinal approach was used, which allowed us to compare physicians work experiences during the Covid-19 pandemic with the situation prior to the pandemic.

Perhaps the most interesting finding of the present study was the fact that the perceived employability of physicians was significantly *higher* during the pandemic than it was before. Specifically, the results show that physicians' employability increases in the time prior to the Covid-19 pandemic to the early phase of the Covid-19 pandemic and continues to increase in a later phase of the Covid-19 pandemic. This goes contrary to our expectations, since other studies found that physicians' work motivation decreases [10] and stress and burn-out increase during previous pandemics [11,12]. There are various substantive explanations for this increase in employability. It could be related to a change in physicians' work characteristics, or an increase in societal appreciation of health care professionals during the pandemic. This study shows that physicians experienced a lower workload during an early phase of the Covid-19 pandemic compared to the time prior to the pandemic. Workload has also been shown to correlate with employability. Therefore, a lower workload at this time could possibly explain why physicians perceive to be better able to continue working until their retirement. This is in line with research showing that job demands, such as workload, negatively relate to well-being and self-reported health [e.g. 15]. This suggests that having a period of lower job demands may be beneficial for an individual's well-being or related concepts such as employability. More research is needed to examine this further.

More appreciation for physicians' work by society [9] may provide an alternative explanation for the increase in their employability. Physicians and other health care workers have been portrayed as 'heroes' [39], and citizens have expressed their support through a public applause and by placing

white t-shirts with red hearts in front of their windows. Physicians are on the shortlist of 'vital professions', which gives them certain privileges during the pandemic compared to people with other professions (e.g. they may use public transport and their children can still go to daycare and school). This might have resulted in physicians feeling highly appreciated during the Covid-19 pandemic, which may have boosted their ability and willingness to work and to continue their essential and meaningful work.

A possible explanation for the different conclusions drawn in this study compared to other studies on the impact of previous pandemics [10-12] may be the result of a different approach taken in our study compared to these past studies. Earlier studies drew conclusions on the basis of cross-sectional, retrospective data. Recall biases are inherent to studies using retrospective techniques to understand a change in experience over time [29]. Studies have shown that when respondents have reason to believe in change, they will report change when they are asked to reflect on the past, even if no change has occurred [29]. In a crisis situation, such as a pandemic, respondents may believe that they were more positive before the outbreak of a pandemic than during the pandemic. This perspective is likely to be strengthened by the public debate where the negative impact of the pandemic on health care workers has frequently been emphasized. A strength of our study is that we used real-time data collection, instead of retrospective methods. We asked physicians about things that they *can* report, namely their current experiences at the moment of taking the survey, i.e. they reported on their current feelings, not on their perceptions of their feelings in the past. This approach allows for drawing considerably more reliable conclusions about physicians' work experiences prior to a pandemic and during a pandemic than is possible using non-longitudinal methodologies.

Physicians employability differed across surgical, medical and other specialties. This difference is also apparent before the Covid-19 pandemic. This is in line with previous studies showing that physicians with different specialties experience their work differently. There are for instance significant differences in job stressors, demands and resources among medical specialties [e.g. 40]. Another interesting finding is that the employability of physicians with surgical specialties increased stronger

from the time prior to the Covid-19 pandemic to the time during the Covid-19 pandemic compared to physicians with medical or other specialties. We tested whether this difference is caused by the degree of involvement with care for Covid-19 patients, but this was not the case. Other factors might explain this difference. Physicians with different specialties had very diverse roles during the Covid-19 pandemic. While some physicians were directly involved in taking care for Covid-19 patients, or were part of crisis teams, making very long workdays, other physicians work was significantly reduced due to postponed or cancelled non-Covid related care [41]. Therefore, the job demands of physicians with different specialties varied during the Covid-19 pandemic. For example, job demands for physicians with surgical specialties could be lower during the Covid-19 pandemic as they saw their work being reduced due to the cancellations of operations. This could have reduced their (physical) workload more strongly than the workload of physicians with medical or other specialties which could explain the rise in their employability.

Limitations

This study has some limitations. First, although a longitudinal approach is highly relevant to understanding the impact of a pandemic over time, the disadvantage of this approach is a high attrition rate of participants. In this study, around one third of the participants did not complete all three surveys and were therefore excluded from the analyses. It is possible that nonresponders differed from responders, for example in terms of workload. However, non-significant non-response analyses show that it is unlikely that this has biased our results. Future studies in larger samples with low attrition rate, would enhance the generalizability of the findings.

Second, some questions in this study might generate a recall bias as they ask for past situations, for instance in the items measuring emotional workload asking for the existence of emotionally demanding past situations. We believe that this bias is limited, as we did not use retrospective questions in this study. Further, research has shown that people are usually able to remember long-term periods or specific events, such as the Covid-19 pandemic [29].

Study implications

This study contributes to the body of knowledge about the psychological impact of the Covid-19 pandemic on health care workers. It shows that the Covid-19 pandemic does not necessarily affect health care workers negatively; rather, it may also result in positive outcomes (i.e. increasing employability). As physicians work experiences are dynamic, a longitudinal approach is necessary to capture the dynamics of a pandemic on physicians work experiences. Furthermore, this study is valuable to practice as the healthcare system's ability to cope during an influenza pandemic will depend, to a large extent, on the number of health care workers, including physicians, who are able and willing to work through the crisis [8]. This study can inform global health actors that develop human resource strategies for dealing with the aftermath of the Covid-19 outbreak on health care workers. This study shows that physicians with surgical, medical and other specialties experience the Covid-19 pandemic differently. Therefore, tailor-made human resource strategies seem appropriate that pay attention to the specific needs of individual physicians.

Conclusion

This is the first study to provide evidence on the effects of the Covid-19 pandemic on physicians' employability and work experience, using a longitudinal approach with real-time data at three moments in time. We found evidence that physicians' employability significantly increased from the time prior to the pandemic to the period during the Covid-19 pandemic. Also, physicians experience a lower workload during the first peak of the Covid-19 pandemic compared to the time before the pandemic. At a later phase in the pandemic, their experiences of workload bounce back to initial levels. These results show that employability and work experiences vary, not only over time, but also in different phases of the Covid-19 pandemic. Physicians further experience the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Footnotes

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Competing interests: None declared.

Patient and public involvement: Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. The survey was co-constructed with the authors, some of them work within the hospital. The survey was also pilot tested with physicians who gave feedback on it.

Patient consent for publication: Not required.

Ethics approval: The Ethical Committee of the University Medical Center Utrecht confirmed that this study falls outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 20/328).

Data availability statement: Raw data are available upon reasonable request. Ethical restrictions related to participant confidentiality prohibit the authors from making the dataset publicly available.

Authors' contributions: All authors conceptualized the research project. EvL coordinated the study and gathered participants. EvL analyzed the data and drafted the manuscript. All authors reviewed and provided comments and revisions. TT, EvR, JWL and EK secured funding for the project. All authors read and approved the final manuscript.

References

1 Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsi E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain, behavior, and Immunity* 2020;**88**:901-907. doi:10.1016/j.bbi.2020.05.026

2 Ripp J, Peccoralo L, Charney D. Attending to the emotional well-being of the health care workforce in a New York city health system during the Covid-19 pandemic. *Acad Med* 2020;**64**:1–4. doi:10.1097/ACM.0000000000003414

3 Smith CC. The structural vulnerability of healthcare workers during COVID-19: Observations on the social context of risk and the equitable distribution of resources. *Soc Sci Med* 2020;**258**:1–4. doi:10.1016/j.socscimed.2020.113119

4 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *N Engl J Med* Published Online First: 2020. doi:10.1056/NEJMp2008017

5 Cooch N. The psychological impact of Covid-19 on physicians: Lessons from previous outbreaks. 02-06-2020. 2020.https://www.practiceupdate.com/content/the-psychological-impact-of-covid-19-on-physicians-lessons-from-previous-outbreaks/100995/45?trendmd-shared=0 (accessed 9 Jul 2020).

6 Fargen KM, Leslie-Mazwi TM, Klucznik RP, *et al.* The professional and personal impact of the coronavirus pandemic on US neurointerventional practices: a nationwide survey The Pandemic and Neurointervention. *J Neurointerv Surg* 2020;**12**. doi:10.1136/neurintsurg-2020-016513

7 Lai J, Ma S, Wang Y, *et al.* Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open* 2020;**3**:1–12. doi:10.1001/jamanetworkopen.2020.3976

8 Ives J, Greenfield S, Parry JM, *et al.* Healthcare workers' attitudes to working during

pandemic influenza: a qualitative study. *BMC Public Health* 2009;**9**:1–13. doi:10.1186/1471-2458-9-56

9 Vindrola-Padros C, Andrews L, Dowrick A, *et al.* Perceptions and experiences of healthcare workers during the COVID-19 pandemic in the UK. *BMJ Open* 2020;**10**:1–8. doi:10.1136/BMJOPEN-2020-040503

10 Imai H, Matsuishi K, Ito A, *et al.* Factors associated with motivation and hesitation to work among health professionals during a public crisis: a cross sectional study of hospital workers in Japan during the pandemic (H1N1) 2009. *BMC Public Health* 2010;**10**:1–8. doi:10.1186/1471-2458-10-672

11 Liu X, Kakade M, Fuller CJ, *et al.* Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr Psychiatry* 2012;**53**. doi:10.1016/j.comppsych.2011.02.003

12 Maunder RG, Lancee WJ, Balderson KE, *et al.* Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Eerging Infect Dis* 2006;**12**:1924–32. doi:10.3201/eid1212.060584

13 Bakker AB, Van Veldhoven M, Xanthopoulou D. Beyond the demand-control model. *J Pers Psychol* 2010;**9**:3–16. doi:10.1027/1866-5888/a000006

14 Karasek RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Adm Sci Q* 1979;**24**:285–308.https://www.jstor.org/stable/pdf/2392498.pdf?casa_token=Lv7e61ddZFkAAAAA:cDIPyGRTkgjcINSmVlIVUYGHt0E2srz5VXhjl3ak28KDkdFVZRDUx-g9yeZF8Vm3XAAdRPJQ5z3Mh-opCYGqlqZlK-GjAajHupaW4G1TQUayGhs9IIua (accessed 15 Feb 2021).

15 De Lange AH, Taris TW, Kompier MAJ, *et al.* The very best of the millennium: longitudinal research and the Demand-Control-(Support) Model. *J Occup Health*

Psychol 2003;**8**:282–305. doi:10.1037/1076-8998.8.4.282

16 De Cuyper N, Sulea C, Philippaers K, *et al.* Perceived employability and performance: moderation by felt job insecurity. *Pers Rev* 2014;**43**:536–52. doi:10.1108/PR-03-2013-0050

17 Kirves K, Kinnunen U, De Cuyper N, *et al.* Trajectories of perceived employability and their associations with well-being at work. *J Pers Psychol* 2014;**13**:46–57. doi:10.1027/1866-5888/a000103

18 Akkermans J, Seibert SE, Mol ST. Tales of the unexpected. Integrating career shocks in the contemporary career literature. *SA J Ind Psychol* 2018;**44**:1–10. doi:10.4102/sajip.v44i0.1503

19 Akkermans J, Richardson J, Kraimer ML. The Covid-19 crisis as a career shock: Implications for careers and vocational behavior. *J Vocat Behav* 2020;**119**:1–5. doi:10.1016/J.JVB.2020.103434

20 Wallace JE, Lemaire JB, Ghali WA. Physician wellness: A missing quality indicator. *Lancet* 2009;**374**:1714–21. doi:10.1016/S0140-6736(09)61424-0

21 Maunder R. The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. *Philos Trans R Soc London* 2004;**359**:1117–25. doi:10.1098/rstb.2004.1483

22 Naushad VA, Bierens JJ, Nishan KP, *et al.* A systematic review of the impact of disaster on the mental health of medical responders. *Prehosp Disaster Med* 2019;**34**:632–43. doi:10.1017/S1049023X19004874

23 Wu Y, Wang J, Luo C, *et al.* A comparison of burnout frequency among oncology physicians and nurses working on the frontline and usual wards during the COVID-19 epidemic in Wuhan, China. *Journal of pain and symptom management* 2020;**60**:e60-e65. doi:10.1016/j.jpainsyman.2020.04.008

24 Tiete J, Guatteri M, Lachaux A, Matossian A, Hougardy JM, Loas G, Rotsaert M. Mental health outcomes in healthcare workers in COVID-19 and non-COVID-19 care units: a cross-sectional survey in Belgium. *Frontiers in Psychol* 2020;**11**:1-10. doi:10.3389/fpsyg.2020.612241

25 Willan J, King AJ, Jeffery K, *et al.* Challenges for NHS hospitals during Covid-19 epidemic. *BMJ* 2020;**368**:1–2. doi:10.1136/bmj.m1117

26 Tan, B. Y., Chew, N. W., Lee, G. K., Jing, M., Goh, Y., Yeo, L. L., ... & Shanmugam GN. Psychological impact of the Covid-19 pandemic on health care workers in Singapore. *Ann Intern Med* 2020;:1–3. doi:10.7326/M20-1083

27 Chong MY, Wang WC, Hsieh WC, *et al.* Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry* 2004;**185**:127–33.

28 Preti E, Di Mattei V, Perego G, *et al.* The psychological impact of epidemic and pandemic outbreaks on healthcare workers: rapid review of the evidence. *Curr Psychiatry Rep* 2020;**22**:1–22. doi:10.1007/s11920-020-01166-z

29 Schwarz N. Retrospective and concurrent self-reports: The rationale for real-time data capture. In: Stone A, Shiffman SS, Atienza A, *et al.*, eds. *The science of real-time data capture: Self-reports in health research*. New York: : Oxford University Press 2007. 11–26.https://dornsife.usc.edu/assets/sites/780/docs/schwarz_retrospective_self-reports_mdc_2007.pdf

30 Van Leeuwen, E. H., Knies, E., Van Rensen, E. L. J., Taris TW. Stimulating perceived ability and willingness to continue working and job crafting behaviour of physicians: An intervention study. In: *Dutch HRM Network Conference*. Tilburg: 2019.

31 RIVM. Current information about Covid-19. https://www.rivm.nl/en/coronavirus-covid-19/current-information. Retrieved on 13th of July 2021.

32 Blank, J. L. T., Niaounakis TK. Productiviteitsontwikkelingen bij medisch specialisten: Resultaten en technische rapportage. Delft: 2019.

33 Van Veldhoven, M., Prins, J., Van der Laken, P., Dijkstra L. *VBBA 2.0: Update van de standaard voor vragenlijstonderzoek naar werk, welbevinden en prestaties*. Enschede: Gildeprint 2014.

34 Demerouti E, Le Blanc PM, Bakker AB, *et al.* Present but sick: a three-wave study on job demands, presenteeism and burnout. *Career Dev Int* 2009;**14**:50–68. doi:10.1108/13620430910933574

35 Morgeson FP, Humphrey SE. The work design questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *J Appl Psychol* 2006;**91**:1321–39. doi:10.1037/0021-9010.91.6.1321

36 Oude Hengel KM, Blatter BM, Geuskens GA, *et al.* Factors associated with the ability and willingness to continue working until the age of 65 in construction workers. *Int Arch Occup Environ Health* 2012;**85**:783–90. doi:10.1007/s00420-011-0719-3

37 Wanous JP, Reichers AE, Hudy MJ. Overall job satisfaction: How good are single-item measures? *J Appl Psychol* 1997;**82**:247–52. doi:10.1037/0021-9010.82.2.247

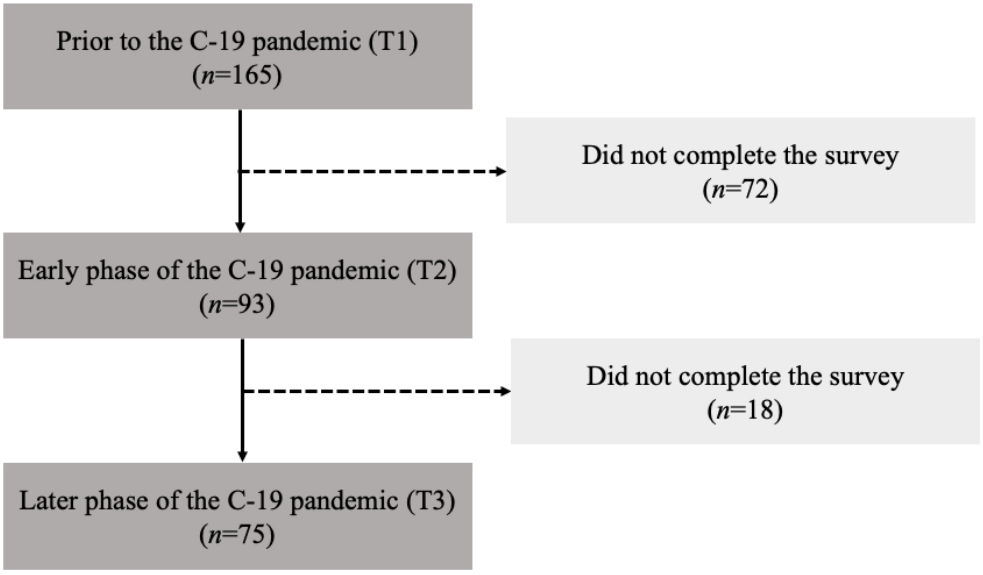
38 Martins LL, Eddleston KA, Veiga JF. Moderators of the relationship between work-family conflict and career satisfaction. *Acad Manag J* 2002;**45**:399–409. doi:10.5465/3069354

39 Van Dooren W, Noordegraaf M. Staging science: Authoritativeness and fragility of models and measurement in the Covid-19 crisis. *Public Adm Rev* 2020;**80**:610–5. doi:10.1111/puar.13219

40 Bernburg M, Vitzthum K, Groneberg DA, *et al.* Physicians' occupational stress, depressive symptoms and work ability in relation to their working environment: a cross-sectional study of differences among medical residents with various specialties

working in German hospitals. *BMJ Open* 2016;**6**:1–9. doi:10.1136/BMJOPEN-2016-011369

41 Fowler A, Abbott TEF, Pearse RM. Can we safely continue to offer surgical treatments during the COVID-19 pandemic? *BMJ Qual Saf* Published Online First: 20 November 2020. doi:10.1136/BMJQS-2020-012544



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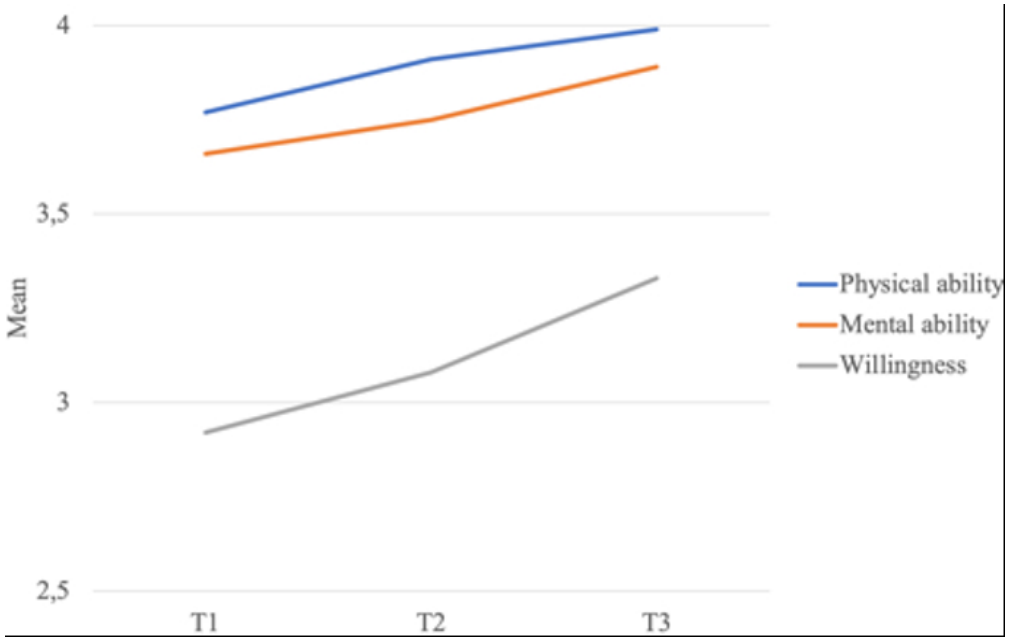

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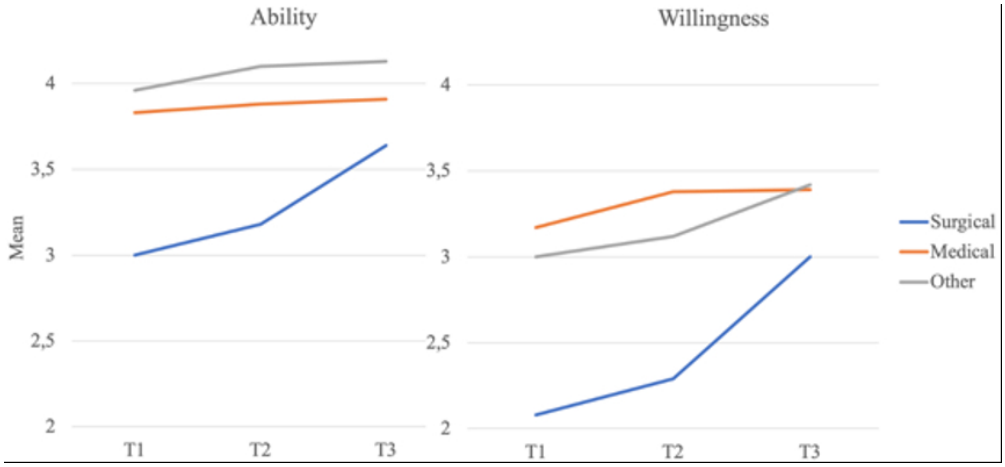

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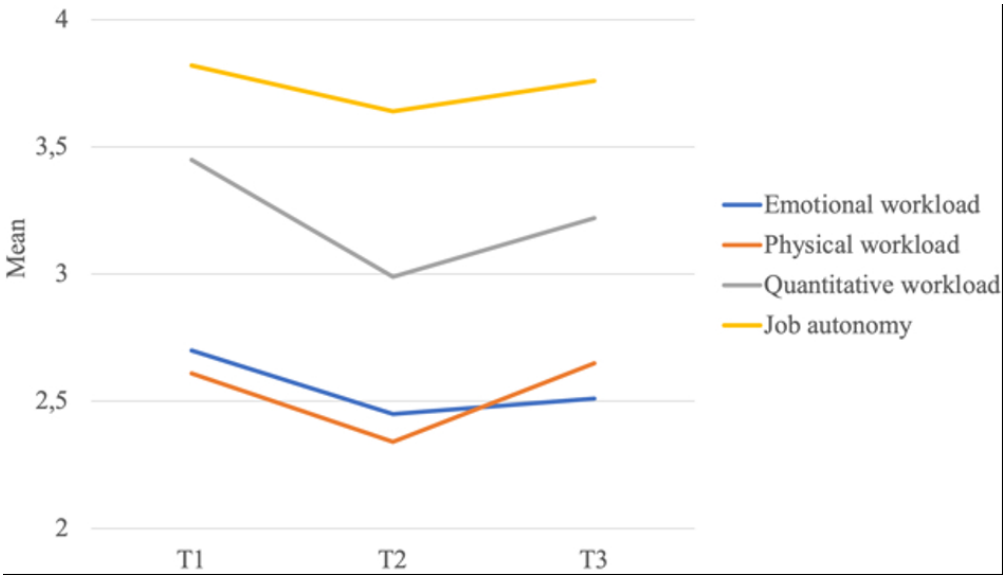

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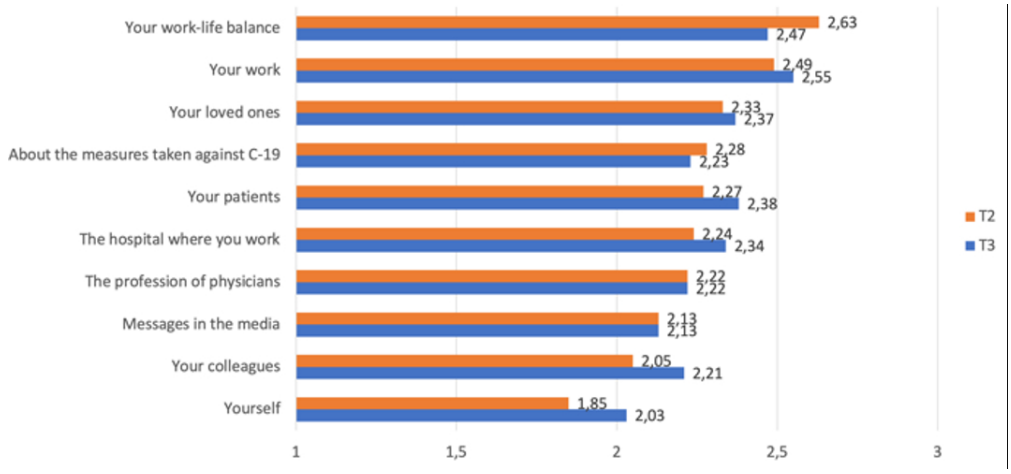

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STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed (NA)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable (NA)
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, explain how loss to follow-up was addressed
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram (not included yet, could still be included but I think it is clear from the text and I am not sure whether it increases the readability)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount)
Outcome data	15*	Report numbers of outcome events or summary measures over time
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a

		meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

BMJ Open

A positive impact of the Covid-19 pandemic? A longitudinal study on the impact of the Covid-19 pandemic on physicians' work experiences and employability

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Title: A positive impact of the Covid-19 pandemic? A longitudinal study on the impact of the Covid-19 pandemic on physicians' work experiences and employability

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Abstract

Objective – The Covid-19 pandemic places an enormous demand on physicians around the world. The aim of this study was to examine the impact of the Covid-19 pandemic on physicians' work experiences and their ability and willingness to continue working in their profession until retirement (i.e. their employability).

Design - A longitudinal comparative design was used. Survey data were collected on three moments: before (May 2019), in the early phase (May 2020) and in a later phase (November 2020) of the Covid-19 pandemic. Time effects were tested using repeated-measures analyses of variance (RM ANOVA) and one-way analyses of variance (one-way ANOVA).

Setting – This study took place among physicians of two hospitals in a large city in the Netherlands.

Participants – 165 hospital physicians with surgical, medical and other specialties participated in this study.

Results – Physicians' employability significantly increased from the time prior to the Covid-19 pandemic, compared to the period during this pandemic. Employability differs among physicians with surgical, medical and other specialties. Furthermore, physicians experienced a lower emotional, physical and quantitative workload during the first peak of the Covid-19 pandemic, compared to before the pandemic. Moreover, physicians experienced the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Conclusions – This study shows that physicians' employability and work experiences are affected by the Covid-19 pandemic. Work experiences vary for physicians with different specialties. These varieties stress the importance of attention for physicians' individual needs and challenges regarding working during the Covid-19 pandemic, and the possibility of continuing work in the aftermath of this crisis. Based on this, physicians can be offered tailor-made solutions. This is important to maintain a healthy and employable workforce which is essential for a sustainable health care system.

Strengths and limitations of this study

- The study captured the work experiences of physicians prior to and during the Covid-19 pandemic, allowing for within-person comparisons

- The study used a longitudinal study approach with data collected at three moments in time
- Despite the highly relevant longitudinal study approach, this has also resulted in participants dropout

Introduction

Health care workers stand in the frontline of health care pandemics [1]. They are highly vulnerable during these pandemics, given the risk of exposure to the virus, concerns about infecting their loved ones, shortages of personal protective equipment, extended workload, and involvement in emotional and ethical decision making [2,3,4]. The Covid-19 pandemic is likely to have implications for health care workers' ability and willingness to work in the short-run and to continue their essential work on the frontlines in the long-run [5]. Evidence from earlier studies on the impact of the Covid-19 pandemic on health care workers, including meta-analyses and systematic reviews, show that the Covid-19 pandemic results in stress [6], illness, insomnia [1,7], fear for becoming infected [8], hesitation to work [9] or a lack of motivation to work [10] in the short-run. From previous research on crises we know that a pandemic may even result in more adverse consequences for physicians in the long-run, such as developing burn-out, psychological distress, and post-traumatic stress-disorder [11,12].

The possible consequences of crises for physicians make it important to monitor physicians' work experiences (i.e. their perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability). It is important to prevent adverse consequences, because health care workers' well-being might be at stake. Studying physicians' work experiences helps to monitor their ability to work in the short-term. Especially job demands (such as workload) and job resources (such as job autonomy) have been shown to be important factors that affect well-being, stress and performance [13–15]. Furthermore, employability provides an indication of physicians' ability and willingness to continue working in their profession. Research has shown that employability positively affects well-being and performance [16,17]. Research has shown that crises, such as the Covid-19 pandemic, are so-called "career shocks" referring to disruptive and extraordinary

events caused by factors outside an individual's control, triggering a deliberate thought process concerning ones' career [18]. This may result in people reconsidering their position, leaving their profession or lower job or career satisfaction [19]. This challenges their employability, which is especially problematic in a health crisis as employable physicians are needed to handle the high demands for health care, and in the aftermath of the health crisis due to delayed operations and other treatments for instance.

In this study we examine the impact of the Covid-19 pandemic on physicians' work experiences and employability, by addressing the following research question in the context of a three-wave prospective study: "What is the impact of the Covid-19 pandemic on physicians' work experiences (i.e. perceived workload, job autonomy and stress) and their ability and willingness to continue working in their profession (i.e. employability)?" Understanding the impact of the Covid-19 pandemic on physicians' work is important to be prepared for future outbreaks of health crises, as maintaining a healthy and employable workforce is essential for a sustainable health care system. These themes, and topics related to this, have to date received little attention, especially in a medical setting. Physicians tend to self-ignore attention for their well-being and health systems poorly support this [20], emphasizing the importance of this research.

This study examines the impact of the Covid-19 pandemic on physicians with varying specialties. Previous studies have found mixed outcomes for the impact of the Covid-19 pandemic on health care workers working in different departments [21,22,23]. Some studies have shown that the impact of pandemics varies for health care workers working in different departments [22,23]. For instance, one study found that those who work in emergency departments, intensive care units, and isolation wards have a greater risk of developing adverse psychiatric outcomes than those working in other departments [22]. Another study found the opposite, physicians and nurses who worked in the frontline had a lower frequency of burn-out and were less worried about being infected with the Covid-19 virus compared to those working in usual wards [23]. Yet another study found no differences in mental health outcomes for physicians and nurses working in Covid-19 care units, non

Covid-19 care units or in both units [24]. Despite possible differences between physicians working in different departments, it is likely that pandemics, such as the Covid-19 pandemic, affects them all to some extent as their work has suddenly changed, both in terms of content (e.g. change in cases, increase in the use of video consults) and location (e.g. working from home or in different departments), and due to an uncertain future. These changes may result in various job demands such as a high (emotional) workload or stress [1,25] which may vary between groups of physicians. More research is needed to understand the impact of pandemics on physicians with different specialties. This study examines physicians with surgical, medical, and other specialties to examine the impact on their work and possible differences between specialties.

Studies examining the psychological effects of pandemics (e.g. SARS, H1N1 influenza and avian influenza H5N1), including recent studies into the Covid-19 pandemic, often use cross-sectional methods [7,10–12,26]. A disadvantage of this approach is that it cannot capture the dynamics of pandemics. The impact of pandemics on health care workers has been shown to vary in different phases of the pandemic. During the initial outbreak health care workers perceive feelings of extreme vulnerability, uncertainty, anxiety and threat while mental health problems such as depression are more likely to develop in a later phase [27]. For this reason, a longitudinal approach where experiences are measured at multiple points in time is more appropriate to study the impact of a pandemic. In this study we use a longitudinal approach by examining physicians experiences at three moments in time.

In addition, a meta-analysis shows that these studies often use retrospective questions where respondents are asked for their past experiences [28]. This approach is problematic as psychologists and survey methodologists have shown that subjective experiences are poorly represented in memory. Retrospective questions often ask respondents for information that they cannot provide with any validity [29]. Therefore, examining behaviour and experiences by using real-time data is highly preferable [29]. This is done in this study by asking for physicians' current behaviour, at the three moments of taking the surveys.

Based on prior studies into the impact of health crises on health care workers, together with early evidence on the impact of the Covid-19 pandemic on health care workers, we expect that physicians experience their work more negatively during the Covid-19 pandemic compared to the situation prior to this pandemic, which will be reflected in a higher emotional, physical and quantitative workload. Furthermore, we expect that physicians are more negative about their employability during the pandemic, compared to the situation prior to the Covid-19 pandemic, and have a lower job and career satisfaction during the pandemic compared to the time prior to the pandemic.

Method

Three surveys were sent to physicians in two hospitals in a large Dutch city, an academic hospital and a general hospital. The first survey was sent as part of another study [30]. The sample size of this study was therefore predetermined by the sample of the prior study that was calculated according to a power analysis. The first survey was sent in May 2019 (T1), prior to the Covid-19 outbreak. A second survey was sent in May 2020, in an early phase of the Covid-19 pandemic. This was one month after the first peak of Covid-19 infections in the Netherlands [31]. At this time, both hospitals had established a Covid-19 clinic and an Covid-19 intensive care unit which were separated from other departments in the hospital. Furthermore, in both hospitals non-emergent care and surgeries were postponed. Physicians and health care workers from different departments were requested to support on the Covid-19 departments. Health care professionals were supported with volunteers from "outside" who were not employed by the hospitals. The long period in which the Covid-19 pandemic dominates the world, made it relevant to add a study wave in a later phase of the pandemic to examine its longer-term consequences. Therefore, a third survey was sent in November 2020 (T3), one month after the second peak of Covid-19 in the Netherlands. During the first and second peak of the number of Covid-19 infections, there were 60 patients infected with the Covid-19 virus in the academic hospital (20 on the intensive care and 40 in the Covid-19 clinic) and 30 in the general hospital (8 on the intensive care and 22 in the Covid-19 clinic). When the surveys were sent at T2 and T3, many countries, including the Netherlands, were partly or fully in lockdown, social distancing was required

and the number of patients infected with Covid-19 was high. In the two hospitals where this study took place, waiting lists for patients were higher at T3 than at T2 due to non-emergent care that was still being postponed.

Participants were recruited through promotional presentations and through an internal mailing list. Participants provided informed consent at the start of each survey stating that participation is voluntary, outcomes are held confidential, participants can withdraw from the study at any time, and all study material was anonymized and saved on a protected server. 165 physicians participated in this study at T1. These 165 physicians were invited by e-mail to complete a second and a third survey. 93 physicians completed the survey at T2 (response rate: 56%), and 75 physicians completed all three surveys (response rate: 45%). A flowchart of the participants in this study is presented in figure 1. We compared participants who completed all three surveys (T1, T2 and T3) (n=75) with participants who only completed the survey sent at T1 (n=72). Multivariate analysis of variance indicated that there were no significant differences between these participants in terms of age (F(1,124)=0.037, p=0.849), hours worked according to contract (F(1,135)=0.555, p=0.458), occupational tenure (F(1,133)=0.591, p=0.443), and organisational tenure (F(1,129)=0.804, p=0.371). For the dichotomous variables gender, hospital type (general vs. academic), type of specialism (surgical, medical vs. other, following the categorization of [32]) and type of employment contract (employed by the hospital vs. independently established) we conducted chi-square tests, again showing that there were no significant differences between participants who dropped out of this study and the participants who completed all three surveys (all p's>0.452).

Please insert: Figure 1: Flow chart of participants at T1, T2 and T3

Physicians provided several reasons for not completing the surveys sent at T2 and/or T3. At T2, 1 physician had left the hospital, and 10 physicians were on leave (either a pregnancy leave, holiday leave or were abroad). At T3, 2 physicians had left the hospital, 10 physicians were on leave, and 1 physician was "too busy" to complete the survey. These reasons, apart from the latter, are unlikely to

result in biased outcomes. This, together with the non-significant results for the non-response analysis, show that there are no significant differences between the participants who dropped out of this study and the participants who completed all three surveys. The result section reports on the results of the analyses based on the data from participants who completed the surveys on T1, T2 and T3 (n=75).

The questions addressed sociodemographic characteristics (gender, age), job characteristics (specialism, autonomy, workload, occupational tenure referring to the time working as a medical specialist and organizational tenure referring to the time working in their current hospital) and involvement with care for patients with the Covid-19 virus. Most variables were measured with validated scales, if available. Work characteristics were measured using validated scales from the popular surveys: 'VBBA 2.0' [33] and the Work Design Questionnaire [34]. Physicians were asked to rate their emotional workload (5 items: *"Is your job emotionally demanding?", "Are you confronted in your work with things that affect you personally?", "Are you in your work in contact with difficult patients or their relatives?", "Do you have to convince or persuade people for your job?" and "Do you encounter emotionally demanding events in your work?"*, α_{T1}=0.96; α_{T2}=0.82; α_{T3}=0.82, [33]), quantitative workload (3 items: "*Do you have too much work to do?", "Do you have to put in extra effort to finish your work?" and "Do you have to hurry?"*, α_{T1}=0.90; α_{T2}=0.91; α_{T3}=0.93, [33]), physical workload (1 item: "*My job is physically demanding"*, [35]), and job autonomy (3 items: "*The job allows me to decide on my own how to go about doing my work", "The job provides me with significant autonomy in making decisions" and "The job gives me a chance to use my personal initiative or judgment in carrying out the work"*, α_{T1}=0.80; α_{T2}=0.72; α_{T3}=0.79, [34]). Answers were given on a 5-point Likert scale (1=never, 5=very often).

Other questions asked for physicians' perceptions of their own employability (2 items measured ability: *"I am [physically (item 1)/ mentally (item 2)] able to continue to work until the age of 67 in my current profession"*; 1 item measured willingness: *"I am willing to continue to work until the age of 67 in my current profession"*, [36]). This is a common way to measure employability, which is also

used in a big survey research among employees in the Netherlands called the NEA (abbreviation for 'Nederlandse Enquête Arbeidsomstandigheden', translation: Dutch Survey on Work conditions). Job satisfaction and career satisfaction were both measured with 1 item ("*Generally speaking, I am very satisfied with my job"* [37] and "*Generally speaking, I am very satisfied with my career*" [38]). Previous studies have shown that a single item measure of job satisfaction is appropriate especially when situational constraints limit or prevent the use of scales [37]. Answers were given on a 5-point Likert scale (1=totally disagree, 5=totally agree).

The surveys sent on T2 and T3 additionally asked for perceived stress associated with the Covid-19 situation. This was measured with items that are relevant for employees working during the Covid-19 pandemic. Some specifically related to the work of health care workers as they may experience stress due to the health of their patients or colleagues who have a higher risk of infection (10 newly-developed items: "*How often do you experience stress caused by Covid-19 [for work* (item 1)/ *about the measures taken against Covid-19* (item 2)/ *for your work-life balance* (item 3)/ *messages in the media* (item 4)/ *yourself* (item 5)/ *love ones* (item 6)/ *your patients* (item 7)/ *your colleagues* (item 8)/ *the hospital where you work* (item 9)/ *the profession of physicians*" (item 10)], that were all rated on a 5-point Likert scale (1=never, 5=very often)).

The University Medical Center Utrecht confirmed that this study fell outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 20/328).

Patient and public involvement

This study was conducted among physicians; patients were not involved in this study. Physicians were involved in developing the surveys that were used in this study. The survey was pilot-tested among five physicians. They were interviewed about the content, wording, and style of addressing physicians in the survey. If needed, the content and the item wordings were adapted. Furthermore, the researchers of this study developed the surveys and interpreted results with the support of a senior board member,

and two physicians, one from the academic and one from the general hospital. The outcomes of this study are discussed in both hospitals in a group of representative physicians from all departments.

Data analysis

To examine physicians' employability, a repeated measures analyses of variance (RM ANOVA) was performed with planned contrasts on Time (Helmert contrasts T1 vs. T2/T3) and with Time as a within-subject factor and Group as a between-subject factor.

Furthermore, one-way ANOVAs were performed to compare groups (physicians with surgical, medical or another specialty) and work experiences over time (T1, T2 and T3).

Results

Table 1 presents the demographics of the respondents.

Table 1: Demographics of participants (n=75)

Gender	Male: *n*=28 (37%) Female: *n*=47 (63%)
Age	*M*=44.9, *SD*=7.8
Work hours according to contract	*M*=41.4, *SD*=11.12
Occupational tenure (years)	*M*=11.6, *SD*=8.4
Organizational tenure (years)	*M*=9.6, *SD*=8.0
Type of employment contract	Self-employed: *n*=10 (13%) Contracted: *n*=65 (87%)
Specialty	Surgical: *n*=14 (19%) Medical: *n*=35 (47%) Other: *n*=26 (35%)
Involved in care for Covid-19 patients at T2	Yes: *n*=24 (32%), of which *n*=6 (25%) had a surgical specialty, *n*=13 (54%) had a medical specialty and *n*=5 (21%) had another specialty

	No: *n*=51 (68%)
Involved in care for Covid-19 patients at T3	Yes: *n*=19 (25%), of which *n*=4 (21%) had a surgical specialty, *n*=10 (53%) had a medical specialty and *n*=5 (26%) had another specialty No: *n*=56 (75%)

Employability is higher during the Covid-19 pandemic than before

RM ANOVAs show that physicians' perceived employability significantly increased over time (Figure 2). Specifically, physicians' mental and physical ability to work and to continue working in their current profession significantly increased from the time before the Covid-19 pandemic (T1) compared to the period during the Covid-19 pandemic (T2 and T3) (F (1,67)=4.954, p=0.029*, *partial* η^2=0.069). Similarly, physicians' willingness to work and to continue to work significantly increases from the time before the pandemic compared to the period during the pandemic (F (1,65)=11.125, p=0.001**, *partial* η^2=0.146).

Please insert: Figure 2: Mean scores for employability on T1, T2 and T3

We observe a similar significant increase in physicians' career satisfaction from prior to the Covid-19 pandemic (T1) to during the Covid-19 pandemic (T2 and T3) (F (1,72)=6.294, p=0.014*, *partial* η^2=0.080). No significant change was found for physicians' job satisfaction in this period. Moreover, no significant differences were found in the employability, job and career satisfaction for physicians who were involved in taking care for patients infected with the Covid-19 virus and physicians that were not involved in Covid-19 related care.

Employability differs between specialties

Further analyses show that employability differs among physicians with surgical, medical and other specialties (Figure 3). At T1, surgical doctors are significantly less positive about their employability than physicians with medical or other specialties (ability: F (2,71)=6.412, p=0.003**, partial η^2=0.153; willingness F (2,68)=4.200, p=0.019*, partial η^2=0.110). Further, during the first phase of

the Covid-19 pandemic (T2), the employability of surgical doctors is still significantly lower than that of physicians with medical or other specialties (ability: F (2,70)=6.492, p=0.003**, partial η^2=0.156; willingness: F (2,71)=5.941, p=0.004**, partial η^2=0.143). At T3 there are no significant differences anymore between the employability of the three groups of medical specialties. Table 2 summarizes the differences in employability over time among physicians with surgical, medical, and other specialties.

Please insert: Figure 3: Mean scores for employability on T1, T2 and T3 for physicians with surgical, medical and other specialties

Table 2: Results one-way ANOVAs employability on T1, T2 and T3 for physicians with surgical, medical and other specialties (n=75)

		Surgical		**Medical**		**Other**			
Variable	**Time**	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F-values***	**Partial *η2***
Ability to continue working	T1	3.00	1.22	3.83	0.79	3.96	0.64	F (2,71)=6.412, p=0.003**	0.153
	T2	3.18	1.05	3.88	0.81	4.10	0.52	F (2,70)=6.492, p=0.003**	0.156
	T3	3.64	1.08	3.91	0.96	4.13	0.71	F (2,69)=1.256, p=0.291	X
Willingness to continue working	T1	2.08	1.26	3.17	1.22	3.00	1.04	F (2,68)=4.200, p=0.019*	0.110
	T2	2.29	1.07	3.38	0.99	3.12	0.99	F (2,71)=5.941, p=0.004**	0.143
	T3	3.00	1.24	3.39	1.20	3.42	1.06	F (2,70)=0.700, p=0.500	X

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Physicians' work experiences during the Covid-19 pandemic

We further examined how physicians experience their work during the Covid-19 pandemic. Table 3 shows that physicians experience a significant lower emotional workload ($F(2,70)=10.579$, $p<0.001$**, physical workload ($F(2,72)=5.159$, $p=0.008$**, and quantitative workload ($F(2,62)=5.702$, $p=0.005$** during an early phase of the Covid-19 pandemic (T2), compared to the time before the pandemic (T1). In a later phase of the pandemic (T3), the experience of workload showed a tendency to return to the pre-pandemic levels (T1) (Figure 4). There were no significant differences in the experiences of these work characteristics for physicians who were involved in Covid-19 related care and physicians who were not.

Please insert: Figure 4: Mean scores for work characteristics on T1, T2 and T3

Table 3: Results one-way ANOVAs experience of work characteristics on T1, T2 and T3 (n=75)

	T1		**T2**		**T3**			
Work characteristics	**M**	**SD**	**M**	**SD**	**M**	***SD***	***F-values***	***η2***
Emotional workload	2.70	0.67	2.45	0.63	2.51	0.67	$F(2,70)=10.579$, $p<0.001$**	0.232
Physical workload	2.61	0.98	2.34	0.93	2.65	0.99	$F(2,72)=5.159$, $p=0.008$**	0.125
Quantitative workload	3.45	1.11	2.99	1.03	3.22	1.11	$F(2,62)=5.702$, $p=0.005$**	0.155
Job autonomy	3.82	0.80	3.64	0.54	3.76	0.60	$F(2,63)=2.417$, $p=0.097$	x

*=significant at the 0.05 level (2-tailed), ** significant at the 0.01 level (2-tailed)

Stress factors during the Covid-19 pandemic

Physicians further reported to what extent they experience stress in several areas because of the Covid-19 pandemic (Figure 5). During an early phase of this pandemic (T2), physicians experienced the most stress from combining work and private life ($M=2.63$; $SD=1.27$), from work in general ($M=2.49$;

SD=0.95) and due to the possible impact of Covid-19 on their loved ones' health (*M*=2.33; *SD*=0.93). They experienced the least stress for the possible consequences of Covid-19 for themselves (*M*=1.85; *SD*=0.85). During a later phase of the Covid-19 pandemic (T3), physicians reported to experience the most stress from their work in general (*M*=2.55; *SD*=1.00), from combining work and private life (*M*=2.47; *SD*=1.12), and due to the health of their patients (*M*=2.38; *SD*=0.98). Again, they reported to experience the least stress for the possible impact of Covid-19 on themselves (M=2.03; SD=0.72).

Please insert: Figure 5: Mean scores on how often physicians experience stress in several areas on T2 and T3 caused by Covid-19

Discussion

The aim of this study was to provide insight into the impact of the Covid-19 pandemic on physicians' employability and work experiences. A longitudinal approach was used, which allowed us to compare physicians work experiences during the Covid-19 pandemic with the situation prior to the pandemic.

Perhaps the most interesting finding of the present study was the fact that the perceived employability of physicians was significantly *higher* during the pandemic than it was before. Specifically, the results show that physicians' employability increases in the time prior to the Covid-19 pandemic to the early phase of the Covid-19 pandemic and continues to increase in a later phase of the Covid-19 pandemic. This goes contrary to our expectations, since other studies found that physicians' work motivation decreases [10] and stress and burn-out increase during previous pandemics [11,12]. There are various substantive explanations for this increase in employability. It could be related to a change in physicians' work characteristics, or an increase in societal appreciation of health care professionals during the pandemic. This study shows that physicians experienced a lower workload during an early phase of the Covid-19 pandemic compared to the time prior to the pandemic. Workload has also been shown to correlate with employability. Therefore, a lower workload at this time could possibly explain why physicians perceive to be better able to continue working until their retirement. This is in line with research showing that job demands, such as workload, negatively relate to well-being and self-

reported health [e.g. 15]. This suggests that having a period of lower job demands may be beneficial for an individual's well-being or related concepts such as employability. More research is needed to examine this further.

More appreciation for physicians' work by society [9] may provide an alternative explanation for the increase in their employability. Physicians and other health care workers have been portrayed as 'heroes' [39], and citizens have expressed their support through a public applause and by placing white t-shirts with red hearts in front of their windows. Physicians are on the shortlist of 'vital professions', which gives them certain privileges during the pandemic compared to people with other professions (e.g. they may use public transport and their children can still go to daycare and school). This might have resulted in physicians feeling highly appreciated during the Covid-19 pandemic, which may have boosted their ability and willingness to work and to continue their essential and meaningful work.

A possible explanation for the different conclusions drawn in this study compared to other studies on the impact of previous pandemics [10-12] may be the result of a different approach taken in our study compared to these past studies. Earlier studies drew conclusions on the basis of cross-sectional, retrospective data. Recall biases are inherent to studies using retrospective techniques to understand a change in experience over time [29]. Studies have shown that when respondents have reason to believe in change, they will report change when they are asked to reflect on the past, even if no change has occurred [29]. In a crisis situation, such as a pandemic, respondents may believe that they were more positive before the outbreak of a pandemic than during the pandemic. This perspective is likely to be strengthened by the public debate where the negative impact of the pandemic on health care workers has frequently been emphasized. A strength of our study is that we used real-time data collection, instead of retrospective methods. We asked physicians about things that they *can* report, namely their current experiences at the moment of taking the survey, i.e. they reported on their current feelings, not on their perceptions of their feelings in the past. This approach allows for drawing considerably more reliable conclusions about physicians' work experiences prior to a pandemic and during a pandemic than is possible using non-longitudinal methodologies.

Physicians employability differed across surgical, medical and other specialties. This difference is also apparent before the Covid-19 pandemic. This is in line with previous studies showing that physicians with different specialties experience their work differently. There are for instance significant differences in job stressors, demands and resources among medical specialties [e.g. 40]. Another interesting finding is that the employability of physicians with surgical specialties increased stronger from the time prior to the Covid-19 pandemic to the time during the Covid-19 pandemic compared to physicians with medical or other specialties. We tested whether this difference is caused by the degree of involvement with care for Covid-19 patients, but this was not the case. Other factors might explain this difference. Physicians with different specialties had very diverse roles during the Covid-19 pandemic. While some physicians were directly involved in taking care for Covid-19 patients, or were part of crisis teams, making very long workdays, other physicians work was significantly reduced due to postponed or cancelled non-Covid related care [41]. Therefore, the job demands of physicians with different specialties varied during the Covid-19 pandemic. For example, job demands for physicians with surgical specialties could be lower during the Covid-19 pandemic as they saw their work being reduced due to the cancellations of operations. This could have reduced their (physical) workload more strongly than the workload of physicians with medical or other specialties which could explain the rise in their employability.

Limitations

This study has some limitations. First, although a longitudinal approach is highly relevant to understanding the impact of a pandemic over time, the disadvantage of this approach is a high attrition rate of participants. In this study, around one third of the participants did not complete all three surveys and were therefore excluded from the analyses. It is possible that nonresponders differed from responders, for example in terms of workload. However, non-significant non-response analyses show that it is unlikely that this has biased our results. Future studies in larger samples with low attrition rate, would enhance the generalizability of the findings.

Second, some questions in this study might generate a recall bias as they ask for past situations, for instance in the items measuring emotional workload asking for the existence of emotionally demanding past situations. We believe that this bias is limited, as we did not use retrospective questions in this study. Further, research has shown that people are usually able to remember long-term periods or specific events, such as the Covid-19 pandemic [29].

Study implications

This study contributes to the body of knowledge about the psychological impact of the Covid-19 pandemic on health care workers. It shows that the Covid-19 pandemic does not necessarily affect health care workers negatively; rather, it may also result in positive outcomes (i.e. increasing employability). As physicians work experiences are dynamic, a longitudinal approach is necessary to capture the dynamics of a pandemic on physicians work experiences. Furthermore, this study is valuable to practice as the healthcare system's ability to cope during an influenza pandemic will depend, to a large extent, on the number of health care workers, including physicians, who are able and willing to work through the crisis [8]. This study can inform global health actors that develop human resource strategies for dealing with the aftermath of the Covid-19 outbreak on health care workers. This study shows that physicians with surgical, medical and other specialties experience the Covid-19 pandemic differently. Therefore, tailor-made human resource strategies seem appropriate that pay attention to the specific needs of individual physicians.

Conclusion

This is the first study to provide evidence on the effects of the Covid-19 pandemic on physicians' employability and work experience, using a longitudinal approach with real-time data at three moments in time. We found evidence that physicians' employability significantly increased from the time prior to the pandemic to the period during the Covid-19 pandemic. Also, physicians experience a lower workload during the first peak of the Covid-19 pandemic compared to the time before the pandemic. At a later phase in the pandemic, their experiences of workload bounce back to initial levels. These results show that employability and work experiences vary, not only over time, but also

in different phases of the Covid-19 pandemic. Physicians further experience the most stress from the impact of Covid-19 on their work in general and from combining work and private life.

Footnotes

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Competing interests: None declared.

Patient and public involvement: Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. The survey was co-constructed with the authors, some of them work within the hospital. The survey was also pilot tested with physicians who gave feedback on it.

Patient consent for publication: Not required.

Ethics approval: The Ethical Committee of the University Medical Center Utrecht confirmed that this study falls outside the scope of the Dutch Law on Medical Research (WMO) and therefore formal ethical approval was not required (METc 2019, 20/328).

Data availability statement: Raw data are available upon reasonable request. Ethical restrictions related to participant confidentiality prohibit the authors from making the dataset publicly available.

Authors' contributions: All authors conceptualized the research project. EvL coordinated the study and gathered participants. EvL analyzed the data and drafted the manuscript. All authors reviewed and provided comments and revisions. TT, EvR, JWL and EK secured funding for the project. All authors read and approved the final manuscript.

References

1 Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsi E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain, behavior, and Immunity* 2020;**88**:901-907. doi:10.1016/j.bbi.2020.05.026

2 Ripp J, Peccoralo L, Charney D. Attending to the emotional well-being of the health care workforce in a New York city health system during the Covid-19 pandemic. *Acad Med* 2020;**64**:1–4. doi:10.1097/ACM.0000000000003414

3 Smith CC. The structural vulnerability of healthcare workers during COVID-19: Observations on the social context of risk and the equitable distribution of resources. *Soc Sci Med* 2020;**258**:1–4. doi:10.1016/j.socscimed.2020.113119

4 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *N Engl J Med* Published Online First: 2020. doi:10.1056/NEJMp2008017

5 Cooch N. The psychological impact of Covid-19 on physicians: Lessons from previous outbreaks. 02-06-2020. 2020.https://www.practiceupdate.com/content/the-psychological-impact-of-covid-19-on-physicians-lessons-from-previous-outbreaks/100995/45?trendmd-shared=0 (accessed 9 Jul 2020).

6 Fargen KM, Leslie-Mazwi TM, Klucznik RP, *et al.* The professional and personal impact of the coronavirus pandemic on US neurointerventional practices: a nationwide survey The Pandemic and Neurointervention. *J Neurointerv Surg* 2020;**12**. doi:10.1136/neurintsurg-2020-016513

7 Lai J, Ma S, Wang Y, *et al.* Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open* 2020;**3**:1–12. doi:10.1001/jamanetworkopen.2020.3976

8 Ives J, Greenfield S, Parry JM, *et al.* Healthcare workers' attitudes to working during

pandemic influenza: a qualitative study. *BMC Public Health* 2009;**9**:1–13. doi:10.1186/1471-2458-9-56

9 Vindrola-Padros C, Andrews L, Dowrick A, *et al.* Perceptions and experiences of healthcare workers during the COVID-19 pandemic in the UK. *BMJ Open* 2020;**10**:1–8. doi:10.1136/BMJOPEN-2020-040503

10 Imai H, Matsuishi K, Ito A, *et al.* Factors associated with motivation and hesitation to work among health professionals during a public crisis: a cross sectional study of hospital workers in Japan during the pandemic (H1N1) 2009. *BMC Public Health* 2010;**10**:1–8. doi:10.1186/1471-2458-10-672

11 Liu X, Kakade M, Fuller CJ, *et al.* Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr Psychiatry* 2012;**53**. doi:10.1016/j.comppsych.2011.02.003

12 Maunder RG, Lancee WJ, Balderson KE, *et al.* Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Eerging Infect Dis* 2006;**12**:1924–32. doi:10.3201/eid1212.060584

13 Bakker AB, Van Veldhoven M, Xanthopoulou D. Beyond the demand-control model. *J Pers Psychol* 2010;**9**:3–16. doi:10.1027/1866-5888/a000006

14 Karasek RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Adm Sci Q* 1979;**24**:285–308.https://www.jstor.org/stable/pdf/2392498.pdf?casa_token=Lv7e61ddZFkAAAAA:cDIPyGRTkgjcINSmVlIVUYGHt0E2srz5VXhjl3ak28KDkdFVZRDUx-g9yeZF8Vm3XAAdRPJQ5z3Mh-opCYGqlqZlK-GjAajHupaW4G1TQUayGhs9IIua (accessed 15 Feb 2021).

15 De Lange AH, Taris TW, Kompier MAJ, *et al.* The very best of the millennium: longitudinal research and the Demand-Control-(Support) Model. *J Occup Health*

Psychol 2003;**8**:282–305. doi:10.1037/1076-8998.8.4.282

16 De Cuyper N, Sulea C, Philippaers K, *et al.* Perceived employability and performance: moderation by felt job insecurity. *Pers Rev* 2014;**43**:536–52. doi:10.1108/PR-03-2013-0050

17 Kirves K, Kinnunen U, De Cuyper N, *et al.* Trajectories of perceived employability and their associations with well-being at work. *J Pers Psychol* 2014;**13**:46–57. doi:10.1027/1866-5888/a000103

18 Akkermans J, Seibert SE, Mol ST. Tales of the unexpected. Integrating career shocks in the contemporary career literature. *SA J Ind Psychol* 2018;**44**:1–10. doi:10.4102/sajip.v44i0.1503

19 Akkermans J, Richardson J, Kraimer ML. The Covid-19 crisis as a career shock: Implications for careers and vocational behavior. *J Vocat Behav* 2020;**119**:1–5. doi:10.1016/J.JVB.2020.103434

20 Wallace JE, Lemaire JB, Ghali WA. Physician wellness: A missing quality indicator. *Lancet* 2009;**374**:1714–21. doi:10.1016/S0140-6736(09)61424-0

21 Maunder R. The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. *Philos Trans R Soc London* 2004;**359**:1117–25. doi:10.1098/rstb.2004.1483

22 Naushad VA, Bierens JJ, Nishan KP, *et al.* A systematic review of the impact of disaster on the mental health of medical responders. *Prehosp Disaster Med* 2019;**34**:632–43. doi:10.1017/S1049023X19004874

23 Wu Y, Wang J, Luo C, *et al.* A comparison of burnout frequency among oncology physicians and nurses working on the frontline and usual wards during the COVID-19 epidemic in Wuhan, China. *Journal of pain and symptom management* 2020;**60**:e60-e65. doi:10.1016/j.jpainsyman.2020.04.008

24 Tiete J, Guatteri M, Lachaux A, Matossian A, Hougardy JM, Loas G, Rotsaert M. Mental health outcomes in healthcare workers in COVID-19 and non-COVID-19 care units: a cross-sectional survey in Belgium. *Frontiers in Psychol* 2020;**11**:1-10. doi:10.3389/fpsyg.2020.612241

25 Willan J, King AJ, Jeffery K, *et al.* Challenges for NHS hospitals during Covid-19 epidemic. *BMJ* 2020;**368**:1–2. doi:10.1136/bmj.m1117

26 Tan, B. Y., Chew, N. W., Lee, G. K., Jing, M., Goh, Y., Yeo, L. L., ... & Shanmugam GN. Psychological impact of the Covid-19 pandemic on health care workers in Singapore. *Ann Intern Med* 2020;:1–3. doi:10.7326/M20-1083

27 Chong MY, Wang WC, Hsieh WC, *et al.* Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry* 2004;**185**:127–33.

28 Preti E, Di Mattei V, Perego G, *et al.* The psychological impact of epidemic and pandemic outbreaks on healthcare workers: rapid review of the evidence. *Curr Psychiatry Rep* 2020;**22**:1–22. doi:10.1007/s11920-020-01166-z

29 Schwarz N. Retrospective and concurrent self-reports: The rationale for real-time data capture. In: Stone A, Shiffman SS, Atienza A, *et al.*, eds. *The science of real-time data capture: Self-reports in health research*. New York: : Oxford University Press 2007. 11–26.https://dornsife.usc.edu/assets/sites/780/docs/schwarz_retrospective_self-reports_mdc_2007.pdf

30 Van Leeuwen, E. H., Knies, E., Van Rensen, E. L. J., Taris TW. Stimulating perceived ability and willingness to continue working and job crafting behaviour of physicians: An intervention study. In: *Dutch HRM Network Conference*. Tilburg: 2019.

31 RIVM. Current information about Covid-19. https://www.rivm.nl/en/coronavirus-covid-19/current-information. Retrieved on 13th of July 2021.

32 Blank, J. L. T., Niaounakis TK. Productiviteitsontwikkelingen bij medisch specialisten: Resultaten en technische rapportage. Delft: 2019.

33 Van Veldhoven, M., Prins, J., Van der Laken, P., Dijkstra L. *VBBA 2.0: Update van de standaard voor vragenlijstonderzoek naar werk, welbevinden en prestaties*. Enschede: Gildeprint 2014.

34 Morgeson FP, Humphrey SE. The work design questionnaire (WDQ): Developing and validating a comprehensive measure for assessing job design and the nature of work. *J Appl Psychol* 2006;**91**:1321–39. doi:10.1037/0021-9010.91.6.1321

35 Demerouti E, Le Blanc PM, Bakker AB, *et al.* Present but sick: a three-wave study on job demands, presenteeism and burnout. *Career Dev Int* 2009;**14**:50–68. doi:10.1108/13620430910933574

36 Oude Hengel KM, Blatter BM, Geuskens GA, *et al.* Factors associated with the ability and willingness to continue working until the age of 65 in construction workers. *Int Arch Occup Environ Health* 2012;**85**:783–90. doi:10.1007/s00420-011-0719-3

37 Wanous JP, Reichers AE, Hudy MJ. Overall job satisfaction: How good are single-item measures? *J Appl Psychol* 1997;**82**:247–52. doi:10.1037/0021-9010.82.2.247

38 Martins LL, Eddleston KA, Veiga JF. Moderators of the relationship between work-family conflict and career satisfaction. *Acad Manag J* 2002;**45**:399–409. doi:10.5465/3069354

39 Van Dooren W, Noordegraaf M. Staging science: Authoritativeness and fragility of models and measurement in the Covid-19 crisis. *Public Adm Rev* 2020;**80**:610–5. doi:10.1111/puar.13219

40 Bernburg M, Vitzthum K, Groneberg DA, *et al.* Physicians' occupational stress, depressive symptoms and work ability in relation to their working environment: a cross-sectional study of differences among medical residents with various specialties

working in German hospitals. *BMJ Open* 2016;**6**:1–9. doi:10.1136/BMJOPEN-2016-011369

41 Fowler A, Abbott TEF, Pearse RM. Can we safely continue to offer surgical treatments during the COVID-19 pandemic? *BMJ Qual Saf* Published Online First: 20 November 2020. doi:10.1136/BMJQS-2020-012544

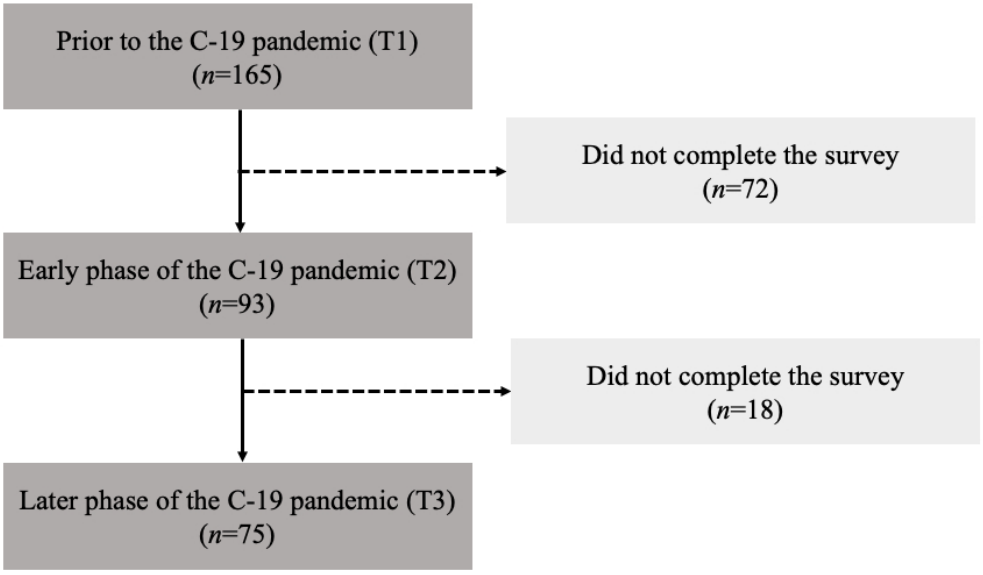

Figure 1: Flow chart of participants at T1, T2 and T3

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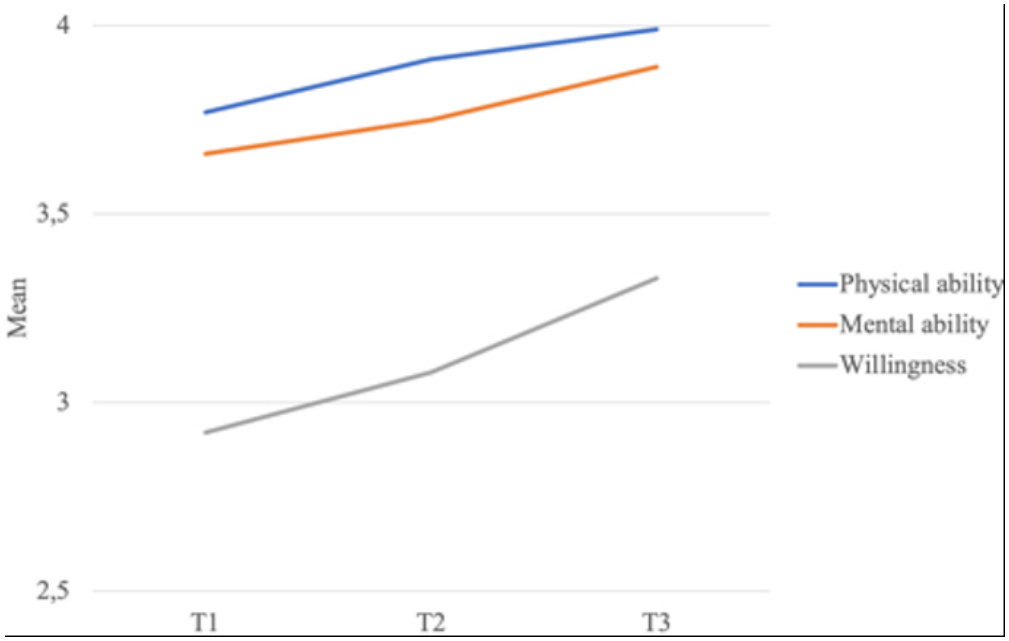

Figure 2: Mean scores for employability on T1, T2 and T3

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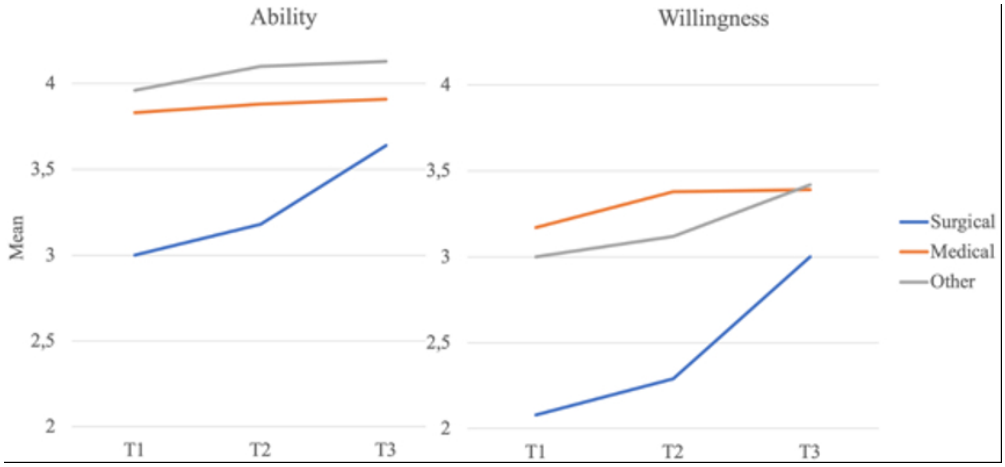

Figure 3: Mean scores for employability on T1, T2 and T3 for physicians with surgical, medical and other specialties

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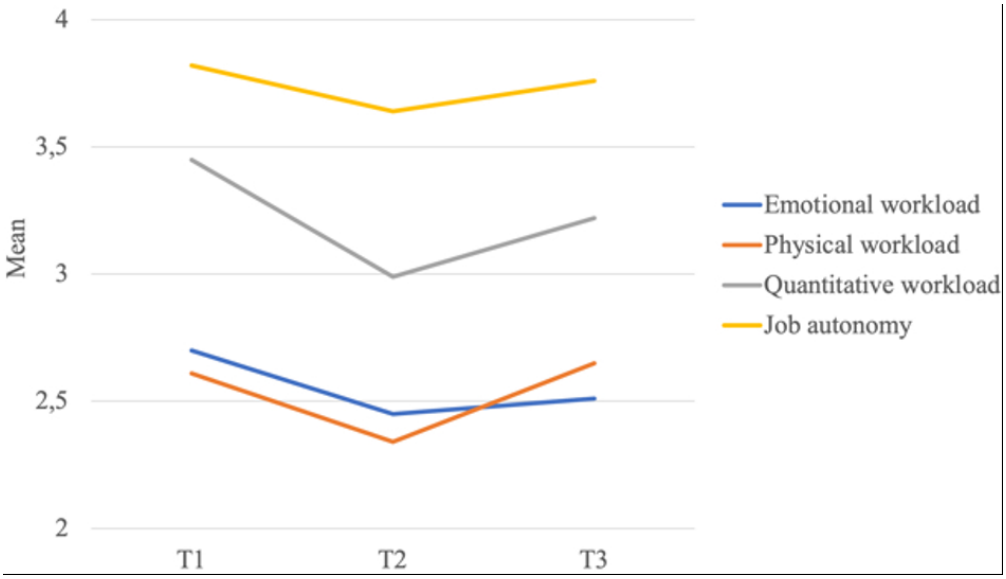

Figure 4: Mean scores for work characteristics on T1, T2 and T3

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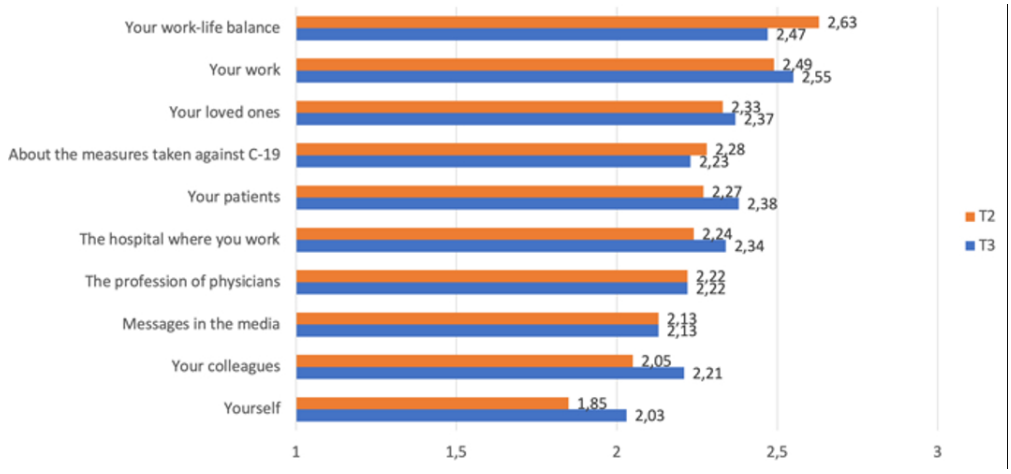

Figure 5: Mean scores on how often physicians experience stress in several areas on T2 and T3 caused by Covid-19

459x213mm (59 x 59 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed (NA)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable (NA)
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, explain how loss to follow-up was addressed
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram (not included yet, could still be included but I think it is clear from the text and I am not sure whether it increases the readability)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount)
Outcome data	15*	Report numbers of outcome events or summary measures over time
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a

		meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.