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Positive screens for mental disorders among healthcare professionals during the first covid19 wave in Belgium

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ABSTRACT

We examined the manifestation of major depressive disorder, generalized anxiety disorder, substance use disorder, post-traumatic stress disorder, and panic attacks among health care professionals during the first COVID-19 wave (n = 6409) by means of mental disorder screening instruments. Logistic regressions were used to gauge individual risk factors; population attributable risk proportions (PARP) were inferred to identify the most important risk factors at the societal level. Data were weighted to represent general profiles of Belgian health care professionals. Lifetime, pre-pandemic emotional problems and work-related factors during the first wave of COVID-19 were strongly associated (mean adjusted odds ratios of 3.79 and 1.47, respectively) with positive screens for current mental disorders (occurrence of 29.3%). Most prominently, the data suggest that disruptions of work-life balance account for more than a quarter of the observed mental health problems due to the combination of widespread occurrence and strong association.

1. Introduction

On March 13th, 2020, the WHO considered Europe as the new epicenter of the COVID-19 pandemic (WHO 2020). Despite unprecedented measures being taken in the European countries struck by the virus, nearly all were relatively unprepared and challenged by an enormous pressure on the health care system and its professionals, as the number of infections, hospitalizations and deaths entered a phase of rapid exponential growth before stabilizing, and eventually decreasing. With only limited testing capacity in place, the cumulative number of confirmed cases in Belgium was 1364 on March 13th, at the very early stages of the exponential increase. The country went in lockdown on March 18th, with 3100 cumulative cases, by which point, 650 COVID-19 patients had already been admitted in the hospitals. This was the beginning of a wave that would subsequently occupy 5759 hospital beds at its high point on April 06 (sciensano, 2020) and stretch far into May and June. In the present study, we report a first estimate of the short-term impact of this wave on the mental health of care workers in Belgium.

Studies on the impact of previous epidemic outbreaks (see, e.g., Chua et al., 2004; Bai et al., 2004; Chong et al., 2004, following the SARS outbreak in 2002–2004), and initial studies in the context of COVID-19 (for a meta-analysis, see Pappa et al., 2020), shed light on the potentially substantial impact of the pandemic on healthcare professionals and patients. Specifically frontline healthcare workers may be at highest risk of mental turmoil because of the combination of the experienced impact of the pandemic, the social isolation due to social distancing and their ongoing job requirements (see, e.g., Alonso et al., 2021). Pappa et al. (2020) performed a meta-analysis including 13 studies with more than 30,000 professionals and report high proportions of depressive and anxiety symptoms and sleeping problems. Although some studies are more optimistic about the impact (e.g., Tan et al., 2020), it is imperative to hold a finger close to the pulse, especially in regions that have less experience with such outbreaks. The most prominent limitation of

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scientific knowledge so far is that studies generally report upon symptoms of anxiety or depression, without using screening instruments for mental disorders. Against this, we report first estimates of mental disorders among healthcare professionals in the first wave of COVID19 pandemic in Belgium, based on well-validated screening instruments. Healthcare workers were surveyed by the Recovering Emotionally from COVID19 (RECOVID) consortium. We build upon previous reports of this study (Bruffaerts et al., 2021) and aim to estimate the occurrence, first-onset, and persistence of positive mental disorders screenings among healthcare professionals. Furthermore, the analyses presented here include risk profiling and population attributable risk analyses focusing on the following screening outcomes: major depressive disorder (MDD), generalized anxiety disorder (GAD), post-traumatic stress disorder (PTSD), substance use disorder (SUD), and panic attacks.

2. Materials and method

2.1. Procedure

Data come from the Recovering Emotionally from COVID19 (RECOVID) consortium. Data were gathered through a collaboration of 4 Belgium hospitals in Leuven-Brussels-Antwerp, one of the most populated regions in Europe [Leuven, Brussels, and Antwerp - Wikipedia, 2020], with 3 professional associations (i.e. medical doctors, practicing psychiatrists, and clinical psychologists) and the Flemish umbrella organization for healthcare institutions. For three collaborating hospitals, participants were invited by email. For the remaining participating sites, the study was announced and responses were collected by posting a weblink link in newsletters and websites for personnel. No advertising of the survey was done; no incentives were offered. The study protocol was approved by the KULeuven Ethical Commission (approval #S63888). The survey ran between April 13 and July 13, 2020.

2.2. Included variables

The instrument was developed by the World Mental Health consortium (https://www.hcp.med.harvard.edu/wmh/. For lifetime emotional problems, we used screening questions asking for lifetime presence of depression, anxiety disorders (or problems with anxiety/nerves), problems with consumption of alcohol, medication, or other substances, panic disorder (or panic attacks), manic depression, mania, or bipolar disorder.

We assessed the proportion of respondents with a positive screen for 2-week generalized anxiety disorder (GAD) using the GAD-7 (Spitzer et al., 2006) and major depressive disorder in the past 2 weeks (MDD) using the PHQ-9 (Kroenke et al. 2001). The GAD-7 was scored in the range of 0–21 and collapsed into the categories normal (0-4), mild (5–9), moderate (10–14), and severe (15–21). The PHQ-9 was scored in the range of 0–27 and collapsed into the categories normal (0–4), mild (5–9), moderate (10–14), and severe (15–27). Positive screen for 30-day post-traumatic stress disorder (PTSD) was assessed with the four-item screening version of the PCL-5 (Price et al., 2016; Zuromski et al., 2019), with scores in the range of 0–16 and collapsed into the categories normal (0–4), mile (5–8), moderate (9–10), and severe (11–16). Substance use disorder screen (SUD) was evaluated with the CAGE-AID since the COVID19 outbreak (Hinkin et al., 2001), with scores ranging between 0 and 4 and collapsed into the categories normal (0–1), moderate (2), and severe (3–4). Panic was assessed with self-report of the number of panic attacks in the past 30 days and collapsed into the categories normal (0), moderate (1–4), and severe (5+). The cutoff scores for detecting clinically significant levels of positive screens for MDD, GAD, PTSD, SUD, and panic attacks were set at the moderate categories, and thus 10, 10, 7, 2 and 1 respectively.

2.3. Risk factor domains

Four risk factor domains were included in the risk analyses. Unless otherwise noted, the risk factors were responses to binary questions, where 1 refers to presence and 0 to absence of a specific risk factor. First, lifetime (pre-pandemic) emotional problems included *depressive problems*, *anxiety problems*, *substance use problems*, and *panic attacks*. Second, **exposure to COVID19 infection (infection status)** included being infected with COVID19 and quarantined (*quarantined*), being infected with COVID and hospitalized (*hospitalized*), and the experience of a close one who has been infected with COVID19 (*someone close infected*). Third, work-related factors **(work context)** included *exposure to COVID19* patients in the professional context, *working overtime*, distortion of a healthy work-life balance (*work-life imbalance*), *conflicts with co-workers*, and shortage of professional equipment (*shortage of equipment*). Fourth, the **social** support domain included whether respondents were *living together* (vs. not) and whether there was a *social network* available. Availability of a social network was constructed on the basis of two 5-point Likert scale questions (Cronbach's alpha = 0.61; higher scores reflect better social network). In Table B1 we provide an overview of the risk domains and factors, with abbreviations and the corresponding questions.

2.3.1. Ethical considerations

Standardized descriptions of the goals and procedures of the study, data uses and protection, and the rights of respondents were provided in written form to all potentially eligible respondents before obtaining informed consent for participation in the survey. Quality control protocols were standardized across the participating sites where this study took place. The institutional review board of the organization that coordinated the survey in Belgium approved and monitored compliance with procedures for obtaining informed consent and protecting participants.

2.3.2. Analyses

For the present analyses, we withheld participants with full records (i.e., 6409 out of the 8758 records), that is, participants who finished the survey. After making this selection, the percentage of missing values across variables ranged between 0% and 7.8%. Missing data were multiply imputed (Buuren and Groothuis-Oudshoorn, 2010), simulating five data sets using a maximum of 20 iterations. Then, calibration weights were added to adjust for differences between age, gender, and profession distributions in the sample and the population (Lumley 2011). Calibration weights were obtained by iterative proportional fitting (raking; Deville and Särndal 1992) on the basis of population marginal proportions for said variables (https://www.riziv.fgov.be).

Pooled estimates of the occurrence and first onset of positive current mental screenings from multiple imputations and standard errors were obtained, taking into account within-imputation and between-imputation variances. For each of the emotional problems under scrutiny, total scores for the respective screening instruments were calculated, classified according to specified cut-offs, and positive screen proportions were calculated for the entire population. First-onset proportions were calculated by restricting the sample to respondents without any pre-pandemic emotional problems. Confidence intervals and statistical significance were adjusted for multiple imputation and calibration, and evaluated at $\alpha = .05$.

Individual-level approaches focus on the change in odds of an outcome for an individual, given the occurrence of specific risk factors. Such associations between risk factors and outcomes were analyzed with logistic regression analyses, using a logit link function. For each outcome, we ran two models. We examined the presence of current positive mental disorder screens and included all demographic covariates in Table 1 and all risk factors. With the next model, we looked into first-onset of mental positive mental disorder screens, adding all predictors before, but excluding respondents with pre-pandemic emotional

Table 1
Sociodemographc characteristics and extrapolated population demographics [95% CI].

attribute	category	n	unweighted %	weighted %
gender	female	4640	72.4%	75% [75%; 75%]
	male	1694	26.4%	24% [24%; 24%]
	other	75	1.2%	1% [1%; 1%]
living alone or together	together	4791	77.6%	78.3% [77.1%; 79.4%]
	alone	1385	22.4%	21.7% [20.6%; 22.9%]
profession	MD	2824	47.8%	24.8% [24.8%; 24.8%]
	nurse	1333	22.6%	34.8% [34.8%; 34.8%]
	other non-clinical	594	10%	14.9% [14%; 15.8%]
	psychologist	468	7.9%	8.1% [8.1%; 8.1%]
	other clinical	394	6.7%	9.5% [8.7%; 10.4%]
	laboratory	151	2.6%	3.9% [3.3%; 4.6%]
	administrative	147	2.5%	3.9% [3.3%; 4.5%]
education	master/doctoral	4937	77.7%	28.9% [27.6%; 30.2%]
	bachelor	1157	18.2%	64.7% [63.4%; 66%]
	secondary education	258	4.1%	6.4% [5.7%; 7.1%]

problems. We did not consider interaction effects. Model adequacy was evaluated by calculating the area under the ROC (AUC, Zweig and Campbell 1993). Adjusted Odd Ratio's (aOR) are the exponential of the regression coefficient for a particular risk factor. Confidence intervals and statistical significance were evaluated at 0.05 level.

Population-level effects were estimated using population attributable risk proportions (PARPs; Levin, 1953; MacMahon and Pugh, 1970). From a public health perspective, PARPs enable us to quantify the impact of the various predictors on the studied outcomes, taking into account their inferred influence at the individual level and their prevalence in the population. To the extent that a risk factor is causally related to the mental disorder, the PARP can be interpreted as the proportion of cases that may be reduced when it is entirely cancelled out (e.g., preventable or fully treated). We provide multivariate PARPs, calculated on the basis of the regression models. We also calculated PARPs for the combination of risk factors (cancelling out a set of risk factors), e.g., all risk factors tied to a particular risk domain.

To retrieve estimates of the PARPs and estimation uncertainty for the multiply imputed and calibrated data, we simulated point estimates and confidence intervals. For each imputed set (m = 5), 100 data sets were sampled with replacement on the basis of the observed data and the calibration weights. Each of the data sets was analyzed with the above specified Logistic regression models, after which we sampled 100 times from the posterior distribution of regression coefficients.[1] For each of the 100 sampled sets of regression coefficients, we calculated the attributable fraction for every exposure variable. In total, this yielded 50,000 samples (5 times 100 times 100) from the posterior distribution of the PARP, accounting for the uncertainty from multiple imputation, calibration weighting and parameter inference. From these posterior distributions, we derived a point estimate (the posterior mean) and 95% confidence intervals (Gelman and Hill 2006).

[1] under assumption of uniform priors, see Gelman and Hill (2006).

All analyses were performed in R version 4.0.2 (2020-06-22) (R Core Team, 2020). For multiple imputation we relied on the "mice" package (Buuren and Groothuis-Oudshoorn, 2010), for calibration weighting and inferential statistics we made use of the "survey" package (Lumley 2011). Analyses scripts and a synthetic data set simulated from the observed data can be found on open science framework (https://osf.io/bkcwy/?view_only=98a612adcb1c4b2d9080df9e6a03f38c).

3. Results

In total, 6409 participants completed the survey, 26.4% male, with a mean age of (42.91). Detailed information is given in Table 1. The response rate based on the surveys we obtained through the 3 hospital sites was 46.7%, ranging between 40.5 and 53.4% between hospital sites, and between 20.9% for MD through 60.3% for psychologists.

3.1. Lifetime, current, and first-onset positive screens for mental disorders

Table 2 provides an overview of the results concerning pre-pandemic and current mental problems. Lifetime problems were common, with 19.1% [18.1%; 20.2%] of respondents indicating having had at least one emotional problem in the past. Main problem categories were anxiety problems 12% [11.2%; 12.9%] and depressive problems 7.7% [6.9%; 8.4%]. Turning to the current timeframe, 29.8% [28.5%; 31.1%] of respondents met screening criteria for at least one of the measured mental disorders, with almost one in five health care workers having experienced panic attacks (19.5% [18.3%; 20.6%]), followed by positive screens for MDD (8.7% [7.9%; 9.4%]), and GAD (8.3% [7.6%; 9.1%]). Among respondents without any prior mental health problems, 23.7% [22.4%; 25.1%] met the screening threshold of any current mental disorder, with 15.1% [13.9%; 16.3%] having suffered panic attacks in the last 30 days.

Further univariate analysis revealed no evidence for different pre-pandemic emotional problems in respondents with direct exposure to COVID-19 patients in their professional context, from those without (OR = 1.03 [0.9, 1.19]). However, direct exposure to COVID-19 patients was associated with positive screens for current mental disorder (OR = 1.37 [1.2, 1.56]). Additionally, pre-pandemic emotional problems were also associated with screening positive for current mental disorders (OR = 4.01 [3.46, 4.64]).

3.2. Prevalence of risk factors

Apart from pre-pandemic emotional problems, we also take into account a number of risk factors related to the current situation. Next to their association to an outcome, the prevalence of risk factors in the population is crucial in evaluating their impact on the outcome from a

Table 2
Lifetime emotional problems and positive screens for current mental disorders among healthcare professionals.

	pre-pandemic emotional problems	Positive screen for current mental disorder	Current positive screen among respondents without lifetime emotional problems
depressive problems	7.7% [6.9%; 8.4%]	8.7% [7.9%; 9.4%]	6.6% [5.9%; 7.4%]
anxiety problems	12% [11.2%; 12.9%]	8.3% [7.6%; 9.1%]	6.2% [5.5%; 7%]
panic	2.8% [2.4%; 3.3%]	19.5% [18.3%; 20.6%]	15.1% [13.9%; 16.3%]
subst abuse problems	0.9% [0.7%; 1.1%]	4.9% [4.3%; 5.5%]	3.8% [3.2%; 4.4%]
PTSD	–	5.7% [5%; 6.3%]	3.7% [3.1%; 4.3%]
any	19.1% [18.1%; 20.2%]	29.8% [28.5%; 31.1%]	23.7% [22.4%; 25.1%]

population perspective. In Table 3, we provide an overview of all risk factors per domain. It is clear that the professional domain yields the more prevalent risk factors.

3.3. Individual-level risk factors

Risk factors for positive mental disorder screens were assessed by running a set of independent logistic regressions including the factors of the three risk domains (LT problems, work context, and infection status). All regressions included basic demographic predictors (gender, age, profession and education level), the three risk domains and presence of life time problems. Adjusted odds ratios (aOR) are presented in Table 4; model fits were decent, with AUC's ranging between 0.7 and 0.81.

Table 4 reveals that positive screens for current mental disorders are mainly associated with the presence of pre-pandemic emotional problems and work-related risk factors, and not so much personal exposure to COVID-19: the mean adjusted odds ratio for lifetime emotional problems was 3.79 and for work-related factors 1.47. There is, however, some evidence for a considerable association with having been hospitalized, but with much uncertainty. Looking at work related factors, an work-life imbalance was associated strongest with positive screens for mental disorders, with a mean aOR of 2.68. Being able to fall back on social support (living together and having a social network) was consistently found to protect against mental problems.

Although additional logistic regression models revealed limited evidence for interaction effects between any pre-pandemic emotional problems and the other risk domains, we also ran planned analyses focusing on current mental problems among healthcare workers without prior emotional problems. Very similar associations emerged (see appendix table A1 for full results): Again, work related factors are of key importance (mean aOR for onset = 1.52), with imbalanced work-life balance being strongly associated across the board (mean aOR: 2.77). Social network again was found consistently protective.

3.4. Population level exposure effects

We provide an overview of the PARPS for each of the outcome variables. Social network was measured on an ordinal scale, and therefore does not lend itself well to the interpretation of its PARP, as the value of 0 is the most extreme absence of a social net, and fewer than 1% of cases were assigned 0. Analyses are reported for positive mental disorder screens in the entire sample (Table 5) and among health care workers without prior emotional problems (Appendix Table A2).

The fraction of respondents with any positive mental disorder screen associated with work-related factors was estimated at 42.5% [35.3%; 49.5%], as compared to only 16.1% [13.5%; 18.8%] for pre-pandemic occurrence of emotional problems, and 3.7% [0.3%; 7.3%] for infection status. This is mainly due to the salient prevalence of some of the work-related risk factors. Indeed, almost half of the healthcare workers are inferred to having experienced difficulties maintaining a healthy work-life balance (46.6% [45%; 48.1%]). As such, avoiding disruptions of the work-life balance of healthcare workers emerges as the single most interesting protective factor across the board, with 25.7% [20.2%; 31.1%] of the observed positive screens being potentially prevented by avoiding work-life disruptions, and more than half of those respondents at risk for of MDD, GAD and PTSD. Results were similar for health care workers with no history of emotional problems, as can be seen in appendix in Table A2. Again, work-life balance emerges as the single most important risk factor to keep track of at a societal level, with 29.3% [22.3%; 36.3%] of onsets of any mental problems potentially avoided by maintaining a healthy work-life balance, and up to 55.2% [40.1%; 68.4%] for positive major depression screen and 54.6% [34.3%; 69.9%] for positive anxiety disorder screen.

Table 3
Estimated population occurrence (and 95% CI) of risk factors for Belgian healthcare workers in the first COVID19 wave in Belgium.

domain	risk factor	occurrence
lifetime emotional problems	lifetime depressive problems	7.7% [6.9%, 8.4%]
	lifetime anxiety problems	12% [11.2%, 12.9%]
	lifetime panic attacks	2.8% [2.4%, 3.3%]
	lifetime substance abuse problems	0.9% [0.7%, 1.1%]
infection status	quarantine	0.4% [0.2%, 0.5%]
	hospitalized	8.2% [7.3%, 9%]
	someone close infected	28.8% [27.6%, 30.1%]
work context	exposure to COVID-19	45.5% [44.2%, 46.8%]
	working overtime	51.5% [50.1%, 52.9%]
	work-life balance	18% [16.7%, 19.2%]
	conflicts with co-workers	25.3% [24.1%, 26.5%]
	shortage of equipment	21.8% [20.6%, 23%]
	inadequate training	46.6% [45%, 48.1%]

4. Discussion

This study estimated the proportion of Belgian healthcare professionals suffering from mental disorders, associated risk factors, and the proportion of cases that can be attributed to a range of different risk factors in Belgium during the first wave of COVID19. Estimates of prevalence relied on validated screening instruments. Whereas previous studies have examined the prevalence of mental disorders in healthcare professionals (e.g., Tan et al., 2020; Pappa et al., 2020; Pablo et al., 2020; Wilson et al., 2020) and individual risk factors associated with mental disorders during the COVID19 crisis (e.g., da Silva and Neto, 2020; Que et al., 2020; Zhang et al., 2020), our analyses have extended the scope to providing an estimate of the proportion of current cases that could be avoided if we were able to eliminate risk factors, under assumption of a causal relation between risk factors and outcomes.

We found that the proportion of positive screens for current mental disorders was estimated at 29.8% [28.5%; 31.1%], with the estimated proportion of positive screens among healthcare professionals without pre-pandemic emotional problems being substantial (23.7% [22.4%; 25.1%]). The estimate for MDD (i.e. 8.7% [7.9%; 9.4%]) is elevated as compared to the general population (4.8%, Van der Heyden et al., 2018). For GAD screens, our current estimate (8.3% [7.6%; 9.1%]) is slightly lower than in the general population (11.2%), and for substance abuse estimates are comparable (4.9% [4.3%; 5.5%] in our study compared to 5.9% in the general population). For panic disorder and PTSD no recent comparable estimates were available.

As to risk factors, our findings suggest that particular risk factors are associated with up to one fourth of the current proportion of positive mental disorder screens in Belgian healthcare professionals, and that these cases may be prevented by strategically focusing on the right issues. Pre-pandemic emotional problems (as distal factors) are the most important risk factors on an individual level, but proximal, contextual factors (that are more specific to the COVID-19 pandemic) appear to carry higher impact on a societal level. Moreover, we did not find evidence for interactions between the pre-pandemic emotional problems and any of the other risk factors under scrutiny, suggesting an additive effect of pre-pandemic and context specific risk factors.

Our study thus strongly emphasizes the importance of proximal factors such as work-related factors, a finding that is consistent with earlier reports (Gomez et al., 2020): shortage of equipment, conflicts with co-workers, working longer hours, experienced work-life imbalance, and lack of adequate training. Because of their prevalence, these factors may very well be co-responsible for many of the emotional problems in the first wave of the COVID-19 pandemic. Indeed, we estimate that around 4/10 cases may be avoided if all work-related risk factors were to be removed, with individual risk reduced by a factor close to 4. While these associations cannot be readily interpreted as

Table 4
Multivariate associations (odds-ratios [95% ci]) between risk factor domains and positive screen for current mental disorder among healthcare workers in Belgium.

domain	predictors[a]	MDD positive screen	GAD positive screen	Panic attacks	SUD positive screen	PTSD positive screen	Any positive screen for mental disorders
lifetime emotional problems	lifetime depressive problems	2.23 [1.63; 3.04]*	1.42 [1.05; 1.93]*	1.09 [0.83; 1.44]	1.9 [1.29; 2.8]*	1.91 [1.34; 2.74]*	1.79 [1.4; 2.28]*
	lifetime anxiety problems	1.9 [1.47; 2.45]*	2.96 [2.31; 3.78]*	3.45 [2.82; 4.23]*	1.28 [0.92; 1.78]	2.81 [2.1; 3.75]*	3.18 [2.63; 3.86]*
	lifetime panic attacks	0.91 [0.52; 1.61]	0.92 [0.56; 1.53]	3.93 [2.62; 5.9]*	1.77 [0.92; 3.38]	1.74 [1.04; 2.9]*	3.93 [2.5; 6.17]*
	lifetime substance abuse problems	2.33 [1.24; 4.39]*	1.58 [0.75; 3.33]	1.45 [0.66; 3.19]	14.63 [7.63; 28.06]*	3.67 [1.68; 7.99]*	6.28 [3.25; 12.14]*
infection status	quarantine	1.22 [0.81; 1.82]	0.97 [0.63; 1.47]	1.29 [0.92; 1.79]	0.93 [0.6; 1.43]	1.02 [0.64; 1.62]	1.15 [0.86; 1.53]
	hospitalized	2.58 [0.65; 10.25]	2.04 [0.52; 8.05]	2.16 [0.49; 9.44]	3.3 [0.96; 11.34]	1.54 [0.35; 6.81]	3.21 [0.88; 11.64]
	someone close infected	1.15 [0.9; 1.47]	1.13 [0.9; 1.44]	1.21 [1.02; 1.44]*	1.43 [1.09; 1.88]*	1.34 [1.01; 1.77]*	1.18 [1.01; 1.38]*
work context	exposure to COVID-19	1.12 [0.86; 1.46]	1.03 [0.8; 1.34]	1.15 [0.95; 1.4]	0.95 [0.69; 1.29]	1.21 [0.89; 1.64]	1.13 [0.95; 1.34]
	working overtime	1.28 [1.01; 1.62]*	1.2 [0.95; 1.52]	0.96 [0.8; 1.15]	1.31 [0.98; 1.76]	1.06 [0.8; 1.41]	1.05 [0.9; 1.24]
	work-life balance	3.37 [2.58; 4.41]*	4.01 [2.97; 5.42]*	2.3 [1.92; 2.74]*	1.33 [0.99; 1.79]	2.65 [1.84; 3.81]*	2.41 [2.06; 2.82]*
	conflicts with co-workers	1.9 [1.45; 2.51]*	2.06 [1.6; 2.66]*	1.46 [1.19; 1.8]*	1.11 [0.8; 1.55]	2.06 [1.53; 2.78]*	1.64 [1.37; 1.95]*
	shortage of equipment	0.98 [0.77; 1.24]	1 [0.78; 1.28]	1.13 [0.95; 1.35]	1.53 [1.13; 2.06]*	1.12 [0.83; 1.51]	1.21 [1.04; 1.41]*
	inadequate training	1.76 [1.4; 2.21]*	1.55 [1.18; 2.04]*	1.23 [1.02; 1.49]*	1 [0.73; 1.36]	1.54 [1.17; 2.04]*	1.37 [1.16; 1.62]*
social support	living together	0.87 [0.69; 1.1]	0.95 [0.75; 1.2]	0.85 [0.71; 1.03]	1.15 [0.82; 1.6]	0.76 [0.57; 1.01]	0.82 [0.69; 0.96]*
	social network	0.77 [0.72; 0.83]*	0.78 [0.73; 0.84]*	0.88 [0.83; 0.93]*	0.91 [0.83; 0.99]*	0.78 [0.72; 0.84]*	0.81 [0.77; 0.86]*

*$p < .05$.
[a] All aORs are adjusted for age, gender, profession, education and all predictors in the table.

causal, they do point to the importance of the professional context. In particular, disruptions of the work-life balance may be the most interesting factor emerging from the present study. About a quarter of all 30-day manifestations (be it onset or persistence) of the proportions of positive screens were associated with work-life imbalances. Additionally, we observed a protective effect of living together with someone and having a social network against the development or presence of emotional problems.

Overall, Belgian professionals seem to have survived the first wave with fewer bruises compared to their foreign colleagues. Pappa et al. (2020) report pooled 30-day prevalence of 23% for GAD, 22% for MDD, and Alonso et al. (2021) estimates 30-day prevalence at 28.1% for MDD, 22.5 for GAD, 24.0% for panic, 22.2% for PTSD and 6.2 for SUD, with an overall prevalence of 45.7% of any mental disorder. Each of these estimates are substantially lower in our study, especially for MDD (8.7% [7.9%; 9.4%]), GAD (8.3% [7.6%; 9.1%]) and PTSD (19.5% [18.3%; 20.6%]) These comparisons raise the question what underlies the differences. One potential factor is the response rate: while we were unable to evaluate the overall response rate (as distribution on certain sites did not allow to do so), we did have a substantially higher response rate than Alonso et al. (2021) on the sites where we could calculate response rate. Higher response rates may be indicative of a sample that is less biased towards mental disorders, however, response rates in Pappa et al. were substantially higher than ours. A second factor may be the composition of our sample, in which medical doctors were overrepresented and we had a clear underrepresentation of supportive non-clinical staff members: only 10% were non-clinical workers, as compared to 20.3% in Alonso et al. (2021). By calibrating our sample to the marginal population proportions, and by including profession as a control variable in the logistic regression analyses, however, we have statistically accommodated these differences. While the significant risk factors examined in the present study may be more universal, their prevalence may very well vary greatly between countries and depend, again, on the particular organization of health care, the height of the epidemiological wave and the strain it put on the health care system.

When interpreting our findings, a number of limitations should be taken into consideration. First, the relatively low response rate should raise some caution about the representativeness of the sample and stresses the necessity to replicate the study among a more diverse group of healthcare professionals drawn from a more diverse set of hospitals. In addition, healthcare professionals were invited only twice for participation, due to institutional requirements. We have carefully weighted the data to reproduce the (marginal) distributions of age, gender, and professional discipline of healthcare professionals in Belgium, but potential systematic differences between responders and non-responders were not statistically controlled for. Second, our data are based on the results of a screening instrument that assesses a limited range of mental disorders. Some burdensome conditions (such as psychotic problems) or other relevant conditions associated with mental health (such as tobacco use) were not included in the RECOVID assessment, nor were detailed assessments on important sociodemographic predictors (such as detailed family situation at time of survey).

Perhaps the most important limitation is that our results rely on screening instruments for mental disorders instead of structured instruments aimed at diagnosing mental disorders. Despite our use of well-validated instruments with good internal reliability and external validity, the use of such instruments implies that findings might have been different if we would have used full diagnostic interviews. Since we screened for MDD and GAD in the past 2 weeks, we are not capable of estimating the real-life prevalence of these disorders in a 12-month or lifetime perspective. More importantly, screening instruments largely

Table 5
Multivariate population attributable risk proportions [95% ci] of risk factor domains and positive screens for current mental disorders among healthcare workers in belgium.

domain	predictors[a]	MDD positive screen	GAD positive screen	Panic attacks	SUD positive screen	PTSD positive screen	Any positive screen for mental disorder
lifetime emotional problems	lifetime depressive problems	7.7% [3.4%; 12.1%]*	3.2% [-0.8%; 7.4%]	0.7% [-1.5%; 2.9%]	6.6% [0.9%; 12.7%]*	7.3% [1.7%; 13.3%]*	2.9% [1.4%; 4.5%]*
	lifetime anxiety problems	9.5% [4.2%; 14.9%]*	16.8% [11.3%; 22.5%]*	13.9% [10.6%; 17.2%]*	3.4% [-3.4%; 10.4%]	18.1% [10.3%; 26.1%]*	9.3% [7.3%; 11.5%]*
	lifetime panic attacks	−0.3% [-2.7%; 2.3%]	−0.3% [-2.8%; 2.4%]	3.9% [2.4%; 5.5%]*	2.4% [-1%; 6.5%]	3% [-0.8%; 7.2%]	2.3% [1.4%; 3.2%]*
	lifetime substance use problems	1.3% [-0.1%; 2.9%]	0.6% [-0.7%; 2.2%]	0.3% [-0.4%; 1%]	7.8% [4.4%; 11.8%]*	2.5% [0.3%; 5.1%]*	0.9% [0.4%; 1.4%]*
Infection status	quarantine	1.7% [-2.2%; 5.8%]	−0.2% [-3.7%; 3.6%]	1.7% [-0.6%; 4%]	−0.6% [-4.9%; 4.1%]	0.1% [-4.3%; 4.9%]	0.7% [-1%; 2.4%]
	hospitalized	0.5% [-0.4%; 1.6%]	0.4% [-0.4%; 1.7%]	0.3% [-0.2%; 0.8%]	0.9% [-0.3%; 3.1%]	0.4% [-0.7%; 4.4%]	0.3% [-0.1%; 0.6%]
	someone close infected	3.4% [-4%; 11.1%]	3% [-4.2%; 10.3%]	4% [-0.4%; 8.8%]	9.5% [-0.4%; 19.6%]	7.7% [-1.5%; 17%]	2.7% [-0.7%; 5.9%]
work context	exposure to COVID-19	4.3% [-9%; 17.3%]	1.3% [-11.8%; 14.4%]	4.5% [-2.5%; 11.7%]	−2.4% [-19.8%; 14.2%]	8% [-7.6%; 22.9%]	3.4% [-2%; 8.8%]
	working overtime	7% [-1%; 15%]	5% [-2.9%; 13.2%]	−0.8% [-5.2%; 3.6%]	7.3% [-2.4%; 17.6%]	1.8% [-8%; 11.6%]	0.8% [-2.3%; 3.8%]
	work-life imbalance	49.5% [37.5%; 61%]*	54.5% [42%; 65.6%]*	28.8% [21.8%; 35.8%]*	12.6% [-4.2%; 29%]	42.2% [26.2%; 57.1%]*	25.7% [20.2%; 31.1%]*
	conflicts with co-workers	14.2% [6.7%; 21.8%]*	16% [8.9%; 23.3%]*	5.7% [1.9%; 9.5%]*	2.1% [-5.9%; 10.9%]	17.1% [8.1%; 26.5%]*	6% [3.3%; 8.8%]*
	shortage of equipment	−1.8% [-17.4%; 12.9%]	0.1% [-15%; 15.1%]	4.8% [-3.1%; 12.7%]	19.3% [2.1%; 35.4%]*	6% [-13.1%; 24.1%]	5.9% [0%; 11.8%]
	inadequate training	13.8% [6.3%; 21.4%]*	10.8% [3%; 18.6%]*	3.6% [-0.5%; 7.7%]	−0.2% [-9.2%; 8.9%]	11% [1.8%; 20.4%]*	4.4% [1.5%; 7.4%]*
social support	living together	−8.5% [-27.9%; 9.4%]	−3% [-22.2%; 15%]	−8.4% [-20.5%; 3.7%]	8% [-19.1%; 34%]	−17.4% [-42.4%; 6.1%]	−8.9% [-18.4%; 0.2%]
	social network	−183.5% [-267.7%; −109.7%]*	−170.6% [-252.2%; −98%]*	−60.8% [-96.6%; −27.6%]*	−63.5% [-159.1%; 6.5%]	−198% [-316.2%; −100%]*	−78.4% [-101.2%; −55.4%]*

*$p < .05$.
[a] All PARPs are adjusted for age, gender, profession, education, and all predictors in the corresponding logistic regression models.

overestimate the prevalence of mental disorders (Levis et al., 2020). We would have yield more accurate estimates of disorder prevalence when we should have included measures on disorder burden or severity, which is required to identify mental disorder caseness (Zimmerman et al., 2018).

Finally, this study is limited to the use of cross-sectional data, adjusting for a limited range of basic socio-demographic correlates. Future studies may include additional predictor domains to investigate patterns of mental disorders throughout a professional clinical career and investigate all possible interactions between predictors. Future studies, both cross-sectional and longitudinal, with larger samples should address these issues.

In a critical era where both clinical care for patients and workplace wellbeing for healthcare professionals are quintessential elements of dealing with the COVID19 pandemic, we found (across age, gender, professional discipline, exposure to COVID in the personal or professional context) that (a) pre-pandemic emotional problems reinforce current emotional problems, (b) first-onset positive screen for disorders are common, and (c) context-related factors potentially hold great potential for reducing both the occurrence and first-onset of mental disorders. These factors could guide governments and healthcare organizations in taking up responsibilities in preventing emotional problems and developing resilience among healthcare professionals during, but probably beyond, the current COVID19 pandemic. Public health approaches to mental disorder prevention in health care professionals are of paramount importance, especially in the COVID-19 era.

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Declaration of competing interest

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Appendix A

Table A1
Multivariate associations (odds-ratios [95% ci]) between risk factor domains and current mental problems among healthcare workers without previous emotional problems

domain	predictors[a]	MDD	GAD	panic	SUD	PTSD	any
Infection status	quarantine	1.33 [0.82; 2.16]	0.86 [0.5; 1.48]	1.44 [1; 2.08]	0.89 [0.5; 1.6]	0.72 [0.36; 1.43]	1.26 [0.92; 1.72]
	hospitalized	5.05 [1.24; 20.62]*	2.59 [0.47; 14.2]	1.39 [0.19; 10.41]	0.94 [0.11; 7.65]	2.62 [0.4; 17.37]	3.16 [0.7; 14.31]
	someone close infected	1.17 [0.86; 1.61]	1.38 [1.04; 1.84]*	1.12 [0.9; 1.38]	1.44 [1.03; 2.02]*	1.55 [1.05; 2.29]*	1.13 [0.95; 1.36]
work context	exposure to COVID-19	1.08 [0.78; 1.5]	0.99 [0.71; 1.4]	1.34 [1.06; 1.69]*	0.97 [0.66; 1.43]	1.28 [0.86; 1.89]	1.19 [0.98; 1.45]
	Working overtime	1.43 [1.06; 1.94]*	1.27 [0.94; 1.72]	0.99 [0.79; 1.23]	1.12 [0.76; 1.65]	1.06 [0.71; 1.58]	1.11 [0.92; 1.34]
	work-life imbalance	3.9 [2.76; 5.51]*	4.01 [2.65; 6.06]*	2.26 [1.84; 2.79]*	1.36 [0.94; 1.96]	2.65 [1.54; 4.56]*	2.43 [2.04; 2.9]*
	conflicts with co-workers	2.18 [1.57; 3.02]*	2.1 [1.5; 2.95]*	1.57 [1.22; 2.01]*	1.39 [0.92; 2.11]	2.19 [1.47; 3.26]*	1.72 [1.4; 2.1]*
	shortage of equipment	1.02 [0.75; 1.39]	1.2 [0.87; 1.64]	1.18 [0.95; 1.48]	1.37 [0.95; 1.97]	1.23 [0.81; 1.87]	1.24 [1.03; 1.48]*
	inadequate training	1.93 [1.46; 2.56]*	1.61 [1.17; 2.22]*	1.33 [1.05; 1.69]*	0.89 [0.61; 1.28]	1.55 [1.05; 2.28]*	1.44 [1.17; 1.76]*
social support	living together	0.86 [0.63; 1.16]	0.91 [0.67; 1.25]	0.97 [0.76; 1.24]	1.25 [0.8; 1.96]	0.95 [0.63; 1.42]	0.87 [0.72; 1.06]
	social network	0.76 [0.69; 0.83]*	0.77 [0.7; 0.85]*	0.86 [0.81; 0.92]*	0.93 [0.83; 1.04]	0.75 [0.67; 0.83]*	0.81 [0.76; 0.86]*

*$p < .05$.
[a]All aORs are adjusted for age, gender, profession, education and all predictors in the table.

Table A2
MULTIVARIATE POPULATION ATTRIBUTABLE RISK PROPORTIONS [95% CI] OF RISK FACTOR DOMAINS AND CURRENT MENTAL PROBLEMS AMONG HEALTHCARE WORKERS [95% CI] WITHOUT PREVIOUS EMOTIONAL PROBLEMS

domain	predictors[a]	MDD	GAD	panic	SUD	PTSD	any
Infection status	quarantine	2.3% [-2.4%; 7.6%]	−1% [-5.3%; 3.8%]	2.6% [-0.4%; 5.9%]	−0.7% [-5.7%; 5.5%]	−2.4% [-7.8%; 4%]	1.4% [-0.7%; 3.6%]
	hospitalized	0.9% [-0.2%; 2.5%]	0.6% [-0.4%; 3.4%]	0.1% [-0.6%; 0.9%]	1.4% [-1.7%; 9.5%]	1.2% [-0.5%; 8%]	0.3% [-0.2%; 0.8%]
	someone close infected	4.1% [-6.2%; 14.5%]	8.5% [-1.4%; 19.1%]	2.7% [-3.4%; 8.8%]	10.4% [-1.8%; 23.8%]	12.7% [-1%; 27.3%]	2.6% [-2%; 7.2%]
work context	exposure to COVID-19	3.2% [-14.3%; 20.3%]	−1.2% [-19.1%; 16.3%]	10.5% [0.6%; 20.2%]*	−1.3% [-24.6%; 20.5%]	10.6% [-11.7%; 32.2%]	5.6% [-1.8%; 13%]
	working overtime	10.1% [-1%; 21.5%]	7.1% [-3.9%; 18.5%]	−0.2% [-6.2%; 5.7%]	3.1% [-9.5%; 16.3%]	1.6% [-12.4%; 16.5%]	2% [-2.5%; 6.5%]
	work-life imbalance	55.2% [40.1%; 68.4%]*	54.6% [34.3%; 69.9%]*	30.6% [21.7%; 39.1%]*	12.8% [-6.3%; 32.1%]	42% [18.4%; 62.4%]*	29.3% [22.3%; 36.3%]*
	Conflicts with co-workers	18.1% [8.7%; 28.1%]*	17% [7%; 27.6%]*	7.6% [2.5%; 12.7%]*	6.5% [-3.8%; 18%]	19% [6.5%; 31.9%]*	7.7% [4%; 11.3%]*
	Shortage of equipment	0.4% [-19.6%; 19.8%]	8.8% [-11.1%; 28.2%]	7.5% [-4.3%; 18.6%]	14.6% [-8.5%; 36.3%]	10.7% [-16.8%; 36.3%]	7.7% [-0.5%; 16.1%]
	inadequate training	16.9% [7.6%; 26.3%]*	11.8% [2.1%; 22.8%]*	5.6% [0%; 11.3%]	−2.8% [-13.1%; 8.3%]	11.7% [-0.8%; 25.3%]	6% [2.1%; 10%]*
social support	living together	−10.3% [-37.2%; 15.7%]	−6% [-34.7%; 19.9%]	−2% [-20.1%; 15.5%]	13.6% [-24.2%; 47.3%]	−4% [-42.5%; 31.7%]	−7.2% [-20.7%; 5.7%]
	social network	−223.9% [-355.1%; −113.1%]*	−202.1% [-349.8%; −87%]*	−83.9% [-138%; −34.5%]*	−54.2% [-187%; 30.8%]	−291.9% [-521.2%; −109.9%]*	−102.8% [-138.5%; −66.9%]*

*$p < .05$.
[a]All PARPs are adjusted for age, gender, profession, education and all predictors in the corresponding logistic regression models.

Appendix B

Table B1
Overview of risk factors.

domain	risk factor abbr.	description	response
lifetime emotional problems	lifetime depressive problems	Before the COVID-19 crisis, did you ever suffer from or were you treated for depression?	binary
	lifetime anxiety problems	Before the COVID-19 crisis, did you ever suffer from or were you treated for anxiety problems?	binary
	lifetime panic attacks	Before the COVID-19 crisis, did you ever suffer from or were you treated for panic attacks?	binary
	Lifetime substance abuse problems	Before the COVID-19 crisis, did you ever suffer from or were you treated for substance abuse problems?	binary
infection status	quarantine	Have you been hospitalized for COVID-19?	binary
	hospitalized	Have you been quarantined for COVID-19?	binary
	someone close infected	Has someone close to you been infected with COVID-19?	binary
work context	exposure to COVID-19	Were you directly exposed to patients with COVID-19?	binary
	working overtime	Have you experienced any shortage of safety equipment or resources?	binary
	work-life balance	Did you experience interpersonal problems with your colleagues?	binary
	conflictswith co-workers	Did you work overtime due to the COVID-19 health crisis?	binary
	shortage of equipment	Did you have to perform tasks, because of the COVID-19 health crisis, without having received a proper training?	binary

(*continued on next page*)

Table B1 (*continued*)

domain	risk factor abbr.	description	response
	inadequate training	Has your work-life balance suffered due to the COVID-19 health crisis?	binary
social support	living together	Living alone or together with someone?	binary
	social network	When you have a problem or worry, how often do you let someone in your personal life know about it?	5-point Likert scale
		How much can you rely on your family and friends for help if you have a serious problem?	5-point Likert scale

References

Alonso, J., Vilagut, G., Mortier, P., Ferrer, M., Alayo, I., Aragón-Peña, A., MINDCOVID Working group, 2021. Mental health impact of the first wave of COVID-19 pandemic on Spanish healthcare workers: A large cross-sectional survey. Revista de psiquiatria y salud mental 14 (2), 90–105.

Bai, Y., Lin, C.C., Lin, C.Y., Chen, J.Y., Chue, C.M., Chou, P., 2004. Survey of stress reactions among health care workers involved with the sars outbreak. Psychiatr. Serv. 55 (9), 1055–1057.

Bruffaerts, R., Voorspoels, W., Jansen, L., Kessler, R.C., Mortier, P., Vilagut, G., et al., 2021. Suicidality among healthcare professionals during the first COVID19 wave. J. Affect. Disord. 283, 66–70.

Buuren, S.V., Groothuis-Oudshoorn, K., 2010. Mice: multivariate imputation by chained equations in R. J. Stat. Software 1–68.

Chong, M.Y., Wang, W.C., Hsieh, W.C., Lee, C.Y., Chiu, N.M., Yeh, W.C., Chen, C.L., 2004. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. Br. J. Psychiatr. 185 (2), 127–133.

Chua, S.E., Cheung, V., Cheung, C., McAlonan, G.M., Wong, J.W., Cheung, E.P., Chan, M. T., Tsang, K.W., et al., 2004. Psychological effects of the sars outbreak in Hong Kong on high-risk health care workers. Can. J. Psychiatr. 49 (6), 391–393.

da Silva, F.C.T., Neto, M.L.R., 2020. Psychological effects caused by the covid-19 pandemic in health professionals: a systematic review with meta-analysis. Prog. Neuro Psychopharmacol. Biol. Psychiatr. 104, 110062.

Deville, Jean-Claude, Särndal, Carl-Erik, 1992. Calibration estimators in survey sampling. J. Am. Stat. Assoc. 87 (418), 376–382.

Gelman, A., Hill, J., 2006. Data Analysis Using Regression and Multilevel/Hierarchical Models. Cambridge university press.

Gomez, S., Anderson, B.J., Yu, H., Gutsche, J., Jablonski, J., Martin, N., Prasad Kerlin, M., Mikkelsen, M.E., 2020. Benchmarking critical care well-being: before and after the coronavirus disease 2019 pandemic. Crit. Care Expl. 2 (10).

Hinkin, C.H., Castellon, S.A., Dickson-Fuhrman, E., Daum, G., Jaffe, J., Jarvik, L., 2001. Screening for drug and alcohol abuse among older adults using a modified version of the cage. Am. J. Addict. 10 (4), 319–326.

Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. J. Gen. Intern. Med. 16 (9), 606–613.

Levin, M.L., 1953. The occurrence of lung cancer in man. Acta Unio Int. Contra Cancrum 9 (3), 531–541.

Levis, B., Benedetti, A., Ioannidis, J.P.A., Sun, Y., Negeri, Z., He, C., Wu, Y., Krishnan, A., Bhandari, P.M., Neupane, D., Imran, M., Rice, D.B., Riehm, K.E., Saadat, N., Azar, M., Boruff, J., Cuijpers, P., Gilbody, S., Kloda, L.A., McMillan, D., et al., 2020. Patient Health Questionnaire-9 scores do not accurately estimate depression prevalence: individual participant data meta-analysis. J. Clin. Epidemiol. 122, 115–128.e1. https://doi.org/10.1016/j.jclinepi.2020.02.002.

Lumley, T., 2011. Complex surveys: a guide to analysis using R, 565. John Wiley & Sons.

MacMahon, B., Pugh, T.F., 1970. Epidemiology; Principles and Methods. Brown and Company, Boston, Litle.

de Pablo, G.S., Serrano, J.V., Catalan, A., Arango, C., Moreno, C., Ferre, F., Fusar-Poli, P., 2020. Impact of coronavirus syndromes on physical and mental health of health care workers: Systematic review and meta-analysis. J. Affect Disord. 257, 48–57.

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V.G., Papoutsi, E., Katsaounou, P., 2020. Prevalence of depression, anxiety, and insomnia among healthcare workers during the covid-19 pandemic: a systematic review and meta-analysis. Brain Behav. Immun. 88, 901–907.

Price, M., Szafranski, D.D., van Stolk-Cooke, K., Gros, D.F., 2016. Investigation of abbreviated 4 and 8 item versions of the ptsd checklist 5. Psychiatr. Res. 239, 124–130.

Que, J., Le Shi, J.D., Liu, J., Zhang, L., Wu, S., Gong, Y., Huang, W., et al., 2020. Psychological impact of the covid-19 pandemic on healthcare workers: a cross-sectional study in China. General Psychiatr. 33 (3).

R Core Team, 2020. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

sciensano, 2020. "COVID-19." 2020. https://www.sciensano.be/en.

Spitzer, R.L., Kurt, K., Williams, J.B., Löwe, B., 2006. A brief measure for assessing generalized anxiety disorder: the gad-7. Arch. Intern. Med. 166 (10), 1092–1097.

Tan, B.Y., Chew, N.W., Lee, G.K., Jing, M., Goh, Y., Yeo, L.L., Zhang, K., Sharma, V.K., et al., 2020. Psychological impact of the covid-19 pandemic on health care workers in Singapore. Ann. Intern. Med. 173 (4), 317–320.

Van der Heyden, J., Nguyen, D., Renard, F., Scohy, A., Demarest, S., Drieskens, S., Gisle, L., 2018. Belgisch Gezondheidsonderzoek 2018. Brussel, België. Sciensano.

WHO, 2020. Timeline of who's response to covid-19, 2020. https://www.who.int/news-room/detail/29-06-2020-covidtimeline.

Wilson, W., Pradeep Raj, J., Rao, S., Ghiya, M., Menon Nedungalaparambil, N., Mundra, H., Mathew, R., 2020. Prevalence and predictors of stress, anxiety, and depression among healthcare workers managing covid-19 pandemic in India: a nationwide observational study. Indian J. Psychol. Med. 42 (4), 353–358.

Zhang, C., Yang, L., Liu, S., Ma, S., Wang, Y., Cai, Z., Du, H., et al., 2020. Survey of insomnia and related social psychological factors among medical staff involved in the 2019 novel coronavirus disease outbreak. Front. Psychiatr. 11, 306. ISO 690.

Zimmerman, M., Morgan, T.A., Stanton, K., 2018. The severity of psychiatric disorders. World Psychiatr. : Off. J. World Psychiatr. Assoc. (WPA) 17 (3), 258–275. https://doi.org/10.1002/wps.20569.

Zuromski, K.L., Ustun, B., Hwang, I., Keane, T.M., Marx, B.P., Stein, M.B., Ursano, R.J., Kessler, R.C., 2019. Developing an optimal short-form of the PTSD Checklist for DSM-5 (PCL-5). Depress. Anxiety 36 (9), 790–800.