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Prevalence of psychological distress in nurses, physicians and leaders working in intensive care units during the COVID-19 pandemic: a national one-year follow-up study

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ABSTRACT

Objective To report and compare psychological distress as symptoms of anxiety, depression and post-traumatic stress among intensive care units' (ICU) nurses, physicians and leaders at 12 months after the baseline survey (spring 2020), during the COVID-19 pandemic in Norway. Furthermore, to analyse which baseline demographic and COVID ICU-related factors have a significant impact on psychological distress at 12 months.

Design Prospective, longitudinal, observational cohort study.

Setting Nationwide, 27 of 28 hospitals with COVID ICUs in Norway.

Participants Nurses, physicians and their leaders. At 12 month follow-up 287 (59.3%) of 484 baseline participants responded.

Primary and secondary outcome measures Symptoms of anxiety and depression using the Hopkins Symptoms Checklist-10 (HSCL-10). Symptoms of post-traumatic stress using the post-traumatic stress disease checklist for the Diagnostic and Statistical Manual of Mental Disorders 5 (PCL-5).

Demographics (included previous symptoms of anxiety and depression) and COVID ICU-related factors (professional preparations, emotional experience and support) impacting distress at 12 months.

Results Psychological distress, defined as caseness on either or both HSCL-10 and PCL-5, did not change significantly and was present for 13.6% of the participants at baseline and 13.2% at 12 month follow-up. Nurses reported significantly higher levels of psychological distress than physicians and leaders. Adjusted for demographics and the COVID ICU-related factors at baseline, previous symptoms of depression and fear of infection were significantly associated with higher levels of anxiety and depression at 12 months. Previous symptoms of depression, fear of infection and feeling of loneliness was significantly associated with more symptoms of post-traumatic stress.

Conclusion One year into the COVID-19 pandemic 13.2% of the ICUs professionals reported psychological distress, more frequently among the nurses. Fear of infection, loneliness and previous symptoms of depression reported at baseline were associated with higher levels of distress. Protective equipment and peer support are recommended to mitigate distress.

Trial registration number ClinicalTrials.gov. Identifier: NCT04372056.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ National study of healthcare professionals working in 27 out of 28 COVID intensive care units.
⇒ 12 month longitudinal cohort of 59% of baseline respondents.
⇒ Because of an incomplete national register, the response rate among all professionals is unknown.
⇒ Self-report checklists provide an estimate of psychological distress, but they are not comparable with a diagnostic interview in terms of accuracy.

INTRODUCTION

From the onset of the COVID-19 pandemic, nurses, physicians and their leaders (healthcare professionals) worked on the front lines in intensive care units (COVID ICUs). Healthcare professionals worldwide experienced increased workload, exposure to excess death, moral distress because of limited treatment options and capacity, and fear of infection because of insufficient protective equipment.[1] Even before the pandemic, studies have found particular high levels of all types of psychological distress from moral distress and burnout to anxiety, depression and post-traumatic stress disorder (PTSD) among ICU healthcare professionals connected to the high frequency of demanding work-task like end-of-life decisions, critical ill patients and

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advanced treatment regimen.[2 3] The pandemic posed a risk of further rising levels potentially leading to manifest illness and resignation. The first publication from China stated that 50% of all healthcare professionals reported symptoms of depression and 45% symptoms of anxiety.[4] In Italy, which early on during the pandemic was severely affected, 25% of healthcare professionals reported symptoms of depression and 20% symptoms of anxiety, whereas 50% reported symptoms of post-traumatic stress.[5] During the SARS epidemic, up to 40% still reported symptoms of post-traumatic stress up to 3 years after the end of the epidemic.[6]

A systematic review of healthcare professionals during the SARS epidemic concluded that both occupational factors and social factors influenced psychological distress.[7] The occupational factors identified to increase psychological distress were low perceived preparedness, working in a high-risk environment, occupational role (nurse), lack of control at work, being quarantined and the fear of infection.[7] On the other hand, social factors that increased distress were isolation or social rejection, whereas support, both at work and from family/friends, were protective factors.[7]

The COVID-19 pandemic imposed the need to perform a national survey on psychological distress among healthcare professionals working in COVID ICUs. To the best of our knowledge, this is the first national, longitudinal cohort study of healthcare professionals working in COVID ICUs. We have previously published results from the baseline national survey, performed in spring 2020, launched 10 weeks after the first confirmed case in Norway.[8 9] The healthcare professionals reported low levels of anxiety, depression and post-traumatic stress compared with the first reports from China and Italy.[4 5]

The primary aim of the present paper is to report the symptoms of psychological distress as anxiety, depression and post-traumatic stress among the COVID ICU nurses, physicians and leaders at the 12 month follow-up and compare the symptom levels between the professions. Second, analyse which of the baseline demographic and COVID ICU-related factors: professional, emotional and/or supportive, were predictors of psychological distress at the 12 month follow-up.

METHODS

Study design

This was a prospective, longitudinal, cohort study with two follow-up assessments of the same individual respondents. Data were collected at baseline, at 6 month follow-up and at 12 month follow-up. Data from questionnaires at baseline and 12 month are presented in this paper as there was no clinically significant changes in level of distress between baseline and 6 month and 6 month and 12 month. The methods and results are reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) cohort checklist.[10]

Study setting, participants and inclusion process

The baseline data were collected during the period 6 May 2020 to 15 July 2020. The 12 month follow-up data were collected from 5 May 2021 to 6 June 2021. The inclusion criteria were having a Norwegian social security number, working in an ICU with COVID-19 patients and being either a nurse, physician or leader. The subgroups of the professions are described in the two publications of baseline data.[8 9] The leaders included were the managers of the ICUs, with personnel responsibility for the nurses and physicians. The sample included 27 of the 28 hospitals with a COVID ICU in Norway. One hospital did not participate because of delays in the local approval process. The project leader distributed e-mails to all leaders of the COVID ICUs with information about the study and an invitation to participate; these leaders were then asked to forward the invitation to all relevant employees. The recruitment process is described in detail in the first paper of the present study.[8] The online solution for the consent form and questionnaire was delivered by the Services for Sensitive Data (TSD) at the University of Oslo. At baseline, the respondents consented to follow-up questionnaires. At the 12 month follow-up, the baseline respondents received an automatic invitation from TSD to complete the questionnaire.

Questionnaire

The questionnaires have been described in previous publications.[8 9] The present paper is based on 51 variables (online supplemental file 1): demographics from baseline, including self-reported previous symptoms of anxiety/depression (9 items). Moreover, questions on the COVID ICU-related factors professional preparedness, emotional experience and support at work (8 items), along with questions of planned or completed change of job, self-reported COVID-19 infection and collegial support, were included both at baseline and 12 month (3 items). In addition, a single question on vaccination at the 12 month follow-up was presented (1 item). Finally, the two validated questionnaires on psychological distress were included (30 items).

Symptoms of anxiety and depression were measured using the Hopkins Symptoms Checklist-10 (HSCL-10). HSCL-10 regards symptoms experienced the last week and consists of 10 items, measuring symptoms of depression (6 items) and anxiety (4 items).[11–13] Each item is graded on a 1–4-point Likert scale, and an average item score is calculated, here a score of 1. 85 or higher was considered to indicate caseness.[11–13]

Symptoms of post-traumatic stress disorder (PTSD) were measured using the PTSD checklist for the Diagnostic and Statistical Manual of Mental Disorders 5, PCL-5. PCL-5 is a 20-item screening tool for symptoms of traumatisation and the timeframe of symptoms is the last month.[14 15] The 20 questions were answered in a Likert scale graded from 0 to 4, a sum score was calculated and a score of 31 or higher was considered to indicate caseness.[14 15] In the heading of the PCL-5 questions, it was

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stated that the traumatising event had to be related to COVID ICU work.

The COVID ICU-related factors (8 items) were selected through a modified Delphi model practise.[16 17] The research group consisted of both physicians and nurses with both clinical and research experience within the fields of intensive care, anaesthesiology, psychiatry and psycho-traumatology. After repeated rounds of discussions, the research group emphasising current literature and clinical experience, reached a consensus of three groups of factors: (1) professional preparations (professional preparedness, professional information and simulation training), (2) emotional experience (fear of infection and feeling of loneliness), and (3) support at work (no extra support, talk to leader and daily debrief).

Patients and public involvement

No patients were involved. A user representative, who was a member of the Norwegian Association of Intensive Care Nurses, participated during the whole process of developing the study design and during the data collection.

Statistical methods

The characteristics of the sample were described by mean with SD or median with IQR or frequencies with percentages and range (min–max) depending on the scale of the variable. Differences in the distributions in the scores of HSCL-10 and PCL-5 between the three professional groups were examined using the Kruskal-Wallis test. Changes in the scores of HSCL-10 and PCL-5 from baseline to 12 months were assessed by a Wilcoxon signed-rank test. Logistic regression was performed to test the predictive capacity of (1) previous anxiety and/or depression and (2) scores over the cut-off on the PCL-5 and HSCL-10 at baseline, using HSCL-10 and PCL-5 at 12 month as the dependent variable.

Median regression was performed to examine the association between demographic variables and the COVID ICU-related variables at baseline, and the scores of HSCL-10 and PCL-5 at 12 month follow-up as dependent variables. In the modified Delphi process, for selecting the COVID ICU-related variables collinearity was checked, and a Spearman's rho>0.4 was set as the cut-off and the most clinically relevant variable was included in the analysis. Three variables were dichotomised for multivariate analysis. Simulation training was scored as: 'not at all' = 'no' and 'once' and 'several times' which was combined ='yes'. Both professional preparedness and (3) feeling of loneliness were graded as a 5-point Likert scale 'not at all' and 'to little degree' were set to 'no', the three positive answers were set to 'yes'. At 12 months 'not applicable' (NA) was an option for professional preparedness and simulation training, NA was coded as 'yes'. Because of missing data on the outcome variables (197 non-responders of both PCL -5 and HSCL-10 at 12 months) and years of experience (3 missing values), the pooled results from multiple regression with 20 imputed data sets were reported for comparison purposes to a complete case analysis.[18] Multiple imputation by chained equations under the assumption of missing at random were performed to handle the missing values. The strength of the association was quantified as the regression coefficient with 95% CIs. The significance level was set to 0.05. The analyses were performed with Stata/SE V.17.0 and IBM SPSS V.28.0 for Windows.

Ethical considerations

The current study was conducted according to the Declaration of Helsinki and was approved by the Regional Commitee for Medical and Health Research Ethics South-East Norway group A (2020/136144) and the data protective officer at Oslo University Hospital (20/09438). At each of the 27 hospitals, included the study was approved by the local data protective officer, the head of research and the local leaders. Every participant had to sign an electronic informed consent form and could withdraw from the study at any point by contacting the research leader. All sensitive data were stored using the Services for Sensitive Data (TSD) at the University of Oslo.

RESULTS

Study population characteristics

A total of 287 (59.3%) of the 484 COVID ICU healthcare professionals enrolled at baseline, completed the online 12 month follow-up questionnaire. A flowchart is available in the supplemenatry section (online supplemental file 2). The demographic characteristics of the study population at baseline and at 12 month are displayed in table 1. Out of the 197 participants lost to follow-up, age was the only variable that was significantly different (ie, lower) (p=0.037). At the 12 month follow-up, 4.9% of the participants had changed workplaces and all were nurses. Moreover, 95.8% of our study population had been vaccinated, 83.3% with two dosages. Only 1% of the study population reported being infected with the COVID-19 virus.

Levels of distress, professional differences and predispositions

HSCL-10-scores and PCL-5-scores at baseline did not show a statistical difference in the population lost to follow-up (n=197) compared with the population that completed the 12 month follow-up questionnaire (n=287). Symptoms of anxiety and depression is displayed in table 2 and symptoms of post-traumatic stress is displayed in table 3. Anxiety, depression and PTSD at all three measurement times (n=206) is provided for comparison in the supplementay material (online supplemental file 3). The median score of symptoms of anxiety and depression at the 12 month follow-up was 1.2 and there was no significant increase in the median score from baseline. Nurses had significantly higher scores than physicians and leaders (p=0.019). The percentage of the study population that met the criteria for caseness was 12.5% at both baseline and 12 month. The median score of symptoms of post-traumatic stress at the 12 month follow-up was

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Table 1 Demographic characteristic of the study population

	Baseline 484 (100%)	12 month follow-up 287 (59.3%)
Age, mean (SD, min–max)	44.9 (9.7, 24–65)	45.6 (9.1, 25–64)
Gender, female n (%)	377 (77.9)	221 (77.0)
Married/partner n (%)	362 (74.8)	215 (74.9)
Profession n (%)		
Nurse	392 (81.0)	229 (79.8)
Physician	43 (8.9)	29 (10.1)
Leader	49 (10.1)	29 (10.1)
Years of professional experience, mean (SD, min–max)	19.3 (9.5, 2–42)*	19.8 (9.1, 2–40)†
Previous ICU work experience n (%)	444 (91.7)	269 (93.7)
Self-reported previous symptoms of anxiety n (%)	78 (16.1)	46 (16.0)
Self-reported previous symptoms of depression n (%)	97 (20.0)	65 (22.6)
Risk factors for serious COVID-infection n (%)	65 (13.4)	40 (13.9)
Changed job n (%)	6 (1.2)	14 (4.9)
Vaccinated n (%)	–	275 (95.8)
Self-reported COVID-19 infection n (%)	0 (0)	3 (1)

*Data missing for three participants
†Data missing for one participant.
ICU, intensive care unit.

7.0. There was a significant increase in median PCL-5 score (p=0.016) from baseline to 12 month follow-up and nurses were the sole profession that contributed significantly to this increase. Moreover, nurses had significantly higher PCL-5 scores than physicians and leaders at both baseline (p=0.019) and 12-month follow-up (p<0.001). The percentage of the study population that met the threshold for caseness was 6.3%, all of whom were nurses.

The total number of participants who met the caseness criteria for HSCL-10, PCL-5 or both at baseline were 39/287 (13.6%) and at 12 month follow-up 38/287 (13.2%). Of the 287 participants, 210 (73.2%) reported no previous symptoms of anxiety and/or depression, and of them 21 (10%) scored above cut-off on either HSCL-10 or PCL-5 or both at baseline. At the 12 month follow-up the numbers had decreased to 18 (8.6%). Of the 77 (26.8%) participants who reported either previous symptoms of depression or anxiety or both, 18 (24.7%) met caseness criteria either or both of HSCL-10 or PCL-5 at baseline, and at 12 months, 20 (26%) of them met caseness criteria. Previous symptoms of anxiety and/or depression increased the likelihood of caseness on HSCL-10 and/or PCL-5 at the 12 month follow-up with an OR of 2.9 (95% CI: 1.3 to 6.4, p=0.005). Caseness on HSCL-10 and/or PCL-5 at baseline increased the likelihood of caseness at 12 months with an OR of 8.4 (95%

Table 2 Symptoms of anxiety and depression by HSCL-10 at baseline (n=287) and 12 month follow-up (n=287)

	Baseline		12 months		
	Median (IQR, min–max)	n≥1.85 (%)	Median (IQR, min–max)	n≥1.85 (%)	Difference baseline to 12 month*
Total population	1.2 (0.5, 1–3.6)	36 (12.5)	1.2 (0.6, 1–3.9)	36 (12.5)	0.611
Nurses	1.2 (0.5, 1–3.6)	30 (13.1)	1.3 (0.6, 1–3.9)	33 (11.5)	
Physicians	1.1 (0.4, 1–2.4)	3 (10.3)	1.0 (0.4, 1–2.3)	1 (0.4)	
Leaders	1.2 (0.5, 1–2.2)	3 (10.3)	1.1 (0.5, 1–2.1)	2 (0.7)	
Difference between professions†	0.370		0.019‡		

HSCL-10 scale 1.0-4.0, cut off ≥1.85.
*Wilcoxon signed-rank test.
†Kruskal-Wallis test.
‡p≤0.05.
HSCL-10, Hopkins Symptoms Checklist-10.

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Table 3 Symptoms of PTSD by PCL-5 at baseline (n=287) and 12 month follow-up (n=287).

	Baseline		12 months		
	Median (IQR, min–max)	n≥31 (%)	Median (IQR, min–max)	n≥31 (%)	Difference baseline to 12 month*
Total population	6.0 (13, 0–64)	20 (7.0)	7.0 (15, 0–71)	18 (6.3)	0.016†
Nurses	7.0 (13, 0–64)	17 (7.4)	10 (17, 0–71)	18 (7.9)	
Physicians	4.0 (6, 0–36)	1 (3.5)	4.0 (7, 0–29)	0 (0)	
Leaders	5.0 (12, 0–35)	2 (7.0)	4.0 (9, 0–23)	0 (0)	
Difference between professions‡	0.016†		<0.001†		

PCL-5 scale 0 -80, cut off: 31
*Wilcoxon signed-rank test.
†P≤0.05.
‡Kruskal-Wallis test.
PCL-5, post-traumatic stress disease checklist for the Diagnostic and Statistical Manual of Mental Disorders 5; PTSD, post-traumatic stress disorder.

CI: 3.8 to 18.7, p<0.001), and this was more prominent among those who reported either previous symptoms of depression or anxiety (12/18, 66%) compared with those who did not report previous symptoms (6/21, 28.5%).

COVID ICU-related factors

Of the eight COVID ICU- related factors (graphically presented in online supplemental file 4) the major change during the 12 month period was the lessening in fear of infection, from 46.7% to 15.7%. The reported feeling of loneliness increased from 67.2% to 76.0% at the 12 month follow-up. There were no major changes in preparation or support at work. The most frequent support measure (not included in the multiple regression), during the study period, was collegial support and 83.2% (n=240) said this was supportive at 12 months, compared with baseline, 93.6% (n=453).

Multiple median regression

Table 4 shows the association between the demographic variables and the COVID ICU-related variables at baseline levels and the HSCL-10 score at 12 month follow-up. Self-reported previous symptoms of depression and fear of infection were significantly associated with higher HSCL-10 scores after being adjusted for the other covariates in the median regression model. Results from multiple imputation by chained equation showed similar findings (online supplemental file 5, table 1).

Table 5 shows the adjusted association between the demographic variables (table 1) and the COVID ICU-related variables at baseline levels and the PCL-5 score at the 12 month follow-up. Previous symptoms of depression, fear of infection and loneliness were significantly associated with higher PCL-5 scores adjusted for the other covariates in the median regression model. Similar results were found when multiple imputation by chained equation were performed (online supplemental file 5, table 2).

DISCUSSION

Principal findings

In the current national, prospective, longitudinal study of COVID ICU nurses, physicians and their leaders, the primary finding at the 12 month follow-up was psychological distress among 13.2% of the study population. Nurses reported significantly higher levels of distress than physicians and leaders. Adjusting for the COVID ICU-related factors and demographics at baseline, fear of infection was significantly associated with higher symptom levels of anxiety, depression and post-traumatic stress, whereas feeling of loneliness was associated with higher levels of post-traumatic stress. Of the demographic factors, self-reported previous symptoms of depression were significantly associated with more anxiety, depression and post-traumatic stress symptoms. Gender, marital status or profession were not associated with significant influence of levels of psychological distress. Neither were professional preparations or support at work.

Strengths and limitations

To the best of our knowledge, there are no longitudinal and nationwide studies including healthcare professionals working in COVID ICUs during the first year of COVID-19. We included the core ICU professions: nurses and physicians, and their leaders and we followed the individuals for 12 months with a 59% response rate. A limitation is the lack of registers of nurses and physicians working in the COVID ICUs, which makes the response rate unknown. In addition, validated questionnaires (HSCL-10, PCL-5) do not have the accuracy of a diagnostic interview and may overestimate the prevalence of psychological distress.[19] PTSD symptoms are often assessed after a single-potential traumatic event. In the present study, symptoms were assessed related to working under longitudinal potential stressful circumstances in COVID ICUs. The PCL-5 score may be lower in relation to the longitudinal approach and not assessed after a single traumatic event. The results of the HSCL-10 checklist might be influenced by aspects of life other than the COVID ICU experience. Because of small number of

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Table 4 Demographic variables and COVID ICU factors at baseline and their effect on HSCL-10 at 12-month follow-up. Median regression analysis N=286*

Demographic variables			Coefficient	95% CI	P value
Gender	Female		Ref		
	Male		−0.01	−0.2 to 0.1	0.888
Marital status	Single		Ref		
	Married/partner		−0.09	−0.2 to 0.05	0.190
Years of professional experience			0.0008	−0.006 to 0.007	0.823
profession	Nurse		Ref		
	Physician		-0.02	-0.2 to 0.2	0.884
	Leader		−0.04	-0.2 to 0.2	0.734
Previous ICU experience		No Yes	Ref 0.06	−0.2 to 0.3	0.627
Self-reported previous symptoms of anxiety		No Yes	Ref 0.07	−0.1to 0.3	0.485
Self-reported previous symptoms of depression		No Yes	Ref 0.2	0.02 to 0.4	0.031†
Risk factors for serious COVID-infection		No Yes	Ref −0.03	−0.2 to 0.1	0.740
Professional preparations	Professional preparedness	No Yes	Ref −0.003	-0.4 to 0.4	0.987
	Professional information	No Yes	Ref 0.03	−0.09 to 0.2	0.627
	Simulation training	No Yes	Ref −0.02	−0.2 to 0.1	0.745
Emotional experience	Fear of infection	No Yes	Ref 0.13	0.02 to 0.25	0.027†
	Feeling of loneliness	No Yes	Ref 0.07	−0.06 to 0.2	0.307
Support at work	No extra support	No Yes	Ref −0.05	−0.2 to 0.8	0.469
	Talk to leader	No Yes	Ref −0.05	−0.2 to 0.08	0.447
		No Yes	Ref −0.03	−0.3 to 0.2	0.757

*One participant was excluded from the analysis due to missing data on years of professional experience
†≤0.05

physicians and leaders, the generalisability of the results concerning these two groups are limited.

Comparison of levels of distress with those of other studies

We found substantially lower levels of anxiety and depression (12.5%) and post-traumatic stress symptoms (6.3%) than a systematic review of the COVID-19 pandemic effects on mental health that included 239 papers with all types of healthcare workers (n=271.319).[20] The review covered studies published before March 2021 and 23% of the studies were European.[20] Another systematic review of the first year of COVID-19 focused on the ICU setting and included 13 papers. Also, in this review, there were higher levels of distress. Symptoms of anxiety ranged from 31% to 60%, depressive symptoms from 16% to 65% and symptoms of PTSD from 14% to 47%.[21] Most of the studies included in the two reviews were cross sectional. Longitudinal studies of comparable ICU healthcare professionals found no significant change in levels of distress during follow-up: A Dutch study of ICU nurses (n=164), from autumn 2020 to autumn 2021, reported constant, but higher levels of distress as 38.2% reached caseness.[22] A German single-centre study also found mainly unchanged levels of distress during the 6 month follow-up of ICU personnel (n=49) and support of the lock-down contributing more to distress than the COVID-ICU work.[23] Compared with non-ICU professionals, a British study of front-line physicians (n=3079) found the highest levels of distress in the acceleration phase, that is, early in the four

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Table 5 Demographic variables and COVID ICU-related factors at baseline and their effect on PCL-5 at 12 month follow-up*

Demographic variables			Coefficient	95% CI	P value
Gender	Female		Ref		
	Male		−0.5	−3.6 to 4.6	0.809
Marital status	Married/partner		Ref		
	Single		1.7	−2.5 to 5.	0.514
Years of professional experience			−0.01	−0.2 to 0.2	0.902
Profession	Nurse		Ref		
	Physician		−4.8	−10.6 to 0.9	0.098
	Leader		−2.7	−7.9 to 3.6	0.458
Previous ICU experience		No Yes	Ref 4.2	−2.3 to 10.8	0.208
Self-reported previous symptoms of anxiety		No Yes	Ref 0.3	−4.9 to 5.4	0.922
Self-reported previous symptoms of depression		No Yes	Ref 6.9	2.3 to 11.5	0.003†
Risk factors for serious COVID-infection		No Yes	Ref 1.5	−3.2 to 6.1	0.533
Professional preparations	Professional preparedness	No Yes	Ref −0.8	−11.2 to 9.7	0.885
	Professional information	No Yes	Ref 0.1	−3.3 to 3.6	0.938
	Simulation training	No Yes	Ref 1.7	−1.6 to 5.0	0.314
Emotional experience	Fear of infection	No Yes	Ref 4.4	1.1 to 7.7	0.009†
	Feeling of loneliness	No Yes	Ref 4.5	0.7to 8.2	0.020†
Support at work	No extra support	No Yes	Ref −0.5	−4.0 to 2.8	0.741
	Talk to leader	No Yes	Ref −0.4	−4.3 to 3.4	0.826
	Daily debrief	No Yes	Ref −3.7	−9.6 to 2.2	0.221

Median regression analysis, N=286.
*One participant was excluded from the analysis due to missing data on years of professional experience.
†≤0.05
ICU, intensive care unit; PCL-5, post-traumatic stress disease checklist for the Diagnostic and Statistical Manual of Mental Disorders 5.

months of spring 2020.[24] Similar results were reported for British nurses and midwifes.[25] In a single-centre study from Singapore with healthcare workers in the emergency department, they found a significant decrease in the symptom of anxiety after 1 year for all workers pooled, but an increase in the symptoms of depression among physicians.[26] We found no significant change in the symptoms of anxiety and depression, but a significant increase in the PTSD symptoms only among the nurses during the study period. Compared with the prepandemic Norwegian population[27–29] and a prepandemic study of ICU healthcare professionals,[2] there were only minor differences in the data from the present study's population.

Comparison of Findings of COVID ICU-Related Factors with Those of Other Studies

A systematic review including all types of healthcare professionals did not find any significant correlation with age, gender or profession.[20] Several studies during COVID-19 have shown that both age (lower), gender (female) and profession (nurse) correlate significantly with higher levels of psychological distress.[21 30 31] The COVID ICU-related factors associated with psychological distress were fear of infection, stigmatisation/isolation, witnessing colleagues getting infected, poor communications with supervisors, a lack of support from the administrative leadership, lack of personal protective equipment, insufficient

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rest, denying visitors and end-of-life-decisions;[21] however, these factors have not been subject to a meta-analysis. In the present study, we did find some of the same factors: significant associations of psychological distress with fear of infection and loneliness. In a bivariate comparison of the professions, the nursing profession was associated with significantly higher levels of distress, however this association was not significant when adjusting for other demographic and COVID ICU-related factors. Furthermore, our study showed that previous depression was significantly associated with higher levels of distress. The same association has been reported in a review of work-related PTSD in general and after the SARS epidemic but has been less commonly assessed in COVID-19 research so far.[32–34] Moreover, professional preparations and support at work had no significant effect in our study population. Almost all participants acknowledged the collegial support, also identified in a Swedish study of evaluation of implemented types of support.[35]

Possible explanations

Our findings of lower levels of psychological distress compared with similar healthcare professionals' populations may be explained by the high level of professional experience among the study population, that the ICU capacity was never overextended in Norway during the pandemic, and that after 12 months, progress was made in most aspects of the handling of COVID-19 for both patients and professionals. ICU healthcare professionals are regularly exposed, at work, to end-of-life decisions and traumatic death,[36] indicating a selection process like the 'healthy-worker'-effect.[37] Almost all our study participants had previous intensive care experience and a mean total work experience of almost 20 years. A survey of Norwegian physicians autumn 2020 found that those working in 'COVID-19-exposed specialities' had significantly lower odds of concern for infecting their family and although they perceived more scarcity of personal protective equipment (PPE) they had no raised odds of fear of getting oneself infected.[38] A large proportion of our study population had personal resilience promoters: a partner and no prior symptoms of anxiety or depression, along with a specific for the COVID ICU task: no risk factors for serious COVID infection. The difference between the professions may be dual: choice of profession and the nature of the different professions' work tasks.[39] The nurses worked more bedside hours that entailed wearing PPE, which was physically demanding, and at baseline, the uncertainty of the safety of the equipment increased fear of infection among many, in addition to other emotional stressors like denying relatives to visitations.[8] Although the prepandemic ICU capacity in Norway was among the lower in Europe,[40 41] the ICU capacity was never overstretched because of a combination of ceasing elective surgery, construction of temporary ICUs and the authority's early and strict lock-down of the rest of the society.[42] Together, these measures led to low numbers of both infected and dead by the end of the 12 month follow-up data collection (June 2021): 2.4% of the Norwegian population were confirmed infected, and of those 0.015% had died, whereas in total for Europe, 12.3% of the population were infected, and of them, 2.6% had died.[43 44] A survey from the first outbreak in Italy indicated that healthcare professionals in hospitals in high endemic areas like Lombardy reported significantly higher levels of psychological distress than colleagues in hospitals in low endemic areas like Tuscany.[45] Along the same lines, a French study of ICU professionals reported significantly higher levels of distress among professionals working in hospitals in high intensity zones defined as >1 patient to the maximum number of ICU beds available in the hospital before COVID-19.[46] During the first 12 months, COVID-19 knowledge advanced, treatment regimens were established, and the mortality rate was reduced. Hospitals were well equipped and better PPE was made available. Almost all of our study participants had been vaccinated and only 1% of the study population had been infected, compared with 2.4% of the total population.[47]

Contrary to expectations and previous studies, there was no significant effect of professional preparations and support at work on the levels of distress.[34] This might be the results of a homogenous, experienced and resilient study population because 46.7% reported fear of infection, but only 13.2% reported significant psychological distress. Similar findings have been made in a study of Norwegian Medical Helicopter personnel, who are frequently exposed to highly traumatic events, but still reporting low levels of distress. This study remarks training and selection as well as organised peer support and being married/having a partner as possible explanations of the low levels.[48] Finally, the significant association between feeling of loneliness and higher symptoms of PTSD is consistent with previous studies that corroborate social support as a protective measure after a traumatic event.[34]

Meaning and implications

To minimise psychological distress among ICU professionals in future epidemics, this study's results support engaging experienced professionals and ability for immediate expansion of the ICU capacity. Furthermore, to prevent excess fear of infection, sufficient stocks of personal protective equipment and access to vaccines are important. In addition, organisational measures to facilitate peer-support and educational programmes on how to promote resilience and awareness of vulnerability factors like previous depression and loneliness should be encouraged.

CONCLUSION

The COVID ICU healthcare professionals in the present study reported low levels of psychological distress, this is probably explained by their experience

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and adequate ICU capacity. Nurses were at a higher risk of developing distress. According to the current study, the focus areas of prevention are mitigating fear of infection and loneliness. Future research might elaborate on both other psychological and the long-term effects of the COVID ICU experience.

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SUPPLEMENTARY FILE 1

Questionnaire

Healthcare professionals' experiences with COVID-19 patients in intensive care units in Norway

Demographics

1. What is your age?

2. Gender
   - ☐ Female
   - ☐ Male

3. What is your marital status?
   - ☐ Married / partner
   - ☐ Unmarried
   - ☐ Widow / widower
   - ☐ Other

4. What is your pre-Covid profession?
   - ☐ Registered nurse
   - ☐ Intensive care nurse
   - ☐ Anaesthetic nurse
   - ☐ Operating theatre nurse
   - ☐ Clinical teacher
   - ☐ Paediatric nurse
   - ☐ Anaesthesiologist
   - ☐ Intensive care physician
   - ☐ Cardiologist
   - ☐ MD, Permanent resident

- ☐ MD Physician under specialization (LIS)
- ☐ MD Physician, external supervisory tasks
- ☐ Psychiatrist
- ☐ Manager/leader

5. If you are a doctor, how many years have you practiced medicine since earning your degree? If you are a nurse, how many years have you practiced nursing since you trained as a nurse?

6. Have you had any previous experience working in an intensive care unit?
   - ☐ Yes
   - ☐ No

7. Have you previously had symptoms of anxiety?
   - ☐ Yes
   - ☐ No

8. Have you previously had symptoms of depression?
   - ☐ Yes
   - ☐ No

9. Do you currently have any of the following risk factors for becoming infected with the coronavirus?
   Heart disease, including high blood pressure; lung disease; older than 65 years of age; immune disease / immune depressants; diabetes; obesity (BMI> 30)
   - ☐ Yes
   - ☐ No

10. Have you considered quitting your job because of the pandemic?
    - ☐ No
    - ☐ Yes, sometimes

☐ Yes, often

☐ Yes, specifically planning to quit / have already resigned

11. Have you been vaccinated?

☐ Yes, once

☐ Yes, twice

☐ No

12. Have you been infected with COVID-19?

☐ Yes

☐ No

COVID-ICU related factors

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13. Did you experience being well-prepared to begin your work in a COVID-ICU?

☐ Not at all

☐ To a small degree

☐ Partly

☐ To a high degree

☐ To a very high degree

14. Have you participated in practice / simulation with treatment teams in a situation that may be like working with COVID-ICU patients?

☐ Yes, once

☐ Yes, several times

☐ No, never

15. Have you been afraid of being infected with COVID-19 at work?

☐ Yes

☐ No

16. Have you felt lonely?

- ☐ Not at all
- ☐ To a small degree
- ☐ Partly
- ☐ To a high degree
- ☐ To a very high degree

Do/did your employer have any kind of support measures during the COVID ICU work?

17. No special support measures	☐	Yes	☐	No

Did you find other measures at work supportive?

18. Daily debrief	☐	Yes	☐	No
19. Talk to leader	☐	Yes	☐	No
20. Talk to colleague	☐	Yes	☐	No
21. Professional information	☐	Yes	☐	No

PCL-5

Below is a list of issues that may be reactions to highly stressful events such as the COVID-19 pandemic.
Please indicate whether any experiences related to the COVID-19 pandemic have been stressful for you by answering each question. Have you experienced any of the following issues during the last month?

	Not at all	A little bit	Moderately	Quite a bit	Extremely
22. Repeated, disturbing, and unwanted memories of the stressful experiences of the pandemic?	☐	☐	☐	☐	☐

23. Repeated, disturbing dreams of the stressful experience of the pandemic?	☐	☐	☐	☐	☐
24. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	☐	☐	☐	☐	☐
25. Feeling very upset when something reminded you of the stressful experience of the pandemic?	☐	☐	☐	☐	☐
26. Having strong physical reactions when something reminded you of the stressful experience of the pandemic?	☐	☐	☐	☐	☐
27. Avoiding memories, thoughts, or feelings related to the stressful experience of the pandemic?	☐	☐	☐	☐	☐
28. Avoiding external reminders of the stressful experience of the pandemic (for example, people, places, conversations, activities, objects, or situations)?	☐	☐	☐	☐	☐
29. Trouble remembering important parts of the stressful experience of the pandemic?	☐	☐	☐	☐	☐
30. Having strong negative beliefs about yourself, other people, or the world (for example,	☐	☐	☐	☐	☐

having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?					
31. Blaming yourself or someone else for the pandemic?	☐	☐	☐	☐	☐
32. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	☐	☐	☐	☐	☐
33. Loss of interest in activities that you used to enjoy.	☐	☐	☐	☐	☐
34. Feeling distant or cut off from other people?	☐	☐	☐	☐	☐
35. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	☐	☐	☐	☐	☐
36. Irritable behaviour, angry outbursts, or acting aggressively?	☐	☐	☐	☐	☐
37. Taking too many risks or doing things that could cause you harm?	☐	☐	☐	☐	☐
38. Being “super alert” or watchful or on guard?	☐	☐	☐	☐	☐
39. Feeling jumpy or easily startled?	☐	☐	☐	☐	☐
40. Having difficulty concentrating?	☐	☐	☐	☐	☐

41. Trouble falling or staying asleep?	☐	☐	☐	☐	☐

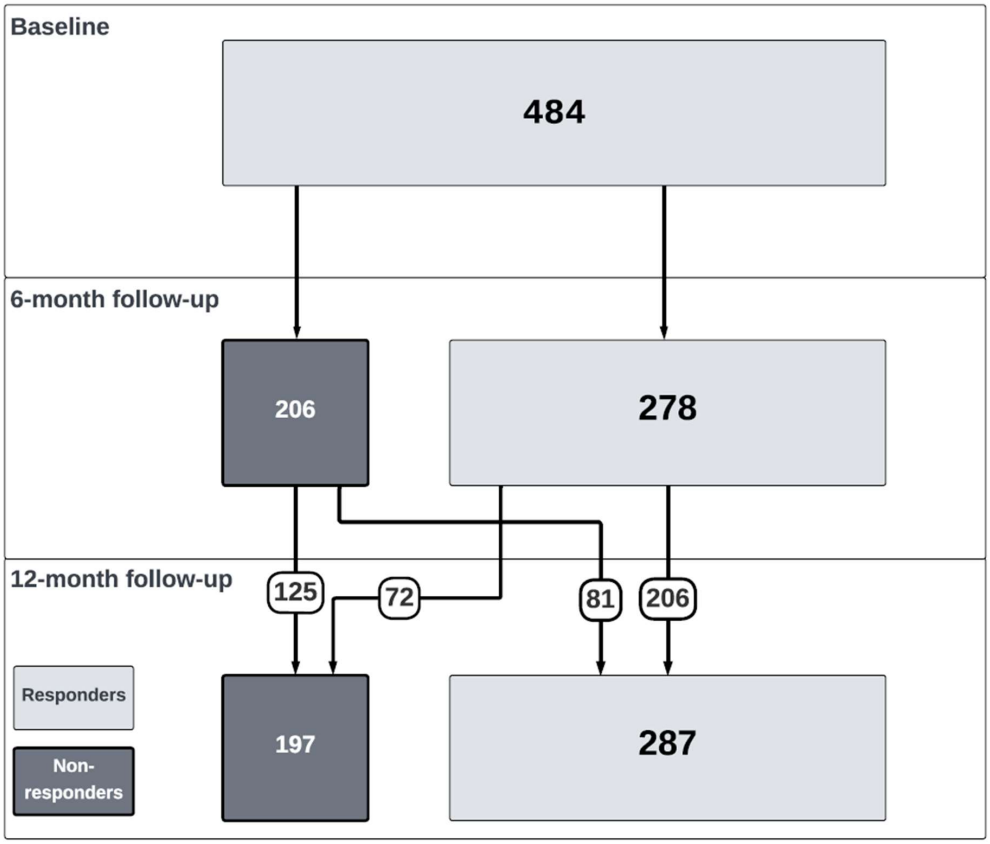
HSCL-10

Have you experienced any of these during the last week (including today)

	Not bothered	A little	Quite a bit	Very much bothered
42. Suddenly scared for no reason	☐	☐	☐	☐
43. Feeling fearful	☐	☐	☐	☐
44. Faintness, dizziness or weakness	☐	☐	☐	☐
45. Feeling tense or keyed up	☐	☐	☐	☐
46. Blaming yourself for things	☐	☐	☐	☐
47. Difficulties in falling asleep or staying asleep	☐	☐	☐	☐
48. Feeling blue	☐	☐	☐	☐
49. Feelings of worthlessness	☐	☐	☐	☐
50. Feeling everything is a effort	☐	☐	☐	☐
51. Feeling hopeless about the future	☐	☐	☐	☐

SUPPLEMENTARY FILE 2

Flowchart of the study participants



SUPPLEMENTARY FILE 3

Table 1 Symptoms of anxiety and depression by HSCL-10 at baseline, 6-month and 12-month follow-up, N=206.

	Baseline		**6-month**		**12-month**	
	Median (IQR, min- max)	n ≥ 1.85 (%)	Median (IQR, min- max)	n ≥ 1.85 (%)	Median (IQR, min- max)	n ≥ 1.85 (%)
Total population	1.25 (0.5, 1.0-3.6)	23 (11.2)	1.10 (0.5, 1.0-3.9)	19 (9.2)	1.20 (0.5, 1.0-3.9)	26 (12.6)
Nurses (n=164)	1.30 (0.58, 1.0-3.6)	19 (11.2)	1.20 (0.5, 1.0-3.9)	17 (10.4)	1.30 (0.6, 1.0-3.9)	24 (14.6)
Physicians (n=21)	1.30 (0.45, 1.0-2.4)	2 (9.5)	1.10 (0.4, 1.0-2.3)	1 (4.8)	1.00 (0.4, 1.0-2.3)	1 (4.8)
Leaders (n=21)	1.20 (0.55, 1.0-2.2)	2 (9.5)	1.00 (0.6, 1.0, 2.3)	1 (4.8)	1.1 (0.45, 1.0-2.1)	1 (4.8)
Difference between professions [a]	0.798		0.365		0.032*	

Notes: HSCL-10 scale 1.0-4.0, cut off ≥1.85. [a] Kruskal-Wallis test *p≤0.05

Wilcoxon signed rank test

Baseline to 6-month 0.025*

6-month to 12-month 0.022*

Baseline to 12-month 0.926

Table 2 Symptoms of PTSD by PCL-5 at baseline, 6-month and 12-month follow-up, N=206.

	Baseline		**6-month**		**12-month**	
	Median (IQR, min- max)	n ≥31 (%)	Median (IQR, min- max)	n ≥31 (%)	Median (IQR, min- max)	n ≥31 (%)
Total population	7 (14, 0-64)	14 (6.8)	5.5 (14, 0-68)	11 (5.3)	6.5 (15, 0-71)	11 (5.3)
Nurses (n=164)	7 (13, 0-64)	12 (7.3)	6.5 (14, 0-68)	10 (6.1)	10 (15,0-71)	11 (6.7)
Physicians (n=21)	4 (6, 0-27)	0	2 (7, 0-15)	0	4 (7, 0-22)	0
Leaders (n=21)	6 (15, 0-35)	2 (9.5)	4 (16, 0-40)	1 (4.8)	3 (9, 0-23)	0
Difference between professions [a]	0.038*		0.097		0.002*	

Notes: PCL-5 scale 0 -80, cut off: 31. [a] Kruskal-Wallis test *p≤0.05

Wilcoxon signed rank test

Baseline to 6-month 0.503

6-month to 12-month 0.004*

Baseline to 12-month 0.108

SUPPELMENATARY FILE 4

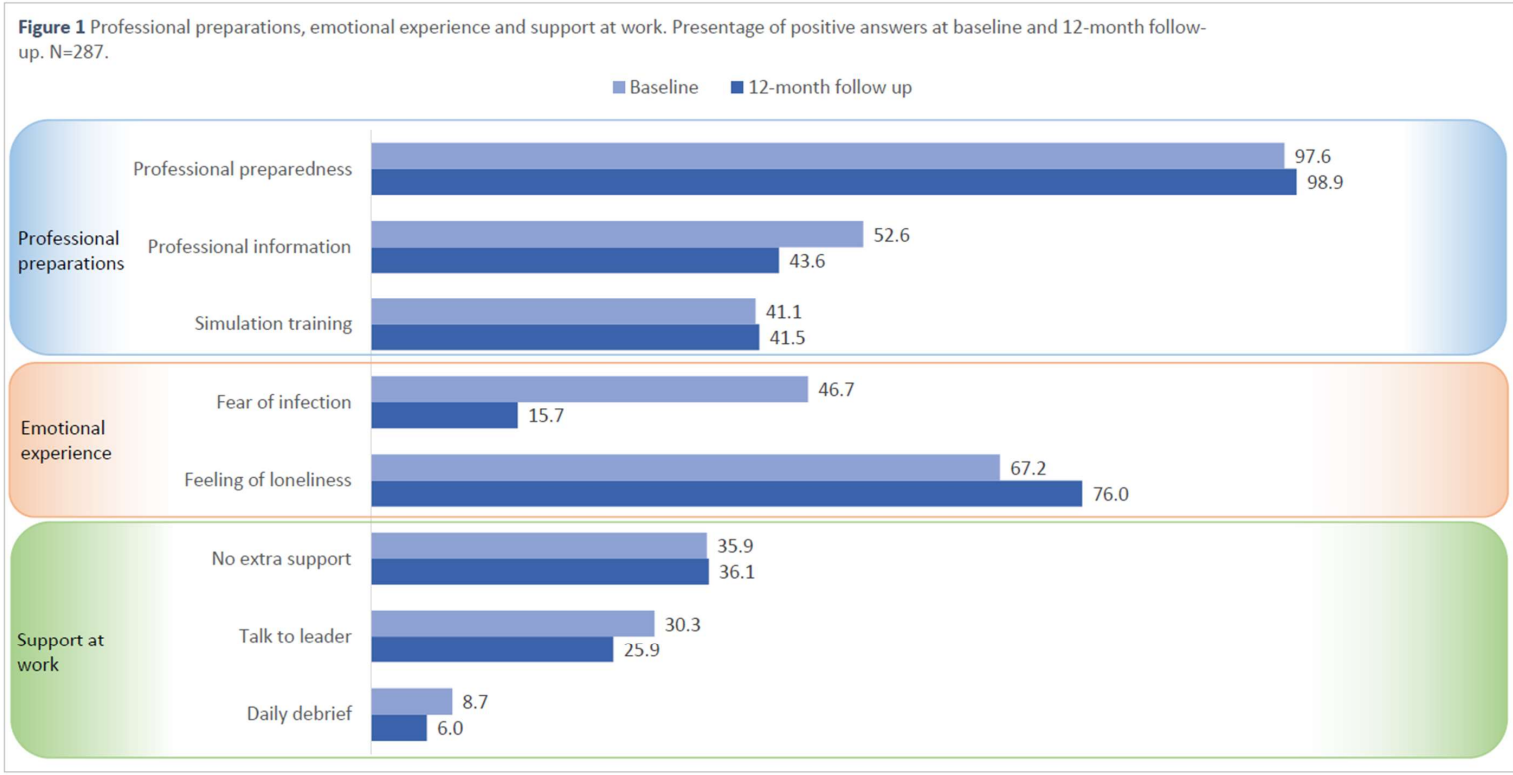


Figure 1 Professional preparations, emotional experience and support at work. Presentage of positive answers at baseline and 12-month follow-up. N=287.

SUPPLEMENTARY FILE 5

Table 1 Demographic variables and preparations, emotional experience and support at baseline and their effect on HSCL-10 at 12 month follow up. Multiple regression analysis. 20 imputed datasets of n=484

Demographic variables			Coefficient	95% CI	P-value
Gender		Female	Ref		
		Male	-0.06	-0.2, 0.08	0.398
Marital status		Single	Ref		
		Married/partner	-0.04	-0.2, 0.09	0.569
Years of professional experience			-0.003	-0.01, 0.01	0.351
Profession		Nurse	Ref		
		Physician	-0.07	-0.3, 0.1	0.509
		Leader	0.02	-0.2, 0.2	0.839
Previous ICU experience		No	Ref		
		Yes	0.1	-0.1, 0.3	0.343
Self-reported previous symptoms of anxiety		No	Ref		
		Yes	0.1	-0.2, 0.3	0.477
Self-reported previous symptoms of depression		No	Ref		
		Yes	0.2	0.001, 0.4	0.047
Risk factors for serious COVID-infection		No	Ref		
		Yes	-0.02	-0.2, 0.2	0.811
Professional preparations	Professional preparedness	No	Ref		
		Yes	0.002	-0.4, 0.4	0.990
	Professional information	No	Ref		
		Yes	0.06	-0.09, 0.2	0.433
	Simulation training	No	Ref		
		Yes	0.007	-0.1, 0.1	0.915
Emotional experience	Fear of infection	No	Ref		
		Yes	0.14	0.02, 0.3	0.023
	Feeling of loneliness	No	Ref		
		Yes	0.09	-0.05, 0.2	0.226
Support at work	No extra support	No	Ref		
		Yes	-0.03	-0.2, 0.1	0.621
	Talk to leader	No	Ref		
		Yes	-0.05	-0.2, 0.1	0.517
	Daily debrief	No	Ref		
		Yes	-0.08	-0.3, 0.1	0.455

Table 2 Demographic variables and preparations, emotional experience and support at baseline and their effect on PCL-5 at 12 month follow up. Multiple regression analysis. 20 imputed datasets n=484

Demographic variables			**Coefficient**	**95% CI**	**P-value**
Gender		Female	Ref		
		Male	-0.3	-3.9, 3.4	0.891
Marital status		Married/partner	Ref		
		Single	0.5	-3.4, 4.3	0.809
Years of professional experience			-0.04	-0.2, 0.1	0.640
Profession		Nurse	Ref		
		Physician	-4.2	-9.3, 0.8	0.099
		Leader	-2.0	-6.6, 2.5	0.377
Previous ICU experience		No	Ref		
		Yes	4.2	-1.7, 10.1	0.159
Self-reported previous symptoms of anxiety		No	Ref		
		Yes	0.7	-4.2 5.7	0.782
Self-reported previous symptoms of depression		No	Ref		
		Yes	5.6	1.0, 10.2	0.017
Risk factors for serious COVID-infection		No	Ref		
		Yes	0.6	-3.8, 4.9	0.801
Professional preparations	Professional preparedness	No	Ref		
		Yes	-4.2	-16.3, 8.0	0.491
	Professional information	No	Ref		
		Yes	0.5	-3.3, 4.3	0.787
	Simulation training	No	Ref		
		Yes	1.4	-1.5, 4.3	0.330
Emotional experience	Fear of infection	No	Ref		
		Yes	4.3	0.8, 7.8	0.017
	Feeling of loneliness	No	Ref		
		Yes	4.7	1.1, 8.3	0.011
Support at work	No extra support	No	Ref		
		Yes	-0.4	-3.8, 3.0	0.815
	Talk to leader	No	Ref		
		Yes	-0.9	-4.6, 2.7	0.611
	Daily debrief	No	Ref		
		Yes	-2.7	-7.5, 2.2	0.289