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Original research

Psychosocial impact of the COVID-19 pandemic on 4378 UK healthcare workers and ancillary staff: initial baseline data from a cohort study collected during the first wave of the pandemic

Danielle Lamb ¹, Sam Gnanapragasam,² Neil Greenberg,³ Rupa Bhundia,⁴ Ewan Carr ⁵, Matthew Hotopf,^{2,6} Reza Razavi,⁷ Rosalind Raine,¹ Sean Cross,⁴ Amy Dewar,⁸ Mary Docherty,⁴ Sarah Dorrington ⁹, Stephani Hatch,⁹ Charlotte Wilson-Jones,⁹ Daniel Leightley,^{3,4} Ira Madan ⁸, Sally Marlow,⁹ Isabel McMullen,⁴ Anne-Marie Rafferty,¹⁰ Martin Parsons,¹¹ Catherine Polling,⁹ Danai Serfioti,³ Helen Gaunt,¹² Peter Aitken,¹³ Joanna Morris-Bone,¹⁴ Chloe Simela,⁸ Veronica French,¹⁵ Rachel Harris,¹⁶ Sharon A M Stevelink ^{3,4}, Simon Wessely ⁴

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/oemed-2020-107276>).

For numbered affiliations see end of article.

Correspondence to

Dr Danielle Lamb, University College London, London, UK; d.lamb@ucl.ac.uk

DL and SG are joint first authors.

Received 1 December 2020

Revised 12 March 2021

Accepted 29 March 2021

Published Online First

28 June 2021



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To cite: Lamb D, Gnanapragasam S, Greenberg N, *et al.* *Occup Environ Med* 2021;**78**:801–808.

ABSTRACT

Objectives This study reports preliminary findings on the prevalence of, and factors associated with, mental health and well-being outcomes of healthcare workers during the early months (April–June) of the COVID-19 pandemic in the UK.

Methods Preliminary cross-sectional data were analysed from a cohort study (n=4378). Clinical and non-clinical staff of three London-based NHS Trusts, including acute and mental health Trusts, took part in an online baseline survey. The primary outcome measure used is the presence of probable common mental disorders (CMDs), measured by the General Health Questionnaire. Secondary outcomes are probable anxiety (seven-item Generalised Anxiety Disorder), depression (nine-item Patient Health Questionnaire), post-traumatic stress disorder (PTSD) (six-item Post-Traumatic Stress Disorder checklist), suicidal ideation (Clinical Interview Schedule) and alcohol use (Alcohol Use Disorder Identification Test). Moral injury is measured using the Moray Injury Event Scale.

Results Analyses showed substantial levels of probable CMDs (58.9%, 95% CI 58.1 to 60.8) and of PTSD (30.2%, 95% CI 28.1 to 32.5) with lower levels of depression (27.3%, 95% CI 25.3 to 29.4), anxiety (23.2%, 95% CI 21.3 to 25.3) and alcohol misuse (10.5%, 95% CI 9.2 to 11.9). Women, younger staff and nurses tended to have poorer outcomes than other staff, except for alcohol misuse. Higher reported exposure to moral injury (distress resulting from violation of one's moral code) was strongly associated with increased levels of probable CMDs, anxiety, depression, PTSD symptoms and alcohol misuse.

Conclusions Our findings suggest that mental health support for healthcare workers should consider those demographics and occupations at highest risk. Rigorous longitudinal data are needed in order to respond to the potential long-term mental health impacts of the pandemic.

Key messages

What is already known about this subject?

- Large-scale population studies report increased prevalence of depression, anxiety and psychological distress during the COVID-19 pandemic.
- Evidence from previous epidemics indicates a high and persistent burden of adverse mental health outcomes among healthcare workers.

What are the new findings?

- Substantial levels of probable common mental disorders and post-traumatic stress disorder were found among healthcare workers.
- Groups at increased risk of adverse mental health outcomes included women, nurses and younger staff, as well as those who reported higher levels of moral injury.

How might this impact on policy or clinical practice in the foreseeable future?

- The mental health offering to healthcare workers must consider the interplay of demographic, social and occupational factors.
- Additional longitudinal research that emphasises methodological rigour, namely with use of standardised diagnostic interviews to establish mental health diagnoses, is necessary to better understand the mental health burden, identify those most at risk and provide appropriate support without pathologising ordinary distress responses.

INTRODUCTION

In the UK, universal health coverage is provided through the National Health Service (NHS). The NHS is largely free at the point of use, funded primarily through general taxation. All residents are automatically entitled to free public healthcare,

including hospital, physician and mental healthcare. The NHS has faced extraordinary pressures during the COVID-19 pandemic. NHS clinical and non-clinical healthcare workers (HCWs) have had to contend with a range of significant stressors including the risk of infection, workload changes, sleep deprivation, loss of colleagues and sometimes providing care in less than adequate settings while reporting insufficient access to personal protective equipment. All of these stressors may contribute to an increase in the prevalence of common mental disorders (CMDs), as well as exposing HCWs to so called 'moral injury', the distress resulting from violation of one's moral code. For example, HCWs may feel betrayed by their employers or others outside the healthcare service who they once trusted, provided patient care in such a way that it violated their own moral codes or values or saw things in the healthcare service that they felt were morally wrong.¹

In addition to workplace-based stressors, HCWs are also vulnerable to wider socioeconomic stressors such as loss of social support, financial difficulties and infection/death of loved ones. Concerns have been raised about the potential psychosocial toll on this population during COVID-19, based on evidence from previous epidemics, mainly severe acute respiratory syndrome, Middle East respiratory syndrome and Ebola. Symptoms of anxiety, depression and post-traumatic stress disorder (PTSD) have been reported as adverse outcomes for HCWs during, and in the years following, those epidemics.²⁻⁴

Self-reported mental health has been deteriorating across the UK during the pandemic, with large-scale population studies reporting increased prevalence of depression and anxiety.⁵⁻⁷ However, there is conflicting evidence about whether the psychosocial impact of the COVID-19 pandemic has been more detrimental for HCWs than for the general population.

A significant limitation of existing research related to the mental health of HCWs during COVID-19 is the use of cross-sectional study designs and convenience samples recruited via social media, with no clear sampling frame or ability to calculate a response rate and assess bias.⁸ Our study (NHS CHECK) aims to remedy these limitations using a cohort design with a defined source population including all NHS staff (not just clinical staff). The detailed information we hold about our population is important in allowing us to assess the representativeness of our sample and understand and mitigate the impact of non-response bias. NHS CHECK is investigating CMDs and moral injury, as well as commonly reported adverse mental health outcomes (eg, anxiety, depression, PTSD, suicidal ideation and alcohol misuse). We report on preliminary baseline data collected during the initial lockdown period in the UK (April–June 2020), describing a cohort of HCWs from a known population of all staff in the first three of the participating Trusts. Here we report associations between sociodemographic and occupational factors with adverse mental health outcomes in HCWs.

Our research questions were:

1. What is the sociodemographic, occupational and mental health profile of our sample of HCWs?
2. What factors are associated with probable CMDs as measured by the General Health Questionnaire (GHQ-12)?
3. What factors are associated with other adverse mental health outcomes as measured by the seven-item Generalised Anxiety Disorder (GAD-7), nine-item Patient Health Questionnaire (PHQ-9), Alcohol Use Disorder Identification Test (AUDIT), six-item Post-Traumatic Stress Disorder checklist (PCL-6) and Clinical Interview Schedule (CIS-R)?

METHOD

Study design and participants

The sample for NHS CHECK includes all staff working in participating NHS Trusts, including medical, nursing, midwifery, allied health professionals, support, administrative, management and students who volunteered or were fast-tracked into clinical roles during the COVID-19 pandemic. In this paper, we report the results from the initial lockdown period of the pandemic (April–June 2020) during which there were ongoing high levels of COVID-19 hospital admissions and mortality. At that time, the study had been launched across three NHS Hospital trusts in South East London serving two of the Greater London boroughs that were in the top 10 for highest rates of COVID-19 related deaths during this period.⁹

Procedures

We identified eligible participants via the Trusts' human resources (HR) systems. We used the Trusts' existing group emails to distribute communications to NHS staff explaining and promoting the study. A dedicated NHS CHECK recruitment email was sent by senior management explaining the study, with a link to the study website. A variation of this email was sent repeatedly during baseline recruitment. We also used existing team-based local contacts established through in-reach staff support, for example, staff support teams/leads, chief nursing officers, medical directors, occupational health departments, trade union representatives and well-being hub users. NHS CHECK was promoted during team briefings, included in Trust newsletters, news items on Trust intranet websites, closed social media groups and screen savers on Trust computers, etc.

Data collection and materials

A survey was developed with input from the NHS CHECK Patient and Public Involvement (PPI) advisory group, and we tested the acceptability of the questions, materials and data collection procedures with this small informal reference group of frontline staff (psychologists, managers, administrators, security staff, intensivists and trainees) and refined it accordingly. Participation in the baseline survey of NHS CHECK involved completing a short (5–10 min) online questionnaire that was hosted using Qualtrics questionnaire software, with the option to complete an additional, longer (10–15 min) questionnaire if they wished. Participant information provided on the study website reinforced that participation was voluntary and confidential. Participants provided online informed consent before starting the online survey. NHS CHECK was launched on 24 April 2020, 5 weeks after the initial lockdown in the UK began (23 March 2020).

Short baseline questionnaire

The short baseline questionnaire collected a variety of information, including: (1) contact details, (2) occupational information (eg, occupational group and length of professional registration) and (3) sociodemographic characteristics (eg, age, sex, ethnicity and marital status). The primary outcome was prevalence of probable CMDs, which were assessed using the GHQ-12, using GHQ scoring method, with a cut-off score of 4 or more indicating 'caseness' (indicating increased probability of experiencing a recognised mental disorder) of a CMD.¹⁰

Longer baseline questionnaire

If participants opted to fill in the longer baseline survey, the following validated measures on mental health were used as

secondary outcomes, with binary outcomes variables defined using the following cut-off scores for caseness: the GAD-7 scale to measure probable moderate anxiety disorder with a cut-off score of 10 or more¹¹; the PHQ-9 to measure probable moderate depression with a cut-off score of 10 or more¹²; the 10-item AUDIT to measure alcohol consumption with a cut-off score of 8 or more indicative of hazardous drinking¹³; and the PCL-6 civilian version to measure PTSD¹⁴ with a score of 14 or more indicating the presence of probable PTSD.

In addition, the nine-item Moral Injury Event Scale (MIES) to measure moral injury,¹⁵ with a higher score indicating more exposure to morally injurious events (possible score range 9–54). For the purpose of analysis, the MIES was split into tertiles (lower: 9; middle: 10–16; upper: 17–54). We also assessed suicidal ideation, using items related to suicidal thoughts, suicide attempts and self-harm derived from the Clinical Interview Schedule (CIS-R).¹⁶ The following items were asked: ‘Have you ever thought of taking your life, even though you would not actually do it?’; ‘Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?’; and ‘Have you ever deliberately harmed yourself in any way but not with the intention of killing yourself?’. Response options were, ‘Yes, in the past 2 months’, ‘Yes, but not in the past 2 months’ or ‘No’.

The measures included aimed to capture commonly reported adverse mental health outcomes and enable comparison with previous and ongoing research. For all validated measures used, recommended scoring methods and cut-off scores have been applied.

Statistical analysis

Aggregate-level population data were provided by participating Trust HR departments including information on the number of employees and the age, sex and ethnicity composition of the workforce. From this, we calculated a response rate for each Trust. Response weights were generated using a raking algorithm based on age, sex and ethnicity.¹⁷ For weighting purposes only, missing demographic data were imputed using multiple imputation. Missingness was no more than 6%, 2% and 2% for age, sex and ethnicity, respectively, before imputation.

Duplicate entries were removed. The analysis then proceeded in five stages. First, we described the representativeness of the sample by comparing composition in terms of age, sex and ethnicity with the HR population data using frequencies and percentages. Second, we summarised survey participants with appropriate descriptive statistics for each variable (frequencies and weighted percentages for categorical variables, mean and SD for continuous variables). Third, we described differences between individuals who completed both the ‘short’ and ‘long’ baseline surveys versus those completing only the ‘short’ survey. Fourth, we summarised the weighted prevalence of the primary (GHQ) and secondary outcomes (GAD-7, PHQ-9, AUDIT, PCL-6, MIES and CIS-R) for all participants and stratified by sociodemographic and occupational factors. Finally, we used multivariable binary logistic regression models to explore relationships of sociodemographic and occupational factors (age, sex, ethnicity and role), as well as moral injury with the primary and secondary outcomes, adjusting for all covariates in the models. All analyses were conducted using Stata V.16.

RESULTS

The total sample size was 4378 (n=37870), representing a response rate of 12%.

Table 1 Demographic characteristics of the sample (n=4378)*

Characteristic	N (weighted %)
Age (years)	Mean age: 41 (SD 12)
≤30	985 (24.2)
31–40	1138 (30.7)
41–50	979 (23.5)
51–60	861 (20.8)
≥61	171 (4.1)
Sex	
Female	3482 (74.8)
Male	833 (24.6)
Other	6 (0.2)
Prefer not to say	18 (0.5)
Relationship status	
Married/civil partnership	1827 (42.2)
Cohabiting/in a relationship	1129 (23.2)
Divorced/separated/widowed	251 (6.3)
Single	1114 (28.3)
Ethnicity	
White	3215 (53.2)
Black/African/Caribbean/black British	373 (20.0)
Asian/Asian British	477 (17.4)
Mixed/multiple racial and ethnic groups	173 (3.9)
Other racial and ethnic minority groups†	90 (4.5)
Country of birth	
UK	2974 (61.1)
EU (not UK)	525 (9.8)
Other	812 (29.2)
Length of time living in the UK (for those born outside the UK) (years)	
<1–2	106 (7.8)
3–5	163 (10.9)
6–10	210 (14.5)
11–20	404 (32.5)
21–29	223 (17.1)
≥30	220 (16.5)
Prefer not to say	7 (0.7)
Main role‡	
Doctor	557 (12.8)
Nurse	1107 (26.7)
Other clinical	1306 (28.3)
Non-clinical	1356 (32.3)

*Frequencies are unweighted, and proportions are weighted. Numbers may not add up due to missing data.

†‘Other racial and ethnic minority groups’ includes the options ‘Arab’ and ‘Any other ethnic background’.

‡In the ‘main role’ variable, ‘other clinical’ includes all other clinical roles, for example, physiotherapist, psychologist, dietician, radiographer, etc. ‘Non-clinical’ includes all other roles, for example, administrative, domestic services, IT support, finance, etc.

Demographic composition of the sample in comparison with population

The demographic characteristics of the sample are described in table 1. In all data presented here, frequencies are unweighted, and proportions are weighted to adjust for Trust size and non-response (Trust-level data provided by Trust HR: see online supplemental table 1 for full weighted and unweighted proportions). There were some statistically significant differences between those who completed only the short survey (n=2212) and those who completed both the long and short survey

Table 2 Prevalence of adverse mental health outcomes*

Characteristic	N	N (% meeting cut-off score) (95% CI)	Mean (95% CI)
Probable common mental disorders (CMDs) (GHQ: cut-off ≥ 4 , scale range: 0–12)	3967	2338 (58.9) (58.1 to 60.8)	4.9 (4.7 to 5.0)
Probable anxiety (GAD-7: cut-off ≥ 10 , scale range: 0–28)	2471	558 (23.2) (21.3 to 25.3)	6.5 (6.3 to 6.8)
Probable depression (PHQ-9: cut-off ≥ 10 , scale range 0–36)	2466	665 (27.3) (25.3 to 29.4)	7.1 (6.8 to 7.3)
Alcohol misuse (AUDIT: cut-off ≥ 8 , scale range 0–45)	2308	278 (10.5) (9.2 to 11.9)	3.5 (3.3 to 3.7)
Probable PTSD (PCL-6: cut-off ≥ 14 , scale range 6–30)	2447	715 (30.2) (28.1 to 32.5)	11.9 (11.7 to 12.2)
Moral injury (MIES: no cut-off, scale range 9–54)	2399	(no cut-off)	15.5 (15.1 to 16.0)

GHQ was measured in the short survey, while the other measures were included in the optional longer survey, hence the difference in numbers completing each.

*Frequencies are unweighted, proportions and means are weighted.

AUDIT, Alcohol Use Disorder Identification Test; GAD-7, seven-item Generalised Anxiety Disorder; GHQ, General Health Questionnaire; MIES, Moral Injury Event Scale; PCL-6, six-item Post-Traumatic Stress Disorder checklist; PHQ-9, nine-item Patient Health Questionnaire.

($n=2166$), with men, those identifying as being from racial and ethnic minority groups, those born outside the EU (including UK), and doctors, other clinical staff and non-clinical staff being less likely than nurses to complete both surveys (see online supplemental table 2 for full details).

Mental health measures

Table 2 shows the prevalence of probable CMDs, measured by the GHQ, with 58.9% (95% CI 58.1 to 60.8) of participants meeting the cut-off score. In terms of secondary outcomes, 23.2% (95% CI 21.3 to 25.8) met the cut-off score for probable anxiety (GAD-7), 27.3% (95% CI 25.3 to 29.4) for probable depression (PHQ-9), 10.5% (95% CI 9.2 to 11.9) for probable alcohol misuse (AUDIT), 30.2% (95% CI 28.1 to 32.5) for probable PTSD (PCL-6) and the sample had a mean score of 15.5 (95% CI 15.1 to 16.0) on the moral injury scale (MIES). A full breakdown of each measure by all demographics is given in online supplemental table 3.

In the past 2 months, 8.5% (95% CI 7.3 to 9.8) of participants had considered taking their own life, while 2.0% (95% CI 1.4 to 2.7) had attempted suicide, and 3.0% (95% CI 2.3 to 3.9) had harmed themselves (see table 3 for full details).

Table 3 Prevalence of suicidal thoughts (CIS-R)*

	N	Yes, in the past 2 months, n (%) (95% CI)	Yes, but not in the past 2 months, n (%) (95% CI)	No, n (%) (95% CI)
Have you ever thought of taking your life, even if you would not really do it?	2487	227 (8.5) (7.3 to 9.8)	526 (19.5) (17.8 to 21.3)	1734 (72.0) (70.0 to 74.0)
Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?	2487	47 (2.0) (1.4 to 2.7)	136 (5.1) (4.2 to 6.2)	2304 (92.9) (91.7 to 94.0)
Have you ever harmed yourself in any way but not with the intention of killing yourself?	2488	75 (3.0) (2.3 to 3.9)	282 (9.6) (8.4 to 10.9)	2131 (87.4) (85.9 to 88.8)

*Frequencies are unweighted, proportions are weighted.
CIS-R, Clinical Interview Schedule.

Logistic regression models

The multivariable logistic regression models showed that the likelihood of meeting the GHQ cut-off score, indicating probable CMDs, was 0.98 (95% CI 0.97 to 0.99) times lower for each increased year of age, adjusting for all other covariates. Males were 0.7 (95% CI 0.5 to 0.9) times less likely to have probable CMDs than females. Nurses were 2.2 (95% CI 1.5 to 3.1) more likely to have probable CMDs than doctors, with other clinical and non-clinical staff also more likely to have probable CMDs than doctors. Those reporting high exposure to potentially morally injurious events were 2.6 (95% CI 2.0 to 3.4) times more likely to report symptoms of probable CMDs than those reporting low exposure (table 4).

These patterns were similar when exploring our secondary outcomes of interest, with older participants and men being less likely to have probable anxiety and PTSD than younger participants and women. Black HCWs were less likely to have probable depression compared with their white peers, while black, Asian and other racial and ethnic minority groups were less likely to engage in alcohol misuse than white HCWs. Doctors were less likely to report symptoms of probable anxiety, depression and PTSD compared with all other groups of HCWs. Those with higher exposure to moral injury were more likely to have probable depression, alcohol misuse and PTSD symptoms. Full details are shown in table 4.

DISCUSSION

Statement of principal findings

Our study found a high prevalence of adverse mental health outcomes among a sample of London-based HCWs during the first wave of the COVID-19 pandemic. Of particular note, we found concerning numbers of HCWs who reported symptoms of PTSD and that higher exposure to moral injury was associated with worse outcomes. We identified groups at higher risk of experiencing poor mental health included women, younger staff and nurses.

Strengths and limitations

The NHS CHECK multisite study provides findings from three different NHS Trusts, including acute and mental health services. The sites are located in London, which had a high regional case burden of COVID-19 during the first wave when recruitment commenced. This study represents a large sample size ($n=4378$) relative to existing literature, with similar demographic characteristics to the overall NHS workforce in terms of age and sex,¹⁸ while London Trusts typically have a higher proportion of staff from racial and ethnic minority groups than other areas of the country, which is represented in our weighted data. We had detailed population-level HR information and were able to estimate response rates and the extent of non-response bias. These are notable methodological strengths compared with existing

Table 4 Weighted multivariable binary logistic regression models of factors associated with adverse mental health outcomes

	Probable common mental disorders OR (95% CI) n=2245	Probable anxiety OR (95% CI) n=2273	Probable depression OR (95% CI) n=2278	Probable alcohol misuse OR (95% CI) n=2112	Probable PTSD OR (95% CI) n=2285
Age	0.98 (0.97 to 0.99)***	0.97 (0.96 to 0.98)***	0.97 (0.96 to 0.98)***	0.99 (0.98 to 1.00)	0.98 (0.97 to 0.99)***
Sex (reference: female)					
Male	0.7 (0.5 to 0.9)**	0.7 (0.5 to 0.9)**	0.8 (0.6 to 1.1)	1.4 (1.0 to 2.0)	0.6 (0.5 to 0.9)**
Other	0.4 (0.1 to 2.7)	1.2 (0.3 to 6.3)	1.0 (0.2 to 4.9)	–	0.3 (0.0 to 2.5)
Prefer not to say	0.3 (0.0 to 3.7)	–	0.28 (0.03 to 2.62)	–	–
Ethnicity (reference: white)					
Black	1.0 (0.7 to 1.4)	1.0 (0.7 to 1.6)	0.6 (0.4 to 0.9)*	0.3 (0.1 to 0.6)**	1.1 (0.7 to 1.6)
Asian	0.8 (0.6 to 1.0)	0.9 (0.6 to 1.3)	0.9 (0.7 to 1.3)	0.3 (0.1 to 0.6)***	0.9 (0.7 to 1.3)
Mixed racial and ethnic minority groups	1.1 (0.7 to 1.8)	1.1 (0.7 to 1.9)	1.1 (0.6 to 1.8)	0.6 (0.3 to 1.2)	1.0 (0.6 to 1.7)
Other racial and ethnic minority groups*	1.3 (0.6 to 3.3)	0.5 (0.2 to 1.4)	1.3 (0.5 to 3.5)	0.3 (0.1 to 0.6)**	0.7 (0.3 to 2.1)
Role (reference: doctor)					
Nurse	2.2 (1.5 to 3.1)***	1.9 (1.2 to 3.1)***	2.3 (1.5 to 3.5)***	1.0 (0.6 to 1.8)	1.9 (1.3 to 2.9)***
Other clinical	1.5 (1.1 to 2.2)**	1.2 (0.7 to 1.9)	1.6 (1.0 to 2.5)*	0.7 (0.4 to 1.3)	1.5 (0.9 to 2.3)
Non-clinical	1.5 (1.1 to 2.2)**	1.8 (1.2 to 2.9)**	2.5 (1.6 to 3.8)***	1.4 (0.8 to 2.3)	1.8 (1.2 to 2.7)**
Moral injury (MIES) score (reference: low)					
Medium	1.3 (1.0 to 1.7) *	1.6 (1.1 to 2.1) **	1.4 (1.0 to 1.8) *	1.4 (0.9 to 2.0)	1.8 (1.4 to 2.4) ***
High	2.6 (2.0 to 3.4) ***	3.0 (2.2 to 4.0) ***	2.9 (2.2 to 3.9) ***	1.7 (1.1 to 2.5) **	4.2 (3.2 to 5.6) ***

Differences within categories are statistically significant at: *p<0.05, **p<0.01, ***p<0.001.

ORs shown are adjusted for all other covariates in each model.

*'Other racial and ethnic minority groups' includes the options 'Arab' and 'any other ethnic background'.

literature that have largely not reported response rates or assessed for related bias.¹⁹ This study was uniquely inclusive in having gathered data from all staff employed by the NHS Trusts, including non-clinical, ancillary, lower paid and temporary staff. To our knowledge, this is also the only study that considers moral injury in the context of COVID-19 in HCWs.

However, there are some limitations. First, despite substantial recruitment efforts as outlined above, the response rate was 12%, and therefore, it is inevitable that findings are open to selection bias, with those for whom the survey had greatest salience (ie, those who were distressed) probably being most likely to participate. We hypothesise that the participation levels may be reflective of HCW burden related to COVID-19, such as work pressures and research/survey fatigue at this time, as well as longer term decline in HCW participation rates in surveys as observed over recent decades.²⁰ We found evidence that participants from some demographic and occupational groups, notably those from racial and ethnic minority groups and men, were less likely to participate. Although we took steps to weight the data for such non-participation, differential participation may lead to inaccuracies in prevalence estimates and hampers generalisability of the results. These concerns are compounded by differential response between our short and long surveys; however, due to the time limitations on HCWs, it was necessary to provide the option to complete only the short survey.

Second, it has also been shown that occupational specific surveys of any given group give rise to higher prevalence of mental health distress compared with population studies that contain sufficient numbers of the same occupational group for analysis, suggesting a possible contextual or framing effect.²¹ Third, given that all three sites were based in London, we have not captured associated national geographical variations. Finally, the data were at this stage cross-sectional, meaning we were unable to look at whether symptoms persist, although as

noted above, these are preliminary data, and 15 additional sites and longitudinal data will follow. Unfortunately, as this study began in response to the COVID-19 pandemic, we do not have pre-COVID-19 baseline data with which to compare our results with, which is a significant limitation.

Comparison with literature

International HCWs

Direct comparison of our findings with other COVID-19 HCW studies is challenging owing to varied methodological quality and heterogeneity of healthcare systems in different countries, which is reflected in the wide range of results published to date. A systematic review of 54 707 HCWs from 59 HCW specific international studies during COVID-19 found median anxiety levels of 24% (range 9%–90%), depression levels of 21% (range 5%–51%) and general psychological distress of 37% (range 7%–97%), although measures and cut-off scores used in the included studies were heterogeneous.²² Compared with the reported median, our results show higher prevalence of poor psychological health, higher levels of depression and similar levels of anxiety.

UK HCWs

In comparison with other UK-based HCW studies, our results show lower levels of anxiety and depression, though higher levels of PTSD. A cross-sectional study (n=1194) using convenience sampling found 47.3% anxiety (using a lower cut-off than us of ≥ 8 on the GAD-7), 46.9% depression (using the same cut-off as us of ≥ 10) and 22.5% PTSD (using a different measure: ITQ²³).²⁴ A different cross-sectional study (n=2773) found levels (using the same cut-off scores of ≥ 10 for the GAD-7 and PHQ9, though a different PTSD measure; IES-R²⁵) of 33.1% for probable anxiety, 28.1% for probable depression and 14.6% for

PTSD symptoms.²⁶ Elevated prevalence of anxiety and depression compared with our study may be attributable to differing sample demographic factors, particularly sex, which was over-represented in these studies.

Previous epidemics

With the notable exception of PTSD, our results are comparable with findings from previous epidemics. A rapid systematic review and meta-analysis of the impact of viral epidemic outbreaks on the mental health of HCWs that included 117 international studies found a pooled prevalence of anxiety (30%), depression (24%) and PTSD (13%).²⁷ The level of probable PTSD in our study (30.2%) was more than double this level; however, Serrano-Ripoll *et al* provide no information about the PTSD measures used in included studies, nor the cut-off scores used, making direct comparisons challenging. We used the recommended cut-off score of ≥ 14 on the PCL-6.¹⁴

General population

Contrasting our results with contemporary non-HCW-specific population-level studies conducted during the COVID-19 pandemic, which use the same measure (GHQ) and cut-off score,⁵ we report higher prevalence of poor general psychological health (58.9%) in HCWs. The Understanding Society (n=17452)⁷ and the UK Household Longitudinal Survey (n=12074)⁵ found prevalence of poor psychological health to be 27.3% and 37.1%, respectively. Prevalence of anxiety and depression symptoms were similar to the 'COVID-19 Social Study' (n=53 328)⁶ and 'Mental health in the UK and COVID-19' study (n=3097),²⁸ which found 24.4% and 26.0% participants, respectively, met the threshold for anxiety and 31.4% and 31.6%, respectively, for depression (using the same measures and cut-off scores as us). However, the demographic profile of these samples (where given) were different to ours, for example, with more men (46.4%) and a higher average age (51 years),⁶ and more white participants (93.6%⁶; 95%⁷).

Associated factors

Notably, some results from population studies large enough to include subsamples of HCWs did not find that HCWs had significantly different mental health to the general population and/or noted that any differences found might be explained by demographic differences between HCWs and the general population.^{7 29} Others show an increase for key workers (samples which included HCWs) of anxiety^{28 30} and depression.³⁰ Similarly, systematic reviews and meta-analyses that compared results from HCW and general population studies found varied results, with some suggesting elevated risk among HCWs,^{31 32} while others did not find any statistically significant difference in depression, anxiety, PTSD and psychological distress related to HCW status.³³ As such, while there is good evidence of increased stress, depression and anxiety across the general population and HCWs, robust evidence is still needed to determine whether the risk of mental ill health is comparatively greater in HCWs.

The odds of having CMDs were greater among women, those of a younger age and in specific occupational roles including nurses, other clinical and non-clinical staff (relative to doctors). Younger age was also associated with increased levels of anxiety, depression and PTSD. Female sex was associated with increased anxiety and PTSD. Nurses and non-clinical staff were disproportionately impacted by anxiety, depression and PTSD. These associations are in-keeping with literature from previous

epidemics²⁷ and COVID-19,^{22 34} whereby female sex, younger age and specific occupational roles (eg, nursing) are associated with increased adverse outcomes. Our findings contribute to this strong and evolving weight of evidence.

Self-harm and suicidality

Our study reported 8.5% of participants had considered taking their own life in the two previous months, while 2.0% had attempted suicide and 3.0% had harmed themselves in the same time period. A contemporary general population study in the UK, COVID-19 Social Study (n=44 775), reported data between March and April 2020 that found 18% experienced thoughts of suicide or self-harm (not directly comparable with our data) and 5% reported self-harm behaviour (higher than our rate).³⁵ A systematic review and meta-analysis (n=25 studies) of doctors conducted prior to the pandemic (1970s–2018) found 17% suicidal ideation and 1% lifetime suicide attempts,³⁶ which is lower than UK population data, at 20.6% suicidal ideation and 6.7% lifetime suicide attempts.³⁷ Overall, while any level of suicide ideation is concerning, our results do not provide evidence for elevated suicidal ideation, or acts of self-harm, compared with the general population; however, it is possible that suicide attempts may be elevated. Interpretation of these findings must be cautious due to a lack of robust comparative data and contextualised with current research findings from high-income countries that have found no population-wide rise in suicide rates due to COVID-19 to date.³⁸

Moral injury

HCWs with high exposure to moral injury had elevated odds of probable CMDs, depression, alcohol misuse and PTSD. This is consistent with concerns during the pandemic³⁹ and previous occupational moral injury literature. A systematic review and meta-analysis, unrelated to COVID-19, that included 13 studies representing 6373 participants found that exposure to potentially morally injurious experiences increased risk of PTSD, depression and suicidality.¹ Although most studies included in the systematic review were from military samples, our study adds to the evidence that there may be an association between exposure to moral injury and mental disorders in HCW populations.

Unanswered questions and future work

The wider NHS CHECK study, from which the data presented here were taken, is collecting data at baseline, with consent from participants to contact them for follow-up data at 6 monthly intervals thereafter, dependent on how the pandemic evolves over time. We have expanded our study population to ensure a broader, more representative geographical spread, and our study now includes 18 sites across England and Wales. In particular, the elevated rates of PTSD identified warrant further investigation in the ongoing study and larger dataset analysis. As data from more sites become available, we will also explore the impact of organisational and social factors on the experiences of staff and mental health outcomes (eg, working practices, perceived support from colleagues and managers, COVID-19 impacts and experiences, and staff support programmes available and used).

Furthermore, although we have used validated mental health questionnaires, questionnaire-based surveys of mental health are case finding, rather than diagnostic tools, which

favour sensitivity over specificity. Occupational self-report measures commonly overestimate rates of ‘caseness’, that is, individuals who are likely to meet true diagnostic criteria and might thus require specific interventions.²¹ Collecting information about distress at a time of great stress means that high proportions of participants reporting difficulties might be expected; however, this is not necessarily indicative of being mentally ill. In particular, we need to know whether these symptoms persist and whether they are associated with a reduction in ability to function at work and home, and other meaningful outcomes, for example, help seeking, reduced desire to remain in their post. Hence, we will be extending the study in a two-stage psychiatric epidemiology design,⁴⁰ using standard psychiatric diagnostic interviews administered by phone with a subsample of participants, in order to distinguish distress from disorder.

We anticipate finishing baseline data collection in December 2020, with follow-up data collection starting at 6 months postbaseline for each individual participant. We will continue to increase response rates through extra engagement tools, including: new PPI initiatives, further work with trade union representatives, offering incentives to participants and ensuring paper surveys are available in addition to the online version. We will also focus on engaging with racial and ethnic minority groups to address the relatively reduced participation rate and completion of the longer component of the survey by forming partnerships with those experienced in such engagements. Inclusion of an ethnicity-focused module at 8 months will help capture inequalities in mental health and occupational outcomes.

Implications

HCWs are experiencing a high burden of adverse mental health outcomes during the COVID-19 pandemic, and some demographic and occupational groups are more vulnerable than others. The mental health offering to HCWs must therefore consider the overlap of these factors. For example, our findings indicate that young female nurses may be more vulnerable to adverse mental health outcomes and therefore may benefit from targeted support.

Despite the high levels reported by our study and others, there remains uncertainty about whether HCWs have worse COVID-19 related mental health outcomes compared with the general population. We urge additional research that emphasises quality and methodological rigour, namely with use of standardised diagnostic interviews with a defined sampling frame. In doing so, the mental health offer will be better able to avoid pathologising ordinary distress responses, identify those most at risk and provide necessary support.

CONCLUSION

Our preliminary data indicate that continued monitoring of HCWs is vital in order to identify those groups most at risk of adverse mental health outcomes. Longitudinal data and diagnostic interviews will be needed to pick apart mental disorders from normal distress responses and ensure appropriate support is provided to those most in need. Our findings suggest that it is not only the clinical staff who may need support, but the full range of HCWs contributing to the pandemic effort.

Author affiliations

¹Department of Applied Health Research, University College London, London, UK
²Maudsley NHS Foundation Trust, London, UK

³Academic Department of Military Mental Health, King’s College London, London, UK
⁴Department of Psychological Medicine, King’s College London, London, UK
⁵Department of Biostatistics and Health Informatics, King’s College London, London, UK
⁶National Institute of Health Research Biomedical Research Centre, London, UK
⁷Life Sciences and Medicine, King’s College London, London, UK
⁸Guy’s and St Thomas’ NHS Foundation Trust, London, UK
⁹Institute of Psychiatry, Psychology & Neuroscience, King’s College London, London, UK
¹⁰Adult Nursing, King’s College London, London, UK
¹¹Mental Health Liaison Team, King’s College London, London, UK
¹²University Hospitals of Leicester NHS Trust, Leicester, UK
¹³Devon Partnership NHS Trust, Exeter, UK
¹⁴Avon & Wiltshire Mental Health Partnership NHS Trust, Bristol, UK
¹⁵Nottinghamshire Healthcare NHS Foundation Trust, Nottingham, UK
¹⁶Cornwall Partnership Foundation NHS Trust, Cornwall, UK

Acknowledgements We are especially grateful to all the participants who took part in the study. We would also like to extend our thanks to Haifa Issa, Dr Howard Burdett, Melanie Chesnokov, the medical students who helped to recruit participants at the research sites and all National Health Service (NHS) staff who promoted NHS CHECK. We would also like to thank the TIDES study team for their support and collaboration. RoR and DLa are supported by the National Institute for Health Research (NIHR) Applied Health Research North Thames (NIHR ARC North Thames).

Contributors DLa and SG wrote the first draft of the manuscript. DLa and EC carried out data analysis. RB managed the study. SAMS, SW, NG, MH, ReR and RoR are cochief investigators. SC, AD, MD, SD, SG, SLH, CWJ, DLa, DLe, IMa, SM, IMC, AMR, MP and CP are coinvestigators. PA, VF, HG, JM-B, RH and CS are site leads. DS designed the data collection tool. All authors contributed edits to the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Funding NHS CHECK has received funding from the following organisations and charities for the period of data collection reported in this manuscript: National Institute for Health Research Maudsley Biomedical Research Centre, King’s College London; Rosetrees Trust; and the National Institute for Health Research Health Protection Research Unit in Emergency Preparedness and Response at King’s College London. The funders had no role in the design, analysis, interpretation or decision to submit this paper. The joint first authors had full access to the data in the study and had final responsibility, with endorsement from the joint last authors (SW and SAMS), for the decision to submit the paper for publication. The views expressed are the views of the authors and do not necessarily represent the views of their organisations or funding sources.

Disclaimer This funder had no role in study design, data collection, data analysis, data interpretation or writing of the report. The views expressed in this article are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care. The views expressed are the views of the authors and do not necessarily represent the views of their organisations or funding sources.

Competing interests RoR reports grants from DHSC/UKRI/ESRC COVID-19 Rapid Response Call, grants from Rosetrees Trust, grants from King’s Together rapid response call, grants from UCL (Wellcome Trust) rapid response call, during the conduct of the study; grants from Innovative Medicines Initiative and EFPIA, RADAR-CNS consortium, grants from MRC, grants from NIHR, outside the submitted work. SH reports grants from NIHR, grants from Wellcome Trust, grants from ESRC, grants from Guy’s and St. Thomas’ Charity, grants from MRC, grants from UKRI, outside the submitted work; and a member of the following advisory groups: The Health Foundation – COVID-19 Research Programme Panel, NHS England and NHS Improvement – Patient and Carers Race Equalities Framework (PCREF) Steering Group, NHS England and NHS Improvement – Advancing Mental Health Equalities Taskforce, Health Education England – Mental Health Workforce Equalities Subgroup, Maudsley Learning – Maudsley Learning Advisory Board, South London and Maudsley NHS Foundation Trust (SLaM) – Independent Advisory Groups, the SLaM Partnership Group, Lambeth Public Health – Serious Youth Violence Public Health Task and Finish Group, NHS England – Workforce Race Equality Standard Advisory Group, Thrive London – Thrive London Advisory Board, Black Thrive – Black Thrive Advisory Board. Commissions: Welsh Government’s Race Equality Plan; contribution to the evidence review for Health and Social Care and Employment and Income policy areas. SAMS reports grants from UKRI/ESRC/DHSC, grants from UCL, grants from UKRI/MRC/DHSC, grants from Rosetrees Trust, grants from King’s Together Fund, during the conduct of the study. NG reports a potential COI with NHSEI, during the conduct of the study; and the managing director of March on Stress Ltd, which has provided training for a number of NHS organisations although NG is not clear if the company has delivered training to any of the participating trusts or not as NG does not get directly involved in commissioning specific pieces of work.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data may be available on request to the corresponding author.

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ORCID iDs

Danielle Lamb <http://orcid.org/0000-0003-1526-9793>

Ewan Carr <http://orcid.org/0000-0002-1146-4922>

Sarah Dorrington <http://orcid.org/0000-0002-6462-1880>

Ira Madan <http://orcid.org/0000-0003-2200-7329>

Sharon A M Stevelink <http://orcid.org/0000-0002-7655-7986>

Simon Wessely <http://orcid.org/0000-0002-6743-9929>

REFERENCES

- Williamson V, Stevelink SAM, Greenberg N. Occupational moral injury and mental health: systematic review and meta-analysis. *Br J Psychiatry* 2018;212:339–46.
- Brooks SK, Dunn R, Amlöt R, et al. A systematic, thematic review of social and occupational factors associated with psychological outcomes in healthcare employees during an infectious disease outbreak. *J Occup Environ Med* 2018;60:248–57.
- Lung F-W, Lu Y-C, Chang Y-Y, et al. Mental symptoms in different health professionals during the SARS attack: a follow-up study. *Psychiatr Q* 2009;80:107–16.
- Wu P, Fang Y, Guan Z, et al. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Can J Psychiatry* 2009;54:302–11.
- Daly M, Sutin A, Robinson E. Longitudinal changes in mental health and the COVID-19 pandemic: Evidence from the UK Household Longitudinal Study [Internet]. *PsyArXiv* 2020.
- Fancourt D, Steptoe A, Bu F. Trajectories of depression and anxiety during enforced isolation due to COVID-19: longitudinal analyses of 59,318 adults in the UK with and without diagnosed mental illness. *medRxiv* 2020.
- Pierce M, Hope H, Ford T, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry* 2020;7:883–92.
- Pierce M, McManus S, Jessop C, et al. Says who? the significance of sampling in mental health surveys during COVID-19. *Lancet Psychiatry* 2020;7:567–8.
- Office for National Statistics. Death registrations and occurrences by local authority and health board. U Office for National Statistics; 2020. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/datasets/deathregistrationsandoccurrencesbylocalauthorityandhealthboard> [Accessed 29/11/20].
- Goldberg DP, Hillier VF. A scaled version of the general health questionnaire. *Psychol Med* 1979;9:139–45.
- Spitzer RL, Kroenke K, Williams JBW, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 2006;166:1092–7.
- Kroenke K, Spitzer RL, Williams JBW. The PHQ-9. *J Gen Intern Med* 2001;16:606–13.
- Babor TF, Fuente J, Saunders J, et al. The Alcohol Use Disorders Identification Test [Internet]. World Health Organisation, 2001. Available: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.505.4146&rep=rep1&type=pdf>
- Lang AJ, Stein MB. An abbreviated PTSD checklist for use as a screening instrument in primary care. *Behav Res Ther* 2005;43:585–94.
- Nash WP, Marino Carper TL, Mills MA, et al. Psychometric evaluation of the moral injury events scale. *Mil Med* 2013;178:646–52.
- Lewis G, Pelosi AJ, Araya R, et al. Measuring psychiatric disorder in the community: a standardized assessment for use by lay interviewers. *Psychol Med* 1992;22:465–86.
- Pfeffermann D. The use of sampling weights for survey data analysis. *Stat Methods Med Res* 1996;5:239–61.
- NHS Digital. NHS Workforce Statistics - August 2020 [Internet]. Available: <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-workforce-statistics/august-2020> [Accessed 30 Nov 2020].
- Lamb D, Greenberg N, Stevelink SAM, et al. Mixed signals about the mental health of the NHS workforce. *Lancet Psychiatry* 2020;7:1009–11.
- Cook JV, Dickinson HO, Eccles MP. Response rates in postal surveys of healthcare professionals between 1996 and 2005: an observational study. *BMC Health Serv Res* 2009;9:160.
- Goodwin L, Ben-Zion I, Fear NT, et al. Are reports of psychological stress higher in occupational studies? A systematic review across occupational and population based studies. *PLoS One* 2013;8:e78693.
- Muller AE, Hafstad EV, Himmels JPW, et al. The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: a rapid systematic review. *Psychiatry Res* 2020;293:113441.
- Cloitre M, Shevlin M, Brewin CR, et al. The International trauma questionnaire: development of a self-report measure of ICD-11 PTSD and complex PTSD. *Acta Psychiatr Scand* 2018;138:536–46.
- Greene T, Harju-Seppänen J, Adeniji M. Predictors and rates of PTSD, depression and anxiety in UK frontline health and social care workers during COVID-19. *medRxiv* 2020.
- Wilson JP, Tang CS. *Cross-cultural assessment of psychological trauma and PTSD* [Internet. New York, NY: Springer, 2007.
- Gillien J, Santaolalla A, Valdearenas L. *The Impact of the COVID-19 Pandemic on the Mental Health and Wellbeing of UK Healthcare Workers* [Internet. Rochester, NY: Social Science Research Network, 2020.
- Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis. *J Affect Disord* 2020;277:347–57.
- Jia R, Ayling K, Chalder T, et al. Mental health in the UK during the COVID-19 pandemic: cross-sectional analyses from a community cohort study. *BMJ Open* 2020;10:e040620.
- Kwong ASF, Pearson RM, Adams MJ. Mental health during the COVID-19 pandemic in two longitudinal UK population cohorts [Internet]. *Psychiatry and Clinical Psychology* 2020.
- Murphy J, Spikol E, McBride O. The psychological wellbeing of frontline workers in the United Kingdom during the COVID-19 pandemic: First and second wave findings from the COVID-19 Psychological Research Consortium (C19PRC) Study [Internet]. *PsyArXiv* 2020.
- da Silva FCT, Neto MLR. Psychiatric symptomatology associated with depression, anxiety, distress, and insomnia in health professionals working in patients affected by COVID-19: a systematic review with meta-analysis. *Prog Neuropsychopharmacol Biol Psychiatry* 2021;104:110057.
- Krishnamoorthy Y, Nagarajan R, Saya GK, et al. Prevalence of psychological morbidities among general population, healthcare workers and COVID-19 patients amidst the COVID-19 pandemic: a systematic review and meta-analysis. *Psychiatry Res* 2020;293:113382.
- Cénat JM, Blais-Rochette C, Kokou-Kpolou CK, et al. Prevalence of symptoms of depression, anxiety, insomnia, posttraumatic stress disorder, and psychological distress among populations affected by the COVID-19 pandemic: a systematic review and meta-analysis. *Psychiatry Res* 2021;295:113599.
- Pappa S, Ntella V, Giannakas T, et al. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav Immun* 2020;88:901–7.
- Iob E, Steptoe A, Fancourt D. Abuse, self-harm and suicidal ideation in the UK during the COVID-19 pandemic. *Br J Psychiatry* 2020;217:543–6.
- Dutheil F, Aubert C, Pereira B, et al. Suicide among physicians and health-care workers: a systematic review and meta-analysis. *PLoS One* 2019;14:e0226361.
- McManus S, Hassiotis A, Jenkins R. Suicidal thoughts, suicide attempts, and self-harm 2014:29.
- John A, Pirkis J, Gunnell D, et al. Trends in suicide during the covid-19 pandemic. *BMJ* 2020;371:m4352.
- Greenberg N, Brooks SK, Wessely S, et al. How might the NHS protect the mental health of health-care workers after the COVID-19 crisis? *Lancet Psychiatry* 2020;7:733–4.
- Dunn G, Pickles A, Tansella M, et al. Two-Phase epidemiological surveys in psychiatric research. *Br J Psychiatry* 1999;174:95–100.
- Office for National Statistics. Death registrations and occurrences by local authority and health board [Internet]. Office for National Statistics, 2020. Available: <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/datasets/deathregistrationsandoccurrencesbylocalauthorityandhealthboard> [Accessed 29 Nov 2020].

Supplementary tables

Supplementary table 1 Weighted and unweighted socio-demographics (n=4,378)

Variable	n	Unweighted %	Weighted %
Age (years)			
≤30	985	23.8	24.2
31-40	1,138	27.5	30.7
41-50	979	23.7	23.5
51-60	861	20.8	20.8
≥61	171	4.1	4.1
Sex			
Female	3,485	80.3	74.8
Male	833	19.2	24.6
Other	6	0.1	0.2
Prefer not to say	18	0.4	0.5
Relationship status			
Married/Civil partnership	1,827	42.3	42.2
Co-habiting/in a relationship	1,129	26.1	23.2
Divorced/separated/widowed	251	5.8	6.3
Single	1,114	25.8	28.3
Ethnicity			
White	3,263	74.5	53.5
Black/African/Caribbean/Black British	373	8.5	20.8
Asian/Asian British	482	11.0	17.4
Mixed/Multiple racial and ethnic minority groups	173	4.0	3.8
Other racial and ethnic minority groups ^a	90	2.1	4.5
Country of birth			
UK	2,974	68.9	61.0
EU not UK)	525	12.2	9.8
Other	815	18.9	29.2
Length of time living in the UK			
<1-2 years	106	8.0	7.8
3-5 years	163	12.2	10.9
6-10 years	210	15.8	14.5
11-20 years	404	30.3	32.5
21-29 years	223	16.7	17.1
>30 years	220	16.5	16.5
Prefer not to say	7	0.5	0.7
Main role			
Doctor	557	12.9	12.8
Nurse	1,108	25.6	26.7
Other clinical	1,306	30.2	28.3
Non-clinical	1,358	31.4	32.3

^a 'Other racial and ethnic minority groups' includes the options 'Arab' and 'Any other ethnic background'.

Supplementary table 2 Socio-demographics of short-survey-only and short-and-long-survey participants

Variable	Short-survey only n (%) ^a	Short- and long-survey n (%) ^a	Significant differences p=
Age (years)			
	≤30	464 (23.4)	0.31
	31-40	574 (31.0)	
	41-50	522 (24.9)	
	51-60	419 (16.7)	
	≥61	86 (4.0)	
Sex			
	Female	1,691 (72.1)	0.001
	Male	473 (27.5)	
	Other	1 (<1)	
	Prefer not to say	10 (<1)	
Relationship status			
	Married/Civil partnership	930 (42.3)	0.24
	Co-habiting/in a relationship	538 (21.9)	
	Divorced/separated/widowed	128 (6.8)	
	Single	566 (29.1)	
Ethnicity			
	White	1,530 (48.4)	<0.0001
	Black/African/Caribbean/Black British	219 (22.7)	
	Asian/Asian British	283 (20.0)	
	Mixed/Multiple racial and ethnic minority groups	83 (3.5)	
	Other racial and ethnic minority groups ^b	55 (5.3)	
Country of birth			
	UK	1,440 (58.2)	0.0007
	EU (not UK)	267 (9.6)	
	Other	454 (32.2)	
Length of time living in the UK			
	<1-2 years	59 (8.1)	0.49
	3-5 years	85 (10.9)	
	6-10 years	102 (12.9)	
	11-20 years	230 (33.9)	
	21-29 years	120 (17.1)	
	>30 years	117 (16.2)	
	Prefer not to say	5 (1.0)	2 (<1)
Main role			
	Doctor	316 (13.9)	0.001
	Nurse	479 (23.7)	
	Other clinical	691 (29.7)	
	Non-clinical	677 (32.8)	

^a Numbers are unweighted, proportions are weighted.

^b 'Other racial and ethnic minority groups' includes the options 'Arab' and 'Any other ethnic background'.

Supplementary table 3 Prevalence of mental health outcomes by socio-demographic factors^a

Characteristic	Probable common mental disorders % (95%CI)	Probable anxiety % (95%CI)	Probable depression % (95%CI)	Probable alcohol misuse % (95%CI)	Probable PTSD % (95%CI)	Perceived moral injury Mean (95%CI)
Age years)	n=3,785***	n=2,369***	n=2,368***	n=2,219	n=2,351***	n=2,304 **
≤30	67.5 [63.8, 70.9]	31.3 (27.0, 35.9)	35.3 (30.9, 40.1)	11.7 (9.1, 15.0)	35.8 (31.4, 40.5)	16.0 (15.2, 16.8)
31-40	60.8 [57.2, 64.2]	24.2 (20.6, 28.1)	30.6 (26.6, 34.8)	11.0 (8.7, 13.9)	32.3 (28.3, 36.5)	15.9 (15.0, 16.7)
41-50	58.5 [54.4, 62.4]	22.0 (18.0, 26.5)	23.6 (19.6, 28.2)	9.2 (7.0, 12.1)	30.6 (25.9, 35.7)	15.6 (14.7, 16.5)
51-60	49.9 [45.6, 54.2]	17.7 (13.9, 22.3)	20.7 (16.7, 25.3)	10.0 (7.3, 13.5)	21.9 (17.8, 26.6)	14.5 (13.7, 15.2)
≥61	43.0 [33.1, 53.5]	6.8 (3.4, 13.1)	12.7 (7.4, 20.9)	8.9 (4.4, 17.2)	19.3 (11.2, 31.3)	14.4 (12.5, 16.2)
Sex	n=3,965***	n=2,471*	n=2,466	=2,308	n=2,447**	n=2,399
Female	62.2 (60.2, 64.3)	24.8 (22.6, 27.1)	28.8 (26.5, 31.2)	9.5 (8.2, 11.0)	32.4 (30.0, 35.0)	15.3 (14.9, 15.7)
Male	48.7 (44.5, 52.9)	18.2 (14.4, 22.7)	22.5 (18.4, 27.3)	13.8 (10.7, 17.6)	23.6 (19.2, 28.5)	16.3 (15.3, 17.4)
Other	58.6 (19.3, 89.3)	32.3 (7.0, 75.0)	32.3 (7.1, 75.0)	0	15.9 (2.0, 63.5)	19.2 (9.7, 28.8)
Prefer not to say	67.0 (34.7, 88.6)	23.9 (4.9, 65.7)	30.2 (7.5, 70.0)	0	9.8 (1.2, 50.4)	14.1 (9.1, 19.1)
Relationship status	n=3,953	n=2,463*	n=2,459***	n=2,301***	n=2,440***	n=2,392**
Married/Civil partnership	55.7 (52.8, 58.5)	20.0 (17.2, 23.0)	21.9 (19.1, 25.0)	8.6 (7.0, 10.6)	25.1 (22.1, 28.4)	14.9 (14.3, 15.5)
Co-habiting/in a relationship	61.3 (57.7, 64.8)	26.5 (22.9, 30.5)	30.4 (26.5, 34.5)	14.2 (11.5, 17.6)	34.8 (30.7, 39.2)	15.6 (14.8, 16.3)
Divorced/separated/widowed	59.8 (51.5, 67.6)	21.4 (14.6, 30.1)	23.3 (16.4, 32.0)	3.6 (1.6, 7.7)	39.7 (30.1, 50.1)	16.3 (14.8, 17.8)
Single	61.9 (58.2, 65.4)	25.6 (21.6, 30.1)	33.7 (29.3, 38.4)	11.4 (8.8, 14.5)	32.1 (27.8, 36.6)	16.4 (15.5, 17.3)
Ethnicity	n=3,958	n=2,466	n=2,461	n=2,303***	n=2,442	n=2,394***
White	59.6 (57.6, 61.4)	22.6 (20.7, 24.7)	27.5 (25.4, 29.7)	14.5 (12.8, 16.4)	29.5 (27.3, 31.7)	14.9 (14.5, 15.4)
Black/African/Caribbean/Black British	58.4 (52.8, 63.9)	24.7 (18.5, 32.1)	21.9 (16.0, 29.1)	4.1 (1.9, 8.4)	31.1 (24.3, 38.97)	15.3 (14.1, 16.4)
Asian/Asian British	55.9 (50.8, 60.8)	24.2 (18.9, 30.5)	30.6 (24.6, 37.2)	4.9 (2.5, 9.3)	32.1 (26.1, 38.8)	18.0 (16.5, 19.5)
Mixed/Multiple ethnic groups	65.8 (57.7, 73.0)	26.4 (18.3, 36.5)	31.3 (22.4, 41.7)	8.7 (4.3, 16.9)	33.2 (24.2, 43.5)	15.5 (13.8, 17.1)
Other racial and ethnic minority groups	59.6 (46.7, 71.3)	17.0 (8.4, 31.5)	33.3 (18.9, 51.7)	0	25.8 (13.4, 43.9)	16.3 (13.4, 19.2)
Country of birth	n=3,943	=2,456	n=2,451	n=2,293***	n=2,432	n=2,385
UK	58.7 (56.5, 60.9)	22.7 (20.5, 25.0)	26.0 (23.7, 28.4)	13.0 (11.4, 14.9)	29.1 (26.7, 31.7)	15.2 (14.8, 15.7)
EU not UK)	63.9 (59.1, 68.4)	23.6 (18.8, 29.3)	29.7 (24.4, 35.7)	7.1 (4.4, 11.4)	33.5 (27.7, 39.8)	16.2 (15.0, 17.3)

	Other	58.0 (53.7, 62.2)	24.5 (19.8, 29.8)	29.5 (24.6, 35.0)	4.8 (3.1, 7.3)	32.0 (28.1, 32.5)	16.1 (15.1, 17.2)
Length of time living in the UK		n=1,176	n=674	n=672	n=627	n=666	n=646**
	<1-2 years	69.4 (58.4, 78.6)	29.1 (17.4, 44.4)	40.3 (27.0, 55.2)	7.0 (2.9, 16.3)	34.8 (22.5, 49.6)	18.4 (15.3, 21.5)
	3-5 years	68.7 (59.8, 76.5)	27.1 (18.6, 37.6)	28.6 (19.8, 39.3)	4.4 (1.8, 10.5)	26.8 (18.4, 37.4)	17.8 (15.2, 20.3)
	6-10 years	57.6 (49.4, 65.4)	25.6 (17.8, 35.4)	29.7 (21.5, 39.5)	8.3 (4.3, 15.3)	29.7 (21.4, 39.7)	16.0 (13.7, 18.3)
	11-20 years	60.5 (54.3, 66.5)	24.2 (17.5, 32.6)	27.1 (20.4, 35.0)	5.3 (2.8, 9.9)	37.7 (29.8, 46.2)	16.0 (14.4, 17.5)
	21-29 years	55.1 (46.6, 63.3)	20.2 (13.0, 30.1)	32.8 (23.0, 44.4)	5.7 (2.5, 12.5)	26.2 (17.8, 36.9)	15.6 (13.9, 17.2)
	>30 years	50.8 (42.4, 59.2)	19.1 (11.6, 29.9)	23.2 (14.5, 35.0)	2.4 (0.8, 7.3)	30.0 (20.3, 42.0)	14.5 (13.1, 15.9)
	Prefer not to say	61.5 (20.0, 91.1)	35.0 (4.6, 85.6)	35.1 (4.7, 85.7)	7.0 (2.9, 16.3)	70.7 (17.9, 96.4)	14.6 (10.0, 19.1)
Main role		n=3,964 ***	n=2,480 ***	n=2,465***	n=2,307	n=2,446***	n=2,398**
	Doctor	46.9 (41.8, 52.0)	13.6 (9.7, 18.9)	15.4 (11.4, 20.4)	10.2 (6.9, 14.8)	18.3 (13.8, 23.8)	14.4 (13.4, 15.4)
	Nurse	68.1 (64.6, 71.3)	30.2 (26.3, 34.5)	33.1 (29.0, 37.4)	10.2 (8.0, 12.8)	36.5 (32.3, 40.9)	17.4 (16.5, 18.3)
	Other clinical	59.5 (56.1, 62.9)	19.5 (16.3, 23.2)	24.0 (20.5, 28.2)	8.2 (6.3, 10.7)	29.0 (25.2, 33.3)	15.2 (14.4, 16.0)
	Non-clinical	55.6 (52.2, 59.1)	23.8 (20.4, 27.5)	29.3 (25.6, 33.2)	12.6 (10.2, 15.5)	30.0 (28.1, 32.5)	14.6 (14.0, 15.3)

a Numbers are unweighted, proportions are weighted.

Differences within categories are statistically significant at: *p<0.05, **p<0.01, ***p<0.001