

The impact of the COVID-19 pandemic on the mental health and wellbeing of UK healthcare workers

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Word count: 3982

Number of tables: 5 tables

Number of figures: 1

Abstract

Background

The COVID-19 pandemic has had a significant psychological impact on healthcare workers (HCW).

Aims

There is an urgent need to understand the risk and protective factors associated with poor mental wellbeing of UK HCW working during the COVID-19 pandemic.

Method

Shortly after the April 2020 UK COVID-19 peak 2,773 HCWs completed a survey containing measures of anxiety, depression, PTSD, stress, as well as questions around potential predictors such as roles, COVID-19 risk perception and workplace-related factors. Respondents were classified as high or low symptomatic on each scale and logistic regression revealed factors associated with severe psychiatric symptoms. Change in wellbeing from pre to during COVID-19 was also quantified.

Results

Nearly a third of HCWs reported the most severe levels of anxiety and depression, and the number reporting very high symptoms was more than quadruple that pre-COVID-19. Several controllable factors were associated with the most severe level of psychiatric symptoms: insufficient PPE availability, workplace preparation, training and communication, and higher workload. Being female, 'frontline', previous psychiatric diagnoses, traumatic events, and being an allied HCW or manager were also significantly associated with severe psychiatric symptoms. Sharing stress, resilience, and ethical support for treatment decisions were significantly associated with low psychiatric symptoms. Frontline workers showed greater worsening of mental health compared to non-frontline HCWs.

Conclusions

Together, poor mental wellbeing was prevalent during the COVID-19 response and controllable factors associated with severe psychiatric symptoms are available to be

targeted to reduce the detrimental impact of COVID-19 and other pandemics on HCW mental health.

Introduction

The rapid transmission rates and clinical severity of COVID-19 on patient health have brought global national health systems and their healthcare workers (HCWs) under considerable pressure. Whilst HCWs already experience high levels of job-related stress (1) and are at risk of poor psychological wellbeing (2), their highly-demanding work (3) will be exacerbated during a pandemic increasing risk of 'burnout' (4), poorer quality of care (5) and risk of developing other mental health problems (2). During epidemics, it has been shown that worse HCW mental health is associated with contact with infected people; redeployment; inadequate training; existing mental health disorders (6,7) and 'moral injury' (distress from being unable to provide treatment) (8); while better support, protective equipment, clear communication (6,9) and resilience (10) may protect mental health. The COVID-19 pandemic presents additional novel and specific challenges and risks to HCW mental wellbeing as they carry out their roles and responsibilities.

An initial study conducted in China early on in the COVID-19 pandemic found that HCW working during COVID-19 experienced a high prevalence of severe depression, anxiety and PTSD. Those were female, young, 'frontline', and working in Wuhan, were factors most associated with severe psychiatric symptoms (11). Since then, COVID-19 has also had a profound effect on the UK health system, and while some recent work has shown there is a significant impact on UK healthcare workers mental wellbeing (12–14), there is a need for additional and more comprehensive research to fully characterise the impact of the COVID-19 pandemic - and this objective warrants urgent attention (15). Identifying factors associated with working during COVID-19 which are detrimental to mental health can provide targets by which their impact on HCW mental well-being may be mediated. This may, in turn, help maintain the efficacy of healthcare systems.

Research to date has largely been in smaller HCW cohorts, outside the UK, and not included consideration of COVID-19-relevant risk factors, or only a limited range

potential risk factors, which may affect HCW mental health. This study aimed to address these shortfalls and provide a comprehensive examination of the mental health of a large cohort of UK HCW and how it has been affected by the COVID-19 pandemic by: 1) quantifying the prevalence of severe psychiatric symptoms in UK HCW shortly after the initial UK COVID-19 peak; 2) identifying factors significantly associated with these symptoms; 3) quantifying how mental health changed compared to before COVID-19; 4) quantifying HCW worries; and 5) revealing whether frontline, London-based, ethnic minorities, HCW, and those making challenging moral/medical decisions, had more severe psychiatric symptoms compared to their counterparts.

Method

Design

We report cross-sectional baseline data acquired shortly after the peak of the COVID-19 pandemic in the UK (between 22nd April and 10th May 2020 inclusive (see supplementary materials S1)) from an on-going, survey-based, longitudinal cohort study. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the University of Roehampton Ethics Committee (REF: PSYCH 20/361) and the UK Health Research Authority.

Participants and survey dissemination

An online web-based survey, outlined below, was open to all UK HCWs to complete. Specific survey dissemination was done as follows (see also supplementary materials S2). The study synopsis survey and weblink was shared through clinical networks, social media and a study webpage and all NHS R&D departments in the UK were contacted and asked to disseminate the survey synopsis and weblink to staff. Within the planned study period, 52 NHS services (see supplementary materials S2) specifically agreed to promote the study to staff either through direct circular emails, staff intranet, or both. Additionally, text in the synopsis and survey encouraged

respondents to share the survey link with other healthcare professionals. The study invitation text strongly encouraged all HCW to take part even if they did not feel affected by the impact of COVID-19. Eligible respondents were UK-based HCWs who were 18 years or older. Written informed consent was obtained from all subjects.

The survey was implemented on the Qualtrics platform and cross-sectional data on the following were collected:

1. Validated mental health scales measuring four symptom domains: The PHQ-9 (16) (Patient Health Questionnaire) measures depressive symptoms in the last 2 weeks; the GAD-7 (17) (General Anxiety Disorder-7) measures anxiety over the previous 2 weeks. The 22-item IES-R (18) (Impact of event scale – revised) measures PTSD symptoms over the past 7 days; and the PSS (19) (Perceived Stress Scale) measures perception of stress over the past month. Only individuals who had experienced a stressful or traumatic event *related to* COVID-19 were administered the IES-R. Also, the CD-RISC (Connor-Davidson Resilience Scale)(20) was administered which measures resilience.

2. Questions addressing potential factors (see supplementary materials S3) associated with psychiatric symptoms were identified using a knowledge-based approach built on scientific literature, through focus groups, study team meetings, and survey piloting feedback. The items included could be clustered within the following themes: (a) Demographics and roles including working on the ‘frontline’ (directly engaged in diagnosing, treating, or caring for patients); (b) Workplace readiness and preparation; (c) Risk management including Personal Protective Equipment (PPE); (d) Experience of traumatic and stressful events; (e) Protective: being able to share stress at work.

3. Respondents also quantified their level of current worry on items concerning their work, personal lives and COVID-19 using a 10-point Likert scale (see supplementary S3 section G and S10).

4. Additionally, ratings were made for items concerning wellbeing, worries and views about work (on a 5-point Likert scale) *during* COVID-19 (at survey completion) and *pre* COVID-19 i.e. retrospectively. These items were again selected from focus groups, study team meetings, and survey piloting feedback and included anxiety, depression, and stress items (see supplementary materials S3 (section F) and table 5).

Data analysis

Analyses were conducted to (i) determine the prevalence of high levels of psychiatric symptoms, (ii) reveal the factors positively or negatively associated with high levels of psychiatric symptoms, and (iii) quantify change in mental health from before COVID, and to investigate group differences in psychiatric symptoms.

Prevalence of high psychiatric symptoms

'High symptoms' of depression and anxiety were determined by individuals scoring ≥ 10 on the PHQ and GAD scales ('moderate' and 'severe' symptoms). Severe stress was classified by a PSS score ≥ 24 (upper quartile) and an IES-R score of ≥ 26 was used to classify high PTSD symptoms.

Factors associated with high psychiatric symptoms

The relationship between 'high' levels of each symptom and potential predictive factors was determined with chi-square analyses. Stepwise multivariable logistic regression analyses for each symptom domain ('high symptoms' vs not) were then performed and included the factors that were significant in chi-square analyses (0.05 significance level to enter / stay in the model).

Change in mental health and group differences

Repeated-measures ANOVA were used to quantify change in wellbeing from *pre* to *during* COVID-19 for the whole cohort, and to examine between-group differences. Stratified analyses were also conducted (i) to reveal whether frontline (FL) vs non-frontline (NFL), ethnic minorities (see table 1 for ethnicity descriptions; vs non-ethnic

minorities) workers, and those making challenging medical decisions (vs not) had higher psychiatric symptoms than their counterparts; and (ii) to compare level of current worries between FL and NFL. Partial η^2 was used as a measure of the effect size for repeated-measures ANOVA. Cut-offs for small, medium and large effect sizes were .0099, .0588, and .1379, respectively (21,22). Analyses were conducted in SAS 9.4 (SAS Institute Inc.) and SPSS v25 (IBM Corp., Armonk, N.Y., USA).

Results

Participant demographics and roles

3379 participants consented. Non-HCW and those who completed <70% of the survey were excluded leaving 2773 respondents (see table 1 for main descriptive statistics and supplementary tables S4-7).

---- Table 1 here ----

Prevalence of high psychiatric symptoms

Table 2 shows cohort psychiatric symptoms. 28.1% (374) were above the cut-off for high depression, 33.1% (919) for high anxiety; and 27.5% (750) were in the top quartile for stress (see table). 60.6% (1681) had experienced a stressful or traumatic event related to COVID-19 and 14.6% (404) were above the cut-off for high PTSD symptoms.

---- Table 2 here ----

Predictive models of high psychiatric symptoms

All stepwise multivariate logistic regression models converged with no significant collinearity of factors, or residual data due to missingness. All models were highly significant (likelihood ratio, core, and Wald $p < .0001$) presenting good fit and high prediction capabilities (c score = 0.739 – 0.82). Significant factors retained in each model of symptoms with odds ratios are shown in table 3 and reported below.

Frequency distributions are shown in table 4; chi-square summaries are reported in supplementary materials S8.

---- Table 3 here ----

---- Table 4 here ----

Anxiety

As shown in table 3, high anxiety was significantly associated with being female, all non-doctor roles (vs doctor), working outside London, being frontline, and having a mental health diagnosis. Friends or family dying from COVID-19, patients asking if they are going to die, and performing resuscitation were also associated with high anxiety, as were insufficient training, extra workload, insufficient information and thinking not enough is currently being done to reduce risk.

PTSD symptoms

All non-doctor (vs doctor) roles - particularly being a manager, and being FL, being from an ethnic minority, and existing mental health conditions were significantly associated with high PTSD symptoms, as did experience of all traumatic and stressful events except aftercare of the deceased. High PTSD symptoms were also significantly associated with pressure to re-use PPE; insufficient information; perception that not enough had been, nor was being done, to reduce risk; and greater workload.

Depression

High depression was significantly associated with being female, all non-doctor roles (vs doctor), working outside London, and having a mental health diagnosis. Those experiencing friends or family dying, patients asking them if they are going to die, and performing aftercare for the deceased were significantly more likely to be in the high depression group. Extra workload, pressure to work without PPE, insufficient

information and perception that not enough had been done to reduce risk were also significantly associated with high depression.

Stress

Being female, older (55-64 years vs <25), all non-doctor roles (vs doctor), working on the frontline, and having a mental health diagnosis were associated with significantly increased likelihood of being in the high stress group; as were insufficient information, pressure to work without PPE, >20% of team members off sick, and perception that not enough had been done to reduce risk.

Factors associated with having lower psychiatric symptoms

Being able to share stress at work and resilience were associated with significantly lower likelihood of being in the high anxiety, stress and depression groups - though there was no significant association with PTSD symptoms.

Change from pre-COVID-19 to during COVID-19.

Across the cohort, every mental health symptom, concern, and work-related issue was rated as significantly worse during COVID-19 compared to pre-COVID-19 - most to a highly significant level with very high effect sizes (see supplementary material S9). HCWs being worried about their family health showed the greatest (negative) change.

FLs rated themselves *lower* than NFLs pre-COVID in terms of: stress, wanting to quit, needing psychological help, worrying about NHS resources and their own health concerns - however time x group interaction effects revealed that FLs reported a significantly greater *worsening* of these from pre- to during COVID-19 than NFLs. For the other negative factors FLs ratings were not significantly different to NFLs *pre*-COVID-19 but FLs reported significantly greater worsening from pre to during COVID-19 for all items, including 'feeling low' (depression) and 'feeling anxious' (shown in Fig. 1).

The anxiety, low mood and stress items mirror the main symptom outcome scores (anxiety-GAD, low mood-PHQ, and stress-PSS), and in concrete terms there was a considerable shift in the distribution of severity of these symptoms during COVID-19 (shown in table 5): pre-COVID 85.9% of HCWs reported 'no' or 'very little' feeling of low mood but this diminished to only 55.6% during the COVID-19 response while the 5.2% reporting 'a lot' or 'very' pre-COVID-19 rose to 21.6% - more than a quadrupling. This shift in frequency distribution towards worse mood across the cohort was highly significant ($\chi^2=1101$, $p<.0001$). A similar pattern was evident for 'feeling anxious': the number of HCWs in the two most severe levels rose from 7.8% to 35.8% – and the number experiencing the most severe levels of 'feeling stressed' rose from 10.7% to 45.7%. These shifts in frequency distribution towards worse anxiety ($\chi^2=962.8$, $p<.0001$) and worse stress across the cohort were highly significant ($\chi^2=623.7$, $p<.0001$).

Every positive factor also significantly worsened across the cohort from pre to during COVID-19 (see supplementary material S9). Pre-COVID-19, FLs felt more resilient, more 'positive' and tech confident, and that their team was more effective than NFLs. However, FLs had significantly greater declines in feeling resilient, as well as remaining positive, and feeling supported compared to NFL.

---- Figure 1 here ----

Frontline, London and ethnic minority workers

FLs were significantly more likely to be more depressed, anxious, have high PTSD symptoms and be more stressed than NFL (all $p<.0001$). Working in London was associated with *lower* risk of depression ($p<.01$) and anxiety ($p<.0005$) than outside London (though no difference in stress or PTSD). Ethnic minority status (N=342) was significantly associated with greater risk of high PTSD symptoms (OR=1.52), but not high anxiety, stress, or depression.

Post-hoc analyses were conducted to explore ethnic minority experiences further. Physically '*at-risk*' ethnic minority individuals (N=85) did not have higher psychiatric

symptoms than ethnic minority individuals not '*at-risk*' (N=257), nor compared to *non-ethnic* minority individuals physically '*at risk*' (N=593) (all $ps > 0.45$). Ethnic minority individuals were, however, significantly more worried about contracting COVID-19 at work (mean(sd)=3.09(1.08) vs non-ethnic minority individuals mean(sd) = 2.67(1.07); $t(2754)=6.84$, $p < .0001$); being uncertain of having COVID-19 (mean(sd)=2.77(1.16) vs non-ethnic minority mean(sd)=2.21(1.09); $t(2754)=8.93$, $p < .001$); getting ill or dying from COVID-19 (mean(sd)=2.2(1.12) vs non-ethnic minority mean(sd)=1.88 (1.19), $t(2754)=4.74$, $p < .001$) and lack of PPE (mean(sd)=2.86 (1.14) vs non-ethnic minority mean(sd) = 2.39(1.12), $t(2754)=7.29$, $p < .001$).

Medical decision-making

11.1% (307) of respondents were in a position to make decisions about whether patients received treatment and 17.9% (53) had denied treatment to a patient (see supplementary materials S7). They reported significantly more anxiety (but not depression, PTSD symptoms (though strong trend), or stress (though strong trend)) than those (N=39) who had not denied treatment (GAD mean=8.00 (5.94) vs 5.46 (5.19), $t(90)=2.13$, $p < .05$). Those with support of an ethics panel in decision-making (58.0% (178)) were significantly less stressed (PSS mean=16.98 (8.1) vs mean=19.06 (7.33), $t(302)=2.29$, $p < .01$) but were not significantly less depressed, anxious, nor had lower PTSD symptoms than those without support (N=126).

Worries

Across the cohort, worry was greatest for family and friends becoming ill or dying from COVID-19 followed by worries that they will infect them (see supplementary table S10 for full list); and lowest for their own mental health and about poor workplace management. FL were significantly more worried than NFL for all concerns (all $p < .001$ except 'ability to support others' which was also significantly higher though at a higher threshold ($p < 0.05$)).

Discussion

To our knowledge this is the first study examining the impact of COVID-19 on the mental health of HCWs in the UK. A significant proportion reported high depression (28%), high anxiety (33%), and high COVID-19-related PTSD symptoms (15%). Across the cohort, mental health indicators had significantly deteriorated compared to before COVID. Analyses revealed a set of *fixed* (demographic and role-related) and a separate set of *controllable* factors which were significantly associated with high levels of psychiatric symptoms in HCW.

The *fixed* risk factors for high psychiatric symptoms were being female, all roles compared to doctor, working on the 'frontline', and having an existing mental disorder. Being single was associated with high depression and being younger to stress. While some of these components have been identified in previous pandemics(6,9) and recent research of much smaller cohorts outside the UK(11,23–25) the present study expands significantly on this work in several ways in terms of sample size, comprehensive examination of risk factors beyond demographics and roles, and scope of findings. We show, that allied HCW, and particularly managers, were at significantly increased risk of high symptoms. Managers, in particular, were 5.2 times more likely to report high PTSD symptoms - likely due to additional pressures and the rapid changes COVID-19 brings to their healthcare settings as well as increased threat to patients, staff and themselves. Nurses were significantly more likely to be in high symptom group compared doctors which is mostly consistent with evidence from COVID-19, and other, pandemics ((6,7) however there is some evidence of doctors having greater psychiatric symptoms compared to other HCWs ((6,7,24). Differences in healthcare settings, HCW roles, and national health systems across countries, as well as their COVID-19 response, may account for some of the differential effects reported from studies from different countries. This suggests the need for additional support for personnel in these roles.

Importantly, a cluster of *controllable* risk factors relating to workplace characteristics and role-related activities were also significantly associated with high psychiatric symptoms. Pressure to work without PPE, and that risk from COVID-19 could have been reduced with better workplace preparation, were significantly associated with

high depression. These factors were also associated with high stress along with practical issues such as absent team members and lack of sufficient information on clinical procedures. The effects of having additional workload were broad – being linked to high anxiety, depression and PTSD symptoms, while insufficient training was uniquely associated with high levels of anxiety (also shown after SARS((26)). High anxiety and PTSD symptoms were additionally associated with insufficient action being taken to reduce risk. There was a further critical role of a lack of sufficient information on COVID-19 clinical practice - being linked to high symptoms in all domains.

Critically then, a number of preventable workplace factors relating to perception of personal risk specifically increases the likelihood of having high PTSD symptoms: pressure to re-use PPE and failure of the workplace to reduce risk through preparation. A strong link between risk perception and PTSD has been reported previously during SARS(26–30). As subjective appraisal of threat may contribute more to PTSD development than objective trauma severity (31) a sense of persistent danger to the self may catalyse the development of PTSD symptoms. This also highlights that perception of risk goes beyond PPE availability and includes multiple systemic and organisational components within healthcare settings. As a longer or repeated exposure (see)(26)(32) raises risk of PTSD, more adequate PPE and workplace preparation may mitigate future development of PTSD. It is indeed noteworthy that over half of respondents stated that more PPE would reduce their anxiety.

Unlike an earlier study from China(11), an epicentre effect was not apparent. Working in London was associated with *lower* risk of anxiety and depression. While London workers were significantly less female, less likely to be pressured to reuse PPE, or expect to get severely ill (each linked to lower risk), they *also* experienced a number of risk factors. These effects could be due to better-resourced healthcare settings, being more accustomed to stress from city living, or that Wuhan was the first global city experiencing a new, fatal virus.

Other factors that were expected to be associated with psychiatric symptoms were not observed. Quarantining of HCW, for example, was not retained as a significant factor in any outcome model despite holding significant independent relationships with

psychiatric symptoms (see supplementary materials S8). At the time the survey was done, UK HCW were required to self-isolate for 7 days if they had possible symptoms or 14 days if exposed to someone known to have COVID-19. While an association was expected, Bell & Wade (7) report mixed evidence of a relationship between quarantine and psychological outcomes, while Kiseley *et al.* (6) report that it was *duration* of self-isolation and *prolonged* quarantine which raised risk. It may then be that this duration of quarantine was too short to have a notable impact on mental health. Alternatively, a shorter quarantine may have even been restful and improved mental health in some individuals (as Chong *et al.* (33) report in relation to SARS), or it may simply be that quarantining does not account for sufficient unique variance in psychiatric outcomes compared to, for example, witnessing traumatic events, or lack of safety equipment.

Unsurprisingly, traumatic events predicted high symptom scores, particularly PTSD symptoms. Personal loss and patients asking if they were going to die were significantly associated with high symptoms of PTSD, anxiety and depression. Having colleagues with, or dying from, COVID-19 also significantly increased the likelihood of being in the high PTSD symptoms group but this was greater with respect to friends or family dying. A peer who contracts or dies from COVID may be more indicative of an on-going threat of danger to the self. Experiences where death is evident (patients dying and delivering bad news) were also associated with high PTSD symptoms (also seen following SARS)(27). Together, personal threat was associated with having high PTSD symptoms while the impaired readiness to work effectively in response to COVID-19 was linked to high anxiety - perhaps due to these being preventable. Lastly, aftercare for the deceased was uniquely linked to depression; performing resuscitation was associated with high anxiety and PTSD symptoms; and practical issues with high stress.

Moral injury may contribute to the development of psychiatric symptoms(8). Here, HCWs who had denied treatment to patients were more anxious than those who had not, while support from an ethics panel was associated with lower stress highlighting the protective effects of shared decision-making on HCW mental wellbeing. The higher risk to managers may be due to such moral injury and the inability to adequately treat patients or protect staff.

Evidence that ethnic minority individuals are at elevated physical risk of COVID-19 was first published near the survey start date(34). While ethnic minority HCW were more likely to report high PTSD symptoms this was not accompanied by a significantly greater risk of high anxiety, depression or stress. Being 'physically at high risk' of COVID-19 was not associated with high psychiatric symptoms, but greater *worry about self-protection*. Elevated prevalence of PTSD in ethnic minority individuals has previously been reported(35) and is associated with 'additional life stress'(36). While more research on PTSD in ethnic minority individuals should be done, this finding may reflect the same sense of sustained threat.

Across the cohort, all wellbeing indicators significantly worsened during COVID-19 compared to before. The proportion of the cohort who rated their psychiatric symptoms (anxiety, low mood, stress) at the most severe levels increased by 4 to 4.5 times during the COVID-19 response compared to pre-COVID levels. FLs had significantly greater worries than NFL and were more also likely to be more depressed, anxious, and stressed than NFL - and were 2.1 times as likely to have high PTSD symptoms - likely due to the traumatic and stressful duties they perform, as well as their concerns about risk, PPE access and preparation.

Resilience and the ability to share stress at work were significantly associated with having low symptoms except PTSD. Inadequate support has previously been shown to raise the risk of psychiatric morbidity in FL(6,7,27). Contrastingly however, scores on the "*I need psychological help?*" item were low as were HCW worries about their 'own mental health'. Staff may indeed prefer practical help such as more rest or PPE to psychological support(37). Resilience training may improve resistance to poor wellbeing, although this has been insufficiently researched in healthcare settings. PTSD symptoms may not be attenuated by resilience perhaps due to the more automatic and physiological, rather than cognitive, nature of these symptoms.

The study has several strengths and limitations. We recruited a large sample by COVID-study standards (though only a 19.8% [52/262] response rate within all NHS services), near the peak of the first COVID-19 UK outbreak, and the study provides the most comprehensive picture to date of the negative psychological impact of HCW

to COVID-19 in the UK and its associated factors. Participation in online surveys involves self-selection and respondents may not be fully representative. However, this approach permitted a rapid response around a critical period very close to the COVID-19 peak. Nonetheless, these findings should be viewed with caution as they may not be generalizable. The survey was de facto open to *all* HCW in the UK and the very large sample size reflected a wide geographical coverage of the UK. That the sample characteristics were similar to the wider NHS workforce in terms of female:male ratio (85%, NHS=77%) and proportion from ethnic minorities (13% vs NHS 19%) indicate that the data are broadly representative. The survey was launched 4 weeks after the UK national 'lockdown' began and psychiatric presentation may be affected by lockdown as well as due to working during the COVID-19 peak – though these would be expected to de facto co-occur.

Pre-COVID-19 wellbeing scores derived from ratings which may not be fully accurate as they were retrospective, however, evidence suggests that ratings of past events in depressed individuals are reliable(38). Nonetheless, these findings should be viewed with caution as they may not be generalizable. If low mood resulted in more negative past ratings(39), this would only *increase* the effect sizes of worsening suggesting these effects are robust. Mood scores indicated that the cohort were not a *particularly* anxious or worrisome group per se and the majority of respondents reported only low or mild symptoms of anxiety and depression and low worry levels before COVID-19. The frequency of psychiatric disorders was also low and very similar to rates in the general population(35), while symptom scale scores and PTSD prevalence were similar to comparable studies(6,11). Lastly, the study information also strongly encouraged those who felt they “were *not* be affected by COVID outbreak” to take part, so we would “have a complete view of HCW mental health” to prevent recruiting a biased cohort of only respondents who felt adversely affected. The scales used were self-report and not diagnostic but have strong validity and reliability and are commonly used. This survey was cross-sectional but planned follow-up surveys will permit longitudinal analysis of effects and relationships. Finally, additional factors not examined may have a role in HCW mental health.

In conclusion, the COVID-19 pandemic has had a discernible and detrimental effect on the mental health and well-being of UK HCWs. High symptoms of poor mental

health were prevalent, and markers of wellbeing had significantly worsened compared to before COVID. A number of *fixed* and *controllable* factors were significantly associated with poor mental wellbeing, the latter reflecting elevated perception of COVID-19 risk and inadequate workplace preparedness. Critically, these findings can guide management strategy such as by improving PPE availability, training, communication of information, and management of staff absence. These are readily amenable targets and may reduce the risk of HCWs developing poor mental health during COVID-19, or other pandemics.

The study also strongly indicates that psychological risk assessments should be carried out based on the factors identified. All staff should be monitored for poor mental health and those showing high symptoms should be referred to mental health services. Employers should improve initiatives for HCWs to share stress particularly those with risk factors and those making challenging treatment decisions – or even just offer more opportunity to rest that HCWs have been reported to need (37). Bespoke interventions could be developed which target these factors, such as role- or duty-specific training. Improving resilience, perhaps through training, may also be effective, as may teaching more adaptive coping styles - recently shown to be associated with better HCW wellbeing during the COVID-19 pandemic (12). Importantly, HCW show only low recognition of the importance of their own mental health so awareness of this should be raised. Lastly, working as a HCW during a pandemic can result in long term effects on mental health, which may persist for years(40). Attenuating these risks may help reduce the possibility of a major mental health crisis in UK healthcare and protect and retain HCWs. This is critical to delivery of effective treatment for patients and for planning a response to a second wave or future epidemic / pandemic - or in other countries where HCWs are yet to experience the impact on their mental health.

Declaration of interests

JG has consulted for Takeda Pharmaceuticals within 3 years of beginning the submitted work. The other authors have no declarations of interest.

Funding Statement

This research received no specific grant from any funding agency, commercial or not-for-profit sectors. Use of scales and webhosting/advertising were covered by a small amount of charitable donations to the project from members of the public (~£500).

Acknowledgements

We first want to thank all the health care workers who shared their experiences with us. We also would like to thank those who contributed their time and hard work to the COVIDA Project: Natasha Ramachandran (UCL, London, UK); Eirini Koutsouroupa for media coordination; and Carl Stratton for website design and media strategy. We also thank Mandy Holmes and Jan Harrison of the University of Roehampton for facilitating a rapid set-up of the study; and Dr. Lin Fou for proof-reading the manuscript.

Author Contributions

JG was the study PI, study coordinator, and lead author. MF and JG led on the development and planning of the study and LV, AS, CS also contributed. AS conducted the Chi-Sq and regression analysis, assisted by MF and JG. JG conducted the ANOVA and post-hoc analyses. LV led on the survey dissemination strategy and liaising with NHS and non-NHS sites for study adoption. All authors worked on the development of the survey. JG is responsible for the overall content as guarantor.

Data Availability

The data that support the findings of this study are available from the corresponding author, JG, upon reasonable request.

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