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Research article

Mental health burden for NHS healthcare staff during the COVID-19 pandemic: First results of a longitudinal survey

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ABSTRACT

Background: The current investigation aimed to assess the mental health burden on healthcare workers during the early stages of the COVID-19 pandemic.

Methods: A link to an online survey was sent to an estimate of 18,100 employees of Sheffield Teaching Hospitals NHS Foundation Trust (STH) who had access to email. The survey was completed between 2nd and June 12, 2020.1390 healthcare workers (medical, nursing, administrative and other professions) participated in the first survey. Data from a general population sample ($n = 2025$) was used for comparison. Severity of somatic symptoms was measured by the PHQ-15. Severity and probable diagnosis of depression, anxiety, and PTSD were measured by the PHQ-9, GAD-7, and ITQ. Linear and logistic regressions were performed to determine if population group predicted the severity of mental health outcomes, and probable diagnosis of depression, anxiety, and PTSD. Additionally, ANCOVAs were performed to compare mental health outcomes between occupational roles in HCWs. Analysis was performed using SPSS.

Findings: Healthcare workers are more likely to experience greater severity of somatic symptoms, as well as severity and probable diagnosis of depression and anxiety, compared to the general population, but not increased traumatic stress symptoms. Scientific and technical, nursing and admin staff were more likely to experience worse mental health outcomes, compared to medical staff.

Interpretation: The COVID-19 pandemic has led to increased mental health burden in some, but not all healthcare workers during the first acute phase of the pandemic. The findings from the current investigation provide valuable insights into which healthcare workers are particularly vulnerable to developing adverse mental health outcomes during and after a pandemic.

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1. Introduction

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2. Literature review

Since the COVID-19 crisis was declared a pandemic by the World Health Organisation on the March 11, 2020, NHS staff have been under high levels of stress due to increased workload and patient needs [1–3]. Redeployment of staff was necessary across all sectors to care for patients with COVID-19 whilst minimising risk for patients with other conditions with face-to-face contact reduced as much as possible. Some NHS staff needed to shield themselves, as they were at a high risk of becoming seriously ill if they had been infected with the COVID-19 virus. As the world moves from the pandemic and begins to live in a 'new normal', healthcare staff continue to fight the COVID-19 virus [4–7]. While out of the news, government statistics show that within a single week, there are approximately over 8000 patients admitted to hospitals due to the COVID-19 virus in England alone [6]. The changes throughout the sectors may have led many healthcare workers (HCWs) to experience feelings of guilt, loneliness and concerns about their ability to deliver adequate care during and after the pandemic [4–6]. Consequently, HCWs are at risk of developing greater severity of psychiatric and psychological disorders, both in the short term [3] and in the wake of the pandemic [7].

Additionally, in an already-struggling healthcare system [5,8,9], the recent pandemic has brought new issues that have worsened mental health concerns among HCWs [3–5,8,10–12]. HCWs experience negative effects due to the pandemic, especially burnout and moral injury that stem from making or witnessing changing decisions [5,7,12,13]. HCWs may also be dealing with the stress and fear that comes from such a sudden, uncontrollable, and devastating event; as well as the continuous threat of future COVID-19 variants. Although more longitudinal investigations are needed, it is unsurprising that recent research revealed that psychological distress remain relatively stable beyond the initial and critical months of the pandemic [14]. Hence, it is likely that HCWs are still dealing with the COVID-19 pandemic, as well as the adverse effects of the initial months [4,8]. Although COVID-19 may not currently impact our everyday lives, it remains a threat to HCWs and the UK healthcare system.

Proactive steps should be taken to support and combat mental health difficulties in HCWs that arise because of the pandemic and other national emergencies [8]. There are strives to create cost-effective digital interventions to encourage positive mental well-being among healthcare workers in the UK[15]. However, more research is needed to identify HCWs who are especially vulnerable to developing mental health difficulties and who might benefit from further support during current and possible future pandemics. Therefore, there is still much more to learn from the initial months of the COVID-19 pandemic in order to develop our current understanding of the mental health burden amongst HCWs. This includes determining who within this population was most at risk of developing severe mental health difficulties during the recent pandemic.

2.1. The current study

The current study presents findings from the first wave of a survey that aims to understand the mental health burden of the COVID-19 pandemic on NHS staff and, specifically who is most at risk of experiencing adverse mental health outcomes. To this end, the present investigation compared mental health outcomes between a sample of NHS HCWs and a published national sample (otherwise referred to as the 'general population'). Additionally, as the term 'healthcare workers' encompasses a wide range of specialists, the current study examined which HCWs occupational roles are most at risk of adverse mental health outcomes during the initial and most crucial months of the pandemic.

3. Methods

3.1. Design

This is a single-centre study, which aims to assess the psychological impact of the COVID-19 pandemic on the employees of a single NHS Trust. An online survey was developed using Qualtrics software and data was collected between the 2nd and June 12, 2020, towards the end of the first UK lockdown (national lockdown restrictions ended and local lockdowns were introduced on 29th of June).

3.2. Study samples

The survey's target population, otherwise known as 'Healthcare workers' were employees of Sheffield Teaching Hospitals (STH)

Table 1
Summary of the demographics (age, gender, and ethnicity) if available for the healthcare workers sample (HCWs) and the general population.

	Age		Gender			Ethnicity	
	N	M (SD)	Female (%)	Male (%)	Other (%)	White British/Irish (%)	Non-White British/Irish (%)
HCWs	1228	43.76 (16.21)	1023 (83.34)	16.02 (197)	3 (.24%)	1134 (92.74)	89 (7.26)
General Population	1319	49.86 (14.94)	615 (46.63)	701 (53.15)	–	–	–

NHS Foundation Trust, with an estimated size of 18,100. 1390 healthcare workers (HCWs) responded to an emailed invitation to take part in the first survey, constituting approximately 7.68% of those eligible. 158 responses were removed as they had insufficient data, as they did not complete at least the demographic questions, leaving 1228 in the final sample. The most represented occupational role was administrative and management staff (33.14%, n = 407), followed by nursing staff (26.79%, n = 329), scientific and technical staff (11.07%, n = 136), doctors (8.55%, n = 105) and therapists (including physiotherapists) (7.49%, n = 92). Table 1. Provides a summary of the demographics of the healthcare workers sample, including age, gender, and ethnicity.

As for a comparison group, data for general population participants was obtained from the second survey wave of the COVID-19 Psychological Research Consortium (C19PRC) study, which is a longitudinal investigation of the impact of the COVID-19 pandemic on the mental health of the general population [16]. This survey first recruited a general population quota sample in late March 2020, which was representative of the UK population in terms of sex, age and household income, but subsequent checks showed that it was also near-representative on many other variables (e.g. voting history). The second survey wave was chosen because the date of collection (22nd April to May 1, 2020) was closest to the STH survey. In the current investigation, participants within the C19PRC's second survey who reported that they were HCWs were removed, leaving a total of 1319 in the general population sample. Table 1. also provides demographics, where available, for the general population.

3.3. Procedure

An introductory email via the Trust nhs.net email system was sent to approximately 18,100 staff inviting them to take part. The email emphasised that participation was voluntary and provided information about the Trust's health and wellbeing information resources. The first invitation was sent on June 2, 2020 with a reminder going out one week later. The survey closed on June 12, 2020.

3.4. Ethics

On accessing the survey link, participants were informed that the study was voluntary, about the purpose of the study, how their data would be treated and reminded of their rights upon responding to the survey. Participants were also informed that some topics may be of a personal nature. Accessing the survey required the participant's informed consent, as well as confirmation that they were over 18 years old. At the end of the survey, all participants were directed to the NHS Trust health and wellbeing information resources if they experienced any distress or had additional concerns about COVID-19. In accordance with GDPR, email addresses were separated from the dataset and personal data is restricted to members of the research team. Ethical approval for this project was provided by the University of Sheffield (Reference number 034002). HRA and Health and Care Research Wales (HCW) approval was gained to conduct the study on NHS premises with NHS staff participants (IRAS project ID 282467).

3.5. Outcomes

Mental health outcomes were chosen to match those used to measure mental health in the general population in C19PRC study, and were somatic symptoms, depression, anxiety, and post-traumatic stress disorder (PTSD). For each outcome both continuous and binary variables based on established clinical cut-offs were analysed.

Somatic symptoms were assessed by the PHQ-15 [17] which is a reliable and valid widely used measure [18]. Somatic symptoms are experiences of physical symptoms such as pain, headaches, and bowel problems, which, whilst often unexplained, are likely due to psychological distress [19]. Higher scores indicate greater severity. A score up to 5 indicates 'little to no somatic symptoms'; a score between 6 and 10 indicates 'mild somatic symptoms'; a score between 11 and 15 indicates 'moderate somatic symptoms'; and lastly, a score over 15 'severe somatic symptoms. The cut-offs to indicate 'little to no', 'mild', 'moderate' and 'severe' somatic symptoms was chosen for categorical analyses. In the present study the coefficient alphas for PHQ-15 were 0.81 and 0.89 respectively in the hospital and general population samples.

Depression was assessed through the nine item Patient Health Questionnaire (PHQ-9) [20] which is reliable, valid, and widely adopted measure [21]. The total score of the PHQ-9 indicates the severity of depression, where higher scores indicate greater severity. A separate binary variable was created to indicate the probable diagnosis of depression, with a score equal to or greater than 10 indicating a probable diagnosis. The coefficient alphas for PHQ-9 were 0.89 and 0.92 respectively in the hospital and general population samples.

Anxiety was assessed by seven item General Anxiety Disorder scale (GAD-7) [22] which, like the PHQ-9, is a reliable, valid, and widely adopted measure [23,24]. A total score of the GAD-7 indicates the severity of anxiety; whereby, higher scores suggest greater severity. Also, a separate binary variable was created to indicate the probable diagnosis of generalized anxiety, using a total score equal to or greater than 10 as indicating a probable diagnosis. The coefficient alphas for the GAD-7, in the present study, were 0.92 and 0.94 respectively in the hospital and general population samples.

Symptoms of PTSD were assessed using the International Trauma Questionnaire (ITQ) [25] which is a reliable and valid measure [26]. The ITQ contains three subscales measuring the clusters of trauma symptoms ('avoidance', 'sense of threat', 're-experiencing in the here and now') and four items assessing upon the individual's level of functioning. The total score of the ITQ is the sum of all the items from the three symptom clusters only. Consistent with the previously described measures, higher total ITQ score indicates greater severity of PTSD. A score equal to or more than two for all the three clusters as well as the function items indicated a probable diagnosis of PTSD. In the current investigation, the coefficient alphas for ITQ were 0.87 and 0.94 respectively in the hospital and general population samples.

Table 2
Summary of the descriptives for the total scores (severity) and cut-offs (prevalence rates) of the PHQ-15, PHQ-9, GAD-7, and the ITQ, for both population groups.

	PHQ-15					PHQ-9					GAD-7				ITQ			
	N	M (SD)	Little to no (%)	Mild (%)	Moderate (%)	Severe (%)	N	M (SD)	No (%)	Yes (%)	N	M (SD)	No (%)	Yes (%)	N	M (SD)	No (%)	Yes (%)
HCWs	1184	6.07 (4.30)	486 (41.05)	466 (39.36)	178 (15.03)	54 (4.56)	1183	7.42 (5.71)	819 (69.23)	364 (30.77)	1181	6.14 (5.18	908 (76.88)	273 (23.12)	1174	4.01 (4.25)	1102 (93.87)	72 (6.13)
General Population	1319	3.96 (4.54)	897 (68.01)	276 (20.92)	91 (6.90)	55 (4.17)	1319	5.11 (5.82)	1062 (80.52)	257 (19.48)	1319	4.28 (5.29)	1106 (83.85)	213 (16.15)	1319	4.00 (5.37)	1140 (86.43)	179 (13.57)

3.6. Statistical analysis

All analysis was performed using SPSS (version 27) [27]. Prior to analysing the data, it was revealed that mental health scores between HCWs who completed the first survey and HCWs who completed the second survey did not significantly differ (see supplementary materials). Hence, whilst the project collects data longitudinally, the focus of the current paper is on the data from the first survey only (cross-sectional).

The percentage of missing data in the healthcare sample was below 5% and Little's [28] test revealed that the data was missing completely at random. Additionally, further analysis was performed to determine if missing data for each of the mental health outcomes (PHQ-9, GAD-7, PHQ-15 and ITQ) were missing at random or not. Little's [28] test revealed that mental health outcomes at survey one and two were missing completely at random. Therefore, in the current investigation, no imputation method was adopted as missing data is not likely to impact the results. Also, the results from the Little's [28] test suggest little to no bias in the HCW sample in relation to missingness.

Descriptives were performed for both the total and the cut-off scores for both population groups (healthcare workers and the general population) and for occupational roles in the HCWs. Linear regressions were performed to determine if the population group predicted severity of mental health outcomes, whilst adjusting for age and gender. Logistic regressions were also performed to confirm that the prevalence of mental health difficulties can be predicted by population group, whilst controlling for age and gender. PHQ-15 logistic regression was not performed due to the categorical nature of the outcome variable. Lastly, two-way ANCOVAs were performed to adjust for age and gender when comparing mental health outcomes between occupational roles in HCWs. Chi-squared tests were performed to confirm that the prevalence of mental health difficulties is associated by population group.

4. Results

4.1. Comparing mental health outcomes between HCW and the general population

As demonstrated in Table 2 descriptive analysis revealed that HCW has higher total mean scores on the PHQ-15, PHQ-9 GAD-7, and ITQ. This suggests that HCWs had greater severity of somatic symptoms, depression, anxiety, and PTSD. Moreover, as for the validated cut-offs, descriptive analysis revealed that HCWs had higher percentage of those who experience mild, moderate, severe somatic symptoms (PHQ-15 scores) compared to the general population. The general population had a higher percentage of little to no somatic symptoms, compared to the HCWs. For the PHQ-9 and GAD-7, HCWs had a higher percentage of those who may warrant a diagnosis, compared to the general population, suggesting a greater likely prevalence rate of depression and, or anxiety. This was not found for ITQ scores. The general population had a higher percentage of those who may warrant a diagnosis, compared to the general population, suggesting a greater likely prevalence rate of PTSD.

Hierarchal linear regressions were performed to determine if population group (healthcare worker or general population) predicted higher scores on the PHQ-15, PHQ-9, GAD-7, and ITQ, whilst adjusting for age and gender. In this analysis, anyone reporting a nonbinary gender was excluded due to small sample size. Age and gender variables were introduced to the model first, followed by the population group. For somatic symptoms, there was a significant change in variance between the first step ($R^2 = 0.05$, F [2] $= 68.33$, $p < .001$) and the step ($R^2 = 0.08$, F [3] $= 67.15$, $p < .001$; R^2 change $= 0.02$, F [1] $= 61.25$, $p < .001$). Also, it was revealed that population group was a significant predictor of PHQ-15 scores (B $= 1.51$, $\beta = -0.17$, $t = 7.83$, $p < .001$), alongside age and gender (respectively: B $= -0.03$, $\beta = -0.10$, $t = 5.14$, $p < .001$; B $= 0.1.01$, $\beta = 0.11$, $t = 5.03$, $p < .001$). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic healthcare workers, compared to the general population, are significantly more likely more experience greater severity of somatic symptoms.

For depression, there was a significant change in variance between the first step ($R^2 = 0.07$, F [2] $= 91.50$, $p < .001$) and the second ($R^2 = 0.08$, F [3] $= 75.17$, $p < .001$; R^2 change $= 0.01$, F(1) $= 39.66$, $p < .001$). Also, it was revealed that population group was a significant predictor of PHQ-9 scores (B $= 1.57$, $\beta = 0.13$, $t = 6.30$, $p < .001$), alongside age, but not gender (respectively: B $= -0.09$, $\beta = -0.21$, $t = 10.57$, $p < .001$; B $= 0.47$, $\beta = 0.04$, $t = 1.82$, $p = .07$). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic healthcare workers, compared to the general population, are significantly more likely more experience greater severity of depression. This conclusion was further supported by a logistic regression, using the validated cut-offs as the dependent variable (see supplementary materials).

For anxiety, there was a significant change in variance between the first step ($R^2 = 0.08$, F (2) $= 106.72$, $p < .001$) and the second ($R^2 = 0.09$, F (3) $= 79.33$, $p < .001$; R^2 change $= 0.01$, F (1) $= 22.67$, $p < .001$). Also, it was revealed that population group was a significant predictor of GAD-7 scores (B $= 1.07$, $\beta = 0.10$, $t = 4.76$, $p < .001$), alongside age and gender (respectively: B $= -0.09$, $\beta = 0.23$, $t = 11.72$, $p < .001$; B $= 0.62$, $\beta = 0.06$, $t = 2.67$, p $< .01$). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic healthcare workers, compared to the general population, are significantly more likely more experience greater severity of anxiety. This conclusion was further supported by a logistic regression, using the validated cut-offs as the dependent variable (see supplementary materials).

For PTSD, there was a significant change in variance between the first step ($R^2 = 0.05$, F (2) $= 58.53$, $p < .001$) and the second ($R^2 = 0.05$, F (3) $= 41.64$, $p < .001$; R^2 change $= 0.003$, F (1) $= 7.57$, $p < .01$). It was revealed that population group was a significant predictor of ITQ scores (B $= 0.58$, $\beta = 0.06$, $t = 2.75$, $p < .01$), alongside age, but not gender (B $= -0.08$, $\beta = -0.22$, $t = 10.91$, $p < .001$; B $= 0.25$, $\beta = 0.02$, t $= 1.13$, $p = .26$). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic the general population, compared to healthcare workers, are significantly more likely more experience greater severity of PTSD. This conclusion was further supported by the logistic regression, using the validated cut-offs as the dependent variable (see

Table 3
Summary of the descriptive for caseness PHQ-15 scores, as well as the PHQ-9, GAD-7 and the ITQ clinical cut-offs, for each occupational role.

	PHQ-15						PHQ-9				GAD-7				ITQ			
	N	M (SD)	Little to No (%)	Mild (%)	Moderate (%)	Severe (%)	N	M (SD)	No (%)	Yes (%)	N	M (SD)	No (%)	Yes (%)	N	M (SD)	No (%)	Yes (%)
Nursing	316	6.26 (4.25)	125 (39.56)	131 (41.46)	43 (13.61%)	17 (5.38)	315	7.55 (5.78)	221 (70.16)	94 (29.84)	315	6.30 (5.36)	235 (74.60)	80 (25.40)	313	4.67 (4.75)	284 (90.73)	29 (9.27)
Scientific and Technical	133	6.80 (4.52)	46 (34.59)	53 (39.85)	26 (19.55%)	8 (6.02)	133	8.47 (6.54)	84 (63.16)	49 (36.84)	132	6.92 (5.67)	96 (72.73)	36 (25.40)	131	3.89 (3.99)	126 (96.18)	5 (3.92)
Administration	393	6.30 (4.29)	145 (36.90)	166 (42.24)	63 (16.03%)	19 (4.83)	393	7.92 (5.67)	254 (64.63)	139 (35.37)	393	6.52 (4.94)	294 (74.81)	99 (25.19)	389	5.53 (4.39)	361 (92.80)	28 (7.20)
Doctors	104	5.43 (4.25)	79 (75.96)	24 (23.08)	1 (.96%)	0	104	4.32 (3.96)	93 (89.42)	11 (10.58)	103	3.59 (3.93)	96 (93.20)	7 (6.80)	103	1.75 (2.25)	103 (100)	0
Therapist	87	5.43 (4.25)	41 (47.13)	30 (34.48)	13 (14.94%)	3 (3.45)	87	6.58 (5.16)	60 (68.97)	27 (31.03)	87	5.47 (5.02)	70 (80.46)	17 (19.54)	87	3.26 (2.75)	83 (95.40)	4 (4.60)
Other	151	6.76 (4.30)	50 (33.11)	65 (41.06)	32 (21.19%)	7 (4.64)	151	7.55 (5.53)	107 (70.86)	44 (29.14)	151	6.28 (5.32)	117 (77.48)	34 (22.52)	151	3.37 (3.66)	145 (96.03)	6 (3.97)

supplementary material).

4.2. Comparing mental health outcomes between HCW's occupational roles

All subsequent analyses were performed on the HCWs only. Table 3 provides a summary of the descriptives of all the total scores for each occupational role.

Table 3 demonstrates that Scientific and Technical staff had the highest scores on the PHQ-15, PHQ-9, and GAD-7 scores. Nursing staff had highest ITQ scores. Additionally, Scientific and Technical staff had the highest percentages of severe somatic symptoms (6.02%), whereas doctors had the highest percentage for little to no somatic symptoms (75.96%) (Table 3) Additionally, Scientific and Technical staff had the highest percentages of those with the clinical caseness of depression (36.84%) and anxiety (27.27%). Yet, for a probable diagnosis of PTSD, nurses had the highest percentage of clinical caseness (9.27%).

Two-way ANCOVAs were performed to determine if occupational role plays a role in the development of severe mental health outcomes, whilst adjusting for age and gender. There were statistically significant differences between groups for PHQ-15, PHQ-9, GAD-7 and the ITQ total mean scores ($F(6, 1181) = 10.80$, $p < .001$; $F(6, 1180) = 7.18$, $p < .001$; $F(6, 1178) = 5.51$, $p < .001$; $F(6, 1171) = 8.50$, $p < .001$ respectively). Whilst not controlling for age and gender, results from the Chi-squared test support the findings from the two-way ANCOVA. Chi-square tests revealed that the relationship between occupational role and the cut-offs for somatic symptoms, depression, anxiety, and PTSD was significant (X^2 (18) = 74.22, $p < .001$, $V = 0.25$; X^2 (6) = 28.26, $p < .001$, $V = 0.15$; X^2 (6) = 19.25, $p < .01$, $V = 0.13$; X^2 (6) = 15.94, $p < .05$, $V = 0.12$). This suggests that occupational roles may to some degree explain differences in the likelihood of developing mild to severe somatic symptoms, as well as clinical caseness for depression, anxiety, and PTSD in HCWs. Therefore, together, it is likely that occupational roles within HCWs is likely to play a role in the development of severe mental health outcomes, including the increase probability of a diagnosis of depression, anxiety, and PTSD.

Following the two-way ANCOVA, post hoc Tukey tests revealed that for PHQ-15 scores, doctors reported significantly lower severity of somatic symptoms compared to nurses (mean difference: 3.08, $p < .001$), scientific and technical staff (mean difference: 3.61, $p < .001$), admin (mean difference: 3.12, $p < .001$), therapists (mean difference: 2.24, $p < .01$) and 'other' (mean difference: 3.57, $p < .001$). For PHQ-9 scores, doctors reported significantly lower severity of depression compared to nurses (mean difference: 3.23, $p < .001$), scientific and technical staff (mean difference: 4.15, $p < .001$), admin (mean difference: 3.60, $p < .001$), and 'other' (mean difference: 3.23, $p < .001$).

The same pattern of results was found for GAD-7 scores, as doctors reported significantly lower severity of anxiety compared to nurses (mean difference: 2.71, $p < .001$), scientific and technical staff (mean difference: 3.32, $p < .001$), admin (mean difference: 2.93, $p < .001$), and 'other' (mean difference: 2.69, $p < .001$). Similarly, doctors reported significantly lower ITQ scores (PTSD symptoms) compared to nurses (mean difference: 2.93, $p < .001$), scientific and technical staff (mean difference: 2.14, $p < .01$), admin (mean difference: 2.79, $p < .001$), and 'other' (mean difference: 1.62, $p < .05$). Additionally, for ITQ scores, nurses also report significantly higher severity of PTSD compared to 'other' occupational roles (mean difference: 1.30, $p < .05$). Together, the post hoc results were consistent in revealing that, nurses, scientific and technical staff, admin, and 'other' roles, were more likely to experience greater mental health difficulties compared to doctors during the first wave of the pandemic.

Lastly, and in addition to population groups, the two-way ANCOVA revealed that age significantly predicted higher PHQ-9, GAD-7 and ITQ scores ($F(1,1166) = 22.06$, $p < .001$; $F(1,1164) = 43.20$, $p < .001$; $F(1,1157) = 9.48$, $p < .01$). This was not found for the total PHQ-15 scores ($F(1,1167) = 3.30$, $p = .07$). Additionally, individuals who reported that their gender was female had higher total mean scores for the PHQ-15 (M = 6.32, SD = 4.30), PHQ-9 (M = 7.59, SD = 5.66), the GAD-7 (M = 6.34, SD = 5.18) and the ITQ (M = 4.22, 4.33), compared to the males (M = 4.66, SD = 4.08; M = 6.45, SD = 5.92; M = 5.12, SD = 5.07; M = 2.91, SD = 3.65, respectively). Whilst adjusting for age, the two-way ANCOVA revealed significant differences between males and females for PHQ-15 scores ($F(1,1167) = 4.38$, $p < .05$). However, this was not revealed for the PHQ-9, GAD-7 and the ITQ total scores ($F(1,1166) = 0.001$, $p = .97$; $F(1,1164) = 0.48$, $p = .49$; $F(1,1157) = 0.07$, $p = .79$). Therefore, female healthcare workers were significantly more likely to experience greater severity of somatic symptoms, compared to male healthcare workers. Yet, for all the scores, no interaction effects between occupational role and gender, whilst controlling for age, was revealed ($F(6, 1167) = 0.35$, $p = .91$; $F(6, 1167) = 0.70$, $p = .65$; $F(6, 1164) = 0.12$, $p = .994$; $F(1,1157) = 4.04$, $p = .97$). The results suggest that the association between occupational role and mental health outcomes might not depend upon the individual's gender.

5. Discussion

Overall, the initial investigation suggested a substantial mental health burden on NHS staff during the first wave of the pandemic. Compared to the general population, the findings revealed that healthcare workers (HCWs) were more at risk of greater severity of somatic, depression and anxiety symptoms. These findings are consistent with the other investigations into the mental health of HCWs during the pandemic [1–3]. This includes investigations also performed in the UK [3,29–31].

Unexpectedly, however, not all findings in the current investigation support previous literature. HCWs were not more likely to experience greater severity of PTSD, compared to the general population. This finding contrasts with recent research by Wanigasooriya et al., [3]. Wanigasooriya et al. conducted a survey-based design collecting data on anxiety, depression, and PTSD symptoms in HCWs (N = 2628, Female = 79.5%, Mean age = 42 years) following the first COVID-19 pandemic peak in the United Kingdom. It was found that reports of anxiety, depression *and* PTSD were high (34.3%, 31.2% and, 24.5%, respectively) in this population. However, in the current investigation, HCWs were not more likely to experience greater severity of, nor probable diagnosis of, PTSD, compared to the general population. A plausible explanation for the contradiction concerns the time of collection. During the first wave, HCWs may not

have had the time to process traumatic events experienced in their working lives, as their workload was increased. Indeed, there is some evidence that PTSD symptoms develop over time in HCWs exposed to a pandemic, as prolonged stress and fatigue take their toll [32].

Secondly, the current investigation highlighted the need to consider HCW's occupational role when discussing their mental health burden during the recent pandemic. Occupational roles such as nurses, scientific and technical, and administration staff were significantly more likely to experience worse mental health outcomes, compared to doctors. Indeed, paradoxically perhaps [33–35], the highest scores on our mental health measures were found in the scientific and administrative staff, who had least direct contact with patients affected by COVID. The finding builds on previous literature by highlighting the need to look at occupational role outside of its current binary assumption: 'front-line workers' and 'non front-line workers' [33–36]. As to why occupational role impacts healthcare worker's mental health, this is currently unknown. There may be training, personality, or policy variability that account for the apparent resilience of doctors. In addition, the effects of exposure to stressors in reducing adverse mental health effects is one of the most consistently reported findings in psychopathology, and is exploited in standard treatments for anxiety disorders and traumatic stress [37]. However, it is possible that the observed differences may be due to the reported stigma around mental health difficulties that surrounds doctors [31,38], reducing reporting of distress in doctors. For now, the findings from the current investigation suggests that occupational role ought to be considered when discussing and addressing the mental health burden of working during a pandemic in health care workers.

5.1. Strengths and limitations

A major strength of the current investigation is the large sample and the availability of a control sample that was representative of the UK population. Hence, the findings that are drawn from the present study are of relevance to NHS services across the UK. However, limitations still exist as bias resulting from willingness to take part in the study cannot be excluded and certain roles could not be analysed in the current study due to low sample sizes. Domestic and Portering staff were invited to take part in the survey, however, perhaps due to limited IT access, the number of those who completed the survey was four. Hence, Domestic and Portering staff were removed the analysis. Similarly to administration and managerial staff, it is important to not ignore or forget these roles when understanding the mental health burden on healthcare workers, so future investigations need to carefully consider how to increase accessibility for domestic and portering staff to participate in such research.

Another major limitation of the current investigation is that the data were collected during the acute phase of the COVID-19 pandemic. Thus, the current investigation should be considered a 'snapshot'. Due to the nature of the pandemic, there were significant and consistent changes to workload, to policies, and to providing adequate care; leading to increased distress as events progressed [31,39]. Also, a comparison could not be made between mental health outcomes before and during the pandemic. It is known that healthcare workers are at risk of developing mental health difficulties due to the traumatic events during their occupational duty before the pandemic [9,40,41]. Therefore, the conclusion drawn from this study is specific to the context of the emergence of a pandemic.

5.2. Unanswered questions and future research

There is a need to understand the mental health burden on HCWs beyond the first wave. Hence, a longitudinal investigation is needed to follow HCWs throughout and after the pandemic. Through such investigations, an in-depth account of the development or trajectory of mental health difficulties during and after the pandemic can be achieved. Moreover, key predictors that play a vital role in the change of mental health difficulties over time, either for worse or better, could be identified. Therefore, future longitudinal investigations which build upon the current study might pave the way for evidence-based policies and practices that aim to identify and support the most vulnerable HCWs throughout, and after, a pandemic emergency. Yet, the recommended longitudinal investigation is already in effect, as the current investigation analysed data collected from the first survey of a single-centre longitudinal study. This longitudinal study aimed to assess the psychological impact of the COVID-19 pandemic on NHS workers.

5.3. Conclusions and implications for clinicians and policymakers

The COVID-19 pandemic has led to an increased mental health burden in some but not all HCWs during the acute phase of the pandemic. The findings from the current investigation suggest that, during the first wave, NHS workers were likely to experience severe somatic symptoms, depression, and anxiety. Yet, within HCWs, there are occupational and individual differences in mental health outcomes among HCWs. An important implication is that different staff groups may require different support mechanisms in the event of future national health emergencies. By understanding who may be most at risk of severe mental health difficulties during the COVID-19 pandemic, preventative measures could be implemented to develop a more robust workforce when future pandemics arise. Regarding the devastating aftermath of the COVID-19 pandemic, we need to monitor the mental health of those most at risk of mental health difficulties to ensure that they receive support from newly established interventions. With the rise of digital interventions to address mental health concerns in HCWs [15], it might be good to know who might benefit from them the most. Alternatively, if not monitored, it may be that those who were severely impacted by the recent pandemic might 'fall through the cracks' when interventions are introduced, as they these HCWs may require specialist support. Together, therefore, the conclusions of the current investigation will be useful in determining who needs support and when under a pandemic-related context.

6. Patient and public involvement

The current study was conducted and performed in collaboration between psychological researchers at the University of Sheffield and NHS staff working at the Sheffield Teaching Hospital NHS Trust. Beyond the Authors, no other NHS staff were involved in the planning or execution of the current study.

Author contribution statement

Sarah Danson: Conceived and designed the experiment; Contributed reagents, materials, analysis tools or data; Analysed and interpreted the data.

Richard Bentall: Conceived and designed the experiment; Analysed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Fuschia Sirois: Conceived and designed the experiments; Analysed and interpreted the data.

Jonathan Wadsley; Jaydip Ray; Rhian Bishop; Janet Horsma; Colette Mann; Loretta Chantry-Groves: Conceived and designed the experiments.

Kathryn Fradley; Richard Bentall; Matthew Young: Analysed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e13765.

Supplementary materials.

Comparison of mental health outcome scores between the first and second survey in healthcare workers.

Repeated measures ANCOVAs were performed to determine if mental health scores differences between the first and second survey in healthcare workers, whilst adjusting for age and gender. The ANCOVA revealed that there was no difference in PHQ-15, PHQ-9, GAD-7, and ITQ scores between the first and second survey ($F(1) = .615$, $p = .44$; $F(1) = .14$, $p = .71$; $F(1) = .64$, $p = .42$; $F(1) = 1.88$, $p = .17$). This means that the severity of somatic symptoms, depression, anxiety, and PTSD was not likely to change from the initial months of the pandemic (June 2020) to months into/during the pandemic (September to October 2020).

Logistic regressions for mental health cut-offs for between population groups.

Depression

Similar to the linear regressions performed in this study, age and gender was introduced to the first step (χ^2 (2) = 108.96, $p < .001$), followed by the population group during the second (χ^2 (3) = 125.03, $p < .001$). There was a significant change in variance between the first step and the second (χ^2 change = 16.07, $p < .001$). As stated, population group was a significant predictor of prevalence rate of depression, as assessed by the PHQ-9 (B = .41, $\beta = 1.51$, $p < .001$), alongside age (B = -.03, $\beta = .97$, $p < .001$). Yet, gender was not revealed to be a significant predictor of prevalence rate (B = -.10, $\beta = .91$, $p = .38$). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic the general population, compared to healthcare workers, are significantly more likely to experience severe symptoms enough to warrant a diagnosis of depression.

Anxiety

Similar to the linear regressions performed in this study, age and gender was introduced to the first step (χ^2 (2) = 99.20, $p < .001$), followed by the population group during the second (χ^2 (3) = 103.09, $p < .001$). There was a significant change in variance between the first step and the second (χ^2 change = 3.89, $p < .001$). Population group was a significant predictor of prevalence rate of anxiety disorder, as assessed by the GAD-7 (B = .22, $\beta = 1.25$, $p < .05$), alongside age (B = -.03, $\beta = .97$, $p < .001$). Yet, gender was not revealed to be a significant predictor of prevalence rate of anxiety disorder (B = 1.16, $\beta = .85$, p = .20). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic the general population, compared to healthcare workers, are significantly

more likely to experience severe symptoms enough to warrant a diagnosis of anxiety.

PTSD

Similar to the linear regressions performed in this study, age and gender was introduced to the first step (χ^2 (2) = 78.61, p <.001), followed by the population group during the second (χ^2 (3) = 121.72, p <.001). There was a significant change in variance between the first step and the second (χ^2 change = 43.11, p <.001). As stated, population group was a significant predictor of prevalence rate of PTSD, as assessed by the ITQ (B = .1.01, β = .37, p <.001), alongside age and gender (B = -.05, β = .96, p <.001; B = .34, β = 1.40, p <.03). Therefore, whilst adjusting for age and gender, during the initial months of the COVID-19 pandemic the general population, compared to healthcare workers, are significantly more likely to experience severe symptoms enough to warrant a diagnosis of PTSD.

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