Psychological distress during the acceleration phase of the COVID-19 pandemic: a survey of doctors practising in emergency medicine, anaesthesia and intensive care medicine in the UK and Ireland

Tom Roberts ,[1,2] Jo Daniels,[3] William Hulme,[4] Robert Hirst,[5] Daniel Horner ,[1,6] Mark D Lyttle ,[2,7] Katie Samuel,[8] Blair Graham ,[9,10] Charlie Reynard,[11] Michael Barrett ,[12,13] James Foley ,[14] John Cronin,[15,16] Etimbuk Umana ,[17] Joao Vinagre,[18] Edward Carlton ,[19,20] on Behalf of the collaborators of TERN, RAFT, PERUKI, ITERN, TRIC, and SATARN

Handling editor Katie Walker

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/emermed-2020-210438).

For numbered affiliations see end of article.

Correspondence to
Dr Tom Roberts, Royal College of Emergency Medicine, London, UK;
tomkieranroberts@gmail.com

Received 20 July 2020
Revised 24 February 2021
Accepted 3 March 2021

To cite: Roberts T, Daniels J, Hulme W, *et al*. *Emerg Med J* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/emermed-2020-210438

ABSTRACT

Objective To quantify psychological distress experienced by emergency, anaesthetic and intensive care doctors during the acceleration phase of COVID-19 in the UK and Ireland.

Methods Initial cross-sectional electronic survey distributed during acceleration phase of the first pandemic wave of COVID-19 in the UK and Ireland (UK: 18 March 2020–26 March 2020 and Ireland: 25 March 2020–2 April 2020). Surveys were distributed via established specialty research networks, within a three-part longitudinal study. Participants were doctors working in emergency, anaesthetic and intensive medicine during the first pandemic wave of COVID-19 in acute hospitals across the UK and Ireland. Primary outcome measures were the General Health Questionnaire-12 (GHQ-12). Additional questions examined personal and professional characteristics, experiences of COVID-19 to date, risk to self and others and self-reported perceptions of health and well-being.

Results 5440 responses were obtained, 54.3% (n=2955) from emergency medicine and 36.9% (n=2005) from anaesthetics. All levels of doctor seniority were represented. For the primary outcome of GHQ-12 score, 44.2% (n=2405) of respondents scored >3, meeting the criteria for psychological distress. 57.3% (n=3045) had never previously provided clinical care during an infectious disease outbreak but over half of respondents felt somewhat prepared (48.6%, n=2653) or very prepared (7.6%, n=416) to provide clinical care to patients with COVID-19. However, 81.1% (n=4414) either agreed (31.1%, n=2709) or strongly agreed (31.1%, n=1705) that their personal health was at risk due to their clinical role.

Conclusions Findings indicate that during the acceleration phase of the COVID-19 pandemic, almost half of frontline doctors working in acute care reported psychological distress as measured by the GHQ-12. Findings from this study should inform strategies to optimise preparedness and explore modifiable factors associated with increased psychological distress in the short and long term.

Trial registration number ISRCTN10666798.

Key messages

What is already known on this subject

- The COVID-19 outbreak has already placed exceptional demand on healthcare systems globally and is likely to continue to do so for the foreseeable future.
- Emergency and critical care doctors are responsible for the management of severely unwell patients with COVID-19. These doctors may be vulnerable to suffering recognised negative psychological effects associated with infectious disease outbreaks, including absenteeism, impaired occupational performance and long-term health conditions.

What this study adds

- This paper presents key findings from the first phase of a cross-sectional longitudinal survey of practising emergency, anaesthetic and intensive care doctors in UK and Ireland during the acceleration phase of the first wave of the COVID-19 pandemic.
- The findings report a rate of psychological distress in responders of 44.2%. This work clarifies the extent and severity of cross specialty psychological impact during the early phase of a pandemic.
- These results could be used as a comparison for other studies analysing the psychological impact of infectious disease outbreaks at different timepoints or different regions.

INTRODUCTION

On 30 January 2020, the WHO declared COVID-19 a Public Health Emergency of International Concern. Following subsequent acknowledgement of disease severity, COVID-19 was declared a global pandemic on 11 March 2020.[1] Clinical studies have consistently demonstrated high acuity among hospitalised patients, with approximately 17% requiring intensive care.[2] In addition, high infection rates have been registered in frontline clinicians, with

over 106 fatalities reported in UK NHS healthcare workers by 12 April 2020[3] and over 550 000 global deaths reported by July 2020.[4]

The rapidity, scale and severity of the pandemic has placed exceptional demands on acute care globally, and this workforce has faced unprecedented burden in workload intensity and personal health risk. Such demands are likely to impact on psychological well-being, including an increased risk of traumatic stress in both the acute phase and at long-term follow-up.[5–8] Elevated psychological distress has significant consequences for health workers; increased sickness rates, absenteeism, impaired performance at work and the development of physical health problems are common examples.[9–11] However, studies to date that have focused on the disaster or infectious disease setting have been conducted during peak or following the occurrence of infectious outbreaks, making meaningful comparison with prepeak incidence very difficult. In the wider literature, the reported prevalence of distress during pre-COVID-19 times has been reported as 28.5% in intensive care unit (ICU) doctors (n=627) and 44.4% emergency medicine (EM) consultants (n=350).[12 13]

Establishing the prevalence of psychological distress, and the associated personal and professional factors, is essential to ensure adequate provision of support and mitigation of adverse effects. Several factors may be associated with poorer psychological outcomes, but these need to be established as relevant in the context of the COVID-19 pandemic.[5 14–17] Prospective longitudinal studies are needed to more fully assess the definitive impact of this major outbreak on psychological well-being.[18]

The COVID-19 Emergency Response Assessment (CERA) study is a three-part longitudinal study, designed to enhance our understanding of the impact of such events on the workforce and underpin the development of policy and interventions to meet the needs of those affected.[19] The primary aim of this CERA phase 1 study is to quantify the degree of psychological distress in EM, anaesthesia and intensive care medicine (ICM) doctors in the acceleration phase of the first wave of the COVID-19 pandemic in the UK and Ireland. The secondary aim is to provide a descriptive synthesis of baseline personal and professional characteristics commonly associated with poorer outcomes related to psychological distress and trauma.

MATERIALS AND METHODS

A quantitative online cross-sectional survey of acute care doctors practising EM, anaesthesia or ICM in the UK and Ireland. This was the first part of a longitudinal survey to be distributed at preplanned phases aligned to the Centers for Disease Control and Prevention pandemic model: (1) the acceleration phase, (2) the pandemic peak and (3) the deceleration/recovery phase of the initial COVID-19 pandemic wave in the UK and Ireland.[20] Data were gathered in the acceleration phase between 18 and 28 March 2020 in the UK, and 25 March–4 April 2020 in Ireland. Results are presented in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).[21] The protocol for the full three phase longitudinal study is published and available from http://dx.doi.org/10.1136/bmjopen-2020-039851.[22] The study was prospectively registered on an open access platform (https://doi.org/10.1186/ISRCTN10666798).

Participants and procedure

Doctors of all grades working in EM, anaesthesia or ICM were invited to participate in the study. Responses excluded from analysis included those from other healthcare professional groups and doctors working outside of EM, anaesthesia and ICM, and doctors working in hospitals based outside of the UK or Ireland. Participants were invited through a multispecialty collaboration of established UK and Irish acute care research networks, led by the Trainee Emergency Research Network (TERN). These include Research and Audit Federation of Trainees (RAFT), Paediatric Emergency Research in the UK and Ireland, Trainee Research in Intensive Care, Irish Trainee Emergency Research Network and Irish Specialist Anaesthesiology Trainee Audit & Research Network. The survey participation link was not shared on wider social media platforms in order to mitigate against duplicate completion and completion by respondents not meeting prespecified inclusion criteria. Access to the survey link was distributed directly to individual participants in each department or hospital by members of the above research networks working within the same department or hospital. This was achieved using established communication links within departments and hospital. To supplement this strategy, RAFT emailed members directly. All participants provided informed electronic consent prior to beginning the survey.

The survey was administered via the Research Electronic Data Capture (REDCap) online platform.[23 24] REDCap is fully compliant with Good Clinical Practice, GDPR and 20 ISO 27001. Data were held securely on secure online server hosted by the University Hospitals Bristol and Weston NHS Foundation Trust, UK. Participants were identifiable through their email address, but these data were only available to the chief investigator (TR), and data extracted for analysis were anonymised. Participants could exit the survey at any time if they no longer wished to participate. In this event, data from questions already completed were included for analysis, in line with consent. The recruitment process is detailed further in the protocol.[22]

Measures

The General Health Questionnaire-12 (GHQ-12) is a brief, 12 item self-report measure devised to screen for psychological distress in the general population.[25] It has high specificity and sensitivity, with reliability demonstrated across a range of cultures and populations[26 27] and has been used in similar studies measuring psychological impact of infectious outbreaks. The GHQ-12 was chosen due to its brevity and suitability for time-poor medical staff.[5 14] The measure assesses current state (rather than long-standing attributes) and asks participants to compare with their own baseline.

Data were also collected on personal and professional factors commonly associated with psychological distress in medical or disaster settings,[5 14–17] derived from a literature review and iterative discussion within the study steering group. Items were included where relevance has previously been established and replicated (eg, factors commonly associated with psychological distress) or where relevance was justified in the context of the current pandemic. Final inclusion was by consensus, underpinned by a requirement for the survey to be sufficiently brief to encourage full and repeated completion (see online supplemental material for a full report of included items, minus the GHQ-12, which has been removed for copyright reasons).

Ethical and regulatory approvals

Regulatory approval was provided by the UK Health Research Authority (ref 218944).

Analysis

Individual study records were checked and validated by the study chief investigator (TR) and statistician (WH) at survey completion; data were excluded in the event of duplicate entry (by email address), absence of consent or non-completion of a predetermined minimum required dataset for analysis (completion of GHQ-12, grade, department and hospital). Descriptive statistics relating to personal and professional characteristics are presented overall and by department and geographic region.

GHQ-12 scores will be presented using two validated methods.[26] The first (bimodal) method is used to identify a clinical cut-off for psychological distress; the second method (Likert-type) is more sensitive to change in psychological distress over time and is most suitable for comparison between different time points. In the bimodal method, item responses are assigned to the values 0, 0, 1 and 1 (from the most positive to the most negative sentiment) and summed to form an aggregate score from zero (least distressed) to 12 (most distressed). A score of more than 3 is indicative of psychological distress.[26] The Likert-type 0-1-2-3 method is also presented. This forms an aggregate score from 0 (least distressed) to 36 (most distressed). This method is more sensitive to changes within individuals over time and was included for consistency with subsequent longitudinal analyses using survey data from phases 2 and 3. Distribution of GHQ-12 aggregate scores were described using quartiles, and comparisons between different personal and professional characteristics were made. A descriptive synthesis was used to summarise key findings in relation to the personal and professional characteristics.

All analyses and statistical outputs were produced using the statistical programming language R V.3.6.3.[28] Analysis scripts for this study are available on a GitHub repository: https://github.com/wjchulme/TERN-CERA-study.

Patient and public involvement

The research team is primarily made up of frontline doctors from all represented specialties who undertook clinical work throughout the first wave of the COVID-19 pandemic on the frontline.

RESULTS

Enrolment is summarised in figure 1. The online survey link was accessed 8111 times, of which 5440 (67%) were suitable for analysis. This represents 15.9% of an estimated 34 188 doctors working across EM (11 843), anaesthetics (20 556) and ICU (1789) in the UK and Ireland (data as per a freedom of information request to the General Medical Council UK and declared numbers by Ireland site leads). The GHQ-12 completion rate was 95.9% (n=5218/5440) of participants eligible for analysis. Online supplemental material outlines the adherence to the CHERRIES checklist.

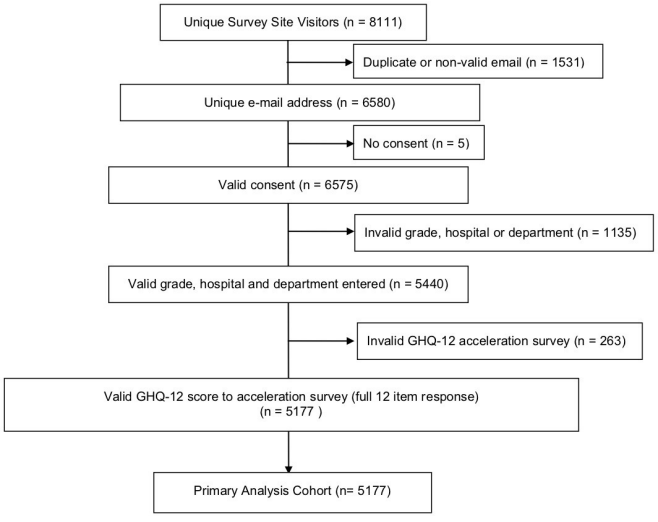

Figure 1 CERA analysis flow chart. CERA, COVID-19 Emergency Response Assessment.

Sample characteristics

Demographics of the study population are summarised in table 1 and were similar across all specialties. The median age was 31–35 years, 50.4% (n=2648) were male and 37.4% (n=2033) identified as a junior doctor grade.

Prevalence of psychological distress

Analysis of GHQ-12 data indicated that 44.2% (n=2405) of respondents reached study threshold for psychological distress (>3 using 0-0-1-1 method) (figure 2). This was higher in both anaesthetics (52.5%, n=1006) and ICM (50.3%, n=444) when compared with EM (41.5%, n=1178). The median aggregate GHQ-12 score (using the 0-1-2-3 method) was 13 (Q1–Q3: 10–17) (figure 3). Collated results to the individual GHQ-12 questions items are displayed in figure 4. From this visual representation, the domains of concentration, sleep, being under strain and day-to-day enjoyment of activities were negatively affected. The highest median GHQ-12 score by grade and department was 15 (Q1–Q3: 11–18) in 'other senior doctors' working in anaesthetics, compared with the lowest median score of 13 (Q1–Q3: 10–16) found in all four grade cohorts working in EM (figure 5). The GHQ-12 was found to have good internal consistency in this population (Cronbach's alpha=0.846 (95% CI 0.838 to 0.853). GHQ-12 bar charts are available for all items in online supplemental material.

Professional characteristics

Professional characteristics are summarised in table 2, with data on all items provided in the online supplementary material. Over half (57.3%, n=3045) reported no prior experience of providing care during infectious disease outbreaks. Although 39.5% (n=2073) reported having no education regarding the clinical care of patients with suspected COVID-19, 48.6% (n=2643) felt 'somewhat prepared' to do so. A total of 56.2% (n=3058) of respondents reported zero (21%) or low (1–5 cases; 35.2%) direct clinical contact with suspected COVID-19 cases. Only 9.3% (n=506) of participants were redeployed to other clinical areas, 73.7% (n=373) of those redeployed were from anaesthetics and the majority of all those redeployed (70.9% (n=359)) were redeployed to ICM. For those doctors redeployed to another clinical area, the median GHQ-12 was 14 (Q1–Q3: 11–18) compared with 13 (Q1–Q3: 10–17) in those not redeployed (figure 6). The location of redeployment did not make a substantial difference to median GHQ-12 scores (online supplemental material).

Provision of training for the *use of personal and protective equipment* (PPE) was variable (table 3). A per centage of 8.2 (n=433) did not receive training in donning and doffing, 17.1% (n=903) had not received formal fit testing for masks and 22.1% (n=1163) had not received PPE training for aerosol generating procedure. The modality of training was variable, with local departmental guidance the most common form of training. In relation to confidence in infection control, 30.4% reported feeling somewhat not confident (21.9%. n=1193) or

Table 1 Demographic characteristics

	All (n=5440) (n (%))	Anaesthetics (n=2005) (n (%))	Emergency medicine (n=2955) (n (%))	Intensive care (n=920) (n (%))
Age (years)				
20–25	204 (3.8)	5 (0.2)	182 (6.2)	17 (1.9)
26–30	1373 (25.3)	355 (17.7)	882 (29.9)	221 (24.1)
31–35	1313 (24.2)	477 (23.8)	702 (23.8)	258 (28.1)
36–40	865 (15.9)	331 (16.5)	458 (15.5)	154 (16.8)
41–45	659 (12.1)	277 (13.8)	337 (11.4)	85 (9.3)
46–50	447 (8.2)	219 (10.9)	203 (6.9)	82 (8.9)
51–55	315 (5.8)	182 (9.1)	108 (3.7)	55 (6.0)
56–60	174 (3.2)	102 (5.1)	56 (1.9)	31 (3.4)
61–65	72 (1.3)	48 (2.4)	20 (0.7)	11 (1.2)
66–70	8 (0.1)	6 (0.3)	1 (0.0)	3 (0.3)
>70	3 (0.1)	1 (0.0)	2 (0.1)	0 (0.0)
Missing	7	2	4	3
Gender				
Male	2648 (50.4)	986 (50.8)	1421 (49.8)	490 (55.2)
Female	2601 (49.5)	953 (49.1)	1427 (50.0)	396 (44.6)
Other	9 (0.2)	2 (0.1)	6 (0.2)	1 (0.1)
Missing	182	64	101	33
Seniority				
Junior doctor	2033 (37.4)	515 (25.7)	1308 (44.3)	327 (35.5)
Middle grade doctor	1254 (23.1)	463 (23.1)	658 (22.3)	248 (27.0)
Senior doctor (consultant grade)	1694 (31.1)	892 (44.5)	676 (22.9)	284 (30.9)
Other senior doctor	459 (8.4)	135 (6.7)	313 (10.6)	61 (6.6)
Nation				
England	4310 (79.2)	1593 (79.5)	2313 (78.3)	738 (80.2)
Northern Ireland	167 (3.1)	83 (4.1)	64 (2.2)	39 (4.2)
Ireland	416 (7.6)	85 (4.2)	317 (10.7)	55 (6.0)
Scotland	367 (6.7)	120 (6.0)	228 (7.7)	47 (5.1)
Wales	180 (3.3)	124 (6.2)	33 (1.1)	41 (4.5)
Geographical region (England)				
East Midlands	303 (5.6)	138 (6.9)	133 (4.5)	47 (5.1)
East of England	327 (6.0)	123 (6.1)	179 (6.1)	54 (5.9)
London	818 (15.0)	201 (10.0)	560 (19.0)	88 (9.6)
North East	210 (3.9)	73 (3.6)	112 (3.8)	47 (5.1)
North West	596 (11.0)	246 (12.3)	270 (9.1)	128 (13.9)
South East	629 (11.6)	196 (9.8)	402 (13.6)	84 (9.1)
South West	686 (12.6)	279 (13.9)	318 (10.8)	126 (13.7)
West Midlands	340 (6.2)	146 (7.3)	161 (5.4)	78 (8.5)
Yorkshire and the Humber	401 (7.4)	191 (9.5)	178 (6.0)	86 (9.3)
Geographical region (Ireland)				
Dublin	221 (4.1)	37 (1.8)	173 (5.9)	27 (2.9)
Rest of Ireland	195 (3.6)	48 (2.4)	144 (4.9)	28 (3.0)
Redeployed				
No	4920 (90.7)	1628 (81.4)	2830 (96.1)	865 (94.2)
Yes	506 (9.3)	373 (18.6)	116 (3.9)	53 (5.8)
Missing	14	4	9	2
GHQ-12 (0-1-2-3)				
Median (Q1Q3)	13 (10–17)	14 (11–18)	13 (10–16)	14 (11–17)
Mean	14.0	14.7	13.5	14.2
Missing	222	86	114	37
GHQ-12 (0-0-1-1)				
≤3	2813 (53.9)	913 (47.6)	1663 (58.5)	439 (49.7)
>3	2405 (46.1)	1006 (52.4)	1178 (41.5)	444 (50.3)
Missing	222	86	114	37

GHQ-12, General Health Questionnaire-12.

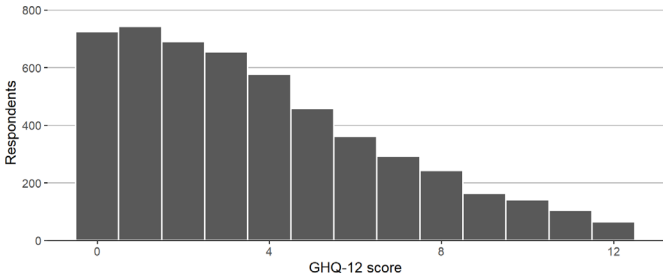

Figure 2 GHQ-12 score (0-0-1-1) distribution. GHQ12, General Health Questionnaire-12.

not confident at all (8.5%, n=461) in their infection control training.

Participants reported highly variable use of information sources for COVID-19 related policy and clinical updates (figure 7). Government and institutional guidelines were the medium most frequently checked on a daily basis (online supplementary material). Social media was checked hourly by 16.3% (n=885) of respondents, while 12.8% (n=699) did not access this at all; no other source was characterised by interaction of this frequency. Online blogs and podcasts were checked less frequently; 17.7% (n=962) checked these daily, and 21.8% (n=1186) never used these sources.

Personal factors

Personal characteristics are summarised in table 4, with data on all items provided in the online supplementary material. Of respondents who reported a physical health condition (42.0%, n=2284), 59.4% (n=1357) thought that COVID-19 could worsen their pre-existing condition. Of those with a pre-existing mental health condition (37% n=2028), 49.0% (n=994) felt the pandemic would exacerbate their symptoms. In the full cohort, 81.1% (n=4414) agreed or strongly agreed that their personal health was at risk during the pandemic due to their clinical role

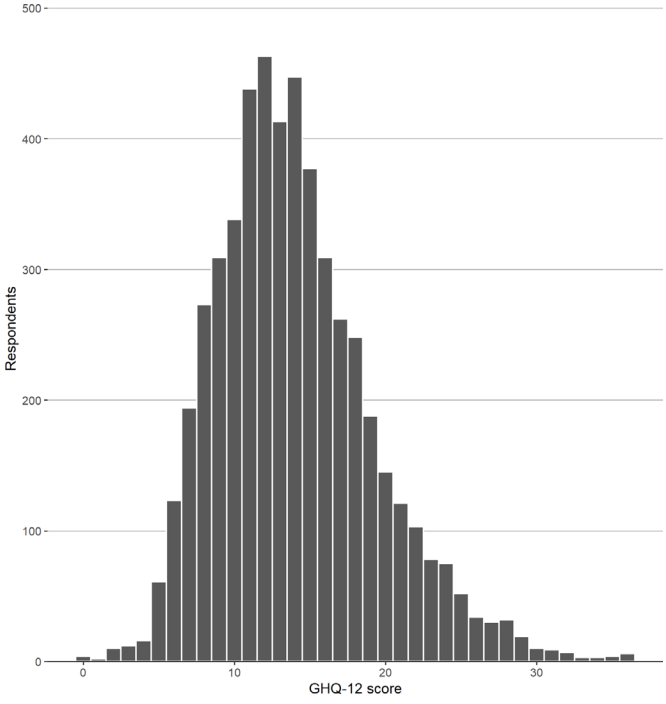

Figure 3 GHQ-12 score (0-1-2-3) distribution. GHQ-12, General Health Questionnaire-12

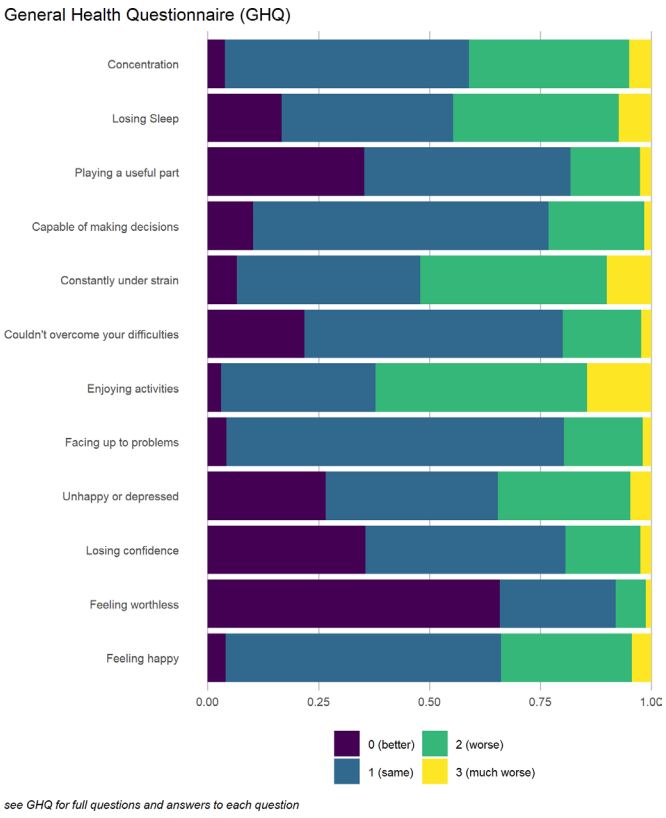

Figure 4 Responses to each individual item of the GHQ-12 (n=5177). GHQ-12, General Health Questionnaire-12.

(49.8% and 31.3%, respectively). However, the greatest concern was the potential risk to families or loved ones due to their clinical role, with 35.3% (n=1921) 'extremely worried' and 43.4% (n=2363) 'generally worried'.

Personal experience of COVID-19

A percentage of 15.3 (n=833) needed to self-isolate by the time of this first survey, the most common reasons being personal symptoms (55.4%, n=460) and symptomatic household contacts (35.8%, n=279). Only 5.2% (n=43) of those who had to self-isolate missed more than 10 clinical shifts.

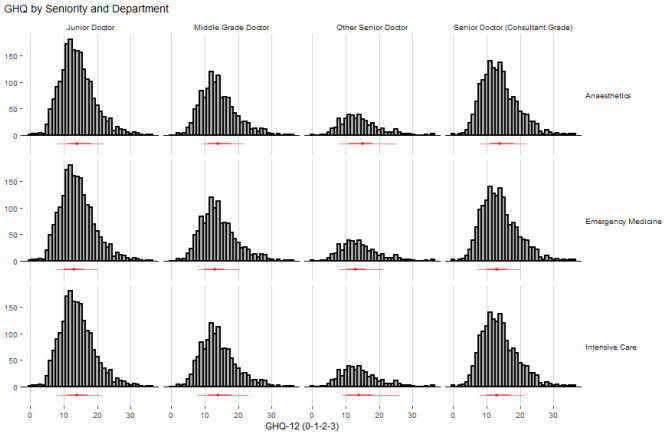

Figure 5 Distribution of GHQ-12 score by seniority and department. GHQ-12, General Health Questionnaire-12.

Table 2 Professional factors

Training and experience	N	% of total	% of non-missing
Have you previously provided direct clinical care to any patients affected by these infectious diseases?*			
None of the below	3045	57.3	48.3
Ebola virus	166	3.1	2.6
MERS-CoV	323	6.1	5.1
SARS	279	5.2	4.4
Chikungunya	152	2.9	2.4
Cholera	160	3	2.5
Influenza (swine, avian, zoonotic)	1996	37.5	31.6
Zika virus	80	1.5	1.3
Other	107	2	1.7
(Missing)	122	2.2	–
How many suspected cases of COVID-19 have you had direct clinical contact with since 1 March 2020?			
0	1144	21	22
1–5	1914	35.2	36.8
6–10	879	16.2	16.9
11–15	465	8.5	8.9
16–20	325	6	6.2
21–25	139	2.6	2.7
26–30	102	1.9	2
31–35	25	0.5	0.5
>36	212	3.9	4.1
(Missing)	235	4.3	–
How confident do you feel in the infection control training that has been provided to you?			
Not confident at all	461	8.5	8.9
Somewhat not confident	1193	21.9	23
Neither not confident or confident	1118	20.6	21.5
Somewhat confident	2150	39.5	41.4
Very confident	274	5	5.3
(Missing)	244	4.5	–
How prepared do you feel to provide direct care to suspected cases?			
Completely unprepared	195	3.6	3.8
Somewhat unprepared	1365	25.1	26.3
Neither unprepared or prepared	577	10.6	11.1
Somewhat prepared	2643	48.6	50.9
Very prepared	416	7.6	8
(Missing)	244	4.5	–
How do you feel the care received by patients who are NOT presenting with either symptoms or a diagnosis of COVID-19 is?			
Significantly worse than before COVID-19	623	11.5	12
Slightly worse than before COVID-19	2018	37.1	38.9
The same as before COVID-19	2145	39.4	41.3
Slightly better than before COVID-19	345	6.3	6.6
Significantly better than before COVID-19	59	1.1	1.1
(Missing)	250	4.6	–

*Participants could select more than one option.
MERS-CoV, Middle East respiratory syndrome coronavirus.

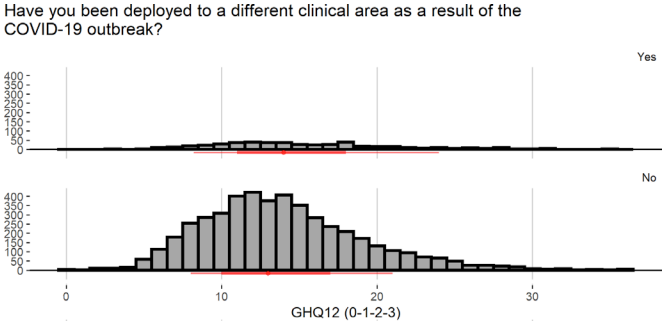

Figure 6 GHQ-12 and redeployed. GHQ-12, General Health Questionnaire-12.

DISCUSSION

In this survey of frontline doctors across the UK and Ireland, over 40% met the criteria for psychological distress, measured by the GHQ-12, during the acceleration phase. These findings are higher than normative data in ICM Doctors and similar to rates found in EM Consultants.[12 13] However, comparison with previous research is limited by sample size, cohort differences and the historical nature of these studies.[29 30] Figures are from early in the pandemic when clinical exposure and case fatality were low; by the end of the study period, there had been 2825 reported COVID-19 cases and 436 reported COVID-19 deaths in the UK[31] and 4014 cases and 131 deaths in Ireland.[32] The data collection period fell during a period of unprecedented and escalating government restrictions, culminating in a full UK lockdown on 23[1] and 27 March 2020 in Ireland, the effect of which cannot be fully accounted for in this work.

Despite efforts to ensure methodological rigour, typical limitations in keeping with survey studies will apply to this study such as response bias and social desirability bias. While data have broadly been captured during the acceleration phase, substantial regional variation in COVID-19 activity was experienced during the survey period, meaning that participants' clinical experience is likely to vary by region. Future phases will attempt to account for this regional variation.

As data have been collected during the acceleration phase of the pandemic, these data cannot be considered a true baseline. However, our data do provide findings from an early timepoint in an infection pandemic, which will inform longitudinal studies assessing the significance of psychological impact during peak and deceleration phases. These findings broadly support the role of several previously identified key (and potentially modifiable) stressors during pandemic medicine, including lack of preparedness and training with PPE; elevated concern in relation to risk to self and others, from provision of clinical care to patients with suspected infectious illness; the potential of moral injury through perceptions of worse care provision to other disease states; and access to information and communication.[5 14–17]

This study highlights a large increase in rates of distress within the ICM cohort when compared with previous work.[12] Whereas in EM, the rates of distress are similar to a cohort of consultants previously studied.[13] The comparisons with this research, conducted in 2002, may be limited by the significant changes of service design, delivery and pressures in the intervening years. However, with such a stark difference between the groups, the reasons underlying this should be a priority for further research.

Findings are consistent with existing research in the field of infectious diseases and COVID-19.[33–37] Despite fairly low rates of exposure and self-isolation due to physical symptoms, between half and two-thirds of respondents expressed concern that exposure to COVID-19 would worsen their pre-existing physical and mental health conditions. This is unsurprising, given the prominently reported death rates of those with existing medical conditions.[38] Concern regarding infection of family and loved ones was highly prevalent and reported by over 80% of respondents, mirroring findings from a recent interview study examining the content of concerns in frontline healthcare workers.[39]

Table 3 PPE training

What training have you received in regard to PPE since the COVID-19 outbreak was declared? (select all that apply)							
	No training	Formal instructional video	Written instruction	Simulation training	Departmental guidance	Other	Missing
Donning and doffing (gloves, gown, facemask and eye protection)	8.2% (n=433)	45.8% (n=2421)	42.9% (n=2267)	45.8% (n=2420)	57.8% (3145)	2.1% (n=109)	2.8% (n=155)
Formal fit testing for mask	17.1% (n=903)	14.1% (n=742)	11.3% (n=596)	38.7% (n=2038)	45.9% (n=2499)	9.9% (n=523)	3.2% (n=172)
PPE training for exposure to aerosol-generating procedure (eg, intubation)	22.1% (n=1163)	27.5% (n=1443)	35.0% (n=1838)	38.4% (n=2019)	46.3% (n=2519)	1.8% (n=97)	3.4% (n=185)

%=percentage of total. Participants could select multiple options
PPE, personal and protective equipment.

Further research has also indicated that having a family member with COVID-19 may be a predisposing factor to psychological distress for healthcare workers themselves.[5] While concern for others and exposure to COVID-19 is unavoidable in frontline clinicians, the distress associated with it is not; psychological well-being warrants careful monitoring and intervention, in line with recommendations by the British Medical Association and British Psychological Society.[40 41]

During this survey, doctors expressed concern that the care of patients without COVID-19 would be negatively impacted. Such concerns have been realised in the literature, with reported increases in out-of-hospital cardiac arrest rates and anecdotal publications on reduced and increasingly late presentations of reversible disease.[42–44] This has also been observed in previous disease outbreaks, such as Ebola.[45 46] The emotional impact of this is likely to result in feelings such as guilt, shame and moral injury,[47] factors commonly associated with poorer psychological outcomes in the context of trauma[15] and worthy of further research in this context.

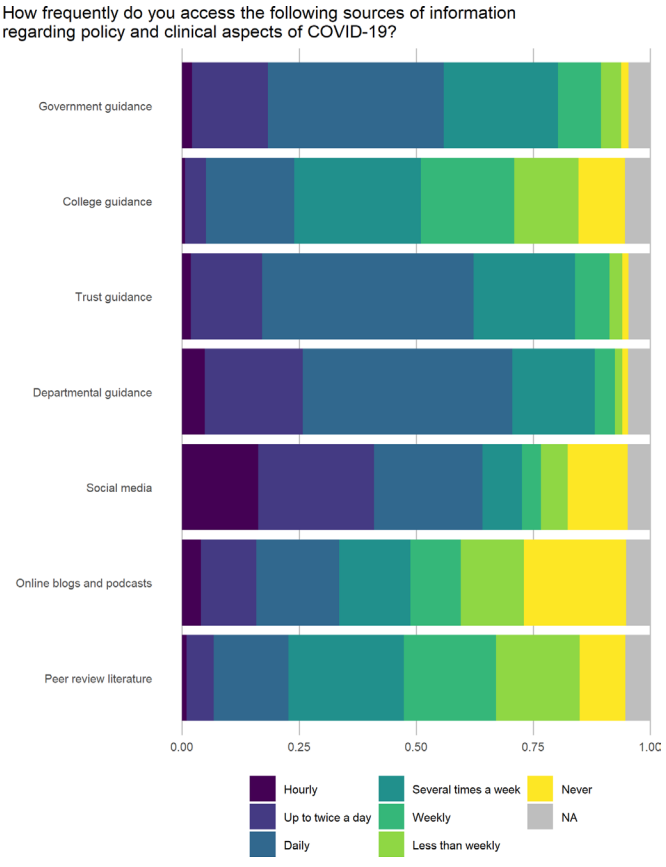

Figure 7 Frequency of accessing information source for clinical updates.

Availability of PPE to frontline clinicians during the COVID-19 outbreak has been a prominent concern internationally.[48 49] However, even where PPE is available, a key driver for related psychological impact is the training, confidence and preparedness in its use. The majority of respondents received some form of training with regards to PPE at an early stage of the pandemic, but this was highly variable and sometimes entirely documentary rather than practical. Given previous literature suggests poorer psychological outcomes with limited preparedness and confidence,[5] it is of note that the percentage of those respondents receiving no training for different PPE procedures, ranged from less than 10% to 22.1%.

Previous research has indicated that accessing social media as a primary source of information can be problematic and associated with acute and post-traumatic stress, particularly when information is conflicting.[35 50] While it was beyond the scope of this analysis to evaluate any such causal impact, further research should seek to assess the relative impact of social media usage in this context. Findings from any research of this nature would be of potential benefit in informing guidance on content and delivery, and end-user insight, to benefit the psychological well-being of clinicians using this source of information.

Current research in the general population reflects our findings of increased distress in doctors. A UK study of 17 452 adults in April 2020 found the prevalence of significant distress (defined by a GHQ-12 of >4) to be 27.3% (95% CI 26.4% to 28.2%).[51] This had increased from 18.8% (95% CI 17.8% to 20.0%) in the 2018–2019 cohort. While comparison with our data is limited by the higher threshold for distress, the trends identified by Pierce *et al*[51] place our results in the context of increased distress in the general population.

While our findings reflect that many doctors struggled with sleep, concentration and feeling strained, many also reported feeling more useful than usual. General confidence, decision making and sense of worth were reported by respondents to be either better or the same for the vast majority of respondents during the pandemic acceleration phase. Research examining resilience and post-traumatic growth in disaster settings have reported similar findings, particularly a sense of accomplishment and enhanced self-esteem.[14] Despite unprecedented restrictions

Table 4 Personal factors

Personal factors			
Are you concerned that the exposure to the COVID-19 outbreak may increase symptoms of any established medical health condition?	n	% of total	% of non-missing
Yes	1357	24.9	26.2
No	927	17.0	17.9
Prefer not to disclose	75	1.4	1.4
I do not have an established medical condition	2826	51.9	54.5
(Missing)	255	4.7	–
Are you concerned that the exposure to the COVID-19 outbreak may increase symptoms of any established mental health conditions?	n	% of total	% of non-missing
Yes	1034	19.0	20.0
No	994	18.3	19.2
Prefer not to disclose	93	1.7	1.8
I do not have an established mental health condition	3054	56.1	59.0
(Missing)	265	4.9	–
I feel that my personal health is at risk during the COVID-19 outbreak due to my clinical role?	n	% of total	% of non-missing
Strongly disagree	93	1.7	1.8
Disagree	216	4.0	4.2
Neither agree nor disagree	450	8.3	8.7
Agree	2709	49.8	52.4
Strongly agree	1705	31.3	33.0
(Missing)	267	4.9	–
How worried are you about the potential risks to your family, loved one or others due to your clinical role in the COVID-19 outbreak?	n	% of total	% of non-missing
Extremely worried	1921	35.3	37.1
Generally worried	2363	43.4	45.6
Neither worried or not worried	392	7.2	7.6
Generally not worried	414	7.6	8.0
Not worried at all	89	1.6	1.7
(Missing)	261	4.8	–
Personal experience of COVID-19			
Have you had to self-isolate?	n	% of total	% of non-missing
Yes	833	15.3	16.1
No	4339	79.8	83.9
(Missing)	268	4.9	–
For what reason did you have to self-isolate?*	n	% of total	% of non-missing
Personal symptoms	460	55.4	47.1
Personal diagnosis of COVID-19	39	4.7	4.0
Symptoms of a member of the household	297	35.8	30.4
Exposure to a positive case of COVID-19 in the work environment	99	11.9	10.1
Exposure to a positive case of COVID-19 in your personal environment	16	1.9	1.6
Other	65	7.8	6.7
(Missing)	3	0.4	–
How many clinical shifts in your rota have you missed due to self-isolation?	n	% of total	% of non-missing
0	81	9.7	9.8
1	77	9.2	9.3
2	119	14.3	14.3
3	131	15.7	15.8
4	124	14.9	14.9
5–7	196	23.5	23.6
8–10	59	7.1	7.1
>10	43	5.2	5.2
(Missing)	3	0.4	–

*Participants could select more than one option.

on individual liberty and freedom of movement, most respondents reported feeling as happy as usual or more so, all things considered. It is a positive indicator to see this early on in the pandemic. Taken together, the findings reflect what may be reasonably expected at an early point in any developing crisis; elevated psychological distress with a degree of impact on functioning.However, protective factors such as increased feelings of worth and usefulness may mitigate against the full impact of the pandemic on mental health. The extent to which a high level of support from the general public towards healthcare professionals influenced feelings of positivity of resilience is unclear and warrants further investigation.

CONCLUSIONS

High levels of psychological distress were present among UK and Ireland frontline EM, anaesthesia and intensive care doctors during the acceleration phase of the initial wave of the COVID-19 pandemic. These frontline staff experienced stress and strain, yet faced this with reasonable levels of confidence in preparedness, mobilisation of skills and increased self-worth. Future work will assess the degree and nature of the relationship between personal and professional factors and psychological distress within a longitudinal framework and consider implications for policy and practice.

Author affiliations
[1]TERN, Royal College of Emergency Medicine, London, UK
[2]Emergency Department, Bristol Royal Hospital for Children, Bristol, UK

[3]Department of Psychology, University of Bath, Bath, UK
[4]Statistical Consultant, Oxford, UK
[5]Department of Anaesthesia, North Bristol NHS Trust, Bristol, UK
[6]Department of Intensive Care and Emergency Department, Salford Royal NHS Foundation Trust, Salford, UK
[7]UWE Faculty of Health and Applied Sciences, Bristol, UK
[8]Department of Anaesthesia, North Bristol NHS Trust, Westbury on Trym, UK
[9]Faculty of Health and Human Sciences, University of Plymouth Faculty of Health and Human Sciences, Plymouth, UK
[10]Emergency Department, Derriford Hospital, Plymouth, UK
[11]Division of Cardiovascular Sciences, University of Manchester, Manchester, UK
[12]Department of Emergency Medicine, Our Lady's Children's Hospital, Dublin, Ireland
[13]Department of Women's and Children's Health, University College Dublin, Dublin, Ireland
[14]Department of Emergency Medicine, University Hospital Waterford, Waterford, Ireland
[15]Department of Emergency Medicine, St Vincents University Hospital, Dublin, Ireland
[16]Department of Women's and Children's Health, University College Dublin School of Medicine, Dublin, Ireland
[17]Emergency Department, Connolly Hospital Blanchardstown, Blanchardstown, Dublin, Ireland
[18]College of Anaesthesiologists of Ireland, Dublin, Ireland
[19]Emergency Department, North Bristol NHS Trust, Westbury on Trym, UK
[20]School of Health and Social Care, University of the West of England Bristol, Bristol, UK

Twitter Tom Roberts @ternfellow, Robert Hirst @hirstposition, Daniel Horner @rcemprof, Mark D Lyttle @mdlyttle, Katie Samuel @katie_samuel_, Blair Graham @timecritical, Michael Barrett @PEMDUBLIN, Etimbuk Umana @timburg and Edward Carlton @eddcarlton

Acknowledgements The authors would like to acknowledge Mai Baquedano, at the University of Bristol, for her support with Research Electronic Data Capture and GL Assessment for providing the licence for the General Health Questionnaire-12 (GHQ-12) free of charge.

Collaborators Trainee Emergency Research Network Collaborators: L Kane, A Hormis, L Mackenzie, R Hannah, S Sharma Hajela, A Corfield, J Phizacklea, J Maney, K Malik, D Metcalfe, N Mathai, S Timmis, A Sattout, C Williams, S Messahel, R Newport, E Fadden, D Bawden, R McQuillan, A Tabner, B O'Hare, H Malik, S Lewis, C Roe, D Bewick, D McConnell, R Taylor, F Taylor, I Hancock Manthalapo, R Ellis, D Ramesh Babu, S Morgan, S Hartshorn, L Barnicott, M Williams, S Foster, A Charlton, J Browning, L Somerset, L McCrae, C Munday, E Godden, A Turner, A Saunders, R Sainsbury, A Lawrence-Ball, E Williams, R House, S Patil, J Muller, R Stewart, I Skene, M Winstanley, M Lim, N Tambe, H Millar, C Magee, A Rai, D Raffo, K Challen, D Mawhinney, S Currie, B Taylor, M Elkanzi, T Hussan, T Perry, G Pells, W Kan, F Barham, L Brown, F Wood, M Cheema, C Szekeres, A Clarey, R Greenhalgh, A Gulati, S Marimuthu, K Webster, R Macfarlane, A Howson, M Alex, R Doonan, B Shrestha, C Magee, L Stanley, A Trimble, J Gumley, C O'Connell, K Thomas, R Wright, M Anderson, E Colley, C Weegenaar, C Rimmer, J Lockwood, S Pintus, T Mohamed, H Jarman, S Ramraj, V Worsnop, M Mackenzie, S Collins, A Robertson, M Colmar, W Niven, N Masood, M Patel, R McLatchie, S Subramaniam, A Peasley, C Holmes, S Rahman, S Bongale, N Mullen, U Bait, L Armstrong, S Nagendran, A Hay, S Rao, R Mills, F Mendes, J Lowe, P Singh, H Raybould, S Subramaniam, A Ali, T Baron, P Cuthbert, C Ponmani, A McKinney, M Depante, S Taylor, R Sneep, V Talwar, A Brookes, Z Al-Janabi, S Williams, C Leech, A Rainey, J Turner, J Brown, L McKechnie, N Marriage, B Mallon, S Manou, J McLaren, S Hart, Y Moulds, M Elsheikh, L Dunlop, L Cocker, F M Burton, M H Elwan, S Keers, K L Vincent, L Robertson, C Nunn, D Craver, N Sarja, N Moultrie, M Viegas, O Williams, S Graham, S Purvis, E Wooffinden, M Clark, C Reynard, C Davies, N Cherian, S Foreman, A Da-Costa, C Ngua, S Duckitt, J Morgan, J Bailey, N Hoskins, L How, J Fryer, T Hine, R Wright, F Ihsan, L Frost, H Abdullah, P Ellis, K Bader, A Mackay, S Pradhan, K Gray, M Manoharan, M Jacobs Musliam, L Kehler, I Veettil Asif, R Muswell, P Amiri, M Bonsano, S Shrivastava, J Evans, F Raza, E Christmas, S Wilson, K Knight, M Riyat, L O'Rourke, H Knott, K Adeboye, M Ramazany, K Iftikhar, S Langston, R Evans, N Abela, R Darke, L Robinson, R Freeman, D Maasdorp, E Grocholski, H Murphy, K Kaur, H Edmundson, H Cooper, R Das, M Mohammad, C Orjioke, L Harwood, D Worley, K Lines, W Collier, C Thomas, J Everson, D Ranasinghe, N Maleki, S Hall, A Stafford, J Wright, S Gokani, S Hall, M Charalambos, N Ali, A Olajide,J Hunt, C Bi, H Ahmad, J Ng, C Ward, S Naeem, M Khan, A Hill,K Holzman, C Boulind, J Ritchie and A Patton. Ireland Trainee Emergency Research Network Collaborators: M Jee Poh Hock, J Lynch, R O'Sullivan, S Gilmartin, S Uí Bhroin, P Fitzpatrick, A Patton, S Kukaswadia, C Prendergast, A Ahmed, C Dalla Vecchia, M Grummell, I Grossi and B MacManus. Research and Audit Federation of Trainees, Trainee Research in Intensive Care and Specialist Anaesthesia Trainee led Audit and Research Network Collaborators: K Samuel, A Boyle, A Waite, B Johnston, J Vinagre, P Turton, D George, C Battle and J Anandarajah.

Contributors TR conceived the idea for the study. TR, EC, JD, MDL and BG were responsible for the initial study design, which was refined with the help of KS, CR, RH, MB and WH. Expert advice on psychological assessment scores was provided by JD. WH provided the statistical plan. TR led the dissemination of the study in UK Adult Emergency Departments, MDL led the dissemination of the study in UK and Ireland paediatric EDs, KS led the dissemination of the study in UK anaesthetic and intensive care unit (ICU) Departments, MB led the dissemination of the study in Ireland EDs, along with JC, JF and EU. JV led the dissemination in Ireland ICUs and anaesthetic departments. TR coordinated study set-up, finalisation of the study surveys and finalisations of study protocols. All authors contributed to the final study design and protocol development, critically revised successive drafts of the manuscript and approved the final version. The study management group is responsible for the conduct of the study.

Funding The chief investigator is directly funded as a research fellow by the Royal College of Emergency Medicine. The GHQ-12 is being used under licence from GL assessment; the fee for use of this instrument within all three surveys has been waived. EC is a National Institute for Health Research Advanced Fellow. The study has direct funding from RCEM. Grant code: G/2020/1.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval was provided by the University of Bath UK - Number 4421 Children's Health at Ireland at Crumlin - REC Reference GEN/806/20.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. Data are available on request to chief investigator. All reasonable requests will be considered and provided as deidentified data.

ORCID iDs
Tom Roberts http://orcid.org/0000-0003-4991-974X
Daniel Horner http://orcid.org/0000-0002-0400-2017
Mark D Lyttle http://orcid.org/0000-0002-8634-7210
Blair Graham http://orcid.org/0000-0002-0005-0476
Michael Barrett http://orcid.org/0000-0003-1775-8347
James Foley http://orcid.org/0000-0001-9635-4513
Etimbuk Umana http://orcid.org/0000-0002-0780-8614
Edward Carlton http://orcid.org/0000-0002-2064-4618

REFERENCES

1 WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March, 2020. Available: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020 [Accessed 31 Mar 2020].
2 Docherty AB, Harrison EM, Green CA, *et al*. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. *BMJ* 2020;369:m1985.
3 Cook T. Exclusive: deaths of NHS staff from covid-19 analysed | Comment | health service Journal. Available: https://www.hsj.co.uk/exclusive-deaths-of-nhs-staff-from-covid-19-analysed/7027471.article [Accessed 7 Jul 2020].
4 COVID-19 situation update worldwide, as of 10 July 2020. Available: https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases [Accessed 10 Jul 2020].
5 Kisely S, Warren N, McMahon L, *et al*. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *BMJ* 2020;369:m1642.
6 Maunder RG, Lancee WJ, Rourke S, *et al*. Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other Hospital workers in Toronto. *Psychosom Med* 2004;66:938–42.
7 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.

8 Allan SM, Bealey R, Birch J, *et al*. The prevalence of common and stress-related mental health disorders in healthcare workers based in pandemic-affected hospitals: a rapid systematic review and meta-analysis. *Eur J Psychotraumatol* 2020;11:1810903.
9 Arora M, Asha S, Chinnappa J, *et al*. Review article: burnout in emergency medicine physicians. *Emerg Med Australas* 2013;25:491–5.
10 Maunder RG, Lancee WJ, Balderson KE, *et al*. Long-Term psychological and occupational effects of providing Hospital healthcare during SARS outbreak. *Emerg Infect Dis* 2006;12:1924–32.
11 Halpern J, Maunder RG, Schwartz B, *et al*. Identifying risk of emotional sequelae after critical incidents. *Emerg Med J* 2011;28:51–6.
12 Coomber S, Todd C, Park G, *et al*. Stress in UK intensive care unit doctors. *Br J Anaesth* 2002;89:873–81.
13 Burbeck R, Coomber S, Robinson SM, *et al*. Occupational stress in consultants in accident and emergency medicine: a national survey of levels of stress at work. *Emerg Med J* 2002;19:234–8.
14 Brooks SK, Dunn R, Amlôt 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.
15 Brooks SK, Dunn R, Sage CAM, *et al*. Risk and resilience factors affecting the psychological wellbeing of individuals deployed in humanitarian relief roles after a disaster. *J Ment Health* 2015;24:385–413.
16 Lancee WJ, Maunder RG, Goldbloom DS, *et al*. Prevalence of psychiatric disorders among Toronto Hospital workers one to two years after the SARS outbreak. *Psychiatr Serv* 2008;59:91–5.
17 Ozer EJ, Best SR, Lipsey TL, *et al*. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychol Bull* 2003;129:52–73.
18 BMA survey finds doctors' lives still at risk despite PPE pledges. Available: https://www.bma.org.uk/news-and-opinion/bma-survey-finds-doctors-lives-still-at-risk-despite-government-pledges-on-ppe [Accessed 23 Apr 2020].
19 Holmes EA, O'Connor RC, Perry VH, *et al*. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry* 2020;7:547–60.
20 Holloway R, Rasmussen SA, Zaza S. Updated preparedness and response framework for influenza pandemics, 2014. Available: https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6306a1.htm [Accessed 8 Apr 2020].
21 Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of Internet E-Surveys (cherries). *J Med Internet Res* 2004;6:e34.
22 Roberts T, Daniels J, Hulme W, *et al*. COVID-19 emergency response assessment study: a prospective longitudinal survey of frontline doctors in the UK and ireland: study protocol. *BMJ Open* 2020;10:e039851.
23 Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–81.
24 Harris PA, Taylor R, Minor BL, *et al*. The REDCap Consortium: building an international community of software platform partners. *J Biomed Inform* 2019;95:103208.
25 Goldberg D, Williams P. *A user's guide to the General Health Questionnaire*. London: GL Assessment, 1988.
26 Goldberg DP, Gater R, Sartorius N, *et al*. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* 1997;27:191–7.
27 Goldberg DP, Oldehinkel T, Ormel J. Why GHQ threshold varies from one place to another. *Psychol Med* 1998;28:915–21.
28 R Core Team. *A language and environment for statistical computing*. R Found. Stat. Comput, 2018.
29 Imo UO. Burnout and psychiatric morbidity among doctors in the UK: a systematic literature review of prevalence and associated factors. *BJPsych Bull* 2017;41:197–204.
30 Kinman G, Teoh K. What could make a difference to the mental health of UK doctors? A review of the research evidence 2018.
31 Coronavirus (COVID-19) in the UK. Available: https://coronavirus.data.gov.uk/#category=regions&map=rate [Accessed 17 Jun 2020].
32 Health Protection Surveillance Centre I. Epidemiology of COVID-19 in Ireland - daily reports, April 2020. Available: https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/casesinireland/epidemiologyofcovid-19inireland/april2020/ [Accessed 26 Oct 2020].
33 Mukhtar S. Psychological health during the coronavirus disease 2019 pandemic outbreak. *Int J Soc Psychiatry* 2020;66:512–6.
34 Shevlin M, McBride O, Murphy J, *et al*. Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic. *BJPsych Open* 2020;6:e125.
35 Torales J, O'Higgins M, Castaldelli-Maia JM, *et al*. The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int J Soc Psychiatry* 2020;66:317–20.
36 Wang C, Pan R, Wan X, *et al*. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun* 2020;87:40–8.
37 Chen N, Zhou M, Dong X, *et al*. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020;395:507–13.
38 Ross J, Weill Peter R D. OpenSAFELY: factors associated with COVID-19-related Hospital death in the linked electronic health records of 17 million adult NHS patients. *J Chem Inf Model* 2006.
39 Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA* 2020;323:2133.
40 BMA. The mental health and wellbeing of the medical workforce-now and beyond COVID-19, 2020. Available: https://www.bma.org.uk/media/2475/bma-covid-19-and-nhs-staff-mental-health-wellbeing-report-may-2020.pdf
41 British Psychological Society Covid19 Staff Wellbeing Group. The psychological needs of healthcare staff as a result of the coronavirus pandemic. Available: www.ics.ac.uk/ICS/Education/Wellbeing/ICS/Wellbeing.aspx [Accessed 7 Jul 2020].
42 Baldi E, Sechi GM, Mare C, *et al*. Out-Of-Hospital cardiac arrest during the Covid-19 outbreak in Italy. *N Engl J Med* 2020;383:496–8.
43 Garcia S, Albaghdadi MS, Meraj PM, *et al*. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. *J Am Coll Cardiol* 2020;75:2871–2.
44 Marijon E, Karam N, Jost D, *et al*. Out-Of-Hospital cardiac arrest during the COVID-19 pandemic in Paris, France: a population-based, observational study. *Lancet Public Health* 2020;5:e437–43.
45 Brolin Ribacke KJ, Saulnier DD, Eriksson A, *et al*. Effects of the West Africa Ebola virus disease on health-care utilization - a systematic review. *Front Public Health* 2016;4:222.
46 Elston JWT, Cartwright C, Ndumbi P, *et al*. The health impact of the 2014-15 Ebola outbreak. *Public Health* 2017;143:60–70.
47 Greenberg N, Docherty M, Gnanapragasam S, *et al*. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020;368:m1211.
48 Rowan NJ, Laffey JG. Challenges and solutions for addressing critical shortage of supply chain for personal and protective equipment (PPE) arising from Coronavirus disease (COVID19) pandemic - Case study from the Republic of Ireland. *Sci Total Environ* 2020;725:138532.
49 Dyer C. Covid-19: doctors are warned not to go public about PPE shortages. *BMJ* 2020;369:m1592.
50 Jones NM, Thompson RR, Dunkel Schetter C, *et al*. Distress and rumor exposure on social media during a campus lockdown. *Proc Natl Acad Sci U S A* 2017;114:11663–8.
51 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.