Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Respiratory Medicine 176 (2021) 106219

Contents lists available at ScienceDirect

Respiratory Medicine

journal homepage: http://www.elsevier.com/locate/rmed

Original Research

Levels of resilience, anxiety and depression in nurses working in respiratory clinical areas during the COVID pandemic

N.J. Roberts [a,*], K. McAloney-Kocaman [a], K. Lippiett [b], E. Ray [b], L. Welch [b], C. Kelly [c]

[a] School of Health and Life Sciences, Glasgow Caledonian University, UK
[b] School of Health Sciences, University of Southampton, UK
[c] Respiratory Research Centre, Edge Hill University, UK

ARTICLE INFO

Keywords:
COVID-19
Resilience
Aerosol generating procedures
Nurse
Anxiety
Depression

ABSTRACT

Background: The delivery of healthcare during the COVID pandemic has had a significant impact on front line staff. Nurses who work with respiratory patients have been at the forefront of the pandemic response. Lessons can be learnt from these nurses' experiences in order to support these nurses during the existing pandemic and retain and mobilise this skilled workforce for future pandemics.

Methods: This study explores UK nurses' experiences of working in a respiratory environment during the COVID-19 pandemic. An e-survey was distributed via professional respiratory societies; the survey included a resilience scale, the GAD7 (anxiety) and the PHQ9 (depression) tools. Demographic data was collected on age, gender, ethnicity, nursing experience and background, clinical role in the pandemic, and home-life and work balance.

Results: Two hundred and fifty-five responses were received for the survey, predominately women (89%, 226/255), aged over 35 (79%, 202/255). Nearly 21% (40/191) experiencing moderate to severe or severe symptoms of anxiety. Similar levels are seen for depression (17.2%, 31/181). 18.9% (34/180) had a low or very low resilience score.

Regression analysis showed that for both depression and anxiety variables, age and years of qualification provided the best model fit. Younger nurses with less experience have higher levels of anxiety and depression and had lower resilience.

Conclusion: This cohort experienced significant levels of anxiety and depression, with moderate to high levels of resilience. Support mechanisms and interventions need to be put in place to support all nurses during pandemic outbreaks, particularly younger or less experienced staff.

1. Introduction

Worldwide, there are already more than 23 million cases of COVID-19 and more than half a million reported deaths from the virus, figures that are likely to rise as the pandemic continues [1]. The current coronavirus disease outbreak was declared a global pandemic by the World Health Organisation (WHO) on the 11th March 2020 [2]. The pandemic has since exerted a significant strain on the provision of healthcare, predominantly critical care and respiratory services. To provide additional support in the UK, the NHS has been asking retired staff and current nursing students to enter or return to clinical practice. Additionally, many staff have been retrained and redeployed to key clinical areas to support services during the pandemic [3].

Nurses are the largest workforce within healthcare systems and are integral to management of a pandemic [4,5]. Nurses working with respiratory patients have specialist skills and knowledge and are crucial to the management of COVID-19, providing expert care not only to COVID-19 patients, but also maintaining care for patients with long-term conditions and complex needs. There are effects on the mental health of the workforce and a psychological impact of working on the front line with COVID-19 patients. Shaw et al. reported feelings of hopelessness and helplessness within the NHS [6]. In the UK at least 100 healthcare workers have died of complications of COVID-19 as of April 20, 2020 [7], unfortunately updated numbers are not reported in the public domain. Li et al. estimated 5% of those infected experienced severe pneumonia and possible multi-organ failure requiring advanced life support [8]; this will be a significant worry for healthcare staff working in these areas.

* Corresponding author. School of Health and Life Sciences, Glasgow Caledonian University, Cowcaddens Rd, Glasgow, G4 0BA, UK.
E-mail address: Nicola.roberts@gcu.ac.uk (N.J. Roberts).

https://doi.org/10.1016/j.rmed.2020.106219
Received 26 August 2020; Received in revised form 3 November 2020; Accepted 4 November 2020
Available online 7 November 2020
0954-6111/© 2020 Elsevier Ltd. All rights reserved.

A previous study of experiences of nurses during the middle east respiratory syndrome outbreak highlights staff experiencing burnout due to high volume of work and safety concerns about being infected [9]. A study in Korea looked at the same pandemic and showed that burnout in emergency nurses was influenced by job stress, poor treatment resources and poor support from family and friends [10]. A US study showed that the majority of nurses reported that they would work during a pandemic, this decreased when the perceived risks were higher, with illness, or if a family member needed care [11]. In China and the US an overall lack of preparedness for the pandemic was reported regarding the provision of protective equipment and available training to use it [12]. Moore et al. have shown that 35% of UK frontline workers needed support but did not feel able to ask for it, and 64% reported feeling anxious during April 2020 [13].

Some of the first studies that have been published on the psychological impact of COVID-19 on patients as reported in the Lancet Psychiatry by Liu et al. (2020) highlight the need for appropriate planning, co-ordination between services, timely and appropriate interventions and the presence of appropriately qualified staff [15]. Stress levels were found to be higher for non-front line nurses and the general public than those working directly (front line nurses) with COVID patients, labelled as 'vicarious traumatization', possibly related to knowledge and confidence and the voluntary nature of those in the front line [14]. Liu (2020) discusses the merits of on-line resources to support practice, in particular counselling and psychological support services not available in previous pandemics [15]. In a study by Lai et al. the mental health status of doctors and nurses are assessed, factors influencing increased stress include: middle age, divorce, being widowed or living alone, and being a nurse (compared to doctor) [16]. Currently, very few UK studies are available; Maben and Bridges (2020) reflect on the challenges of nurses working with COVID-19 patients in the USA, Italy and UK. They highlight the importance of peer support in addition to leadership and also warn of the longer term psychological effects when there is a return to normal [17]. A recent Nursing Times survey highlighted that 33% (n = 3500) described their overall mental health and wellbeing as bad or very bad during the pandemic [18]. The NHS ideally needs to maximise support for nurses who are experiencing high levels of anxiety and stress during the pandemic [18], in order to promote wellbeing, loyalty and value them as skilled professionals. In order to do this there is a need to explore further the experiences of front line nurses working in respiratory areas, to be able to learn from these experiences, identify support needs and strategies that retain and mobilise this skilled workforce for future pandemics.

This cross-sectional survey study explored UK nurses' experiences of working in a respiratory environment during the COVID-19 pandemic in order to understand and explain the levels of resilience, anxiety and depression in nurses working with respiratory patients during the COVID-19 pandemic.

2. Methods

2.1. Design of the survey tool

The survey tool consisted of 90 questions utilising a mixture of open-ended and closed questions. It also includes three well recognised and validated tools: a resilience scale [19], the GAD7 [20] and the PHQ9 [21]. Data were also collected on demographic characteristics such as age, gender, ethnicity, number of years qualified, details of long-term health conditions and UK geographical location. Other sections included nursing background and questions to capture those fast tracking into clinical practice or returning to clinical practice after a break. Respondent's clinical role and role during the pandemic were captured and any training given for those who were redeployed. Characteristics about homelife and work balance were also included. Survey tools were piloted with a small group of nurses from the teams' network (academic, or registered nurses); minor changes were made to questions to enhance ease of understanding.

The online survey was designed using RedCAP© and analysed in SPSS (Version 25.0). The link to the survey was disseminated via social media. Respiratory societies were also asked to circulate the survey link via email and social media (British Thoracic Society, Primary Care Respiratory Society, Association for Respiratory Nurse Specialists). Potential participants were invited to complete the 20 min survey. The survey link was redistributed regularly over a 3-week period in May (during the pandemic) and the survey was closed on the June 1, 2020.

2.2. Data collection

A sample size calculation was not undertaken as it was uncertain what the response rate would be due to the COVID-19 outbreak, a minimum convenience sample for the study was estimated to be approximately 150 participants. The survey was disseminated via the professional respiratory societies and social media (convenience sample) to ensure we did not overburden this group of working nurses. It is planned that a second survey will be issued if there is another significant peak in infections in the future.

The survey is sampling registered nurses working in respiratory clinical areas, including those who have been fast-tracked (student nurses) and registered early, or who have come out of retirement or switched role to work in a clinical area managing COVID-19 patients.

2.3. Data analysis

Survey data was entered into SPSS (Version 25.0)© for analysis. Descriptive statistical analysis and univariate inferential testing (Mann-Whitney, Kruskall-Wallis) were undertaken for the survey responses, to explore relationships with the respective dependent scores for resilience, GAD-7 and PHQ-9 and for the purpose of variable reduction in regression modelling. A series of multiple logistic regression models were undertaken to provide an indication of the relative independent association of the independent variables with the outcome variables (anxiety and depression). Variable categories were collapsed for the regression analysis. All four independent variables (Age, years qualified, providing support to the household, undertaking aerosol generating procedures) were entered into an initial regression with each dependent variable, and two further alternative models estimated to account for multicollinearity between two independent variables.

2.4. Ethical approval

As this was a survey study, consent was inferred following the provision of participant information at the start of the survey. Signposting to mental health advice and charities were included at the completion of the survey. All data collected was anonymised and any identifiable information was removed prior to analysis. The study was approved by the School of Health and Life Science committee at Glasgow Caledonian University (HLS/NCH/19/036).

3. Results

Two hundred and fifty-five responses were received for the survey, predominately by women (89%), aged over 35 (79%) (Table 1). Just under ninety-five percent (94.9%, 242/255) of respondents classed themselves as white, only a small sample of other ethnicity groups completed the survey. Most were living with partner and children (43.1%, 110/255), or partner alone (25.9%, 66/255). Thirteen percent (13.3%, 34/255) reported that they lived in a multigenerational household. Forty-one percent (40.8%, 104/255) reported that other family members were keyworkers during the pandemic. When asked about how they were managing to cope with work/home and whether they were having difficulties providing support to their household (food, heat, emotional support) 11.4% stated that they couldn't support their

Table 1
Demographics of survey respondents (n = 255).

	Frequency (%)
Age (years, mean (SD))	45.1 (9.77)
Age (years)	
18-35	53 (20.8)
36-50	104 (40.8)
50+	98 (38.4)
Gender	
Male	28 (11.0)
Female	226 (88.6)
Prefer not to say	1 (0.4)
Ethnicity	
White	242 (94.9)
Asian	7 (2.7)
All other ethnic groups	6 (2.4)
Years qualified	
<20 years	109 (42.7)
>20 years	146 (57.3)
Long term conditions	
No	201 (78.8)
Yes	53 (20.8) (Cardiac 8; diabetes 7; asthma 29, other 9)
UK region	
Scotland	23 (9.0)
Northern Ireland	7 (2.7)
Wales	11 (4.3)
England (excluding London)	200 (78.4)
Greater London	14 (5.5) England – North east 11, North west 30, Yorkshire and Humber 35, West Midlands 16, East Midlands 28, South west 22, South east 43, East of England 15)
Usual clinical setting	
Acute	147 (57.6)
Community	45 (17.6)
Primary Care	27 (10.6)
Other	15 (5.9)
Change of role during COVID pandemic	
Yes	146 (57.3)
No	72 (28.2)
Redeployed from other areas (Yes)	74 (29.0)
Returning to practice (Yes)	6 (2.4)
Fast tract student (Yes)	1 (0.4)
Undertaking aerosol generating procedures	
Yes	124 (48.6)
No	96 (37.6)
Concerns about working in your environment	
Catching the virus	116 **(45.5)**
Being exhausted	76 (29.8)
Giving the virus to other people	167 (65.5)
Not being able to cope	55 (21.6)
Not working safely	56 (22.0)
Not enough PPE	72 (28.2)
Long term stress	71 (27.8)
Living arrangements	
Alone	11 (4.3)
With partner/spouse	66 (25.9)
With partner/spouse and children	110 (43.1)
Single parent with children	13 (5.1)
With extended family	9 (3.5)
Do you live in a multi-generational household?	
Yes	34 (13.3)
No	175 (68.8)
Are any other family members working in health services or as a keyworker?	
Yes	104 (40.8)
No	104 (40.8)
Are you able to provide enough support to your household? i.e. food, heat, emotional support	
Yes	178 (69.8)
No/with difficulty	29 (11.4)
Have you potentially had the COVID-19 infection and have you isolated in the last 4–6 weeks (surveyed March/April)	
Yes	63 (24.7)
No	144 (56.5)

household or had difficulty.

Twenty-five percent (24.7%, 63/255) reported that they thought that they had had COVID-19 and had self-isolated over the last 4–6 weeks. Just over twenty percent of participants reported having a long-term condition, most commonly asthma (cardiac = 8, diabetes = 7, asthma = 29). Nine percent of participants (23/255) reported that they were in an at-risk (vulnerable) group. Respondents were from all regions of the UK with the majority from England. Fifty-eight percentage usually worked in an acute setting, 57.3% (146/255) had changed their role due to the pandemic, and 48.6% (124/255) were undertaking aerosol generating procedures which may be perceived as high risk. Aerosol generating procedures are any procedures that are likely to produce aerosols of respiratory secretions, this includes (but is not limited to), intubation/extubation, tracheotomy procedures, bronchoscopy, sputum induction, provision of high flow nasal oxygen and manual ventilation [22]. Twenty-nine percent of participants (74/255) had been redeployed from other areas. A small proportion (2.4%, 6/255) of the respondents had returned to clinical practice, and only one student completed the survey.

3.1. Anxiety, depression and resilience scores

The median score for anxiety (GAD-7) was 4 (range 0, 21), the frequencies show that 50.3% experienced minimal anxiety, 28.8% (55/191) experienced mild symptoms and 20.9% experienced moderate severe to severe symptoms (Table 2). Scores were similar for depression, median scores were 4 (range 0,27) with 51.9% experiencing minimal depression symptoms, 30.9% mild symptoms and 17.2% experiencing moderate to severe symptoms (Table 2). The median score for resilience was 82 (range 14, 98), only 18.9% had resilience at the low end of the scale and below, 65% had a moderate or moderately high resilience score. The average resilience scores were moderate meaning that individuals may possess some of the characteristics of resilience but these need strengthening [19]. Resilience had a significant negative correlation with both anxiety (Pearson correlation −0.316) and depression (Pearson correlation −0.372) (both $p < 0.001$). Anxiety and depression scores were significantly correlated with each other (Pearson correlation 0.779, $p < 0.001$).

3.2. Regression analysis

Several variables were identified as potentially significantly important (Table 3) in influencing anxiety, depression and resilience scores: ethnicity, participant age, years of experience, usual clinical setting, undertaking aerosol generation procedures and providing support to their household (Table 3). Sample sizes met power calculation requirements (minimum sample size of 180 respondents) specifically for a logistic regression [23]. The results of the logistic regression model are shown in Tables 4 and 5. All significant variables (cut-off $p < 0.05$) were entered into multiple logistic regression models for anxiety and depression. A model was not undertaken for resilience as only one significant variable was found [participant age] which influenced resilience.

Three models (shown in Table 4) were designed to assess the variables which would predict depression score (>10 equating to moderate

depression), one with all four predictors entered, and due to moderate multicollinearity between age and years of qualification (r = 0 0.70) two separate models were estimated with each independent variable entered separately. Examination of the Nagelkerke R square value indicates that model one, which included both age and years of qualification, was the best fitting, although age was not significantly associated with depression, it was shown that the ability to provide support to the household (financial, heat, food, emotional) was important in all three models ($p < 0.01$). Consistently supporting the household is a significant predictor of scoring above the threshold for depression. In model 1, individuals who reported difficulties in support in the household had over 5 times greater odds of meeting the criteria for depression, while those qualified for 20 years or more had significantly lower odds of meeting the criteria for depression.

For predictors of anxiety, three models (Table 5) were estimated, as age and years of qualification have some multicollinearity. Examination of Nagelkerke R squared indicated model 1 and 3 to be the best fitting models, which both included age. Across all three models there was a consistent association between scoring above the threshold (>10) for anxiety and support in the household, those indicating difficulties in household support had over 6 times greater odds of meeting the criteria for anxiety than those with no such difficulties. In the absence of age (model 2) as an independent variable, those qualified over 20 years were significantly less likely to score about the threshold for anxiety; and when only age is considered (model 3) those in the age groups 35–50 and older than 50 were less likely to meet the criteria for anxiety. However, in model 1 when both variables are included only age is significant, with individuals aged 35–50 significantly less likely to score above the threshold for anxiety. Undertaking aerosol generating procedures had no significant association with anxiety and depression scores across any of the models.

4. Discussion

This study set out to understand and explain the levels of resilience, anxiety and depression in nurses working with respiratory patients during the COVID-19 pandemic. Resilience can be described as an individual's ability to 'bounce back' in difficult circumstances [24]. It has been shown to be important in the ability to cope in crisis situations, such as the COVID-19 pandemic. This study particularly targeted nurses working in a respiratory context who have a transferable skill set which may encompass managing acute and long-term management of patients with respiratory disease in different care settings. This includes non-invasive ventilation and oxygen therapy (key treatments for COVID-19) as well as diagnostics, pharmacotherapy, support for self-management, rehabilitation, health promotion and palliative care.

This study has analysed 255 responses from nurses working with respiratory patients (including COVID-19) during the pandemic. Just under half (46.7%) had a moderate or a lower resilience score, comparable to other studies [25,26]. Regression analysis was not possible for resilience as our results showed that resilience was only influenced by participant age in this study, with older participants experiencing increased resilience ($P = 0.009$). Understanding what influences levels of resilience, anxiety and depression in this population, and how health managers can promote and support resilience in the nursing workforce, will be a key attribute to any future pandemic planning. However, resilience is not solely a personal experience, or influenced only by employment. Resilience has been shown to be influenced by some personal characteristics (home ownership, siblings, commute, working relationships) as well as environmental factors (social support, role model) [27].

Sul et al. [28] has shown that resilience increases with age, and job banding, the average resilience scores were moderate, suggesting that

Table 2
Anxiety, depression and resilience scores.

	Frequency, (%)
Anxiety (n = 191)	
Minimal anxiety (0–4)	96 (50.3)
Mild anxiety (5–9)	55 (28.8)
Moderate severe anxiety (10–14)	21 (11.0)
Severe anxiety (15–21)	19 (9.9)
Median score (min, max)	**4 (0,21)**
Depression (n = 181)	
Minimal depression (0–4)	94 (51.9)
Mild depression (5–9)	56 (30.9)
Moderate depression (10–14)	17 (9.4)
Moderately severe depression (15–19)	9 (5.0)
Severe (20–27)	5 (2.8)
Median score (min, max)	**4 (0, 27)**
Resilience (n = 180)	
Very low (14–56)	4 (2.2)
Low (57–64)	7 (3.9)
On the low end (65–73)	23 (12.8)
Moderate (74–81)	50 (27.8)
Moderate high (82–90)	67 (37.2)
High (91–98)	29 (16.1)
Median score (min, max)	**82 (14, 98)**

Table 3
Key variables influencing anxiety, depression and resilience scores.

	Median Anxiety score	Median Depression score	Median Resilience score
Ethnicity			
White	4 (range 21, N = 183)	4 (range 27, N = 27)	82 (range 84, N = 173)
Asian	10 (range 13, N = 5)	8 (range 8, N = 5)	87.5 (range 23, N = 4)
All other ethnic groups	5 (range 6, N = 3)	4 (range 4, N = 3)	81 (range 5, N = 3)
	P = 0.064	P = 0.061	P = 0.668
Participant age			
18-35	10 (range 21, N = 35)	7 (range 27, N = 34)	79 (range 50,N = 35)
36-50	4 (range 21, N = 84)	5 (range 19, N = 81)	82 (range 44, N = 76)
50+	4 (range 21, N = 72)	3 (range 26, N = 66)	85 (range 84, N = 69)
	P = 0.001	**P = 0.001**	**P = 0.009**
Years qualified			
Up to 20 yrs	6 (range 21, N = 80)	6 (range 27, N = 77)	81 (range 50, N = 76)
Over 20 years	4 (range 21, N = 111)	3 (range 26, N = 104)	83 (range 84, N = 104)
	P = 0.000	**P = 0.000**	**P = 0.054**
Usual clinical setting			
Acute	5 (range 21, N = 125)	5 (range 27, N = 121)	83 (range 84, N = 119)
Community	4 (range 19, N = 33)	3 (range 19, N = 32)	83 (range 41, N = 32)
Primary care	4 (range 16, N = 19)	2 (range 10, N = 16)	81.5 (range 25, N = 16)
other	5 (range 20, N = 15)	3 (range 12, N = 12)	81 (range 42, N = 13)
	P = 0.158	**P = 0.012**	**P = 0.916**
Undertaking aerosol generating procedures			
Yes	5 (range 21, N = 111)	5 (range 27, N = 108)	81.5 (range 52, N = 108)
No	4 (range 20, N = 80)	3 (range 19, N = 73)	82 (range 84, N = 72)
	P = 0.006	**P = 0.000**	**P = 0.262**
Able to provide support to your household			
Yes	4 (range 21, N = 165)	3 (range 27, N = 158)	82 (range 84, N = 157)
No/with difficulty	10.5 (range 19, N = 26)	9 (range 26, N = 23)	80 (range 52, N = 23)
	P = 0.006	**P = 0.000**	**P = 0.262**

Table 4
Influence of key variables on depression.[a]

	Depression[a]											
	Model 1 *[Age; years qualified; supporting the household; undertaking aerosol procedures]*				Model 2 *[years qualified; supporting the household; undertaking aerosol procedures]*				Model 3 *[Age; supporting the household; undertaking aerosol procedures]*			
	OR[b]	95% CI	Wald	P value	OR	95% CI	Wald	P Value	OR	95% CI	Wald	P value
Age												
18 – 35 (reference category)												
35–50	0.458	0.151–1.386	1.912	0.169	-	-		-	0.247	0.086–0.708	6.779	**0.009****
50+	1.690	0.260–10.999	0.301	0.583	-	-		-	0.264	0.077–0.904	4.497	**0.034***
Years Qualified												
Less than 20 (reference category)												
20 or more	0.123	0.023–0.651	6.065	**0.014***	0.185	0.063–0.545	9.392	**0.002****	-	-		-
Support Household									-	-		-
Yes (reference category)												
No with difficulty	5.323	1.795–15.778	9.096	**0.003****	4.866	1.705–13.890	8.741	**0.003****	5.116	1.822–14.649	9.536	**0.002****
Aerosol Procedures												
No (reference category)												
Yes	2.591	0.761–8.827	2.317	0.128	2.377	0.720–7.844	2.021	0.155	3.103	0.942–10.226	3.464	0.063
Nagerleke	0.31				0.28				0.25			

OR, odds ratio; CI, confidence interval; *P < 0.05 **P < 0.001.
[a] threshold for depression a score above 10.
[b] Adjusted ORs: model includes all significant predictors identified in univariate analysis; Wald reported to three significant places.

Table 5
Influence of key variables on anxiety.[a]

	Anxiety[a]											
	Model 1 *[Age; years qualified; supporting the household; undertaking aerosol procedures]*				Model 2 *[years qualified; supporting the household; undertaking aerosol procedures]*				Model 3 *[Age; supporting the household; undertaking aerosol procedures]*			
	OR[b]	95% CI	Wald	P value	OR	95% CI	Wald	P Value	OR	95% CI	Wald	P value
Age												
18 – 35 (reference category)												
35–50	0.235	0.078–0 .708	6.629	**0.010***	-	-		-	0.162	0.059–0.444	12.483	**0.000****
50+	0.419	0.078–2.253	1.028	0.311	-	-		-	0.166	0.054–0.051	9.973	**0.002****
Years Qualified												
Less than 20 (reference category)												
20 or more	0.368	0.091–1.490	1.963	0.161	0.249	0.101–0.611	9.211	**0.002****	-	-		-
Support Household									-	-		-
Yes (reference category)												
No with difficulty	6.290	2.319–17.063	13.05	**0.000****	6.119	2.332–16.053	13.549	**0.000****	6.303	2.353–16.886	13.407	**0.000****
Aerosol Procedures												
No (reference category)												
Yes	1.898	0.682–5.282	1.506	0.220	1.764	0.664–4.687	1.297	0.255	2.062	0.752–5.657	1.977	0.160
Nagerleke	0.31				0.26				0.30			

OR, odds ratio; CI, confidence interval; *P < 0.05 **P < 0.001.
[a] threshold for anxiety a score above 10.
[b] Adjusted ORs: model includes all significant predictors identified in univariate analysis; Wald reported to three significant places.

individuals at this level may possess some of the characteristics of resilience but these need strengthening [26]. Similarly Ang et al. found similar resilience results with working experience and age associated with higher resilience [29]. Purvis et al. examined burnout and resilience in neurosciences critical care unit staff and found similar results [30]. Having a higher educational qualification also influenced resilience in the study by Ang [29] but this was not examined in our survey design. In terms of educational qualifications nurses may be required to study at post graduate level, and for some therefore in this cohort this could have influenced their ability to cope and adapt to the rapidly changing pandemic landscape. This could be further attributed to clinical confidence that comes with knowledge and prior experiences. Hart et al. have found that reduced inner balance, a sense of conflict and difficult workplaces can contribute to reduced resilience. However personal characteristics can help build resilience such as hope, self-efficacy, work life balance etc [31].

Just over half of respondents in this study experienced minimal symptoms of anxiety or depression. Approximately 20% experienced moderate-to-severe anxiety symptoms and 17% experienced moderate-to-severe depression symptoms higher than anxiety levels in the general public and general medical practice [20], and higher than levels reported in the general population [32]. However a large proportion of the nursing population has already been shown to have mental health issues [33]. Participant age, years of experience and providing support to their household were all identified as key variables in the regression analysis for predicting depression and anxiety. There is still a significant proportion of the participants who experienced moderate to severe symptoms of anxiety or depression and 12.4% of participants who could not support their household in terms of heat, food and emotional support. The regression analysis identified age and years of experience as important predictors of anxiety and depression. The ability to provide support to the household was important in the models ($p < 0.01$).

The findings suggest that age and experience are significant indicators in predicting anxiety and depression symptoms. Those people who responded between the age of 35–50 were less likely to score above the threshold (>10) for anxiety and depression. This is reflected in the

experience of the respondents. Individuals younger than 35 would not be able to accrue more than 20 years post qualification, and individuals aged over 50 are more likely to have more time to accrue specialist respiratory skills and knowledge.

Supporting employees in the workplace, listening and acting on genuine family concerns, particularly during pandemic and crisis situations, can enhance front line experiences and enable confidence in employers. Therefore, healthcare leaders need to consider how to support healthcare workers during the pandemic, to reduce emotional distress and risks staff have taken [34]. The COVID-19 pandemic has enabled many people to work remotely to prevent unnecessary cross-infection, however the lack of visibility of management has been highlighted by some [35]. Healthcare managers and leaders do have a responsibility to support work life balance initiatives, to enhance clinical resilience in the workplace and need to signpost staff to existing and new interventions and support mechanisms.

4.1. Strengths and limitations

This study represents a good representation of nurses working in respiratory clinical contexts. However, it is limited by the lack of breadth of ethnicities and age-groups working in these areas. The demographics are similar to that of the study carried out on the workforce by the British Thoracic Society [36]. This analysis is part of a programme of work looking at other components of the survey, a mixed methods paper is underway examining some of the other components of the survey, such as the provision of PPE and the mental health provisions and support provided during the first few months of the pandemic. This is just one snapshot of the pandemic and it is planned to survey this population of nurses working in respiratory clinical areas again if there is a significant wave of infections and hospitalisations in the future. We do not plan to match the population as we felt it was unethical to repeatedly sample the same group working under significant pressures at the peak of the pandemic.

5. Conclusions

The nurses who responded however were overall fairly resilient, as many of this particular group were older and with significant nursing experience. However, a proportion experienced significant symptoms of anxiety or depression and some experienced difficulties providing support to their households. This study explored short-term resilience, but did not examine burnout which looks at the impacts of prolonged stress and physical exhaustion.

It is important that we continue to support our healthcare professionals to improve and maintain levels of resilience and reduce anxiety and depression. In part this can be done by informing appropriate organisations, NHS management and professional bodies to implement interventions and programmes to support employees. There is an urgent need to develop evidence based self-help interventions to improve and support those working on the front line during the COVID pandemic [37].

Psychological support needs to be available in a variety of formats which is tailored to the individual's needs. The support can be via phone, internet or forms as well as support groups and information leaflets and other reading materials but it needs to be flexible to allow tailoring for the individual [16,38,39]. In addition to psychological support, and in order to be pandemic prepared, resilience training could be offered. Resilience training has been researched before the pandemic with positive effects after the SARS epidemic. The training showed that participants felt better able to cope after the session [40].

Some of these types of interventions have been put in place as part of the response to COVID, however, as expected, public NHS mental health services are really overstretched at the moment because of increased need.

CRediT authorship contribution statement

N.J. Roberts: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Project administration. **K. McAloney-Kocaman:** Methodology, Formal analysis, Writing - review & editing. **K. Lippiett:** Conceptualization, Methodology, Investigation, Writing - review & editing. **E. Ray:** Conceptualization, Methodology, Investigation, Writing - review & editing. **L. Welch:** Conceptualization, Methodology, Investigation, Writing - review & editing. **C. Kelly:** Conceptualization, Methodology, Investigation, Writing - review & editing.

Declaration of competing interest

No conflicts of interest were declared by any of the authors.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.rmed.2020.106219.

References

[1] Coronavirus Disease, COVID-19) Situation Reports, accessed, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. (Accessed 26 August 2020).
[2] D. Cucinotta, M. Vanelli, WHO declares COVID-19 a pandemic, Acta Biomed. 91 (2020) 157–160, https://doi.org/10.23750/abm.v91i1.9397.
[3] J. Willan, A.J. King, K. Jeffery, et al., Challenges for NHS hospitals during covid-19 epidemic, BMJ (2020) 368, https://doi.org/10.1136/bmj.m1117.
[4] M.J. Johnstone, S. Turale, Nurses' experiences of ethical preparedness for public health emergencies and healthcare disasters: a systematic review of qualitative evidence, Nurs. Health Sci. 16 (2014) 67–77, https://doi.org/10.1111/nhs.12130.
[5] D. Jackson, C. Bradbury-Jones, D. Baptiste, et al., Life in the pandemic: some reflections on nursing in the context of COVID-19, J. Clin. Nurs. 29 (2020) 2041–2043, https://doi.org/10.1111/jocn.15257.
[6] S.C.K. Shaw, Hopelessness, helplessness and resilience: the importance of safeguarding our trainees' mental wellbeing during the COVID-19 pandemic, Nurse Educ. Pract. 44 (2020) 102780, https://doi.org/10.1016/j.nepr.2020.102780.
[7] The Guardian, At least 100 UK healthcare workers have died from coronavirus, figures show, https://www.theguardian.com/world/2020/apr/20/at-least-100-uk-health-workers-have-died-from-coronavirus-figures-show (accessed 2 Jul 2020).
[8] H. Li, L. Liu, D. Zhang, et al., SARS-CoV-2 and viral sepsis: observations and hypotheses, Lancet 395 (2020) 1517–1520, https://doi.org/10.1016/S0140-6736(20)30920-X.
[9] H.S. Kang, Y.D. Son, S.M. Chae, et al., Working experiences of nurses during the Middle East respiratory syndrome outbreak, Int. J. Nurs. Pract. 24 (2018), https://doi.org/10.1111/ijn.12664.
[10] J.S. Kim, J.S. Choi, Factors influencing emergency nurses' burnout during an outbreak of Middle East respiratory syndrome coronavirus in Korea, Asian Nurs. Res. 10 (2016) 295–299, https://doi.org/10.1016/j.anr.2016.10.002.
[11] S.D. Martin, Nurses' ability and willingness to work during pandemic flu, J. Nurs. Manag. 19 (2011) 98–108, https://doi.org/10.1111/j.1365-2834.2010.01190.x.
[12] D.J. Mason, C.R. Friese, Protecting health care workers against COVID-19—and being prepared for future pandemics, JAMA Heal Forum 1 (2020), https://doi.org/10.1001/JAMAHEALTHFORUM.2020.0353 e200353–e200353.
[13] C. Moore, J. Kolencik, Acute depression, extreme anxiety, and prolonged stress among COVID-19 frontline healthcare workers, Psychosociological Issues Hum Resour Manag 8 (2020) 55–60, https://doi.org/10.22381/PIHRM8120209.
[14] Li Z, Ge J, Yang M, et al. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. Brain Behav Immun Published Online First: 10 March 2020. doi:10.1016/j.bbi.2020.03.007.
[15] S. Liu, L. Yang, C. Zhang, et al., Online mental health services in China during the COVID-19 outbreak, The Lancet Psychiatry 7 (2020) e17–e18, https://doi.org/10.1016/S2215-0366(20)30077-8.
[16] J. Lai, S. Ma, Y. Wang, et al., Associated with mental health outcomes among health care workers JAMA network open, JAMA Netw Open 3 (2020) 203976, https://doi.org/10.1001/jamanetworkopen.2020.3976.
[17] J. Maben, J. Bridges, Covid-19: supporting nurses' psychological and mental health, J. Clin. Nurs. (2020) 15307, https://doi.org/10.1111/jocn.15307.
[18] Nursing Times, Exclusive: Nursing Times survey reveals negative impact of Covid-19 on nurse mental health. https://www.nursingtimes.net/news/mental-health/exclusive-survey-reveals-negative-impact-of-covid-19-on-nurse-mental-health-29-04-2020/ (accessed 1 Jul 2020).
[19] RS14 - Resilience Scale 14-items. https://eprovide.mapi-trust.org/instruments/resilience-scale-14-items. (Accessed 2 July 2020).
[20] R.L. Spitzer, K. Kroenke, J.B.W. Williams, et al., A brief measure for assessing generalized anxiety disorder: the GAD-7, Arch. Intern. Med. 166 (2006) 1092–1097, https://doi.org/10.1001/archinte.166.10.1092.

[21] R.L. Spitzer, K. Kroenke, J.B.W. Williams, Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study, J. Am. Med. Assoc. 282 (1999) 1737–1744, https://doi.org/10.1001/jama.282.18.1737.
[22] NHS University Hospitals Birmingham NHS FoundationTrust, Aerosol generating procedures, in: https://www.uhb.nhs.uk/coronavirus-staff/aerosol-generating-procedures.htm (accessed 26 Aug 2020).
[23] P. Peduzzi, J. Concato, E. Kemper, et al., A simulation study of the number of events per variable in logistic regression analysis, J. Clin. Epidemiol. 49 (1996) 1373–1379, https://doi.org/10.1016/S0895-4356(96)00236-3.
[24] M.M. Tugade, B.L. Fredrickson, Resilient individuals use positive emotions to bounce back from negative emotional experiences, J. Pers. Soc. Psychol. 86 (2004) 320–333, https://doi.org/10.1037/0022-3514.86.2.320.
[25] C. Callegari, L. Bertù, M. Lucano, et al., Reliability and validity of the Italian version of the 14-item resilience scale, Psychol. Res. Behav. Manag. 9 (2016) 277–284, https://doi.org/10.2147/PRBM.S115657.
[26] G. Wagnild, The Resilience Scale User's Guide: for the US English Version of the Resilience Scale and the 14-item Resilience Scale, RS-14), 2011.
[27] A. Alkaissi, N. Said, O. Almahmoud, et al., Personal Characteristics and Behavioral Factors that Promote Resilience Among Nurses: a Cross-Sectional Study, 2019.
[28] A. Sull, N. Harland, A. Moore, Resilience of health-care workers in the UK; A cross-sectional survey, J. Occup. Med. Toxicol. 10 (2015), https://doi.org/10.1186/s12995-015-0061-x.
[29] S.Y. Ang, T. Uthaman, T.C. Ayre, et al., Association between demographics and resilience – a cross-sectional study among nurses in Singapore, Int. Nurs. Rev. 65 (2018) 459–466, https://doi.org/10.1111/inr.12441.
[30] T.E. Purvis, B.M. Powell, G. Biba, et al., Burnout and resilience among neurosciences critical care unit staff, Neurocritical Care 31 (2019) 406–410, https://doi.org/10.1007/s12028-019-00822-4.
[31] P.L. Hart, J.D. Brannan, M. de Chesnay, Resilience in nurses: an integrative review, J. Nurs. Manag. 22 (2014) 720–734, https://doi.org/10.1111/j.1365-2834.2012.01485.x.
[32] Martin A, Rief W, Klaiberg A, et al. Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the General Population. doi:10.1016/j.genhosppsych.2005.07.003.
[33] P. Nolan, M. Smojkis, The mental health of nurses in the UK, Adv. Psychiatr. Treat. 9 (2003) 374–379, https://doi.org/10.1192/apt.9.5.374.
[34] L. Rangachari P, Woods J. Preserving organizational resilience, patient safety, and staff retention during COVID-19 requires a holistic consideration of the psychological safety of healthcare workers, Int. J. Environ. Res. Publ. Health 17 (2020) 4267, https://doi.org/10.3390/ijerph17124267.
[35] STAT, As a nurse, my hospital's leaders frighten me more than Covid-19 - STAT. https://www.statnews.com/2020/05/06/nurse-frightened-hospital-administrators-more-than-covid-19/ (accessed 2 Jul 2020).
[36] Y. Janelle, Correction: evaluation of the current landscape of respiratory nurse specialists in the UK: planning for the future needs of patients, BMJ Open Respir. Res. 4 (2017) 210–211, https://doi.org/10.1136/bmjresp-2017-000210corr1, e000210) DOI: 10.1136/bmjresp-2017-000210). BMJ Open Respir. Res. 2017.
[37] L. Yang, J. Yin, D. Wang, et al., Urgent need to develop evidence-based self-help interventions for mental health of healthcare workers in COVID-19 pandemic, Psychol. Med. (2020), https://doi.org/10.1017/S0033291720001385.
[38] Huang J, Liu F, Teng Z, Chen J, Zhao J, Wang X, Wu R. Care for the Psychological Status of Frontline Medical Staff Fighting Against Coronavirus Disease 2019 (COVID-19). Clinical Infectious Diseases, ciaa385, https://doi.org/10.1093/cid/ciaa385x.
[39] G.D. Smith, F. Ng, W. Ho Cheung Li, COVID-19: emerging compassion, courage and resilience in the face of misinformation and adversity, J. Clin. Nurs. 29 (2020) 1425–1428, https://doi.org/10.1111/jocn.15231.
[40] A. Aiello, M. Young-Eun Khayeri, S. Raja, et al., Resilience training for hospital workers in anticipation of an influenza pandemic, J. Continuing Educ. Health Prof. 31 (2011) 15–20, https://doi.org/10.1002/chp.20096.