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ORIGINAL ARTICLE

Mental stress in health care professionals during COVID-19 outbreak

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Abstract

Background In December 2019, an outbreak of novel corona virus pneumonia occurred in Wuhan City, China, and spread throughout the whole of country in a short period. Figures from China's National Health Commission show that more than 3300 health care workers have been infected as of early March. In Italy, 20% of responding health care professionals was infected, and some have died. Health care professionals are exposed to different types of stress both physical and psychological in response to this serious infectious public health event.

Research aims The aim of this study is to measure the degree of mental stress among front line health care workers dealing with COVID-19 patients.

Methods We conducted the study through online survey questionnaire after obtaining the ethics approval from the Research Ethics Committee of Galway University Hospital in Ireland (Ref: C.A. 2355). All personal information of the medical staff involved in the survey has been kept confidential.

Results Three hundred nine health care members (209 male and 97 female) have agreed to participate in our survey from different hospitals and different specialties all over the world. Overall PSS Score: mean 19.42 (Standard Deviation ± 5.876, range 1–33). Frontline health care workers working in University Hospitals and tertiary referral centres had lower levels of stress compared to those working in peripheral hospitals ($P = 0.007$, Kruskal Wallis).

Conclusion The COVID-19 pandemic is one of the most stressful events that a health care worker may face during his life time. Most of the participants in the survey developed a moderate degree of stress.

Keywords COVID-19 · Health care workers · Outbreak · Stress

Introduction

In December 2019, an outbreak of novel corona virus pneumonia occurred in Wuhan City, China, and rapidly spread worldwide [1–3]. Up to 11 Jun 2020, approximately more than 7 million cases infected with corona virus have been confirmed according to the World Health Organisation statistics (WHO) [4]. Infection occurs through several routes including large droplets produced during coughing and sneezing by both symptomatic and asymptomatic patients and through contact with contaminated surfaces [5]. Studies have shown that viral loads present in huge amounts in the nasal cavity as compared to the throat can be infectious for as long as the symptoms last and even on clinical recovery [6].

Worldwide, health care professionals have continued to go to their clinics and hospitals serving patients and helping those infected with COVID-19. By April 2020, 22,073 cases of COVID-19 among health care professionals from

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52 countries had been reported to World Health Organization (WHO) [7]. One of the major problems that health care professionals faced during the COVID-19 pandemic was the uncertainty associated with the disease arising from the different means of transmission of infection, the false negative results of laboratory investigations aiming to detect the virus, the uncertainty of approaches to protection and their effectiveness and the difficulty in implementing social distancing within clinical practice.

Due to these risks and uncertainties, frontline health care professionals are exposed to different types of stress, both physical and psychological [8–10]. Stress is defined as an individual's reaction to perceiving a discrepancy in resources and/or the ability to respond to an event or stimulus or stressor [11]. Stress is considered as a double-edged tool during clinical practice. While some degree of stress may help people perform at a higher baseline state, it has been shown that too much stress can impair doctors' skills [12–14]. Negative aspects of work related stress include burn out, depersonalization and feelings of diminished personal accomplishment. Burn out refers to the draining of emotional resources, which is paramount in the case of frontline health care workers, as this depletion can lead to a negative attitude towards their patients and recipients of care [15].

Stress is a subjective perception. Capturing stress levels can be difficult due to this subjective nature. However, appropriate assessment of stress levels and identification of triggers of stress could inform further measures to support health care workers' mental health and minimise the emotional impact of future pandemics. One of the classic stress assessment tools used to measure the degree of mental stress is the Perceived Stress Scale (PSS). It is a global self-reporting questionnaire, which was designed and presented by Cohen et al. in 1983 [16]. The PSS 10-item model aims to measure how individuals believe their life has been unpredictable, uncontrollable and overloaded during the previous month [16].

We aimed to capture a cross-sectional snapshot of stress levels in frontline health care professionals, exposed to the circumstances of working within COVID-19 pandemic. Using a survey study design allows for wide penetration of multiple groups of health care professionals. This aids in the gathering of targeted results, while maintaining the anonymity of participants, thus providing a vehicle for more honest responses [17].

Objectives

The aim of this study was to quantify the level of mental stress within frontline health care professionals during COVID-19 pandemic. Measuring the severity of this type of stress will help to identify those who need psychological support which in turn will improve their psychological well-being.

1. Primary end point is the degree of mental stress in frontline health care professionals dealing with COVID-19 patients.
2. Secondary endpoints include:

    a) Comparing levels of stress in different health care specialties.
    b) Identification of causes of mental stress in such health care workers.

Methods

All research was conducted with integrity and in line with generally accepted ethical principles and approved by our institutional clinical Research Ethics Committee (Ref: C.A. 2355). The study design was a survey questionnaire sent to frontline health care professionals with the rise of COVID-19 infection curve in April 2020 (Appendix 1). Frontline health care workers were defined as clinicians either directly dealing with patients, or those indirectly dealing with patients through handling and management of lab samples. The survey was in an electronic format. The link to the survey was emailed to health care workers in different countries that had a similar trend in their COVID-19 infection curve at the same time as our own country (Ireland). The email included a statement requesting consent from the participants, clearly stating that all results would be anonymised and that participants cannot be identified. The emailed link directed the participant to a SurveyMonkey questionnaire (www.Surveymonkey.com). This link did not request any personal identifiers, which ensured anonymity, as the investigators did not have access to any participant identifiers. However, information regarding age, gender, clinical specialty, level of experience, location of practice and degree of exposure to COVID-19 patients was requested in order to stratify our results. To avoid unintentional duplicate entries by participants, the electronic questionnaire was set up to only allow one response per emailed link. A reminder email was sent to non-responders, 2 weeks after the initial email invitation.

The survey questionnaire was based on the PSS-10 [16]. The Cohen Perceived Stress Scale is one of the most frequently used tools in various countries to measure psychological stress. It is a global self-reporting scale designed to measure the intensity of perceived stress and evaluate the stressful situations of daily life [16]. The PSS is a 10-item questionnaire to measure the self-reported level of stress in the respondents by assessing feelings and thoughts during the last month. Each item is scored from zero (never) to five (very often), with a range of zero to 40 for the total score

of the scale. A higher level of stress is indicated by higher scores on this scale. Six items of the PSS-10 measure stress, while four items assess the coping strategy to stress [16]. A PSS score from 0 to 13 is associated with a low degree of stress. A PSS score from 14 to 26 is associated with moderate stress, while a PSS score from 27 to 40 is indicative of high levels of perceived stress. A list of potential sources of stress in order of importance was requested from the participants.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26 (SPSS, New Orchard Road, Armonk, New York, USA). The stress scale score being continuous data was assessed for normality of distribution. Independent sample *t* test, one-way ANOVA and Kruskal Wallis were applied as appropriate to compare PSS scores between groups.

Results

Six-hundred emails were sent to frontline health care professionals. Three-hundred and nine responses were received from different hospitals and different specialities from 19 different countries worldwide, giving a response rate of 51.5%. One response was excluded due to failure to complete the survey, leaving a total of 308 valid responses. Two hundred nine of the valid respondents were males, and 99 were females. The mean PSS score for all participants was 19.42 (standard deviation (SD) ± 5.876, range 1–33), placing it within the category of moderate stress.

There was no difference in the mean PSS score between males and females (males: 19 vs females: 20.25) ($P = 0.085$, independent sample *t* test), nor between younger and older health care workers (Table 1).

Regarding different experience levels, senior house officers (SHOs) or residents had a significantly lower PSS score (mean 15.85, SD 6.982) compared to other levels of experience of health care workers ($P = 0.022$, one-way ANOVA) (Table 2). On the other hand, nurses (mean 20.18, ± SD 5.546) followed by registrars (mean PSS 19.52, ± SD 5.543) had a higher degree of mental stress (Table 2).

Surprisingly, intensive care specialists had the lowest level of stress compared to other specialties (PSS: mean 15.88, ± SD 7.440) ($P = 0.024$, one-way ANOVA) (Table 3).

Staff working in infectious disease departments followed by those working in emergency and respiratory medicine departments respectively had higher levels of stress compared to other clinical areas (Table 3).

Frontline health care professionals working in university hospitals and tertiary referral centres had lower levels of stress (mean 18.47 ± SD 6.073) compared to those working in peripheral hospitals (mean 20.80 ± SD 5.039) ($P = 0.007$, Kruskal Wallis) (Table 4). There was no difference in the stress levels regarding the frequency of dealing with potential or confirmed cases ($P = 0.308$, one-way ANOVA).

The most common cause for mental stress mentioned by participants was the fear that health care workers may transmit infection to their families, with 30% of participants ranking this as their foremost cause of stress. The second most common cause for stress was lack of clear protocol on how to deal with COVID-19 cases (18.7% of participants), followed by lack of clear protocol on how to deal with unconfirmed/undiagnosed cases (12.36% of participants) and fear that the participants themselves could contract COVID-19 infection (10.27% of participants). Insufficient availability of PPE and being redeployed to assist in areas outside their specialty and area of expertise were also considered as causes of stress by 7.83% and 6.19% of participants respectively. Only 5.09% of participants considered inadequate training on donning and doffing of PPE to be a cause of stress.

Discussion

A pandemic is an extraordinary situation associated with uncertainty and multiple unknowns. Studies conducted during the Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) [18, 19] epidemics showed that doctors and frontline medical professionals experienced high rates of depression and post-traumatic stress disorders (PTSDs). Potential differences between these pandemics and COVID-19 are the high

Table 1 PSS between different age groups

	Number	Mean	Std. deviation	Std. error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
18–24	3	17.33	10.970	6.333	-9.92	44.58	5	26
25–34	74	19.31	6.583	0.765	17.79	20.84	1	32
35–44	118	19.57	5.805	0.534	18.51	20.63	3	33
45–54	100	19.79	5.302	0.530	18.74	20.84	4	32
55–64	13	16.23	5.069	1.406	13.17	19.29	3	21
Total	308	19.42	5.876	0.335	18.76	20.07	1	33

Table 2 Difference between different grades regarding PSS

	Number	Mean	Std. deviation	Std. error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
Nurse	11	20.18	5.546	1.672	16.46	23.91	12	29
Intern	10	20.30	6.961	2.201	15.32	25.28	5	29
SHO	27	15.85	6.982	1.344	13.09	18.61	1	28
Registrar	125	19.52	5.543	0.496	18.54	20.50	4	32
Consultants	135	19.90	5.724	0.493	18.93	20.88	3	33
Total	308	19.42	5.876	0.335	18.76	20.07	1	33

infection and mortality rate and uncertainty about ways of transmission and diagnosis. Our survey questionnaire revealed that front line health care professionals suffered from a moderate degree of mental stress during the COVID-19 pandemic. Wen Lu et al. showed similar results with their study conducted in Fujian provincial hospital [20]. They compared the degree of fear, anxiety and depression in a single centre between health care and administrative workers, by using the numeric rating scale (NRS) to measure the degree of fear and the Hamilton Anxiety Scale (HAMA) and Hamilton Depression Scale (HAMD) to measure the degree of anxiety. Their results showed that health care professionals suffered from moderate to severe degrees of fear compared to administrators.

The same study by Wen Lu et al. confirmed that within the health care staff, those working in a clinical capacity experienced a higher degree of anxiety compared to those working on non-clinical duties [20]. Similarly in our survey, when comparing stress scores between different specialities, laboratory-based clinicians' experienced mild levels of mental stress. This could be explained by lack of physical contact between them and COVID-19 patients. Wen Lu et al. confirmed that those working in non-clinical areas and those not in direct contact with COVID-19 patients had lower levels of fear and anxiety compared to other workers on clinical sites [20].

We found that frontline health care professionals in infectious disease, respiratory and emergency departments experienced higher degrees of mental stress compared to other clinical departments. This could be explained by the highly contagious nature of COVID-19 and its spread through droplets between individuals, even those who are asymptomatic. Surprisingly, intensive care specialists had the lowest level of stress compared to other specialties. Anaesthesiologists also showed lower scores of stress compared to other frontline health care professionals. These two findings may be related to the degree of knowledge and medical experiences between different individuals and specialties. Most intensive care doctors and anaesthesiologists worldwide received proper training to deal with COVID-19 patients. This could explain their low degree of mental stress compared to other specialties. Hidiroglu S et al. [21] reported the importance of enriching health care professionals with evidence-based information, in order to provide patients with the adequate level of care and support. Other studies suggested that the implementation of appropriate education and protective measures improved staff members' willingness to work [22, 23]. Siew E Chua et al. reported that health care professionals confident of infection control strategies, after adequate infection control training programs, exhibited low degrees of stress [24]. Based on these findings, providing all health

Table 3 Different specialties participated in the survey and their PSS

	Number	Mean	Std. deviation	Std. error	95% confidence interval for mean		Minimum
					Lower bound	Upper bound	
Anaesthesia	80	19.10	5.959	0.666	17.77	20.43	3
Intensive care	17	15.88	7.440	1.805	12.06	19.71	1
Emergency medicine	18	21.28	5.909	1.393	18.34	24.22	7
General internal medicine	79	20.73	5.227	0.588	19.56	21.91	5
Respiratory medicine	2	21.00	4.243	3.000	− 17.12	59.12	18
Infectious disease	3	23.00	6.928	4.000	5.79	40.21	19
Surgery	95	19.15	5.554	0.570	18.02	20.28	6
Microbiology	1	20.00	–	–	–	–	20
Laboratory based specialty	13	16.23	6.882	1.909	12.07	20.39	3
Total	308	19.42	5.876	0.335	18.76	20.07	1

Table 4 Health care workers working in different areas and their PSS

	Number	Mean	Std. deviation	Std. error	95% confidence interval for mean		Minimum
					Lower bound	Upper bound	
University hospital	180	18.47	6.073	0.453	17.57	19.36	1
General/district hospital	97	20.80	5.039	0.512	19.79	21.82	4
Primary care	28	20.61	5.731	1.083	18.39	22.83	7
COVID-19 testing centre	3	20.33	11.930	6.888	−9.30	49.97	7
Total	308	19.42	5.876	0.335	18.76	20.07	1

care professionals with proper training and education should decrease the degree of mental stress they experience during this pandemic. It is of note that Siew E Chua et al.'s study confirmed that health care workers showed positive psychological consequences in response to the SARS pandemic, compared to healthy control volunteers [24].

Surgeons developed a low level of stress during this pandemic. This could be explained by the cancellation of most elective surgical procedures during this health crisis and proceeding only with emergency ones.

In our survey, we compared the degree of mental stress developed during this pandemic between different clinical grades and experiences. Medical staff that had a few years of clinical experience, such as Senior House Officers (SHOs) or residents, had a significantly lower PSS score compared to other health care professionals. This cannot be explained by their young age, as there was no difference between younger and older health care professionals. However, this possibly could be explained by their level of experience. A study conducted in China between January and February 2020 by Jianbo Lai et al. found that junior staff including physicians and nurses had a mild form of stress symptoms including anxiety, depression and insomnia compared to those having intermediate levels of experience [25].

Our survey revealed that frontline health care professionals working in university hospitals and tertiary referral centres had lower levels of stress compared to those working in peripheral ones. Jianbo Lai et al. [25] confirmed that working in secondary hospitals was associated with higher degrees of depression, anxiety and stress compared to working in tertiary ones. This can be related to inadequate testing, limited treatment options, insufficient PPE and other medical supplies and extended workloads in peripheral hospitals. The findings correlate with results by Cooper et al. [26] who confirmed that prolonged working hours and excessive workload were among the top causes of workplace stress factors. The same study [26] took place in the UK, Sweden, Germany, Japan, Singapore, USA, Nigeria, South Africa, Brazil and Egypt and revealed that time pressure, deadlines and poor working conditions are among the main causes of stress for health care professionals.

One of the most common causes for mental stress in health care professionals during the COVID-19 pandemic was transmitting of infection to their families and beloved ones. This finding correlates with previous studies [20, 27] which revealed that the most common cause of unwillingness to care for patients with COVID-19 was risk of transmission of infection to health care's families when dealing with those critical patients.

Other causes of stress recorded in our study included lack of clarity on how to deal with COVID-19 patients and lack of clear protocols regarding dealing with unconfirmed COVID-19 cases. These findings were the same as those reported by Stergachis et al. [23] and Qureshi et al. [22] who showed that appropriate training is a mandatory tool for health care professionals to deal with infected cases during period of pandemics. This reiterates the point that uncertainty increases the levels of stress in health care workers and that the implementation of appropriate education improved staff engagement [22, 23].

Insufficient personal protective equipment (PPE) was one of the causes recorded for mental stress during this crisis. Wen Lu et al. [20] confirmed that the shortage of PPE and concerns that the epidemic would not be controlled were among the main causes of fear, depression and anxiety for medical staff. Our study's findings regarding the causes of stress correlates with previous studies [28, 29] which showed that infection of family members and colleagues and lack of proper PPE were the most common causes of stress for frontline medical professionals.

Conclusion

COVID-19 pandemic is one of the most stressful events that health-care professionals may face during their life time. Clear protocols on how to deal with COVID-19 patients, implementation of appropriate training and education are mandatory tools for every organisation and hospital to deal properly with this health crisis as well as decreasing level of stress among their staff. Early diagnostic tools to detect mental stress should be implemented to detect those at risk of developing anxiety and depression disorders. Psychological

support should be offered for all medical staff during these stressful periods.

Limitations

This study has few limitations. Due to the nature of a survey design, the response rate can vary significantly between different participant groups. In our study, the number of respondents from different specialties was quite variable. This carries the risk of self-reporting bias. The study was conducted over a short period of time, to capture stress levels during the peak of the pandemic wave. As such, there was no longitudinal follow-up. Because of the severity of infectious state of SARS-COV 2, long-term psychological consequences should be further investigated. This study concentrated on documenting stress levels and causes of stress. We did not look at means to improve or ease the levels of stress.

Appendix. Survey questionnaire sent to frontline health-care professionals with the rise of COVID-19 infection curve in April 2020

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Declarations

Conflict of interest The authors declare no competing interests.

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