

# Stress among health care providers in NICU department, tertiary pediatric care hospital during COVID-19 pandemic in Egypt

Journal of Public Health Research  
2023, Vol. 12(1), 1–7  
© The Author(s) 2023  
DOI: 10.1177/22799036221147095  
journals.sagepub.com/home/phj  


Amira Aly Hegazy<sup>1</sup>, Tamer A Abdel Hamid<sup>2</sup>, Marwa M Zein<sup>1</sup> ,  
Ahmed Taha Aboushady<sup>3</sup>  and Dina M Akmal<sup>2</sup>

## Abstract

**Background:** Many of the pediatric health care workers (HCWs) suffered from sleep disturbance, anxiety, and potential stress disorder during the COVID-19 pandemic. Work-related stress is a potential cause of concern in HCWs and is associated with decreased job satisfaction, anxiety, depression, medical errors, and near misses. This study aims to investigate the various psychological consequences on medical personnel working in the neonatal intensive care unit (NICU) in the context of the COVID-19 pandemic.

**Design and methods:** A cross-sectional analytical study was conducted on a convenient sample of doctors and nurses working in NICU in pediatric hospitals at Cairo University teaching hospitals, Egypt. Two anonymous self-administered validated questionnaires were used to assess the level of stress, and the COVID-19 Rapid Quantitative Assessment Tool to assess the knowledge, attitude, and perception about COVID-19.

**Results:** Among 96 participants, 66.7% were nurses, and 33.3% were physicians, 79.2% of the participants showed a reasonably safe level of stress. The mean work stress score was  $43.89 \pm 5.77$ . The mean score for commonly experienced stress symptoms was  $7.53 \pm 4.54$ , median 7, IQR (4, 10). Females and physicians were found to be with a statistically significantly higher median score of commonly experienced stress symptoms than males ( $p$ -value  $< 0.001$  and  $0.028$  simultaneously).

**Conclusion:** While such descriptive research provides valuable information on the scope of the problem, a strong theoretical framework is required to interpret these findings appropriately and develop preventive and therapeutic strategies. Particular attention should be warranted to the mental health well-being of women treating patients with COVID-19.

## Keywords

Stress, health care providers, NICU, COVID-19 pandemic

Date received: 7 August 2022; accepted: 5 December 2022

## Background

Ever since the World Health Organization (WHO) announced the COVID-19 outbreak as a public health emergency of international concern (PHEIC) on January 30, 2020, and later declared it as a pandemic on March 11, 2020,<sup>1</sup> the Egyptian health system has been confronted with a rapidly increasing demand that was generated by the pandemic.<sup>2</sup>

<sup>1</sup>Public Health and Community Medicine Department, Kasr Alainy School of Medicine, Cairo University, Cairo, Egypt

<sup>2</sup>Pediatrics Department, Kasr Alainy School of Medicine, Cairo University, Cairo, Egypt

<sup>3</sup>Faculty of Medicine, Alexandria University, Alexandria, Egypt

### Corresponding author:

Ahmed Taha Aboushady, Faculty of Medicine, Alexandria University, Alexandria 21544, Egypt.

Email: a.taboushady@gmail.com



This dictated a balance of responding directly to COVID-19, while simultaneously engaging in strategic planning and coordinated action to maintain essential health service delivery, mitigating the risk of system collapse in a well-organized and prepared manner that guarantees the maintenance of equitable access to essential service delivery.<sup>3,4</sup>

In the center of this response lies the healthcare workers (HCWs), particularly the front-liners, to whom the COVID-19 pandemic was considered as a threat to both physical and mental health. In addition to infection protection measures implemented by the government of Egypt in the beginning of the pandemic such as social restrictions and lockdowns in 15th March 2020 which are associated with indirect health consequences as well as significant psychological burdens.<sup>3-5</sup>

Large numbers of people were affected by a diversity of mental health and psychosocial consequences such as fear, depression, and anxiety/worry as a reaction to the emerging critical situation. These consequences were found to be more exaggerated among front-line health care workers and all medical field personnel.<sup>6</sup>

Egypt has existing health workforce challenges, including shortages, misdistribution, and misalignment, that were overloaded by factors that posed an additional strain on the ability of HCWs to deliver health services during the pandemic, including re-assignment of staff to treat increasing numbers of patients with COVID-19, and loss of staff who may be quarantined, infected or required to care for infected friends and family.<sup>5,7</sup>

Despite the lesser exposure and the lesser infection probability among pediatric cases, much of the pediatric HCWs suffered from sleep disturbance, anxiety, and potential stress disorder.<sup>8</sup> Work-related stress is a potential cause of concern in HCWs and is associated with decreased job satisfaction, days off work, anxiety, depression, sleeplessness, medical errors, and near misses.<sup>9,10</sup>

A systematic review was done to approximate the prevalence of stress, anxiety and depression within front-line HCWs caring for COVID-19 patients, it was clearly demonstrated that the prevalence of stress, anxiety and depression within front-line HCWs caring for COVID-19 patients is high.<sup>8</sup>

With reference to the COVID-19 pandemic, many studies were performed about the psychological consequences of quarantine measures for various infections for example: Ebola, among them, were studies dealing with the consequences for medical staff. It is therefore expected that the issue of the psychological burden on medical staff has been addressed in the context of the current COVID-19 pandemic.<sup>11,12</sup>

Therefore, this study aims to investigate the various psychological consequences on medical personnel (physicians, and nurses) working in the neonatal intensive care unit (NICU) in Kasr Alainy medical hospital in the context of the COVID-19 pandemic, particularly since this is the first study to address the COVID-19 pandemic psychological effects on healthcare staff working on NICUs in Egypt.

## Methods

**Study design:** this is a cross-sectional analytical study conducted on doctors and nurses.

**Study population and study setting:** the study was conducted at the NICU in pediatric hospital of Kasr Alainy medical hospital, Cairo University, Egypt (a tertiary care hospital). with dates of recruitment (from July 2020 to September 2020). The total work forces of nurses and physicians during the period of recruitment was 120. The annual mean of patients was 460 patient per year.

**Participants:** A convenient sample technique was included from the physicians and nurses in the NICU department who were willing to participate in the study.

### Study variable:

**Outcome:** assessing the degree of knowledge, attitude and perception toward COVID-19, the degree of work stress score and the commonly experienced stress symptoms.

**Independent variables:** job title, age, gender, years of experience.

**Data sources/ measurement:** data were collected through a self-administered anonymous questionnaire.

The questionnaire was consisted of:

1. sociodemographic background questions: age (in years), job title (physician/nurse), gender (male/female), and years of experience (less than 1 year/1–5 years/ 5–10 years/ more than 10 years).
2. The COVID-19 Rapid Quantitative Assessment Tool<sup>10</sup>: 20 questions assessing knowledge, attitude, and perception (KAP) about COVID-19.
3. The work stress questionnaire, which has been developed by the Indian Council of Medical Research (ICMR)<sup>7</sup>, having 23 questions to be scored on 1/2/3 criteria, Never—1, Sometimes—2, Always—3. (annex 1)
4. The commonly experienced stress symptoms: 10 questions that were developed by ICMR.<sup>7</sup> The questionnaire assesses the general health. Each question had symptoms that needed to be scored 0/1/2 on the criteria Never—0, Sometimes—1, and Always—2. (annex 1)

**Sample size:** Using openEpi version 3 software ([http://www.openepi.com/Menu/OE\\_Menu.htm](http://www.openepi.com/Menu/OE_Menu.htm)), with an estimated prevalence of stress among the hospitals' Hospital staff caring for the COVID-19 patients of 45%<sup>8</sup> and, a population size of 120, with a 95% confidence interval and power of 80% the minimum required sample size was 96.

Using this equation Sample size n =

$$\left[ \frac{DEFF * Np(1-p)}{\left[ \left( \frac{d2}{Z21-\alpha/2} * (N-1) + p * (1-p) \right) \right]} \right]$$

**Table 1.** Sample characteristic of NICU physicians and nurses working in NICU at a tertiary hospital in Egypt during COVID-19 pandemic. Egypt, 2020.

Variable	Sample <i>n</i> (%) <i>n</i> = 96		Population <i>n</i> (%) <i>n</i> = 120	
	Physicians ( <i>n</i> = 32)	Nurses ( <i>n</i> = 64)	Physicians ( <i>n</i> = 39)	Nurses ( <i>n</i> = 81)
Gender				
Male	13 (40.6)	28 (43.8)	15 (38.5)	35 (43.2)
Female	19 (59.4)	36 (56.3)	24 (61.5)	46 (56.8)
Age group				
≤27 years	14 (43.8)	37 (57.8)	17 (43.6)	46 (56.8)
>27 years	18 (56.3)	27 (42.2)	22 (56.4)	35 (43.2)
Years of experience				
Less than 5 years	23 (71.9)	34 (53.1)	26 (66.7)	38 (46.9)
More than 5 years	9 (28.1)	30 (46.9)	13 (33.3)	43 (53.1)

### Data analysis and management

1. The age was categorized to less than median age (27 years) and more than median age. The years of experience was categorized to less than 5 years and more than 5 years.
  2. The COVID-19 Rapid Quantitative Assessment Tool, 20 questions were analyzed as frequency and percentage.
  3. The work stress questionnaire 23 questions scores were interpreted as:
    - Scores 23–38 (very well stress management): You manage your stress levels very well. Too little stress can reduce stimulation, so strive to achieve the balance between negative and positive stress.
    - Scores 39–53 (reasonably safe level of stress): You have a reasonably safe level of stress, but certain areas need improvement.
    - Scores 54–68 (stress level is too high): Your level of stress is too high. You need to develop new strategies to improve it.
4. The commonly experienced stress symptoms: 10 questions scores were interpreted as a score less than 10 meaning health is not affected, and a score more than 10 meaning commonly experienced stress symptoms affect individuals' health.

**Statistical methods:** Descriptive analyses were conducted, and the data were reported as mean and standard deviation (SD), median and IQR, frequencies, and percentages.

Quantitative variables were tested for normality, the data was not normally distributed, so non-parametric tests were used. Mann-Whitney U test for numerical variables was used to compare survey answers, where a *p*-value ≤ 0.05 was considered statistically significant. Spearman correlation was used to correlate the numerical variables (work stress score, commonly experienced stress symptoms, studied population age).

**Ethical consideration:** The study was approved by the appropriate hospital leadership, to enable its administration in the NICU. All participants provided informed consent before filling the anonymous self-administered questionnaire. The study was conducted in accordance with the Declaration of Helsinki. To guarantee the anonymity of the respondents, they were identified by the codes.

### Results

All questionnaires were completed anonymously by a sample of 96 participants out of total population of 120 physicians and nurses, (41) 42.7% of the participants were males, 55 (57.3%) were females.

Majority of the participants 64 (66.7%) were nurses and 32 (33.3%) were physicians. From the physician participants; 56.3% were more than 27 years old, 59.4% were females, and 71.9% were working for less than 5 years. Regarding the nurses; 56.3% were females, 57.8% were less than or equal to 27 years, and 53.1% were working for less than 5 years. (Table 1).

By asking about the KAP toward COVID-19, 70% of the participants hadn't receive any COVID-19 related training courses, 74% of them agreed that COVID-19 is very dangerous, 46.9% of them think that the HCWs are most at risk of contracting the new COVID-19 virus, 52.1% of the participant felt that they were well prepared to deal with any possible COVID-19 case, 70% of them thought that they are likely to get the new virus, 61% of the participants thought that infection with COVID-19 is a stigma, and 91.7% of them thought their jobs would lead to problems due to COVID-19 (Table 2).

Among the participants 76 (79.2%) showed a reasonably safe level of stress, 15 (15.6%) of them showed a very well level of stress management, and 5 (5.2%) showed a high level of stress (Figure 1). Regarding the stress symptoms; 64 (66.7%) of the participant's health hadn't affected versus 32 (33.3%) of them stress symptoms had affected their health.

**Table 2.** Knowledge, Attitude, and Practice (KAP) toward COVID-19 among nurses and physicians working in NICU at a tertiary hospital in Egypt during COVID-19 pandemic. Egypt, 2020.

KAP Questions		Count	Column N %		
Knowledge	Have you received any COVID-19-related training courses?	Yes	29	30.2%	
		No	67	69.8%	
	In your opinion, How dangerous is Coronavirus?	Very dangerous	71	74.0%	
		More or less dangerous	22	22.9%	
		Not dangerous	2	2.1%	
		Other than that	1	1.0%	
		Who do you think is most at risk of contracting the new Corona virus?	Children under 5 years old	2	2.1%
	Attitude	Do you feel well prepared to deal with any possible COVID-19 case?	Adolescents up to the age of 15	0	0.0%
			Youth	3	3.1%
		Do you think you're likely to have a new Corona virus?	Adults	2	2.1%
The elderly			35	36.5%	
Pregnant women			9	9.4%	
Do you think it is important to take action to prevent the spread of the new Corona virus within your community?		Health care workers	45	46.9%	
		Yes	46	47.9%	
		No	50	52.1%	
		Do you think the new Corona virus is a stigma toward people infected by it?	Yes	67	69.8%
Practice	Do you think your job leads to problems in the time of corona?	No	3	3.1%	
		I don't know	26	27.1%	
	What have you and your family done to prevent the new Corona virus infection in recent days?	Yes	80	83.3%	
		I don't know	12	12.5%	
		Other than that	4	4.2%	
Practice	What would you do if you or your family member were infected with the new Corona virus?	Yes	37	38.5%	
		No	59	61.5%	
	What would you do if you or your family member were infected with the new Corona virus?	Yes	88	91.7%	
		No	8	8.3%	
		What have you and your family done to prevent the new Corona virus infection in recent days?	Wash your hands regularly with an alcohol-based detergent or soap and water	46	47.9%
			Cover the mouth and nose when coughing or sneezing	21	21.9%
			Avoid close contact with anyone with a fever and cough	12	12.5%
			Cook meat and eggs well	8	8.3%
		What would you do if you or your family member were infected with the new Corona virus?	Avoid direct unprotected contact with live animals and surfaces in contact with animals	6	6.3%
			Other than that	3	3.1%
What would you do if you or your family member were infected with the new Corona virus?	I will go to the hospital or health unit		28	29.2%	
	I will go to buy medicines at the pharmacy		5	5.2%	
	I will remain in home quarantine	62	64.6%		
	Other than that	1	1.0%		

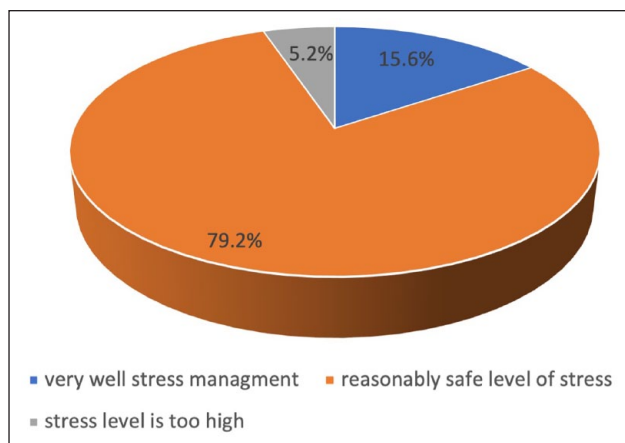
The mean work stress score was  $43.89 \pm 5.77$ , median 43, and IQR (39, 48). No statistically significant differences were found between work stress score and sex, age group, and years of experience (Table 3).

The mean score for commonly experienced stress symptoms was  $7.53 \pm 4.54$ , median 7, IQR (4,10). Females were found to be with a statistically significantly higher median score of commonly experienced stress symptoms than males ( $p$ -value  $< 0.001$ ). There were no statistically

significant difference between the median score of commonly experienced stress symptom and age group, years of experience ( $p$ -value 0.26, 0.489) Table 4.

Physicians were also, found to be with statistically significant higher median score of commonly experienced stress symptom than nurses ( $p$ -value 0.028).

The correlation between work stress score and commonly experienced stress symptoms showed a moderate positive correlation ( $p$ -value  $< .001$ ,  $r = .446$ ).



**Figure 1.** Stress management level among physicians and nurses working in NICU at a tertiary hospital in Egypt during COVID-19 pandemic 2020.

No correlation was found between the studied population's age and work stress score. however, a weak positive correlation was found between the studied population's age and commonly experienced stress symptoms ( $p$ -value .029,  $r = .223$ ).

## Discussion

The novel coronavirus disease (COVID-19) pandemic is a global health crisis, with over 135,000,000 cases and nearly 3,000,000 deaths reported to date (April 20th, 2021).<sup>13</sup> Besides its immediate impact on patients themselves and the healthcare system, this pandemic can adversely affect millions of people's mental health.<sup>14</sup> Because of this, some authors have already termed the COVID-19 pandemic a "public mental health crisis"<sup>15</sup> and have pointed out the need for making mental health services easily accessible in

these times, while keeping in mind the restrictions necessitated to minimize contagion.<sup>16</sup>

There is Egyptian already a growing body of literature on the mental health impact of COVID-19 on different populations, in terms of symptoms of anxiety, depression, or post-traumatic stress.<sup>17,18</sup>

This cross-sectional survey enrolled 96 participants and revealed a high prevalence of mental health symptoms among HCWs treating patients with COVID-19. Therefore, this study aims to explore the psychological impact of the COVID-19 pandemic on the HCWs, particularly those working in the neonatology department in Kasr Alainy medical hospital in Cairo.

In this study, a significant proportion of participants showed a reasonably safe level of stress (79.2%). In a previous systematic review done by Mehta et al. study in 2018 to study the stress among HCWs, 59% was having moderate stress which needs better stress management; 41% was having safe levels of stress and they manage stress levels very well,<sup>7</sup> while a cross-sectional study conducted in Pakistan, on HCWs during the COVID-19 pandemic found that 45.7% of the HCWs had mild, 14.6% had moderate, and 3.3% had severe symptoms of anxiety, whereas the remaining 36.4% had no anxiety.<sup>19</sup>

Of note, 57.3% of all participants were women, and 66.7% were nurses, our findings further indicate that women reported more severe symptoms of work stress, agreeing with papers studying the psychological and mental health impact of COVID-19 on frontline HCWs treating patients with COVID-19 are likely exposed to the highest risk of infection because of their close, frequent contact with patients and working longer hours than usual.<sup>17,20-22</sup>

During the SARS outbreak, a study conducted among health care workers in emergency departments also showed that nurses were more likely to develop distress and use behavioral disengagement than physicians, which is quite

**Table 3.** Relation between work stress score and sociodemographic characters of the physicians and nurses working in NICU at a tertiary hospital in Egypt during COVID-19 pandemic 2020.

		Work stress score								
		Physicians (n=32)			Nurses (n=64)			All sample (n=96)		
		Mean ± SD	Median (IQR)	p value	Mean ± SD	Median (IQR)	p value	Mean ± Sd	Median (IQR)	p value
Gender	Male	43.8 ± 5.7	42 (40, 44)	0.47	43.3 ± 6.3	43 (39, 47)	0.78	43.4 ± 6.0	43 (39, 47)	0.47
	Female	45.4 ± 6.3	47 (41, 49)		43.6 ± 5.1	43 (39, 47.5)		44.2 ± 5.1	44 (40, 49)	
Age group	≤27 years	45.8 ± 4.5	44 (42, 49)	0.19	43.4 ± 5.8	43 (39, 47)	0.99	44.1 ± 5.2	44 (40, 48)	0.53
	>27 years	43.9 ± 7.0	42 (38, 48)		43.6 ± 5.5	42 (39, 49)		43.7 ± 5.8	42 (39, 49)	
Years of experience	less than 5 years	45.7 ± 5.9	44 (41, 49)	0.20	42.4 ± 5.7	43 (39, 45)	0.14	43.8 ± 5.1	43 (40, 47)	0.73
	more than 5 years	42.1 ± 6.0	44 (37, 47)		44.7 ± 5.3	43.5 (40, 49)		44.1 ± 5.7	44 (39, 49)	



**Table 4.** Relation between commonly experienced stress symptoms and sociodemographic characters of the physicians and nurses working in NICU at a tertiary hospital in Egypt during COVID-19 pandemic 2020.

		Commonly experienced stress symptoms								
		Physicians (n=32)			Nurses (n=64)			All sample (n=96)		
		Mean ± SD	Median (IQR)	p value	Mean ± SD	Median (IQR)	p value	Mean ± SD	Median (IQR)	p value
Gender	Male	6.46 ± 2.88	7 (4, 8)	0.01*	4.9 ± 4.0	4 (1, 8)	0.001*	5.4 ± 3.7	6 (2, 8)	<0.001*
	Female	10.74 ± 4.54	11 (7, 15)		8.3 ± 4.2	8 (4.5, 11)		9.1 ± 4.4	9 (6, 12)	
Age group	≤27 years	8.86 ± 4.59	8 (5, 14)	0.99	5.9 ± 4.1	5 (2, 8)	0.1	6.7 ± 4.4	7 (4, 10)	0.1
	>27 years	9.11 ± 4.46	7 (7, 11)		8.1 ± 4.6	8 (4, 11)		8.5 ± 4.5	7 (4, 11)	
Years of experience	Less than 5 years	8.65 ± 4.27	8 (5, 13)	0.68	5.8 ± 4.3	5 (2, 8)	0.08	6.9 ± 4.5	7 (4, 10)	0.19
	5 years									
	More than 5 years	9.89 ± 5.01	10 (7, 11)		7.9 ± 4.4	7 (4, 11)		8.4 ± 4.6	7 (4, 11)	

different from the results shown in the study results that physicians were significantly higher.<sup>23</sup>

The survey used is available in the supplemental files.

Frontline HCWs treating patients with SARS were physically and psychologically challenged when committing themselves to provide high-quality nursing care for patients. Thus, particular attention is warranted regarding the mental health well-being of women and nurses treating patients with COVID-19.<sup>24</sup>

During the COVID-19 outbreak, 67.43% of our study population suffered sleep disturbance, and we found a positive correlation between sleep disturbances and stress and anxiety. Furthermore, 19.42% of subjects were suffering anxiety and 53% were at risk of developing an acute stress disorder, which also matched the results of Lai et al. that found that working in the front line was an independent risk factor for worse mental health outcomes in all dimensions of interest.<sup>17</sup>

Our findings further indicate that women reported more severe symptoms of depression, anxiety, and distress. In our study females were found to be with a statistically significant higher median score of commonly experienced stress symptom than males ( $p$ -value < 0.001), this agrees with the cross-sectional study that was done on the HCWs; where the females showed more severe degrees of measurement of anxiety symptoms than males,<sup>8</sup> also in a study performed by Lai et al. which indicated that being a woman was associated with experiencing severe depression, anxiety, and distress.<sup>17</sup>

Together, our findings present concerns about the psychological well-being of physicians and nurses involved in the acute COVID-19 outbreak. While such descriptive research provides valuable information on the scope of the problem, a strong theoretical framework is required in order to interpret these findings appropriately and develop preventive and therapeutic strategies. Particular attention should be warranted to the mental health well-being of women treating patients with COVID-19.

## Acknowledgement

The authors would like to thank all the participants in the study, the workers in the hospital who facilitated their work greatly.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Significance for public health section

This article reiterates on healthcare workers' stress during the pandemic. Despite working with a lower-risk group, they were still affected by the pandemic. This confirms the need to look at the healthcare system more holistically and that all services are interlinked.

## ORCID iDs

Marwa M Zein  <https://orcid.org/0000-0001-7908-4021>

Ahmed Taha Aboushady  <https://orcid.org/0000-0002-8245-6591>

## Supplemental material

Supplemental material for this article is available online.

## References

1. World Health Organization. *Public health emergency of international concern (PHEIC)*. WHO, 2020, pp.1–10.
2. Abdelhafiz AS, Mohammed Z, Ibrahim ME, et al. Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). *J Community Health* 2020; 45: 881–890.
3. Amin S. Egyptian government's anti-virus plan met with mixed reactions, <https://www.al-monitor.com/originals/2020/03/>

- egypt-coronavirus-curfew-sisi-measures-protests.html (2020, accessed 4 April 2020).
- Awadalla N. Egypt shuts schools, universities for two weeks as virus cases increase, <https://www.reuters.com/article/us-health-coronavirus-egypt/egypt-shuts-schools-universities-for-two-weeks-as-virus-cases-increase-idUSKBN2110SH> (2020, accessed 4 April 2020).
  - International Monetary Fund. Policy responses to COVID19, <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19> (accessed 19 March 2021).
  - World Health Organisation. *The impact of COVID-19 on mental, neurological and substance use services*. Geneva: World Health Organization, 2020. pp.49. <https://www.who.int/publications/i/item/978924012455>
  - Mehta M, Singh MM, Gupta SK, et al. Study of stress among health care professionals: a systemic review. *Int J Res Found Hosp Healthc Adm* 2018; 6(1): 6–11.
  - Salari N, Khazaie H, Hosseini-Far A, et al. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. *Hum Resour Health* 2020; 18(1): 1–14.
  - Filippo P. Di, Attanasi M., Dodi G., et al. A survey on mental health impact caused by COVID-19 pandemic in Italian pediatric healthcare workers, 2020, pp.1–21.
  - WHO. Guidance COVID-19 preparedness and response, pp.1–26. <https://www.who.int/> (2020, accessed 19 March 2021).
  - Koh Y, Hegney DG and Drury V. Comprehensive systematic review of healthcare workers' perceptions of risk and use of coping strategies towards emerging respiratory infectious diseases. *Int J Evid Based Healthc* 2011; 9: 403–419.
  - 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: 248–257.
  - Worldometer. COVID-19 coronavirus pandemic, <https://www.worldometers.info/coronavirus/> (2020, accessed 10 April 2021).
  - Bao Y, Sun Y, Meng S, et al. 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 2020; 395: e37–e38.
  - Dong L and Bouey J. Public mental health crisis during COVID-19 pandemic, China. *Emerg Infect Dis* 2020; 26: 1616–1618.
  - Pfefferbaum B and North CS. Mental health and the COVID-19 pandemic. *N Engl J Med*.2020; 383: 510–512.
  - Lai J, Ma S, Wang Y, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open* 2020; 3: e203976.
  - Xiong J, Lipsitz O, Nasri F, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J Affect Disord* 2020; 277: 55–64.
  - Hasan SR, Hamid Z, Jawaid MT, et al. Anxiety among doctors during COVID-19 pandemic in secondary and tertiary care hospitals. *Pak J Med Sci* 2020; 36(6): 1360–1365.
  - Chen Q, Liang M, Li Y, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry* 2020; 7: e15–e16.
  - Greenberg N, Docherty M, Gnanapragasam S, et al. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020; 368: m1211.
  - Petzold MB, Plag J and Ströhle A. Dealing with mental health stress in health professionals as part of the Covid-19 pandemic. *Neurologist*. Epub ahead of print 27 March 2020. DOI: 10.1007/s00115-020-00905-0
  - Wong TW, Yau JK, Chan CL, et al. The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. *Eur J Emerg Med* 2005; 12(1): 13–18.
  - Shih FJ, Gau ML, Kao CC, et al. Dying and caring on the edge: Taiwan's surviving nurses' reflections on taking care of patients with severe acute respiratory syndrome. *Appl Nurs Res* 2007; 20(4): 171–180.