RESEARCH ARTICLE

Burnout syndrome among frontline doctors of secondary and tertiary care hospitals of Bangladesh during COVID-19 pandemic

Fahmida Rashid1*, Rabiul Alam Md. Erfan Uddin1, H. M. Hamidullah Mehedi2, Satyajit Dhar1, Nur Hossain Bhuiyan1, Md. Abdus Sattar1, Shahanara Chowdhury1

1 Chittagong Medical College, Chattogram, Bangladesh, 2 Chattogram General Hospital, Chattogram, Bangladesh

* dr.fahmidaswati@gmail.com

Abstract

Introduction

During the COVID-19 pandemic, healthcare workers had a high workload and were exposed to multiple psychosocial stressors. However, a knowledge gap exists about the levels of burnout among Bangladeshi frontline doctors during this COVID-19 pandemic. The study investigated burnout syndrome (BOS) among frontline doctors in two public secondary and tertiary care hospitals in Chattogram, Bangladesh.

Materials & methods

This cross-sectional study involved frontline doctors working at two hospitals treating COVID-19 and non-COVID patients from June to August 2020. A self-administered questionnaire that included Maslach Burnout Inventory for Human Services Survey (MBI-HSS) was used to capture demographic and workplace environment information. ANOVA and t-test were used to determine the statistical differences in the mean values of the three dimensions of MBI-HSS. Scores for three domains of burnout: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA) were calculated. Post-hoc analysis was done to identify the significant pair-wise differences when the ANOVA test result was significant. Multiple logistic regression was performed to determine the influence of factors associated with BOS.

Results

A total of 185 frontline doctors were invited to participate by convenience sampling, and 168 responded. The response rate was 90.81%. The overall prevalence of BOS was 55.4% (93/168) (95% CI: 47.5% to 63.0%). Moderate to high levels of EE was found in 95.8% of the participants. High DP and reduced PA were observed in 98.2% and 97% of participants. Younger age (25–29 years), being female, and working as a medical officer were independently associated with high levels of burnout in all three domains. EE was significantly higher
in females \(P = 0.011\). DP was significantly higher in medical officers, those at earlier job periods, and those working more than 8 hours per day.

**Conclusion**

During the COVID-19 outbreak, BOS was common among Bangladeshi frontline doctors. Females, medical officers, and younger doctors tended to be more susceptible to BOS. Less BOS was experienced when working in the non-COVID ward than in the mixed ward.

**Introduction**

The novel Coronavirus, SARS-CoV2, has led to a substantial death toll worldwide. Healthcare workers (HCWs) have been disproportionately affected, with World Health Organisation estimates from September 2021 placing the number of deaths among hospital staff between 80000 and 180000 [1]. Widespread underreporting means that the actual total is likely to exceed this [1].

COVID-19 has exposed HCWs to unusual physical and mental stresses [1]. Burnout syndrome (BOS) is a psychological condition caused by (chronic) workplace-related stresses specifically refers to such an occupational context [2]. According to Maslach and Jackson, it consists of three dimensions: emotional exhaustion (EE), depersonalization (DP), and feelings of reduced personal accomplishment (PA) [3]. Feelings of being "emotionally overextended and weary by one's work" are referred to as EE [3]. "An unfeeling and impersonal approach towards receivers of one’s care or assistance" is described as DP [3]. Reduced PA refers to reduced 'feelings of competence and achievement in one's work with people' [3]. BOS refers specifically to phenomena in the occupational context and should not be applied to describe experiences in other areas of life [2]. A systemic review conducted in 2018, which included 176 studies, showed overall BOS prevalence in physicians was 48.7% [4], and a meta-analysis of BOS among residents found a prevalence of 51% [5].

Previous outbreaks of respiratory infections were associated with increased psychological morbidity among healthcare workers. In the severe acute respiratory syndrome (SARS) outbreak of 2003, emotional distress, depression, and anxiety occurred more frequently among frontline HCWs [6, 7]. Increased rate of psychological distress in HCWs was also reported during the H1N1 influenza pandemic (2009) and the Middle East respiratory syndrome (MERS-CoV) outbreak (2014) [1, 8, 9]. High levels of BOS have been reported among HCWs, especially in the emergency and Intensive Care Units (ICU) [10].

Factors contributing to an increased risk of BOS include excessive workload, high time pressure, high mortality rate, and lack of time to address patients’ needs adequately [11]. These emotions might deteriorate during a pandemic because of the unknown nature of the sickness, dealing with numerous infected people, and the personal risk of contracting the virus. Burnout also negatively affects patients and coworkers since it increases the probability of making poor decisions, potential animosity toward patients, medical errors, challenging interpersonal interactions, and infections of HCWs’ families [12, 13]. BOS is one of the primary factors affecting the quality of work and performance [14]. According to several systematic reviews, high levels of BOS in HCWs have been linked to less safe patient care [15, 16]. Specifically, burnout in HCWs has consistently shown a dose-response relationship with poorer patient safety outcomes [15]. It has also been associated with anxiety, depression, marital stress, early retirement, substance abuse, and suicide among HCWs [17].
The study was carried out six months following the onset of COVID-19 when there had been no reports of the pandemic’s effects on BOS among HCWs. For health authorities to create interventions and policies to assist their employees better and prepare for future infectious disease outbreaks, they must have access to adequate data on BOS prevalence among HCWs.

The purpose of the study was to describe the BOS status of the frontline doctors in secondary and tertiary care institutions (mixed hospitals) in Bangladesh’s south-eastern region.

**Materials & methods**

1. **Settings and participants**

This cross-sectional study was carried out in Chittagong Medical College Hospital (CMCH) and Chattogram General Hospital (CGH), Chattogram, Bangladesh, from June to August 2020. CMCH is a 1313-bedded, tertiary-level teaching hospital that repurposed 200 beds for COVID-19 patients, including ICU, while keeping other services functional. CGH is a 250-bedded district general hospital repurposed with 140 beds, including ICU, for COVID-19 patients. The doctors in these hospitals provided services exclusively to COVID-19 patients, non-COVID-19 patients, or a mixture of COVID-19 and non-COVID-19 patients (termed ‘mixed’ in this study) following the principles of isolation and quarantine.

The researchers approached the prospective participants (convenience sampling), and those who had given informed written consent were included, and unwilling doctors were excluded from the study. The completed questionnaires were collected, verified, sorted, and analyzed.

2. **Data collection tool**

A self-administered questionnaire with two sections was used to collect the data. The first section included questions regarding socio-demographics and workplace details. The second section evaluated burnout using the Maslach Burnout Inventory for Human Services survey (MBI-HSS). The MBI-HSS consisted of 22 items and was divided into three domains: emotional exhaustion (EE, nine items), depersonalization (DP, five items), and personal accomplishment (PA, eight items) [3].

The items were measured with a 5-point Likert scale, from 1-never, 2-a few times a year, 3-a few times a month, 4-a few times a week, and 5-everyday. The numeric responses for each item were added to give the total score for each domain. Based on the scores, participants were categorized as having low (≤18 points), moderate (19–26 points), high (≥27 points) levels of EE; low (≤5 points), moderate (6–9 points), high (≥10 points) levels of DP, and low (≥ 40 points), moderate (39–34) and high (≥ 33) levels of reduced PA.

Although in Bangladesh, 25-item Shimul Burnout Inventory (SBI) (Bengali version) was used to measure job-related BOS administered in heterogeneous occupational categories [18]. As the medium of instruction for the graduation of frontline doctors was English in Bangladesh, the original MBI-HSS (english version) was used to collect the data.

The Reliability Statistics (reliability Alpha coefficient) for all items of MBI-HSS were included in the analysis. The Cronbach’s Alpha value is 0.715 for the total scale. And the values for the EE, PA, and DP were 0.616, 0.602, and 0.145, respectively.

3. **Ethical considerations**

The research received approval from the ethical review committee of Chittagong Medical College, Bangladesh. All participants signed an informed consent form, and confidentiality was maintained.
4. Data analysis
Data were analyzed using SPSS statistical software version 22. To ascertain the statistical differences between the mean values of the three dimensions of the MBI-HSS, we employed the ANOVA and t-tests. When the ANOVA test result was significant, post-hoc analysis was carried out to pinpoint the important pair-wise differences. Multiple logistic regression analysis was conducted to ascertain the impact of parameters related to BOS. A p-value of <0.05 was considered significant.

5. Assessment of Burnout syndrome in the participants
Participants with high scores for EE (≥ 27), DP (≥10), and reduced PA (≤33) were designated as having a high degree of burnout. Factors associated with BOS were also determined.

Results
1. Demographic and service-related characteristics of enrolled doctors
A total of 185 doctors were invited to participate in the study; 168 frontline doctors responded. The response rate was 90.81%. The overall prevalence of high BOS was 55.4% (93/168) (95% CI: 47.5% to 63.0%). Table 1 describes the demographic and service-related data of the respondents. The male-female ratio of the respondents was 106:62 (1:0.6), where about two-thirds were male and rest were female. About one-third of the respondents were 25–29 years, and the rest were >30 years old. More than three-quarters were government employees, and the remaining were private doctors from different specialties. About two-thirds were post-graduate students, and one-third were medical officers. Three-fifth of them was in their first to the...
third year of academic study or employment, and the remainders were in later job/academic year periods (4th to 5th year). More than one-third worked in the medicine department. Two-fifth provided care for COVID-19 patients, and almost half were in the ‘mixed’ duty place.

2. MBI subscale scores among the participants

The mean MBI score was 66.2±13.5. The mean and standard deviation of the MBI score is represented in Table 2. Mean scores for EE, DP, and PA were 27.7±5.5, 16.7±2.9, and 21.7±4.9, respectively (Table 2).

3. Frequency of Burnout among participants

The EE, DP, and PA levels were grouped into mild, moderate, and high based on the defined criteria. Among participants, 95.8% of respondents had moderate to a high level of EE, and almost all of them had a high level of DP (98.2%) and reduced PA (97%) (Table 3).

4. EE, DP, and reduced PA in participants

There was no significant difference between age groups across the three domains of burnout. Significantly higher EE was observed in females than in males (p-value 0.011) (Table 4). The medical officers suffered more DP than post-graduate students (p-value 0.011). More DP was also observed in more junior doctors (1st–3rd year vs. 4th–5th year) (p-value 0.029). Respondents who worked >8 hours/day suffered from high BOS in all three domains.

5. High burnout in all three domains related to demographic and job-related characteristics

Younger participants (25–29 years) were 6.45 times more likely to have high burnout in all three domains than the participants >35 years (AOR: 6.45, 95% CI: 1.95–21.43; p = 0.002). Females had significantly higher burnout in all three domains than males (p-value 0.014). Medical officers had higher BOS than the post-graduate students (AOR: 3.55, 95% CI: 1.55–9.50; P = 0.011). Participants in non-COVID wards experienced less BOS than in mixed wards (OR: 0.22; 95% CI: 0.05–0.91; P = 0.036) (Table 5). Physicians with mixed workplace duty were 3.97 times more likely to have high BOS in all three domains than those who had duty in

| MBI subscale | Mean±SD | Range |
|-------------|---------|-------|
| EE subscale | 27.7±5.5| 13–45 |
| PA subscale | 21.7±4.9| 8–36  |
| DP subscale | 16.7±2.9| 9–24  |
| Total score | 66.21±13.5| |

Table 2. MBI subscale scores among the participants (n = 168).

| Burnout domains               | Low     | Moderate | High    |
|-------------------------------|---------|----------|---------|
| Emotional exhaustion          | 7 (4.2) | 63 (37.5)| 98 (58.3)|
| Reduced personal accomplishment| 0 (0)   | 5 (3.0)  | 163 (97.0)|
| Depersonalisation             | 0 (0)   | 3 (1.8)  | 165 (98.2)|

Data were expressed as frequency (percentage).

Table 3. Frequency of Burnout among participants (n = 168).
the non-COVID unit only (AOR: 3.97, 95% CI: 1.06–14.85, p = 0.040). There were no significant differences regarding the type of employment, course/job designations, academic year, placement of duty, patient turnout, and duration of duty hours.

Discussion

The COVID-19 pandemic has negatively affected healthcare workers’ physical and psychological well-being [1]. The current study demonstrated high levels of BOS among frontline doctors in Bangladeshi hospitals caring for COVID and non-COVID patients during the pandemic. Increased EE, DP, and reduced PA were observed six months after the COVID-19 outbreak in
the country. During the study period, the country witnessed the pandemic’s first peak, causing a rise in hospital admission of COVID-19 cases, including severe diseases. Frontline doctors became fatigued due to the increased workload and discomfort of wearing PPE. These findings agree with other studies on COVID-19 [19–21].

Studies that predate the emergence of COVID-19 have shown that 'large-scale natural disasters and pandemics are associated with significant increases in mental health disorders among health care providers' [22]. That might be due to the unprecedented challenge the healthcare system was unprepared to face [23]. Worldwide disruption of the health system [24] during the COVID pandemic increased morbidity and mortality even in developed countries, adding to the psychological distress of the HCWs. Another psychological problem that doctors experienced during the COVID pandemic was workplace violence [25].

Table 5. High Burnout in all three domains and demographic and job-related characteristics (n = 168).

|                          | High burnout in all three domains | COR (95% CI for COR) | AOR (95% CI for AOR) | P value |
|--------------------------|----------------------------------|----------------------|----------------------|---------|
| Age, years               | No (n = 75)                      | Yes (n = 93)         |                      |         |
| 25–29                    | 16 (21.3)                        | 40 (43.0)            | 4.54 (1.78–11.59)    | 6.45 (1.95–21.43) | 0.002* |
| 30–34                    | 39 (52.0)                        | 42 (45.2)            | 1.96 (0.83–4.61)     | 2.37 (0.87–6.47)  | 0.093  |
| >35                      | 20 (26.7)                        | 11 (11.8)            | 1                    | 1       |
| Sex                      |                                   |                      |                      |         |
| Male                     | 55 (73.3)                        | 51 (54.8)            | 1                    | 1       |
| Female                   | 20 (26.7)                        | 42 (45.2)            | 2.66 (1.18–4.36)     | 1.39 (0.59–3.24) | 0.450  |
| Type of employment:      |                                   |                      |                      |         |
| Government               | 57 (76.0)                        | 74 (79.6)            | 1.23 (0.59–2.55)     | 1.03 (0.19–4.01) | 0.889  |
| Private                  | 18 (24.0)                        | 19 (20.4)            | 1                    | 1       |
| Course/Job Designation   |                                   |                      |                      |         |
| Postgraduate residents   | 55 (73.3)                        | 55 (59.1)            | 1                    | 1       |
| Medical officer          | 20 (26.7)                        | 38 (40.9)            | 1.90 (0.98–3.67)     | 3.55 (1.55–9.50) | 0.011* |
| Academic year            |                                   |                      |                      |         |
| 1st–3rd year             | 41 (54.7)                        | 63 (67.7)            | 1.74 (0.93–3.27)     | 1.19 (0.54–2.60) | 0.672  |
| 4th and 5th year         | 34 (45.3)                        | 30 (32.3)            | 1                    | 1       |
| Placement of duty        |                                   |                      |                      |         |
| Obs. &Gynae              | 10 (13.3)                        | 25 (26.9)            | 1.525 (0.57–4.09)    | 1.05 (0.30–3.61) | 0.939  |
| Medicine                 | 33 (44.0)                        | 28 (30.1)            | 0.56 (0.22–1.19)     | 0.39 (0.15–1.02) | 0.055  |
| ICU                      | 18 (24.0)                        | 17 (18.3)            | 0.58 (0.23–1.47)     | 0.67 (0.18–2.45) | 0.667  |
| Surgery& emergency       | 14 (18.7)                        | 23 (24.7)            | 1                    | 1       |
| Unit of duty place       |                                   |                      |                      |         |
| Non-COVID                | 10 (13.3)                        | 4 (4.3)              | 1                    | 1       |
| Mixed                    | 33 (44.0)                        | 51 (54.8)            | 3.86 (1.12–13.34)    | 3.97 (1.06–14.85) | 0.040* |
| COVID                    | 32 (42.7)                        | 38 (40.9)            | 2.97 (0.85–10.38)    | 2.27 (0.58–8.89) | 0.241  |
| Patient turnout/ Day     |                                   |                      |                      |         |
| <30/24 Hours             | 48 (64.0)                        | 55 (59.1)            | 1.23 (0.65–2.30)     | 1.11 (0.39–3.33) | 0.709  |
| >30/24 Hours             | 27 (36.0)                        | 38 (40.9)            | 1                    | 1       |
| Duration of duty hour/day|                                   |                      |                      |         |
| <8 Hours/Day             | 40 (53.3)                        | 37 (39.8)            | 1                    | 1       |
| 8–12 Hours/Day           | 35 (46.7)                        | 56 (60.2)            | 1.73 (0.94–3.19)     | 1.14 (0.75–4.12) | 0.335  |

*P values were obtained from Chi-square tests.
COR: Crude odds ratio; AOR: Adjusted odds ratio; CI: Confidence interval; 1 = Reference category

https://doi.org/10.1371/journal.pone.0277875.t005
In the current study, the overall prevalence of high BOS was 55.4% which was similar to that of Portugal (53%) [26], higher than that in other nations during the COVID-19 pandemic, including Brazil (21%) [27], Wuhan (FL 13% Vs. UW 39%) [28], Australia (30%) [29], Italy (37%,25%,15.3%) [30], Spain (41%,15.2%,8.4%) [31], and Egypt (35.5%, 70.6%, 26.5%) [32]. The difference might be due to cultural backgrounds, social factors, and different health system organizations. The small sample size and under-resourced infrastructure might be an additional factor in the current study.

The socio-demographic and work-related variables revealed that high BOS in all three domains was significantly more prevalent in the younger age group (25–29 years). They were more than six times more likely to have BOS than participants >35 years. Additionally, younger doctors (1st-3rd year vs. 4th-5th year) or early study levels suffered greater DP. This result agrees with a study conducted in Egypt [32] and India [33]. Similar findings were observed in the different studies conducted before the pandemic [34–36]. Because of less professional experience, younger and earlier job holders were more prone to anxiety and stress. And they often act as the first contact while dealing with COVID-19 patients [37]. However, a study on Jordanian nurses contradicts our findings, which show increased BOS among nurses with more education [38].

In this study, females were significantly more likely to experience burnout across all three domains. Particularly, EE was significantly more common in women than in men. This conclusion is in line with findings from other research [39, 40]. Studies in physicians before the pandemic also found that females suffered from more EE than their counterparts [12, 41]. In another study, being female predicts more EE [42]. In Bangladesh, female healthcare workers often have to play a dual role with a double workload, combining professional committee members with their domestic role, including caring for other family members. The high prevalence of EE in females might be due to this additional family stress and child-care commitments [43] and a less supportive work environment [12, 41].

EE and DP were significantly higher in the physicians working in the medicine department, who had to deal with most COVID-related deaths. EE, DP, and reduced PA were higher in gynaecology and obstetrics departments; they had to deal with COVID and non-COVID patients, which might cause high burnout. Martini et al. found the highest burnout rate in obstetrics and gynecology (75%), compared to 63% for internal medicine, 40% for general surgery, and the lowest in family medicine (27%) [44]. This difference might be because the units dedicated to COVID-19 in the hospitals were served predominantly by medical officers and residents from the medicine department. However, limited frontline physicians in the obstetrics and gynaecology department had to deal with more patients, which made it impossible to spare a dedicated group to deal with COVID-19 patients.

In this study, the physicians who worked in the mixed workplace duty showed more burnout in all three domains than in the non-COVID unit. A low level of burnout in frontline COVID unit medical professionals was observed in several studies compared to non-COVID wards in different centers [21, 27, 45]. An Egyptian study found high EE and DP in HCWs working in the COVID unit, but the difference was not statistically significant [32].

Working more than eight hours a day was significantly correlated with all three domains of burnout in the current study. This finding agrees with other studies conducted during the COVID-19 pandemic [32] and pre-pandemic era in Yemen, 2009, and Lebanon, 2010 [36, 46].

Burnout affects the quality of life and the delivery of health care services [32], which jeopardizes physical, mental, emotional, and social wellbeing. The high level of EE is related to a low level of mental health [47, 48] and needs effective intervention to combat it. A pandemic situation impairs the ability of physicians to maintain an appropriate work-life balance to combat anxiety and stress.
Since the study has shown that high burnout is more prevalent in Bangladesh than in many other settings, we have identified a dire need for a strategy to prevent it. A stress reduction program, which includes a program to reduce everyday stress and a system to cope with stress, seems to avoid burnout effectively [49]. Other individual-level interventions to improve resilience and coping methods with effective tools like online cognitive behavioral therapy appear effective [50]. But during the COVID-19 pandemic, system-level issues like—optimizing work quality and quantity should be addressed in Bangladesh.

Options to achieve these include interventions that reduce work inefficiencies, such as non-physician administrative support [51], satisfaction with work-flow, relationship with peers, spare time and resources for CME, opportunity to affect decision making, and a trusted advisor would reduce burnout [52].

And it was found that the strategy that addresses system-level matters is more effective. Physician burnout during the COVID-19 pandemic might be reduced if personal-level intervention could be combined with system-level intervention, enhancing job quality and quantity [51].

Limitations
The scarcity of data on pre-pandemic burnout in the study hospitals for comparison was a limitation. The smaller sample size, inclusion of doctors solely from public (government) hospitals, and no data obtained from private (non-govt.) hospitals were other limitations. The effect of workplace factors for BOS’s ‘job demand-control model’ (JDCM) was not used here. Finally, the study was conducted during the peak of COVID-19 transmission when BOS was anticipated to be high.

Conclusion
Our study demonstrated high levels of burnout among frontline doctors of different specialties during the COVID-19 pandemic in Bangladesh. BOS in females and younger were significantly more prevalent than in their counterparts. Doctors who worked in the non-COVID ward seemed to have less burnout than those in the mixed unit. Therefore, it is crucial to understand the prevalence of BOS and the associated risk factors to better support doctors working during this and future pandemic. A workplace mental health strategy and policy are essential for a healthy working environment during a pandemic crisis. Doctors who lack mental and emotional stability harm their patients, families, workplaces, and healthcare systems. Healthcare organizations and government authorities should develop mitigating strategies to ensure the well-being of doctors and other healthcare staff.

Supporting information
S1 File.
(XLSX)
S2 File.
(XLSX)
S3 File.
(SAV)
S4 File.
(SAV)
Acknowledgments

The authors would like to thank all volunteers for actively cooperating in the study. The authors are grateful to Dr. Farid Uddin Ahmed from the Department of Community Medicine, Chittagong Medical College, for his help in data analysis.

Author Contributions

Conceptualization: Fahmida Rashid, Md. Abdus Sattar.

Data curation: Fahmida Rashid, Rabiul Alam Md. Erfan Uddin, H. M. Hamidullah Mehedi, Satyajit Dhar, Nur Hossain Bhuiyan, Md. Abdus Sattar, Shahanara Chowdhury.

Methodology: Fahmida Rashid, Rabiul Alam Md. Erfan Uddin, H. M. Hamidullah Mehedi, Satyajit Dhar, Nur Hossain Bhuiyan, Md. Abdus Sattar, Shahanara Chowdhury.

Project administration: Fahmida Rashid.

Supervision: Fahmida Rashid, Rabiul Alam Md. Erfan Uddin.

Writing – original draft: Fahmida Rashid, Rabiul Alam Md. Erfan Uddin, H. M. Hamidullah Mehedi, Satyajit Dhar, Nur Hossain Bhuiyan.

Writing – review & editing: Fahmida Rashid, Satyajit Dhar, Nur Hossain Bhuiyan, Md. Abdus Sattar, Shahanara Chowdhury.

References

1. World Health Organization. (2021). The impact of COVID-19 on health and care workers: a closer look at deaths. World Health Organization. https://apps.who.int/iris/handle/10665/345300. License: CC BY-NC-SA 3.0 IGO.

2. World Health Organisation.Geneva: WHO;2019. Burn-Out an "Occupational Phenomenon": International Classification of Diseases. 28 May 2019. p 1. https://www.who.int/mental_health/evidence/burn-out/en

3. Maslach C. and Jackson S.E. The Measurement of Experienced Burnout. Journal of Organizational Behavior. 1981; 2, 99–113. https://doi.org/10.1002/job.4030020205

4. Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of Burnout Among Physicians: A Systematic Review. JAMA. 2018; 320(11):1131–1150. https://doi.org/10.1001/jama.2018.12777 PMID: 30326495

5. Low ZX, Yeo KA, Sharma VK, et al. Prevalence of burnout in medical and surgical residents: a meta-analysis. Int J Environ Res Public Health 2019; 16:1479. https://doi.org/10.3390/ijerph16091479 PMID: 31027333

6. Chan AO, Huak CY. Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. Occup Med (Lond). 2004; 54(3):190–196. https://doi.org/10.1093/occmed/kqh027 PMID: 15133143

7. Nickell LA, Crighton EJ, Tracy CS, et al. Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. CMAJ. 2004; 170(5):793–798. https://doi.org/10.1503/cmaj.1031077 PMID: 14993174

8. Mobaraki K, Ahmadzadeh J. Current epidemiological status of Middle East respiratory syndrome coronavirus in the world from 1.1.2017 to 17.1.2018: a cross-sectional study. BMC Infect Dis. 2019; 19 (1):351. Published 2019 Apr 27. https://doi.org/10.1186/s12879-019-3987-2 PMID: 31029095

9. Memish ZA, Al-Tawfiq JA, Makhdoo H, et al. Screening for Middle East respiratory syndrome coronavirus infection in hospital patients and their healthcare worker and family contacts: a prospective descriptive study. Clin Microbiol Infect. 2014; 20(5):469–474. https://doi.org/10.1111/1469-0691.12562 PMID: 24460964
10. Elshaer NSM, Moustafa MSA, Aiad MW, Ramadan MIE. Job stress and burnout syndrome among critical care healthcare workers. *Alexandria J Med.* 2018; 54:273–277. https://doi.org/10.1016/j.ajme.2017.06.004

11. Talae N, Varahram M, Jamaati H, et al. Stress and burnout in healthcare workers with COVID-19 pandemic: validation of a questionnaire. *Z Gesundh Wiss.* 2020; 30(3):531–536. https://doi.org/10.1007/s10389-020-01313-z PMID: 32837840

12. Kumar S. Burnout and Doctors: Prevalence, Prevention, and Intervention. Healthcare (Basel). 2016; 4(3):37. Published 2016 June 30. https://doi.org/10.3390/healthcare4030037 PMID: 27417625

13. Denning M, Goh ET, Tan B, et al. Determinants of burnout and other aspects of psychological well-being in healthcare workers during the Covid-19 pandemic: A multinational cross-sectional study. *PLoS One.* 2021; 16(4):e0238666. Published 2021 Apr 16. https://doi.org/10.1371/journal.pone.0238666 PMID: 33861739

14. Aryankhesa A, Mohammadibakhsh R, Hamidi Y, et al. Interventions on reducing burnout in physicians and nurses: A systematic review. *Med J Islam Repub Iran.* 2019; 33:77. Published 2019 Jul 31. https://doi.org/10.3417/mjir.33.77 PMID: 31696071

15. Dewa CS, Loong D, Bonato S, Trojanowski L. The relationship between physician burnout and quality of healthcare in terms of safety and acceptability: a systematic review. *BMJ Open.* 2017; 7(6):e015141. Published 2017 Jun 21. https://doi.org/10.1136/bmjopen-2016-015141 PMID: 28637730

16. Hall LH, Johnson J, Watt I, Tsipa A, O’Connor DB. Healthcare Staff Wellbeing, Burnout, and Patient Safety: A Systematic Review. *PLoS One.* 2016; 11(7):e0159015. Published 2016 Jul 8. https://doi.org/10.1371/journal.pone.0159015 PMID: 27391946

17. Brown SD, Goske MJ, Johnson CM. Beyond substance abuse: stress, burnout, and depression as causes of physician impairment and disruptive behavior. *J Am Coll Radiol.* 2009; 6(7):479–485. https://doi.org/10.1016/j.jacr.2008.11.029 PMID: 19560063

18. Shimul AM, Islam S. Construction of a Scale for Measuring Job Burnout in Bangladesh. The Dhaka University Journal of Psychology. 2009, Vol 33, 45–55.

19. Elhadi M, Alsoufi A, Alhadi A, et al. Knowledge, attitude, and acceptance of healthcare workers and the public regarding the COVID-19 vaccine: a cross-sectional study. *BMC Public Health.* 2021; 21(1):955. Published 2021 May 20. https://doi.org/10.1186/s12889-021-10987-3 PMID: 34016073

20. Giusti EM, Pedroli E, D’Aniello GE, et al. The Psychological Impact of the COVID-19 Outbreak on Health Professionals: A Cross-Sectional Study. *Front Psychol.* 2020; 11:1684. Published 2020 Jul 10. https://doi.org/10.3389/fpsyg.2020.01684 PMID: 32754102

21. Dimitriu MCT, Pantea-Stoian A, Smaranda AC, et al. Burnout syndrome in Romanian medical residents in time of the COVID-19 pandemic. *Med Hypotheses.* 2020; 144:109972. https://doi.org/10.1016/j.mehy.2020.109972 PMID: 32531540

22. Restauri N, Sheridan AD. Burnout and Posttraumatic Stress Disorder in the Coronavirus Disease 2019 (COVID-19) Pandemic: Intersection, Impact, and Interventions. *J Am Coll Radiol.* 2020; 17(7):921–926. https://doi.org/10.1016/j.jacr.2020.05.021 PMID: 32479798

23. Cruz SP, Cruz JC, Cabrera JH, Abellán MV. Factors related to the probability of suffering mental health problems in emergency care professionals. Fatores relacionados à probabilidade de sofrer problemas de saúde mental em profissionais de emergência. *Rev Lat Am Enfermagem.* 2019; 27:e3144. Published 2019 Apr 29. https://doi.org/10.1590/1518-8345.3079-3144

24. Adams JG, Walls RM. Supporting the Health Care Workforce During the COVID-19 Global Epidemic. *JAMA.* 2020; 323(15):1439–1440. https://doi.org/10.1001/jama.2020.3972 PMID: 32163102

25. Alfuqaha OA, Albawai NM, Alhiaiy SS, et al. Workplace Violence among Healthcare Providers during the COVID-19 Health Emergency: A Cross-Sectional Study. *Behav Sci (Basel).* 2022; 12(4):106. Published 2022 Apr 13. https://doi.org/10.3390/bs12040106 PMID: 35447678

26. Duarte I, Teixeira A, Castro L, et al. Burnout among Portuguese healthcare workers during the COVID-19 pandemic. *BMC Public Health.* 2020; 20(1):1885. Published 2020 Dec 7. https://doi.org/10.1186/s12889-020-09980-z PMID: 32287794

27. Drager, LF, Pachito DV, Moreno CRC, et al. Sleep Disturbances, Anxiety, and Burnout during the COVID-19 Pandemic: A nationwide cross-sectional study in Brazilian Healthcare Professionals. *medRxiv* 2020, 20190603

28. Wu Y, Wang J, Luo C, et al. A Comparison of Burnout Frequency Among Oncology Physicians and Nurses Working on the Frontline and Usual Wards During the COVID-19 Epidemic in Wuhan, China. *J Pain Symptom Manage.* 2020; 60(1):e60–e65. https://doi.org/10.1016/j.jpainsymman.2020.04.008 PMID: 32283221

29. Dobson H, Malpas CB, Burrell AJ, et al. Burnout and psychological distress amongst Australian healthcare workers during the COVID-19 pandemic [published correction appears in Australas Psychiatry].
PLOS ONE | https://doi.org/10.1371/journal.pone.0277875 November 22, 2022 12 / 13

Burnout syndrome among frontline doctors during COVID-19 pandemic

2022 Apr;30(2):280. Australas Psychiatry. 2021; 29(1):26–30. https://doi.org/10.1177/1039856220965045 PMID: 33043677

30. Barello S, Palamenghi L, Graffigna G. Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. Psychiatry Res. 2020; 290:113129. https://doi.org/10.1016/j.psychres.2020.113129 PMID: 32485487

31. Luceño-Moreno L, Talavera-Velasco B, García-Albuerne Y, Martín-García J. Symptoms of Posttraumatic Stress, Anxiety, Depression, Levels of Resilience and Burnout in Spanish Health Personnel during the COVID-19 Pandemic. Int J Environ Res Public Health. 2020; 17(15):5514. Published 2020 Jul 30. https://doi.org/10.3390/ijerph17155514 PMID: 32751624

32. Elghazzali SA, Alkarn AF, Elkhayat H, Ibrahim AK, Elkhayat MR. Burnout Impact of COVID-19 Pandemic on Health-Care Professionals at Assiut University Hospitals, 2020. Int J Environ Res Public Health. 2021; 18(10):5368. Published 2021 May 18. https://doi.org/10.3390/ijerph18105368 PMID: 34069955

33. Khasne RW, Dhakulkar BS, Mahajan HC, Kulkarni AP. Burnout among Healthcare Workers during COVID-19 Pandemic in India: Results of a Questionnaire-based Survey. Indian J Crit Care Med. 2020; 24(8):664–671. https://doi.org/10.5005/jp-journals-10071-23518 PMID: 33024372

34. Mohammed K. A.-M., Ali E. G., Youssef I. M., Fahmy M. T., & Haggag W. E.-l. (2013). Burnout and personaliy among Egyptian residents. Arab Journal of Psychiatry, 24(2), 148–160. https://doi.org/10.1286/0001373

35. Alidrees TM, Aleissa S, Zamakhshary M, Badri M, Sadat-Ali M. Physician well-being: prevalence of burnout and associated risk factors in a tertiary hospital, Riyadh, Saudi Arabia. Ann Saudi Med. 2013; 33(5):451–456. https://doi.org/10.5144/0256-4947.2013.51 PMID: 24188938

36. Ashkar K, Romani M, Musharrafeh U, Chaaya M. Prevalence of burnout syndrome among medical residents: experience of a developing country. Postgrad Med J. 2010; 86(1015):266–271. https://doi.org/10.1136/pgmj.2009.092106 PMID: 20448222

37. Xiao X, Zhu X, Fu S, Hu Y, Li X, Xiao J. Psychological impact of healthcare workers in China during COVID-19 pneumonia epidemic: A multi-center cross-sectional survey investigation. J Affect Disord. 2020; 274:405–410. https://doi.org/10.1016/j.jad.2020.05.081 PMID: 32663970

38. Alfuqaha OA, Alkawareek MY, Alisharar HS. Self-evaluation and professional status as predictors of burnout among nurses in Jordan. PLoS One. 2019; 14(3):e0213935. Published 2019 Mar 22. https://doi.org/10.1371/journal.pone.0213935 PMID: 30901363

39. Liu N, Zhang F, Wei C, et al. Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. Psychiatry Res. 2020; 287:112921. https://doi.org/10.1016/j.psychres.2020.112921 PMID: 32240896

40. Wang C, Pan R, Wan X, et al. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. Int J Environ Res Public Health. 2020; 17(5):1729. Published 2020 Mar 6. https://doi.org/10.3390/ijerph17051729 PMID: 32155789

41. Lee YR, Lee JY, Kim JM, Shin IS, Yoon JS, Kim SW. A Comparative Study of Burnout, Stress, and Resilience among Emotional Workers. Psychiatry Investig. 2019; 16(9):686–694. https://doi.org/10.1016/j.psychres.2019.07.010 PMID: 31455062

42. Abdelhafiz AS, Ali A, Ziady HH, Maaly AM, Alorabi M, Sultan EA. Prevalence, Associated Factors, and Consequences of Burnout Among Egyptian Physicians During COVID-19 Pandemic. Front Public Health. 2020; 8:590190. Published 2020 Dec 3. https://doi.org/10.3389/fpubh.2020.590190 PMID: 33344401

43. Ramirez-Baena L, Ortega-Campos E, Gomez-Iruquiza JL, Cañadas-De la Fuente GR, De la Fuente-Solana EU, Cañadas-De la Fuente GA. A Multicentre Study of Burnout Prevalence and Related Psychological Variables in Medical Area Hospital Nurses. J Clin Med. 2019; 8(1):92. Published 2019 Jan 15. https://doi.org/10.3390/jcm8010092 PMID: 30650557

44. Martini S, Arfken CL, Churchill A, Balon R. Burnout comparison among residents in different medical specialties. Acad Psychiatry. 2004; 28(3):240–242. https://doi.org/10.1176/appi.ap.28.3.240 PMID: 15507560

45. Maslach C,Leiter MP, Schaufeli WB.Measuring burnout. In: Cooper CL, Cartwright S. (eds). The Oxford handbook of organizational wellbeing. Oxford: Oxford University Press;2009:86-108.

46. Soltan Mohamed R., Soliman Shaimaa Sherif, Al-Hassaini S. A., Elsherief Wessam, ElNaggar Medhat and Gohar Suzy F. “Burnout and work stress among medical oncologists: Egyptian multi-centric study.” Middle East Current Psychiatry. 27 (2020).

47. Zhang S, Wang J, Xie F, et al. A cross-sectional study of job burnout, psychological attachment, and the career calling of Chinese doctors. BMC Health Serv Res. 2020; 20(1):135. Published 2020 Mar 12. https://doi.org/10.1186/s12913-020-4996-y PMID: 32164684
48. McAlonan GM, Lee AM, Cheung V, et al. Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers. Can J Psychiatry. 2007; 52(4):241–247. https://doi.org/10.1177/070674370705200406 PMID: 17500305

49. Stier-Jarmer M, Frisch D, Oberhauser C, Berberich G, Schuh A. The Effectiveness of a Stress Reduction and Burnout Prevention Program. Dtsch Arztebl Int. 2016; 113(46):781–788. https://doi.org/10.3238/arztebl.2016.0781 PMID: 27989278

50. Ho CS, Chee CY, Ho RC. Mental Health Strategies to Combat the Psychological Impact of Coronavirus Disease 2019 (COVID-19) Beyond Paranoia and Panic. Ann Acad Med Singap. 2020; 49(3):155–160. PMID: 32200399

51. Khan N, Palepu A, Dodek P, et al. Cross-sectional survey on physician burnout during the COVID-19 pandemic in Vancouver, Canada: the role of gender, ethnicity and sexual orientation. BMJ Open. 2021; 11(5):e050380. Published 2021 May 10. https://doi.org/10.1136/bmjopen-2021-050380 PMID: 33972345

52. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. Lancet. 2016; 388(10057):2272–2281. https://doi.org/10.1016/S0140-6736(16)31279-X PMID: 27692469