ASSOCIATION BETWEEN WORK STRESS AND EXECUTIVE FUNCTIONING AMONG HEALTH CARE WORKERS DURING COVID-19 PANDEMIC

By

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Abstract

Introduction: Work stress and burnout suffered by health care workers (HCWs) have become an international rising issue with various outcomes. **Aim of Work:** To assess work stress and burnout among HCWs in Menoufia Governorate Hospitals during COVID-19 pandemic, and also to investigate their impact on executive functioning. **Materials and Methods:** A cross-sectional study was carried out on 376 HCWs working at Menoufia governorate, Egypt, during the period from the 1st of February to the end of May 2022. The Arabic validated Beverly Potter questionnaire and Maslach Burnout Inventory Human Services Survey were used for assessment of work stress and burnout respectively. Wisconsin Card Sorting Test was used to evaluate the executive functioning of participants. **Results:** Work stress was reported among 42.3% of the studied HCWs. The Mean ±SD of emotional exhaustion, depersonalization and personal accomplishment was 30.80 ±13.26, 10.09 ±7.65 and 28.52 ±12.81 respectively; which reflected an elevated status of burnout among the studied group. Low personal accomplishment, high emotional exhaustion, and high depersonalization were prevalent in 45.2%, 56.9%, and 44.7% of the studied participants respectively. There was a significant correlation between total score of work stress, emotional exhaustion, depersonalization, personal accomplishment and total errors in Wisconsin Card Sorting Test (r= 0.761, 0.580, 0.484, -0.520) respectively (p value <0.001). **Conclusion and Recommendations:** HCWs experienced both work stress and burnout syndrome during COVID-19 pandemic, which in turn affected their executive functioning, so psychological follow up for frontline HCWs, and proactive response to COVID-19 are recommended to decrease work stress and burnout that already suffered during emergent situations

Key words: Work stress, Burnout, Health care workers, COVID-19 and Executive functioning

Introduction

The first discovery of SARS-COV-2 as the source of the COVID-19 pneumonia outbreak was reported in China in December 2019. On March 11, 2020, the World Health Organization (WHO) identified the 2019 coronavirus infection crash (COVID19) as a pandemic (Alnazly et al., 2021).

Health-care workers (HCWs) are dealing with the critical and perilous situation of COVID-19 spreading pandemic. They are experiencing significant distress. As a result, HCWs are more likely to experience psychological discomfort and other mental health issues (Lai et al., 2020).

Work stress is defined as the outcome of work demands or threats that exceed the individual's capacities, which in turn negatively affects the psychological and physiological states (Chen et al., 2015). Chronic exposure to work stress can result in some disorders such as depression, exhaustion, or burnout (Eskildsen et al., 2015).

Burnout syndrome is defined as the body's reaction to the failure of the coping mechanisms that people typically use to deal with job stress (Marín and Campayo, 2010). Burnout has three measures: emotional exhaustion, personal accomplishment and depersonalization (Bellanti et al., 2021).

Executive functioning is defined as the set of processes that manifest control over other component cognitive abilities (Diamond, 2013). HCWs' cognitive impairment may affect their work, resulting in work mistakes and an elevated risk of infection transmission (Salam et al., 2019).

People who are subjected to work stress report cognitive dysfunction that affects their memory and concentration (Deligkaris et al., 2014). Most of recent studies have concentrated on assessing level of work stress, anxiety, and depression among health care workers during the COVID19 pandemic, while the association between work stress and cognitive function has received little attention (Farahat et al., 2021).

Aim of Work

Assessment of work stress and burnout among HCWs in Menoufia Governorate Hospitals during COVID-19 pandemic, and to investigate the impact of work stress and burnout on their executive functioning.

Materials and Methods

Study design: A cross-sectional study.

Place, and duration of the study: This study was carried out at Menoufia Governorate. In Menoufia Governorate, there are one university hospital, one teaching hospital, five fever hospitals and ten district hospitals. Menoufia University hospital was definitely chosen as it is the main tertiary-care hospital in the governorate. Zawyet Elnaora fever hospital was randomly chosen by simple random sample to be representative to fever hospitals and Elshohadaa central hospital was randomly chosen by simple random sample to be representative to district hospitals. The three hospitals, one tertiary-care hospital and two secondary-care hospitals as these hospitals had isolation units during the period of data collection were involved in this study. Data collection was carried out from the 1st of February to the end of May 2022.

Study Sample: Based on review of past literature (Elbqry et al., 2021) at Suez Canal University Hospitals; who found that moderate COVID-19 psychological stress was prevalent among 57.4% of medical participants. The least sample size calculated using statistics and sample size pro is 376 participants using the following equation: n = Z1-α/2 2 *P (1 - P)/ d2, Where n: Sample size, Z1-α/2 = 1.96, d2= 0.05, alpha: Type 1 error, p: Expected proportion, d: Marginal error. To avoid 10% dropout rate we had to distribute 420 questionnaires. Firstly, we ruled out twenty HCWs as they had one or more items of the exclusion criteria of this study which include advanced chronic diseases, a current neurological disorder, color blindness or current use of any psychotropic drugs. The remaining 400 HCWs were asked to participate in this study but 24 refused to participate so the final sample size of this study was 376 participants, with a response rate of approximately 94% (376/400). The total number of frontline HCWs was 380, 322 and 298 in Menoufia University Hospital, Zawyet Elnaora fever hospital and Elshohadaa central hospital respectively. On basis of sample size estimation, selection of HCWs was done by proportion allocation method in this study, so we had 143, 121 and 112 participants from Menoufia University Hospital, Zawyet Elnaora Fever Hospital and Elshohadaa Central Hospital respectively.

Study methods: Each participant was subjected to:

I. A predesigned questionnaire that was constructed and revised by the authors. It contained questions concerning about personal data (sex, age, marital status, smoking), occupational history (type of occupation, workplace, working in isolation units, type of department, night shifts, day off after shifts, number of years of experience, number of daily work hour) and questions about COVID-19 pandemic (previous infection with COVID-19 virus and vaccination status against COVID-19 virus). To verify the feasibility and application of the questionnaire, a pilot study was conducted in 10 respondents who were excluded from the study population, and modifications were made as needed.

II. Arabic validated Beverly Potter questionnaire: Beverly Potter questionnaire (Potter, 2009) was utilized to evaluate work-related stress among the investigated HCWs. Abdelkader and Rageb (2010) carried out validation of this questionnaire and its translation to Arabic language. This questionnaire is composed of 12 sections of questions to assess causes of stress related to workplace. Four questions are involved in each section, each question is answered according to the frequency of its existence taking grades of 4 (Always), 3 (Often), 2 (Rare), 1 (Never). The result was determined according to the total score that ranges from 48 as a minimum score if the participant answered "Never" to all questions to 192 as a maximum score if the participant answered "Always" to all questions. The participant is considered to free from work related stress if the total score is less than 97 while considered to have work related stress, if the total score is equal or more than 97. The more the total score the more level of work related stress (Farahat et al., 2021).

III. The Arabic version of Maslach Burnout Inventory Human Services Survey for Medical Personnel (MBI-HSS): This scale has high reliability and validity as a burnout measure (Maslach and Jackson, 1981). The Arabic version of Maslach Burnout Inventory Human Services Survey for Medical Personnel (Abd-Allah and El-Hawy, 2019) was used for assessment of occupational burnout in this study. This survey consists of 22 questions for evaluation of the three dimensions of burnout syndrome. Nine questions for assessment of emotional exhaustion, five questions for depersonalization

assessment and eight questions for assessment of personal accomplishment. Each question is answered according to the frequency of its occurrence taking grades as follows: 0 = Never, 1 =A few times a year or less, 2 = Once a month or less, 3 = A few times a month, 4 = Once a week, 5 = A few times a week, and 6 = Every day. Each dimension is assessed separately and the total score can reflect the level of burnout. For emotional exhaustion dimension, Low-degree burnout ≤ 17, Moderate burnout 18–29, High-degree burnout ≥ 30. For depersonalization dimension, Low-degree burnout ≤ 5, Moderate burnout 6–11, High-degree burnout ≥ 12. For personal accomplishment dimension, a total score of more than 40 is Low-level burnout, between 34 and 39 is Moderate burnout and 33 or less indicates High-level burnout. A High level of burnout is indicated by a combination of low personal accomplishment and high levels of emotional exhaustion and depersonalization (Ibtissam et al., 2012).

We modified the score where Low and Moderate categories of different domains of burnout were added as Low and compared to High category.

IV. Wisconsin Card Sorting Test

(The 64 card version): Wisconsin card sorting test is a well-designed test used for assessment of the executive functioning domain of cognition (Heaton and Staff, 1993). Sixty-four variable cards are involved in this test; they differ in color, shape or number of figures. The start is by explaining the test to the participant by introduction of four stimulus cards in front of the participant which are different in color, number and shape. For example the first card with one yellow circle, the second with two blue stars, the third with three green triangles and the fourth card with four red crosses. The participant was instructed to associate one of the four stimulus cards with the response card according to categorization depending on color, shape or number and the participant was told the result of his matching whether wrong or right. The category of matching is changed every ten correct responses. This test can analyze variable items including: preservative replies, preservative faults, non-preservative faults, conceptual level responses, total correct answers, overall errors, and number of categories completed (Farahat et al., 2021). Because of facility of application and calculation of total errors, it was used as a reliable item for the present study.

Consent

Before the start of work, participants who accepted to participate in the study were assured of confidentiality and data anonymity. An informed written consent was taken from each participant.

Ethical Approval

Before the beginning of the study, it was thoroughly examined and officially approved by The Menoufia Faculty of Medicine Committee for Medical Research Ethics in January 2022. This study had been accepted by relevant administrative authorities at all studied hospitals.

Data Management

The data collected were tabulated and analyzed by SPSS (statistical package for the social science software) version 26 on IBM compatible computer. Two types of statistics were conducted: descriptive statistics were expressed as number and percentage (No & %) for qualitative data or mean and standard deviation (X+SD), median and range for quantitative data, and analytic statistics: Chi-square test ($\chi 2$) was utilized to study association between qualitative variables. Fisher's exact test was utilized to study association between qualitative variables whenever any of the expected cells were less than five in 2*2 table. Student's t-test was utilizes to compare normally distributed quantitative variables between two groups. Mann Whitney U test was utilized to compare non-normally distributed quantitative variables between two groups. To show the correlation between two continuous or discrete not normally distributed variables spearman's correlations was used. A logistic regression was conducted to show the predictors of work related stress among the participants. P value <0.05 was considered to be statistically significant.

Results

Figure (1): Work stress among the studied participants.

Work stress
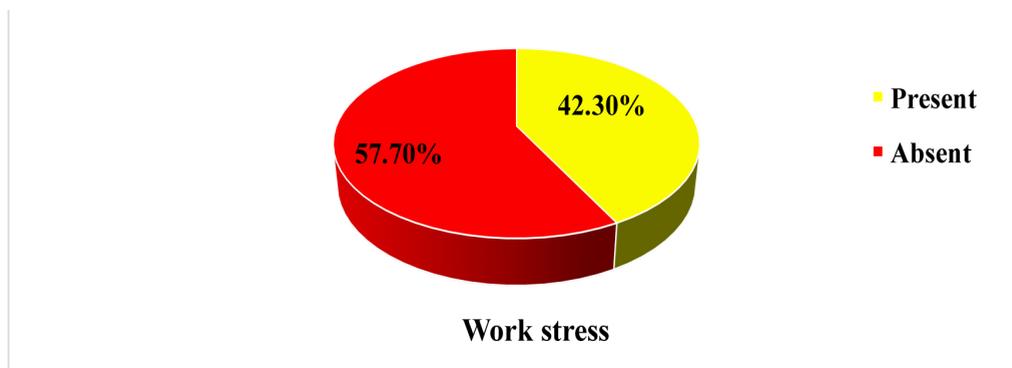
- **Present**
- **Absent**

Figure (1) showed that work stress was reported among 42.3% of the studied HCWs.

Table (1): Univariate and multivariate analysis for work stress in relation to demographic and work features of the studied participants.

Variables	Univariate analysis				p	Multivariate analysis	
	Work stress					OR (95.0% CI)	p
	Present (n=159)		Absent (n=217)				
	No	(%)	No	(%)			
Age (years): Mean ± SD	28.13 ±2.99		31.56 ±6.49		**<0.001****	0.99 (0.85-1.17)	0.957
Sex: Male Female	19 140	26.4 46.1	53 164	73.6 53.9	**0.002***	Ref 1.37 (0.65-2.89)	0.406
Marital status: Single Married	49 110	51.0 39.3	47 170	49.0 60.7	**0.044***	Ref 0.82 (0.45-1.49)	0.519
Smoking: Smokers Non-smokers	1 158	9.1 43.3	10 207	90.9 56.7	**0.023***	Ref 2.29 (0.23-22.71)	0.478
Workplace: Fever hospital University hospital Elshohdaa central hospital	42 92 25	34.7 64.3 22.3	79 51 87	65.3 35.7 77.7	**<0.001**** **p1<0.001**** **p2=0.036*** **p3<0.001****	1.05 (0.36-3.06) 3.74 (1.49-9.33) Ref	0.933 **0.005***
Occupation: Medical Para medical	51 108	31.1 50.9	113 104	68.9 49.1	**<0.001****	Ref 4.88 (2.19-10.87)	**<0.001****

Department:							
Medical	118	41.9	163	58.1	0.842	————	———
Surgical	41	43.2	54	56.8			
Years of experience Mean ± SD Median	5.22 ± 3.07 5.00		8.00 ± 6.46 7.00		<0.001**	1.18 (1.00-1.38)	0.047*
Daily work hours: Mean ± SD	10.52 ± 5.11		7.55 ±3.77		<0.001**	0.97 (0.90-1.04)	0.379
Night shift: Yes	155	48.0	168	52.0	<0.001**	14.64 (3.73-57.53)	<0.001**
NO	4	7.5	49	92.5		Ref	
Day off after night shift: Yes	81	37.3	136	62.7	0.023*	0.48 (0.22-1.08)	0.078
NO	78	49.1	81	50.9		Ref	
Working at isolation unit for COVID-19 patients Yes	89	46.1	104	53.9	0.123	————	———
NO	70	38.3	113	61.7			
Previous COVID-19 infection: Yes	114	46.7	130	53.3	0.018*	2.28 (1.32-3.94)	0.003*
NO	45	34.1	87	65.9		Ref	
Vaccinated against COVID-19: Yes	118	40.1	176	59.9	0.110	————	———
NO	41	50.0	41	50.0			

*: Statistically significant, **: Highly statistically significant, OR: Odds ratio, CI: Confidence interval, Ref: Reference, p1 between fever hospital and university hospital, p2 between fever hospital and Elshohdaa central hospital, p3 between university hospital and Elshohdaa central hospital.

Paramedical: nurses and laboratory technicians

Table (1) showed that work stress was significantly more prevalent among females, married, non-smokers, younger aged participants, paramedical staff, working at university hospital, work at nights shifts, with day off after night shifts, have less years of experience, with more daily work hours and who had previous COVID-19 infection (p value< 0.05).

Multivariate analysis showed that the highest risk factors were having night shifts, paramedical occupation, working at university hospital, had a previous COVID-19 infection and with less years of experience. The odds ratio was (14.640, 4.884, 3.740, 2.284, 1.176) respectively.

Table (2): Results of burnout domains and total errors of Wisconsin Card Sorting Test among the studied participants.

	The studied participants (No=376)	
	Mean ±SD	
Emotional exhaustion Range	30.80 ±13.26 (0-54)	
Depersonalization Range	10.09 ±7.65 (0-27)	
Personal accomplishment Range	28.52 ±12.81 (0-48)	
Total errors of Wisconsin Card Sorting Test Range	1.24 ±1.29 (0-6)	
Burnout domain	The studied participants (No=376)	
	No	**%**
Emotional exhaustion Low High	 162 214	 43.1 56.9
Depersonalization Low High	 208 168	 55.3 44.7
Personal accomplishment Low High	 170 206	 45.2 54.8

Table (2) showed that the Mean ± SD of 30.80 ±13.26 for emotional exhaustion domain, 10.09 ±7.65 for depersonalization domain and 28.52 ±12.81 for personal accomplishment, which can reflect an elevated level of burnout among the studied participants. The mean ±SD of total errors in Wisconsin Card Sorting test was 1.24 ±1.29. Low personal accomplishment, high emotional exhaustion, and high depersonalization were prevalent in 45.2%, 56.9%, 44.7% of the studied participants respectively.

Table (3): Correlation between Wisconsin Card Sorting Test (WCST), total score work stress and burnout domains among the studied participants.

	Wisconsin Card Sorting Test (WCST) among the studied participant (No.=376)	
	r	p value
Total score work stress	0.761	<0.001**
Emotional exhaustion	0.580	<0.001**
Depersonalization	0.484	<0.001**
Personal accomplishment	-0.520	<0.001**

**: Highly statistically significant   r: Spearman's Rho

Table (3) showed that there were highly significant positive correlations between impaired performance of Wisconsin Card Sorting Test (WCST) with total score work stress, emotional exhaustion, and depersonalization. On the other hand, there was a highly significant negative correlation between impaired performance of Wisconsin Card Sorting Test (WCST) with personal accomplishment (p value <0.001).

Discussion

During COVID-19 pandemic, HCWs confront various challenges which might make them more stressed or burnout and also might affect their work performance. Aims of this study included assessment of both work stress and burnout among HCWs in Menoufia Governorate Hospitals during COVID-19 pandemic, and to investigate their impact on executive functioning of the studied participants.

Work stress was present among 42.3% of the studied HCWs (Figure 1). Several studies showed also the presence of work stress among their participants as Arafa et al. (2021) who used the Depression Anxiety Stress Scale-21 in their study on healthcare workers on the frontlines in Egypt and Saudi Arabia and identified stress among 55.9 % of their participants. Also Elbqry et al. (2021) in their study on the effect of COVID-19 stressors on healthcare workers' performance and attitude at Suez Canal university hospitals; reported that the prevalence of moderate COVID-19 psychological stress levels was 57.4%. While Kannampallil et al. (2020) from St Louis , USA; mentioned that 29.4% of the exposed persons to COVID-19

patients had work-related stress. This considerably lower percentage might be attributed to the fact that they relied only on physician trainee as the group of interest in their study.

Two studies showed higher percentages of work-related stress among participants as Khalaf et al. (2020) in their study on coping with depression and anxiety in Egyptian physicians during COVID-19 pandemic and reported that 72% of the participants had stress and Lai et al. (2020) from China found that 71.5% of the participants had stress. These results might be because such studies were conducted throughout the peak of the first surge of COVID-19 pandemic.

Work-related stress was more prevalent among the studied female HCWs (Table 1), this can be explained by the physiological and hormonal nature of females in addition to their friable bodily response to physical symptoms than males. Similar results were obtained by Jahrami et al. (2021) from Bahrain who stated that the mean Perceived Stress Score (PSS) was higher among females compared to males (20.7 ± 0.5 and 19.2 ± 0.9) respectively. Moreover, Kannampallil et al. (2020) noticed that female trainees were more

likely to be stressed. Also Khalaf et al. (2020) reported that female physicians had higher stress scores than males using the Depression Anxiety Stress Scale.

Work-related stress was more prevalent among married HCWs (Table 1).This can be explained by additional overloading responsibilities of marriage and fear of the risk of COVID-19 infection transmission to their families. This is consistent with the findings described by Farahat et al. (2021). On the other hand, Ahn et al. (2021) from South Korea reported that single nurses were more stressed and concerned about their job duties. This association needs more causality investigations to relate all participants' characteristics.

Younger studied participants had more work-related stress (Table 1), this might be due to their lack of experience and more work overload. This is in a line with Ismail et al. (2021) in their study on occupational stress and burnout among frontline Egyptian anesthesiologists during COVID-19 outbreak in Egypt. Additionally, Khasne et al. (2020) from India also reported that younger respondents (21-30 years old) had higher levels of personal and job-related stress.

Paramedical staff were complaining of work-related stress than others (Table 1).This could be attributed to the relatively more direct contact with COVID-19 patients that make them more stressed. Also, they spend more time at hospitals. This finding is in accordance with Prasad et al. (2021) in their study on the prevalence and correlates of stress and burnout among US healthcare workers during the COVID-19 pandemic.

Working at night shifts increases the risk of having work-related stress among the studied HCWs (Table 1). This was in agreement with Arafa et al. (2021) who found that attending night shifts was associated with various forms of anxiety, depression, inadequate sleep and stress.

Work-related stress was more prevalent among the studied participants who have day off after night shifts (Table 1).The results of Aljabri et al. (2022) from Saudi Arabia was in harmony with the findings of the current study as they reported that working in rotating day-and-night shifts, and those who had their shift time and hours changed during the pandemic; all reported higher level of work-related distress.

Also studied HCWs who have less years of work experience were complaining of high level of stress (Table 1). Same results were highlighted by Farahat et al. (2021) who showed a negative significant correlation between work experience of HCWs and stress questionnaire score.

COVID-19 pandemic was associated with increased risk of development of work-related stress among the studied participants (Table 1). Multiple studies recognized the relationship between COVID-19 and work-related stress as Sharma et al. (2020) who found that direct contact with confirmed patients, more family dysfunction, and more colleagues exposed to COVID-19 virus infection may have contributed to a higher DASS score. Lai et al. (2020) also found that HCWs dealing with COVID-19 patients had an elevated risk of development of distress, and Hall et al. (2020) reported that HCWs involved in COVID-19 pandemic had symptoms of depression, anxiety, insomnia, distress and post-traumatic stress disorder.

Low personal accomplishment, high emotional exhaustion, and high depersonalization were prevalent among 45.2%, 56.9%, 44.7% of the studied participants respectively (Table

2). Several studies showed the same prevalence of burnout syndrome such as Kannampallil et al. (2020) who reported that 46.3% of the exposed persons to COVID-19 patients developed burnout syndrome, and Prasad et al. (2021) identified burnout syndrome among 49% of their studied participants. An elevated level of burnout was detected (44.7%) among the studied group (Table 2). This finding was in agreement with Rashid et al. (2022) from Bangladesh who reported high prevalence of burnout among their studied participants (55.4%).

The mean ±SD of total errors in Wisconsin card sorting test was 1.24 ±1.29 in the current study (Table 2) which reflected impaired cognitive executive functioning. This was in accordance with Shields et al. (2016) from USA who reported that cognitive abilities were influenced by stress.

Correlations between work stress, burnout domains and impaired executive functioning were detected among the studied group (Table 3). Similarly, Eskildsen et al. (2015) from Netherlands noticed that patients with work stress exhibited diminished performance, and a cognitive impairment. This is also similar with the findings of Hendrawan

et al. (2013) from Indonisea who suggested that executive functioning processes are directly associated with stress regulation. Correspondingly the case control study that was conducted by Jonsdottir et al. (2012) from Netherlands who demonstrated significant difference of executive functioning when comparing stressed patients with healthy controls.

Limitations and strengths: The most important strength that can make this study valuable is the assessment of both work-related stress and burnout syndrome, so we detected both the short-term and long-term effects of exposure to stressful factors in workplace and their consequences in the form of impaired cognitive executive functioning. The limitation of this study is that it was a cross-sectional study that showed the association between work stress, burnout, and impaired executive functioning performance but not the causality between them.

Conclusion and Recommendations

The present study revealed that HCWs experienced both work-related stress and burnout syndrome during COVID-19 pandemic that in turn affected their executive functioning, so psychological follow up for frontline

HCWs and proactive response to COVID-19 are recommended to decrease stress and burnout that already suffered during emergent situations.

Conflict of Interest

Funding

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