



Factors Influencing Stress Perception among Healthcare Workers during the Coronavirus Pandemic: A Multi-centric Cross-sectional Study

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ABSTRACT

Introduction: Pandemics increase the susceptibility of psychological illnesses among Healthcare Workers (HCWs). We aimed to estimate the stress level and identify factors influencing stress among healthcare workers during the Coronavirus-19 (COVID-19) pandemic. **Methods:** A multi-centric cross-sectional study was performed between November 2020 and January 2021 in Jeddah, Kingdom of Saudi Arabia, involving four governmental hospitals. HCWs volunteered to participate in an electronic self-administered questionnaire, which used the 10-item perceived stress scale to assess stress. **Results:** A total of 413 responses were received. Only 377 were eligible for this study. The mean stress score was 20 (SD=5). Most of the HCWs reported moderate stress levels (82%), compared to low or high-stress levels (10%) and (8%), respectively. Significant predictors for high-stress perception were determined using multivariate analysis. Our study determined that female, frontline, younger age groups and working long hours per day resulted in higher stress development. **Conclusions:** This study indicated that overall, HCWs who worked during the COVID-19 pandemic were moderately stressed. Occupational stress management strategies need to be implemented to decrease stress to help manage COVID-19 related psychological problems and future pandemic-related problems.

Keywords: COVID-19, Healthcare workers, Mental health, Stress, Pandemic, Jeddah

INTRODUCTION

In 2019, the novel Coronavirus Disease (COVID-19) originated in Wuhan, China which has become a global public health emergency [1]. The World Health Organization (WHO) announced COVID-19 to be a pandemic and stated that it poses a high health risk to countries with weak healthcare systems [2]. Naturally, the pandemic has led to concern among many people and has resulted in changes in the cognitive well-being of individuals worldwide [3].

Healthcare Workers (HCWs) are facing critical situations when managing COVID-19 patients [4]. Around 152,888 HCWs have been infected with COVID-19 since the onset of the disease, accounting for approximately 4% of the total cases [5]. HCWs are susceptible to a high risk of infection, mental illnesses, and psychological distress [1,4]. Many factors contribute to the mental burden of HCWs; these include the increasing number of cases, absence of medical supplies, depletion of personal protection equipment, overwhelming workload, and perception of insufficient assistance [4]. Furthermore, HCWs may be worried about spreading the virus to their families, friends, or colleagues [1].

Prior research has indicated that survivors of acute infectious diseases are at risk of developing stress, anxiety, depression, and posttraumatic stress disorder [6-8]. HCWs have been found to experience significant psychological distress as a result of fear of contagion, concern for their relatives, stigmatization, and job-induced stress [9-12]. Moreover, a review revealed that many socio-demographic factors, such as age, gender, place of work, and occupation, and psychological factors, such as lack of social support and self-efficacy, were associated with an increase in insomnia, distress, anxiety, and depression among HCWs [13]. Another study revealed that the perception of stress

was not associated with the HCWs' age or education level but was associated with their gender [14]. Interestingly, older people and those with longer work experience were found to have less stress and increased mental resilience [9,15]. The position in the hospital, e.g., nurse, doctor, or another HCW position, was not found to be associated with the perceived stress levels [14].

Increasing evidence suggests that COVID-19 could be a risk factor for stress among HCWs [13]. Therefore, we employed a cross-sectional study to address the gap of the psychological effects of COVID-19. We aimed to estimate the stress level and identify factors influencing the perception of stress among HCWs working in Jeddah, KSA, during the COVID-19 pandemic.

MATERIALS AND METHODS

Study Design

The present cross-sectional study included HCWs working in four Ministry of Health (MOH) hospitals in Jeddah during the COVID-19 pandemic. The participants were recruited from November 2020 to January 2021. The hospitals were selected according to their geographical distribution. All HCWs within the four MOH hospitals were informed of the aim and objectives of the study, and an electronic questionnaire was distributed through the internal communications department. The survey consisted of an introduction to explain the purpose of the study, a consent form, and a self-questionnaire. It was administered through web-based software, known as SurveyMonkey (<http://www.surveymonkey.com>), which provides a secure, password-protected, and anonymous online exchange. A reminder email was sent two weeks after sending the initial email. The study included male and female HCWs, including physicians, dentists, nurses, pharmacists, allied medical professionals, administration staff, and quality managers, who were above the age of 20 years. HCWs who had a psychiatric disease and those who were not working during the pandemic were excluded.

Questionnaire

In the first section of the survey, the participants were asked to provide the following information: age, gender, number of children, people they were living with, nationality, education level, work experience (years), job title, monthly income, the extent of direct interaction with COVID-19 patients, working hours per day, shift type, personal diagnosis of COVID-19, presence of a preexisting disease, and smoking status. The second section assessed the participants' perception of stress. The 10-item Perceived Stress Scale (PSS) is most commonly used for assessing the perception of stress. The PSS was used in the present study to assess the extent of stress experienced by HCWs over the last month. This scale adopts a five-point Likert scale response format (from 0=never to 4=very often). PSS scores were obtained by reverse scoring the participants' responses (0=4, 1=3, 2=2, 3=1, and 4=0) to four positively stated items (items 4, 5, 7, and 8). The total score was calculated as the sum of the scores for 10 items and ranged from 0 to 40. Higher scores were considered to indicate higher perceived stress. Scores of 0-13 indicated low perceived stress, 14-26 indicated moderate perceived stress and 27-40 indicated high perceived stress [16]. This scale was provided in English and Arabic. The Arabic version was validated in another study [17]. Variables included in statistical analyses were identified from the literature and assessed for suitability in Saudi Arabia.

Ethical Approval

The initial approval for conducting the study was obtained from the Research and Studies Department at the Directorate of Health Affairs in Jeddah on September 14, 2020. The final approval was obtained on March 09, 2021 (approval number, A01004).

Statistical Analysis

An OpenEpi calculator was used to calculate the sample size. The margin of error was 5%, and the Confidence Interval (CI) was 95%. The HCW population size was 15,049 as per the MOH statistics [18]. The potential response rate was considered to be 50%.

Data were collected, coded, and analyzed using SPSS Statistics 26 (IBM). Continuous variables are presented as means and Standard Deviations (SDs), while categorical variables are presented as frequency distributions and percentages. The prevalence of different stress levels is presented as percentages. The association of perceived stress

among HCWs with other variables was examined using an independent Student's t-test and one-way Analysis of Variance (ANOVA) with a post-hoc Tukey HSD test. The correlation of perceived stress with age and work experience (years) was assessed using the Pearson correlation. Multilinear regression analysis was used to predict the PSS score and the outcome variable from independent variables when the p-value was <0.25 in bivariate analysis. A 95% CI was used throughout the study, and p-values <0.05 were considered statistically significant.

RESULTS

Of the 413 respondents, 36 were excluded as they had a psychiatric illness. Consequently, a total of 377 respondents were eligible for the present study. The mean age of the participants was 36 years (SD=7, range=24-63 years). Their mean working experience was 11 years (SD=7, range=0-39 years). The participants' mean PSS score was 20 (SD=5). Most participants (82%) reported experiencing a moderate level of stress in the previous month, while only a few reported experiencing a low (10%) or high (8%) level of stress. The other socio-demographic variables are discussed in Table 1. Gender, number of children, nationality, direct interaction with COVID-19 patients, and working hours per day had a significant association with the participants' PSS score. However, no significant association was observed between the PSS score and other demographic variables (Table 2).

Table 1 General characteristics of HCW in Jeddah

Variable	Item	Number (%)
Gender	Female	245 (65%)
	Male	132 (35%)
Marital status	Single	92 (24.4%)
	Married	257 (68.2%)
	Widowed	4 (1.1%)
	Divorced	24 (6.4%)
Having Children	Yes	252 (66.8%)
	No	125 (33.2%)
Living with	Family	355 (94.2%)
	Friend	2 (0.5%)
	Alone	20 (5.3%)
Nationality	Saudi	350 (92.8%)
	Non-Saudi	27 (7.2%)
Highest level of education	Secondary school	4 (1.1%)
	Diploma	69 (18.3%)
	Bachelors	169 (44.8%)
	Postgraduate studies	135 (35.8%)
Job title	Physician	150 (39.8)
	Dentist	16 (4.2%)
	Nurse	82 (21.8 %)
	Pharmacist	9 (2.4%)
	Allied health personnel	74 (19.6%)
	Other	46 (12.2%)

Monthly Income	Less than 1100 euro	10 (2.7%)
	From 1100 to 2200 euro	73 (19.4%)
	From 2201 to 4500 euro	189 (50.1%)
	From 45001 to 6500 euro	65 (17.2%)
	More than 6500 euro	40 (10.6%)
Smoking status	Yes	95 (25.2%)
	No	261 (69.2%)
	Ex-smoker	21 (5.6%)
Current dealing with COVID-19 patients directly	Yes	214 (56.8%)
	No	163 (43.2%)
Working hours per day	Less than 8hours	14 (3.7%)
	8 hours	238 (63.1%)
	9 hours -12 hours	107 (28.4%)
	More than 12 hours	18 (4.8%)
Usual shift type	Morning shift	248 (65.8%)
	Evening shift	11 (2.9%)
	Night shift	6 (1.6%)
	Mixed	112 (29.7%)
Diagnosed to have COVID-19 infection based on lap result	Yes	55 (14.6%)
	No	322 (85.4%)
Presence of a preexisting disease	Yes	77 (20.4%)
	Diabetes	18 (25.71%)
	Hypertension	33 (47.14%)
	Asthma	20 (28.57%)
	Obesity	18 (25.71%)
	Other	20 (27.14%)
	No	300 (79.6%)

Table 2 The association between perceived stress score and other variables

Variable	Item	Mean score	SD	Statistical test	p-value
Gender	Female	20.7	4.6	t=3.2	0.001
	Male	19.1	4.7		
Marital status	Single	20.88	4.5	F=1.1	0.339
	Married	19.87	4.5		
	Widowed	19.07	4.2		
	Divorced	20.38	6.8		
Having Children	Yes	19.7	4.8	t= -2.3	0.019
	No	20.9	4.4		
Living with	Family	20.09	4.6	F=0.34	0.708
	Friend	20.5	0.7		
	Alone	21	5		
Nationality	Saudi	18.12	5.4	t= -2.3	0.02
	Non-Saudi	20.3	4.6		

Highest level of education	Secondary school	20.29	5.4	F=0.21	0.887
	Diploma	19.76	5.2		
	Bachelors	20.29	4.4		
	Postgraduate studies	20.14	4.8		
Job title	Physician	20.25	4.4	F=1.2	0.285
	Dentist	20.09	3.5		
	Nurse	20.51	5.3		
	Pharmacist	23.14	4.8		
	Allied health personnel	19.62	4.7		
	Other	19.41	5		
Monthly Income	Less than 1100 euro	21.01	4.1	F=0.26	0.904
	From 1100 to 2200 euro	19.9	5.4		
	From 2201 to 4500 euro	20.31	4.7		
	From 45001 to 6500 euro	19.84	3.9		
	More than 6500 euro	20.07	4.6		
Smoking status	Yes	20.07	4.7	F=1.15	0.318
	No	20.29	4.7		
	Ex-smoker	18.68	4.6		
Current dealing with COVID-19 patients directly	Yes	20.7	4.5	t=2.6	0.009
	No	19.4	4.9		
Working hours per day	Less than 8hours	20.82	4.5	F=2.7	0.041
	8 hours	19.71	4.6		
	9-12 hours	20.59	5		
	More than 12 hours	22.62	3.8		
Usual shift type	Morning shift	19.82	4.5	F=2.6	0.48
	Evening shift	21.19	3.4		
	Night shift	16.86	4.1		
	Mixed	20.94	5.2		
Diagnosed to have COVID-19 infection based on lap result	Yes	19.4	4.6	t= -1.3	0.176
	No	20.3	4.7		
Presence of a preexisting disease	Yes	20.8	4.5	t=1.3	0.846
	No	19.98	4.7		

There was a mild correlation between the PSS score and age ($R = -0.21$, $p < 0.001$) and a low correlation between the PSS score and work experience (years) ($R = -0.19$, $p < 0.001$). The scatter diagram for both the comparisons showed a negative linear correlation (Table 3).

Table 3 The correlation of the perceived stress score with age and work experience in years

Variable	Correlation Coefficient	p-value
Age	-0.21	<0.001
Work experience in year	-0.19	<0.001

A stepwise multilinear regression model was used to predict statistical significance. Age (95% CI= -0.192-0.064, $p < 0.0001$), gender (95% CI= -2.60-0.679, $p = 0.001$), direct interaction with COVID-19 patients (95% CI = -2.20-0.347, $p = 0.007$), and working hours per day (95% CI=0.078-1.533, $p = 0.030$) were significant independent

predictors for a higher perception of stress. These factors accounted for 3.14% of the variance in the PSS score ($F=10.16$, $p<0.001$, $R^2=0.099$, and adjusted $R^2=0.089$) (Table 4).

Table 4 Multilinear regression for potentially predictive factors of higher perception of stress among HCWs in Jeddah

	Unstandardized Coefficients B	Standardized Coefficients Beta	p-value	95% C.I. for Odds Ratio	
				Lower	Upper
Age	-0.128	-0.193	0	-0.192	-0.064
Gender	-1.64	-0.167	0.001	-2.60	-0.679
Dealing directly with COVID-19 patients	-1.27	-0.134	0.007	-2.20	-0.347
Working hours per day	0.805	0.108	0.03	0.078	1.533
Constant	26.95	-	0	23.49	30.41
R Square=0.099		Adjusted R Square=0.089			

DISCUSSION

The COVID-19 pandemic has instigated mental health issues as a result of powerlessness, fears of being infected and of infecting others, anxiety, distress, and depression at an individual level. At a community level, the rate of psychiatric illnesses is similar to that observed during the severe acute respiratory syndrome epidemic. HCWs are considered to be at the highest risk of experiencing distress and mental health problems during disease outbreaks [2,19-21]. The present study aimed to assess stress levels and identify factors influencing the perception of stress among HCWs working in Jeddah, Kingdom of Saudi Arabia, during the COVID-19 pandemic. Our findings provide the first step toward understanding the factors that negatively influence mental health within Jeddah.

Most HCWs reported having a moderate stress level in the present study. These results are in line with those of previous studies from China, India, Iraq, Egypt, and Al Madinah Al Munawwarah [22-26]. The high prevalence of perceived stress among HCWs may be explained by the severe strain imposed by COVID-19 on health services and the resultant highly stressful working environment [23]. Furthermore, a previous study reported HCWs and frontline workers to have a higher stress level than the general public because of their direct interaction with COVID-19 patients [27].

In the present study, females were found to have higher perceived stress levels than males; this finding is consistent with previous findings [24,26,27]. Although another study revealed a higher stress level among males, females usually exhibit more reactivity in neural networks than males, resulting in an arousal response to fear [14,28]. Other variables related to significantly higher stress levels included young age, direct interaction with COVID-19 patients, low working experience, and working for more than 12 hours per day. These predictors were similar to those reported by Khalf, et al. and Luan, et al.; these findings could be explained by fatigue caused by work overload and the high physical and mental demands of healthcare services [24,27].

There were no significant differences in the participants' PSS scores based on the following factors: marital status, people they were living with, job title, monthly income, shift type, presence of a preexisting disease, personal diagnosis of COVID-19, and smoking status. Furthermore, participants who were older and had more years of work experience had more stable mental health, were less distracted under stress, and were relatively free of neurotic anxiety. This may be due to the reduced working hours of senior HCWs and their greater experience in handling critical situations than junior HCWs [24]. We found that a higher prevalence of stress among HCWs was a common problem across all four hospitals; these findings are in line with those of previous studies published before the COVID-19 pandemic [29,30].

Certain limitations should be considered when interpreting the present findings. The present study was cross-sectional and was restricted to a single city; therefore, the results cannot be generalized. Moreover, our findings do not reflect the changes in the participants' stress levels overtime during the COVID-19 pandemic. Conducting longitudinal research with an appropriate sample size will help understand the stress experienced on a broader scale and may reveal significant differences in other variables related to the perception of stress. We recommend that future studies should assess more independent variables, such as the type of home (private or rented), the distance between work and home,

and other vital signs of HCWs (such as their weight, body mass index, and blood pressure). Despite these limitations, the present results provide essential information to address the gap between the factors influencing the psychological effects of COVID-19 and the mental health status of HCWs.

CONCLUSION

The present study revealed that HCWs working during the COVID-19 pandemic are at risk of moderate stress levels, contributing to the healthcare burden. Occupational stress management strategies need to be implemented to prepare for future outbreaks and reduce stress levels among HCWs.

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

REFERENCES

- [1] Xiang, Yu-Tao, et al. "Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed." *The Lancet Psychiatry*, Vol. 7, No. 3, 2020, pp. 228-29.
- [2] World Health Organization. "Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV)." 2020.
- [3] Shah, Kaushal, et al. "Focus on mental health during the Coronavirus (COVID-19) pandemic: Applying learnings from the past outbreaks." *Cureus*, Vol. 12, No. 3, 2020, p. e7405.
- [4] Lai, Jianbo, et al. "Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019." *JAMA Network Open*, Vol. 3, No. 3, 2020, p. e203976.
- [5] Bandyopadhyay, Soham, et al. "Infection and mortality of healthcare workers worldwide from COVID-19: A systematic review." *BMJ Global Health*, Vol. 5, No. 12, 2020, p. e003097.
- [6] Wu, Kitty K., Sumee K. Chan, and Tracy M. Ma. "Posttraumatic stress, anxiety, and depression in survivors of Severe Acute Respiratory Syndrome (SARS)." *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, Vol. 18, No. 1, 2005, pp. 39-42.
- [7] Hawryluck, Laura, et al. "SARS control and psychological effects of quarantine, Toronto, Canada." *Emerging Infectious Diseases*, Vol. 10, No. 7, 2004, pp. 1206-12.
- [8] Wu, Kitty K., Sumee K. Chan, and Tracy M. Ma. "Posttraumatic stress after SARS." *Emerging Infectious Diseases*, Vol. 11, No. 8, 2005, pp. 1297-300.
- [9] Wang, Li-Qiong, et al. "Psychological impact of Coronavirus Disease (2019) (COVID-19) epidemic on medical staff in different posts in China: A multicenter study." *Journal of Psychiatric Research*, Vol. 129, 2020, pp. 198-205.
- [10] Park, Ji-Seon, et al. "Mental health of nurses working at a government-designated hospital during a MERS-CoV outbreak: A cross-sectional study." *Archives of Psychiatric Nursing*, Vol. 32, No. 1, 2018, pp. 2-6.
- [11] Al Sulais, Eman, Mahmoud Mosli, and Turki AlAmeel. "The psychological impact of COVID-19 pandemic on physicians in Saudi Arabia: A cross-sectional study." *Saudi Journal of Gastroenterology: Official Journal of the Saudi Gastroenterology Association*, Vol. 26, No. 5, 2020, pp. 249-55.
- [12] Temsah, Mohamad-Hani, et al. "The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country." *Journal of Infection and Public Health*, Vol. 13, No. 6, 2020, pp. 877-82.
- [13] Spoorthy, Mamidipalli Sai, Sree Karthik Pratapa, and Supriya Mahant. "Mental health problems faced by healthcare workers due to the COVID-19 pandemic-A review." *Asian Journal of Psychiatry*, Vol. 51, 2020, p. 102119.
- [14] McAlonan, Grainne M., et al. "Immediate and sustained psychological impact of an emerging infectious disease

- outbreak on health care workers.” *The Canadian Journal of Psychiatry*, Vol. 52, No. 4, 2007, pp. 241-47.
- [15] Purvis, Taylor E., and Deanna Saylor. “Burnout and resilience among neurosciences critical care unit staff.” *Neurocritical Care*, Vol. 31, No. 2, 2019, pp. 406-10.
- [16] Cohen, Sheldon. “Perceived stress in a probability sample of the United States.” *American Psychological Association*, 1988, pp. 31-67.
- [17] Chaaya, Monique, et al. “Validation of the Arabic version of the Cohen Perceived Stress Scale (PSS-10) among pregnant and postpartum women.” *BMC Psychiatry*, Vol. 10, No. 1, 2010, pp. 1-7.
- [18] Ministry of Health. “Statistical Yearbook 1440H” 2020. <https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx>
- [19] Mahase, Elisabeth. “China coronavirus: WHO declares international emergency as death toll exceeds 200.” *BMJ: British Medical Journal (Online)*, Vol. 368, 2020.
- [20] Pfefferbaum, Betty, and Carol S. North. “Mental health and the Covid-19 pandemic.” *New England Journal of Medicine*, Vol. 383, No. 6, 2020, pp. 510-12.
- [21] Liu, Qian, et al. “The experiences of health-care providers during the COVID-19 crisis in China: A qualitative study.” *The Lancet Global Health*, Vol. 8, No. 6, 2020, pp. e790-e98.
- [22] Abdulah, Deldar Morad, and Ayad Ahmad Mohammed. “The consequences of the COVID-19 pandemic on perceived stress in clinical practice: Experience of Doctors in Iraqi Kurdistan.” *Romanian Journal of Internal Medicine*, 2020.
- [23] Surrati, Amal M. Qasem, Farah M. Asad Mansuri, and Abeer A. Ayadh Alihabi. “Psychological impact of the COVID-19 pandemic on health care workers.” *Journal of Taibah University Medical Sciences*, Vol. 15, No. 6, 2020, pp. 536-43.
- [24] Khalaf, Ola Osama, Mohamed A. Khalil, and Reham Abdelmaksoud. “Coping with depression and anxiety in Egyptian physicians during COVID-19 pandemic.” *Middle East Current Psychiatry*, Vol. 27, No. 1, 2020, pp. 1-7.
- [25] Lai, Jianbo, et al. “Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019.” *JAMA Network Open*, Vol. 3, No. 3, 2020, p. e203976.
- [26] Wilson, William, et al. “Prevalence and predictors of stress, anxiety, and depression among healthcare workers managing COVID-19 pandemic in India: a nationwide observational study.” *Indian Journal of Psychological Medicine*, Vol. 42, No. 4, 2020, pp. 353-58.
- [27] Luan, Rongrong, et al. “Comparison of psychological stress levels and associated factors among healthcare workers, frontline workers, and the general public during the novel coronavirus pandemic.” *Frontiers in Psychiatry*, Vol. 11, 2020, p. 1368.
- [28] Felmingham, Kim, et al. “Neural responses to masked fear faces: Sex differences and trauma exposure in posttraumatic stress disorder.” *Journal of Abnormal Psychology*, Vol. 119, No. 1, 2010, p. 241.
- [29] Alharbi, Homood, and Abdualrahman Alshehry. “Perceived stress and coping strategies among ICU nurses in government tertiary hospitals in Saudi Arabia: A cross-sectional study.” *Annals of Saudi Medicine*, Vol. 39, No. 1, 2019, pp. 48-55.
- [30] Grover, Sandeep, et al. “Psychological problems and burnout among medical professionals of a tertiary care hospital of North India: A cross-sectional study.” *Indian Journal of Psychiatry*, Vol. 60, No. 2, 2018, pp. 175-88.