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General health and psychological defense mechanisms of front-line healthcare workers during COVID-19 pandemic in Iran

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Abstract

Introduction: Since December 2019, people throughout the world has been encountering COVID-19 pandemic different populations, especially health care workers have been facing psychological challenges such as high amount of anxiety. In this study, we assessed impacts of COVID-19 pandemic on first-line health care workers psychological well-being in the north of Iran.

Materials and Methods: This cross-sectional analytical study was conducted in 4 hot-spot major hospitals of Rasht, during first month of the outbreak in Iran. Physicians and nurses were divided into two categories as low and high risk groups based on their level of exposure to the virus. Standard general health questionnaire (GHQ-28) and defense style questionnaires (DSQ-40) were also used.

Results: The mean age of participants was 30.2 ± 6.6. Of total 199 subjects, 73.4% were females and 26.6% were males. 63.23% of participants were nurses and 36.86% were physicians. Base on the mental health questionnaire, 60.8% and 10.55% of participants experienced mild to moderate psychological stress. There were no significant differences between high risk and low risk groups. Females those who had lost a family member due to COVID-19 and nurses with less developed defense mechanisms were found to be associated with psychological morbidity ($P<0.001$). Also, in terms of psychological defense mechanisms, nurses working in high risk wards showed more developed mechanisms than their peers.

Conclusion: Majority of physicians and nurses working during COVID-19 pandemic were experiencing levels of psychological distress, mostly in the form of anxiety, sleep dysfunction and depression. Females, individuals who had lost a family member due to the COVID-19 infection and those with less developed psychological defense mechanisms were at higher risk of developing mental morbidity.

Keywords: COVID-19, Mental health, Defense mechanisms, Health-care workers, GHQ-28, DSQ-40

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Introduction

Since December 2019, world has been experiencing a new infectious disease called COVID-19 (1). This highly contagious virus is mostly transmitted via aerosols of the infected patients through direct contact. COVID-19 symptoms can range from unspecific presentations such as fever, chill, myalgia, headache and cough to severe involvement of the lungs manifesting as acute respiratory distress syndrome (ARDS) and even death (1, 2). According to the published guidelines for the diagnosis and treatment of this virulent and fatal disease, COVID-19 patients are classified into mild, moderate, severe and critical groups based on clinical signs and symptoms, laboratory findings, pulmonary involvement and the need for supportive ventilation and critical care (3, 4). Since the onset of COVID-19 pandemic, there have been nearly 641,915,931 confirmed cases of COVID-19, including **6,622,760** deaths worldwide reported to World Health Organization (WHO) (5). In such epidemics, people undergo a great deal of stress levels. Available information about previous epidemics like SARS (Acute Respiratory Syndrome) in 2003 and H1N1 influenza in 2009 indicate that during epidemics, societies suffered from considerable amount of anxiety and psychological stress which led to serious psychological complications for a lot of individuals (6-8). Medical and paramedical staffs are usually at increased risk of anxiety disorders due to working in a stressful environment, facing unpredictable changes in daily work, unrealistic expectations of patients and excessive exposure to mortality issues (9, 10). First-line health care workers are health those who play a critical role in providing care to the infected patients (10). Similar to SARS and Influenza outbreaks, health care workers who are exposed to COVID-19 disease and unparalleled burden of the disease can greatly suffer from increased stress levels, and experience a higher rate of psychological morbidities (6, 11, 12). A vast body of literature have implied a high prevalence of psychological morbidity among healthcare workers which is mediated by a variety of biopsychosocial factors. Under stressful conditions, individuals use different psychological defense mechanisms which are unconscious psychological processes to prevent anxiety. Based on psychoanalytic theories, defensive mechanisms are unconscious intrapsychic mental

processes that get activated in stressful and threatening situations in order to reduce the unpleasant and annoying signals from consciousness (13, 14). These unconscious mechanisms are psychological strategies that are used to defend against irresistible and unbearable shocks , and are divided into 4 general categories: Pathological category (including psychotic thoughts and projective hallucination), immature category (fantasy, projection, passive aggressive, regression) , neurotic (justification, reaction formation, decompensation ,displacement, repression) and mature category (humor, sublimation, suppression, altruism, asceticism) (14, 15) which in overall, they are generally summarized in three categories that are the most used defense mechanisms by general population named as mature, immature and neurotic mechanisms (16).

Neurotic and immature styles are kinds of inefficient and non-adaptive exposure mechanisms. On the other hand, mature defensive mechanisms are considered as efficient, normal and adaptive methods (17). Therefore, considering the great negative impact of COVID-19 pandemic on healthcare workers facing this serious challenge, we aimed to assess COVID-19 psychological effects and defense mechanisms of frontline physicians and nurses in 4 hot-spot teaching hospitals in Rasht, Guilan, during first months of outbreak in Iran.

Materials and Methods

In this comparative cross-sectional study, the study population consisted of physicians and nurses working in 4 COVID-19 hotspot teaching hospitals in Rasht during in April 2020.

The study population were divided into 2 categories as group A and group B. Group A consisted of cases who are directly exposed to COVID-19 patients i.e. physicians and nurses working in high-risk sections such as emergency departments, ICU, respiratory isolation, acute care units and also predetermined wards for admitting COVID-19 patients. Group B included other nurses and doctors who were working in wards that were not in direct contact with COVID-19 patients such as elective patients. Subjects were randomly selected in order to determine their mental health and defense mechanisms. Sampling method was performed based on the total front-line population in 4

mentioned hospital (physicians and nurses) and their ratio with respect to each other.

Present study was approved by Guilan University of medical sciences ethics committee with the code number IR.GUMS.REC.1399.183, and was conducted according to the 2013 guidelines of Helsiniki Declaration. A brief explanation about goals of the study and after obtaining informed consent, questionnaires were given to the participants and were filled in person. The questionnaire had 3 parts. The first part included personal, social and occupational data of physicians and nurses such as age, sex, occupation, married status, number of children, education level, work experience, past psychological and psychiatric history and history of death of first-degree relatives due to COVID-19. In the second part, the General Health questionnaire (GHQ-28), which is a valid questionnaire examining mental health status was used. The third part of the questionnaire comprised the Defense Style questionnaire (DSQ-40) containing 40 items, which examined defense mechanisms of individuals.

The 28-item GHQ-28 Questionnaire is a self-report questionnaire which is set to screen four areas consisting of mental symptoms, anxiety, depression and social dysfunction. Each item in this questionnaire scores 0-3 on a Likert scale. The respondents are asked to mark how they have felt during the past 2 weeks. Each of four domains is scored from 0 to 21 and is divided to three groups base on symptoms severity; mild (0-9 score), moderate (10-15 score) and severe (16-21 score). The final score is divided into four groups from 0 to 84. People with score 0-21 experience minimum psychological distress and their health condition are very desirable. Those with scores between 22-42 experience mild psychological distress, however, their general health condition is acceptable. Individuals with 43-63 scores experience psychological distress moderately indicating that their psychological health is at risk. Finally, those who acquired 64-86 scores are described to experience severe psychological distress which means their general mental health is endangered. Farsi version of this questionnaire was previously validated by Molavi et al. which reported 86.5% sensitivity and 82% feature for 28-GHQ in Iran (18).

DSQ-40 comprises 40 questions in a 9 point Likert format and evaluates 20 defensive mechanisms (2 items for each) in three levels of immature, neurotic and mature styles. The Farsi version of questionnaire was validated and standardized by Heidari Nasab et al (19).

The inclusion criteria for high risk group was to be engaged with direct treatment and care of COVID-19 patients. That is why physicians and nurses who were on leave or had no role in the treatment of COVID-19 patients were omitted from the study. In low risk group, participants who had no direct contact with COVID-19 patients were recruited. Those who were unwilling to participate as well as incomplete questionnaires were excluded.

Data were entered to SPSS 21 software. Frequency, percentage and 95% confidence interval were used to determine mental health status and defense mechanisms. Nonparametric Mann-Whitney U test was used to compare mental health levels (the lowest level, mild, moderate and severe) in two groups. Kruskal-Wallis Test, Nonparametric Mann-Whitney test and CHI- Square test were used to compare defense mechanisms and psychological health in 2 groups. Also, ranking and multinomial regression models were used to determine factors associated with mental health status and defense mechanisms of subjects. Spearman's correlation coefficient and Kruskal-Wallis Test were also used to determine the relationship between mental health and psychological defense mechanisms in studied group. P value of less than 0.05 was considered significant.

Results

In this study, 199 employed doctors and nurses were examined from four hospitals of Rasht (Poursina, Razi, Alzahra, Dr Heshmat) in terms of psychological effects and defense mechanisms of COVID-19 disease in the north of Iran.

Among these 199 health workers (nurse 126 and doctor 73), 73.37% were women and most of them were in 25-30 age group. The mean age of participants was 30.24 ± 6.62 years. 63.32% of cases were nurses and 36.68% were doctors. In terms of educational degree (regarding the great number of nurses) most of them had bachelor's degree (58.29%). Detailed information of

demographic data is shown in Table 1. Eight people stated that they had lost one of their first degree relatives due to COVID-19 disease. Of total 199 cases, 60 cases (30.15%) were working in low-risk sections (group B) and 139 cases (69.85%) were working in high-risk wards (group A). According to the results, there was no statistical differences regarding baseline characteristics between 2 studied groups (P≥0.05).

Table 1. Baseline demographic information of study participants and within group comparisons.

		N (%)	Low risk N (%)	High risk N (%)	P-Value
Sex	Female	146(73.37)	46(76.67)	100(71.94)	0.489
	Male	53(26.63)	14(23.33)	39(28.06)	
Age	≤ 25 years old	32(16.08)	14(23.33)	18(12.95)	0.073
	26-31 years old	105(52.76)	29(48.33)	76(54.68)	
	31-36 years old	27(13.57)	4(6.67)	23(16.55)	
	≥36 years old	35(17.59)	13(21.67)	22(15.83)	
Mean (median) ± SD		30.24 (27.0) ± 6.62			
Max, Min		(55.0, 22.0)			
Marital status	Single	107(53.77)	35(58.33)	72(51.80)	0.396
	Married	92(46.23)	25(41.67)	67(48.20)	
Number of children	Without child	154(77.39)	48(80.00)	106(76.26)	0.396
	One child and more	45(22.61)	12(20.00)	33(23.74)	
Mean (median) ± SD		0.36 (0.0) ± 0.72 1.60 (2.0) ± 0.58			
Max, Min		(3.0, 0.0) (0.3, 0.1)			
Education	Bachelor degree	116(58.29)	34(56.67)	82(58.99)	0.198
	Master degree	105.03 ()	1(1.67)	9(6.47)	
	MD. General practitioner	64(32.16)	24(40.00)	40(28.78)	
	MD. Specialist	9(4.52)	1(1.67)	8(5.76)	
History of death in first-degree relatives due to COVID-19	Yes	8(4.02)	3(5.00)	5(3.60)	0.644
	No	191(95.98)	57()	134(96.40)	
History of previous mental illness	Yes	8(4.02)	3(5.00)	5(3.60)	0.644
	No	191(95.98)	57(95.00)	134(96.40)	
Work experience	< 5 years	129(64.82)	40(66.67)	89(64.03)	0.721
	≥ 5 years	70(35.18)	20(33.33)	50(35.97)	

Regarding the results of GHQ-28 questionnaire (n = 199), Table 2 shows that the majority of physicians and nurses experienced mild (60.8%) and moderate (10.6%) psychological distress. In none of the samples, the level of mental health morbidity was severe.

Table 2. Frequency distribution of the studied samples according to different levels of general health based on GHQ-28 questionnaire (n = 199) .

		No.	Percentage	95% confidence interval	
				Up	Low
Mental health level	The lowest limit	57	28.64	22.70	35.20
	Mild	121	60.80	53.91	67.39
	Moderate	21	10.55	6.86	15.39

In examining the normality of the distribution of mental health scores based on Kolmogorov and Shapiro-Wilk test, the distribution of total scores and aspects of mental health did not follow the normal distribution (p = 0.05). Hence, non-parametric Mann-Whitney Test and Kruskal Wallis Test were used to compare these scores in the two groups and also based on individual and social variables. (Table 3) The highest score of general health disorder was in the dimension of anxiety and sleep disorder and the lowest was in the dimension of depressive symptoms.

Table 3. Evaluation of general health score normality in each area and total (n = 199).

Mental health	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
	Probability	df	P-Value	Probability	df	P-Value
Mental symptoms	0.099	199	0.000	0.983	199	0.014
Sleep dysfunction and anxiety	0.116	199	0.000	0.977	199	0.002
Social reaction aspect	0.141	199	0.000	0.946	199	0.000
Depression symptoms	0.171	199	0.000	0.892	199	0.000
Total score	0.092	199	0.00	0.972	199	0.000

In general, there was no statistically significant difference in the total score of mental health in nurses of low-risk and high-risk groups (P = 0.239). Likewise, there was no statistically significant difference between the mental dimension score, the anxiety dimension and sleep disorder score, the social action score, the depressive symptom score and the total mental health score of the low risk and high risk doctors.

According to the results, the defense mechanism in 61.8% of the studied participants was mature. 24% of the subjects showed neurotic mechanism.

Table 4 compares the types of defense mechanisms of nurses and doctors in 2 groups. According to the information in this table, (p = 0.001). The percentage of neurotic defense style in high risk group nurses was one-fourth of low risk group (10.9% vs. 40%). The percentage of the mature defense mechanism was approximately 20% higher in group A nurses than that of group B (70% vs. 54%) (P= 0.001). In doctors' group, although doctors working in high risk wards were having more developed psychological defense mechanisms than low-risk group physicians, the difference was not statistically significant.

Table 4. Comparison of defense mechanisms styles in nurses and physicians working in COVID-19 and Non-COVID departments.

Defense Mechanisms	Nurses				P value
	High Risk		Low Risk		
	%	No.	%	No	
Mature	70.33	64	54.29	19	
Immature	18.68	17	5.71	2	0.001
Neurotic	10.99	10	40.00	14	
Defense Mechanisms	Physicians				P value
	High Risk		Low Risk		
	%	No.	%	No.	
Mature	60.42	29	44.00	11	
Immature	14.58	7	8.00	2	0.133
Neurotic	25.00	12	48.00	12	

In multiple linear regression analysis, multiple linear regression by Backward method was used to investigate the relationship between working in high-risk and low-risk work department with mental health.

After adjusting the variables (age, sex, marital status, number of children, education, work experience, defense mechanism and history of death in first-degree relatives due to this disease), there was no relationship between working in high risk or low risk group with mental health status. But, as Table 5 shows, a significant relationship between mental health score with gender (p = 0.026, B = 4.06), defense mechanism style (p = 0.001, B = 3.126) and history of first degree relatives' death due to COVID-19 was found (p = 0.068, B = -7.57).

Table 5. Multiple linear regression model assessing the relationship between demographic variables and mental health.

	Unstandardized coefficients		p-Value	95% Confidence interval	
	Parameter estimation	Standard error		Minimum rate	Maximum rate
(constant)	43.610	8.745	.000	26.363	60.857
Sex	-4.060	1.811	.026	-7.631	-.489
History of death in first-degree relatives due to COVID-19	-7.570	4.119	.068	-15.693	-.489
Defense mechanism	3.126	.956	.001	1.241	5.012

Discussion

Regarding similar past situations, it is predictable that this pandemic leads to a variety of psychological complications such as post-traumatic stress disorders (PTSD), acute anxiety dysfunction, depression and even suicide in both general population and healthcare workers. Individuals may experience different degrees of psychological reactions (20-23).

In this study, we evaluated the rate of psychological morbidities and types of psychological defense mechanisms of frontline healthcare workers working in COVID-19 pandemic in 4 major hot-spot teaching hospitals in the north of Iran. Studied cases were nurses and physicians divided into two groups of "low risk" and "high risk" considering their exposure rates to the COVID-19 patients. Most of present study cases (69.85%) were working in high-risk departments. In terms of demographic variables, majority of participants were women and were in the age range of 25-30 years, and 69.9% worked in COVID-19 wards. Similar to our study, earlier surveys investigating mental health of health care workers during recent pandemic indicated that most of their participants were females and worked in COVID-19 wards. However, the mean age of their subjects were higher than ours and healthcare professionals who worked in COVID-19 wards were younger and more likely not in a relationship, in comparison with professionals working in other departments (24, 25). In present inquiry, no significant differences between the two groups of high risk and low risk staff regarding demographic information was found.

This multicenter study revealed that majority of healthcare workers suffered from low to medium levels of psychological distress which were mostly in the form of anxiety and sleep dysfunction. This finding supported the results of previous research evaluating the impact of COVID-19 and other viral outbreaks on healthcare professionals (24-28). In a review by De cock et al. it was confirmed that the psychological impact of COVID-19 pandemic on health care staff was noticeable with considerable levels of anxiety, insomnia and depression(29). In COVID-19 pandemic, health care workers faced with unprecedented challenges including fast decision making, heavy

workload, the pressure to successfully diagnose the suspected patients and act timely, fear of being a silent carrier and passing the disease to their family and friends, hospitalizations of their co-workers, increased pressure and stress when dealing with patients unwilling to cooperate with treatment and isolation, and lack of sources and hospital beds (30).

Regarding personal variables, the level of stress was higher in women and also in those who had lost one of their immediate family due to this disease. This finding is in accordance with previous studies that demonstrated a higher prevalence of psychological morbidities in women in both healthcare workers and general population (24, 31). Women are probably more vulnerable than men in developing depressive symptom, and it is well-known that social supports or supports from their partner can be considered as a protective factor against psychological issues. Furthermore, it is worth mentioning that respondents in most studies were predominantly women and this might have impacted the results (29).

Although it was expected that individuals working in high-risk departments experience more stress due to the exposure to a new unknown and extremely infectious disease with no certain cure, in present study people in both groups of low risk and high risk experienced the same level of stress and there was no significant difference between nurses and physicians in COVID-19 wards and Non-COVID departments. Similarly, Milenna et al showed that in their research 46 % of healthcare workers working in low risk departments and 48% of high risk section workers were suffering from moderate levels of mental distress during COVID-19 pandemic, and there was not found any differences between the two groups(25). On the contrary, other inquiries implied that healthcare staff who worked in COVID-19 wards were under more psychological pressure and distress than their peers working in non-COVID facilities(24). It is worth mentioning that during the time of research, city of Rasht was considered as one of the high-risk cities in Iran. Therefore, the cases in low-risk group were suffering from psychological stress just like the cases in high-risk group due some reasons such as the new and unknown feature of the disease, diversity in clinical symptoms based on personal variables, relatively long recovering period of this disease and also inability to

distinguish SARS-COV-2 carriers and not-infected elective. Another reason for the lack of significant difference in psychological morbidity between the high risk and low risk groups may be the use of different questionnaires in various studies.

In current study, nurses working in COVID-19 wards had more developed psychological defense mechanisms than nurses in non-COVID wards based on DSQ-40 questionnaire. However, this finding was not statistically significant in physicians group. The reason can be that those working in high-risk departments such as ICU and emergency rooms had more mature mechanisms when confronting different work challenges even before COVID-19 pandemic due to working in critical and stressful situations and facing unpredictable daily challenges and trainings. There is also the possibility that employed people in high-risk sections were hired in such sections due to their developed mechanisms. All of these items can lead to a better stress management and lower psychological morbidity during the pandemic. In multiple regression analyses, possible predisposing factors for the psychological morbidities observed in healthcare staff working during COVID-19 pandemic were found to be being female, loss of a family member due to the COVID-19 disease and having less developed psychological defense mechanisms.

Limitation

The limitations of the study are the small sample size, not including staff who were infected and were on leave, and also the cross sectional design of the study.

Conclusions

Present study revealed that majority of physicians and nurses working during COVID-19 pandemic were experiencing levels of psychological distress, mostly in the form of anxiety, sleep dysfunction and depression. Females, those who had lost a family member due to the COVID-19 infection and individuals with less developed psychological defense mechanisms were at higher risk of developing mental morbidity.

Author contribution

SMZZ, introduction author/original researcher (25%); **EM** (10%) and **AV** assistant researcher

(10%), **SSh**, original researcher (10%), **PA** original researcher (10%), **MGh** methodologist/assistant researcher (10%); **NNR** original researcher/ discussion author (25%).

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Conflict of interest

The authors have no conflicts of interest associated with the material presented in this paper.

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