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Original Article

Sources of anxiety among healthcare workers in Tehran during the COVID-19 pandemic

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Abstract

By applying multivariate regression to 2020 survey data from four Tehran hospitals, we measure eight recognized sources of Coronavirus disease 2019 (COVID-19) pandemic-related anxiety among 723 healthcare workers (HCWs) with diverse sociodemographic characteristics employed across different hospital areas and positions. The most prominent anxiety source identified is the risk of workplace COVID-19 contraction and transmission to family, followed by uncertainty about organizational support for personal and family needs in the event of worker infection. A supplemental qualitative analysis of 68 respondents in the largest hospital identifies four additional anxiety sources, namely, health, finances, workload, and leadership. This evidence of the multifaceted nature of anxiety sources among HCWs highlights the differentiated approaches that hospital policymakers must take to combat anxiety.

Keywords: COVID-19, healthcare workers, Iran, anxiety

Introduction

Since Iran reported its first COVID-19 infections in February 2020 (IRNA, 2020), it has become one of the worst affected countries in the Middle East and North Africa region, with 1.9 million documented positive cases by April 2021 and a 4.1% fatality rate of 63 699 deaths, the vast majority in its capital Tehran. Because hospitals allocated for COVID-19 have been operating at a maximum capacity with large numbers of personnel testing positive for the virus and many losing their lives, the pandemic has exposed Tehran's healthcare workers (HCWs) to unprecedented pressures. By the end of August 2020, 164 Iranian medical personnel, one of the groups at highest risk for COVID-19 infection (Sabetian *et al.*, 2021), had died from the virus (Duz, 2020).

In addition to physical health risks, HCWs also have a higher risk of pandemic-related mental health problems, especially symptoms of anxiety (Santabarbara *et al.*, 2021). For example, one recent meta-analysis reports a 25.8% pooled prevalence rate of anxiety among HCWs assessed in 29 studies (Sahebi *et al.*, 2021) and a 23% rate of depression in 10 other studies (Pappa *et al.*, 2020). Healthcare professionals also face greater risk of exposure to infection, extreme workloads, rigid safety measures and guidelines, moral dilemmas, a continuously changing practice environment, reduced social contact, and performance of tasks for which they may be unprepared (Adams and Walls, 2020; Chen *et al.*, 2021; Shanafelt *et al.*, 2020; Vieta *et al.*, 2020). Understanding the sources of anxiety among HCWs is thus essential if hospital policymakers are to provide effective support strategies and targeted education that has a genuinely beneficial impact (Adams and Walls, 2020; Chen *et al.*, 2021; Hofmeyer and Taylor, 2021; Shanafelt *et al.*, 2020; Vieta *et al.*, 2020).

The mental well-being of HCWs has received significant attention from scholars since the outbreak of the COVID-19 pandemic and has been analysed from various perspectives. A study of the psychological impact of the COVID-19 outbreak in Italy reports a high level of anxiety among 71.2% of HCWs (Giusti *et al.*, 2020). In another study on the symptoms of anxiety during the COVID-19 outbreak, 58.6% of HCWs revealed an anxiety disorder (Luceño-Moreno *et al.*, 2020). Similar studies in China, Germany and other countries examined the relation between HCW's anxiety and the COVID-19 pandemic (Bohlken *et al.*, 2020; da Silva Neto *et al.*, 2021; Li *et al.*, 2021; Pappa *et al.*, 2020; Shen *et al.*, 2020). A study covering 85 countries documents the overall prevalence of HCWs' anxiety, depression and severe burnout at 46.5%, 30.2% and 51%, respectively (Azoulay *et al.*, 2020). Although the literature examining the relation between HCWs' anxiety and the COVID-19 pandemic is substantial, studies on the exact sources of anxiety remain limited.

Key messages

- We measure the importance of anxiety sources for workers in four Tehran hospitals according to an eight-dimensional classification recently developed by Stanford University School of Medicine. In order to develop effective approaches to HCW support, it is essential to require a thorough understanding of both HCWs' fears and the sources of their anxiety.
- Using a mixed-methods approach, our analysis reveals high levels of anxiety across the various sources, with the fear of COVID-19 exposure and family transmission being the most pronounced among both clinical and nonclinical staff. Besides fear for personal and family safety, the severe pandemic-induced economic downturns across the globe and the closure and downsizing of many businesses has given rise to job insecurity and associated financial uncertainty as a major concern.
- A multivariate analysis reveals that females, nurses, and those working on the frontlines or in COVID-19 wards suffer the highest levels of anxiety and thus require targeted support programs to enhance their well-being and retention.
- Our analysis also clearly emphasizes the importance of compassionate leadership that provides its HCWs with genuine expressions of gratitude and appreciation to alleviate overall anxiety and offer intrinsic reward when extrinsic compensation is constrained.

Most of the current literature focuses on the prevalence of depression, anxiety and burnout and highlights the associated factors rather than identifying the underlying COVID-19-related stressors. Hence, in this study, using a mixed-methods approach, we aim to determine the main sources of anxiety among HCWs associated with the COVID-19 pandemic and examine the interplay between different variables. In addition, we assess how the prevalence of these sources of anxiety differs by demographic and professional characteristics in the context of Iran. To the best of our knowledge, this study is the first to empirically implement a classification of sources of anxiety developed by Stanford University School of Medicine (SUSM) (Shanafelt *et al.*, 2020), whose categories map so clearly onto HCWs' specific requests to their organizations as to be easily transformable into policy measures (Shanafelt *et al.*, 2020).

Materials and methods

Participants and data collection

Iran has four types of hospitals: state, public nongovernmental, private and military (i.e. dedicated to the armed forces and their families). Whereas state hospitals are directly under the authority of the Ministry of Health and Medical Education (which also trains their medical staff), most public nongovernmental hospitals, located primarily in urban areas, are administered by Iran's Social Security Organization (SSO), the country's largest health insurer. All employees of the formal sector except government officials and service personnel contribute to and receive benefits from this insurance (Mehrdad, 2009). Of the four institutions surveyed in this study, the two larger in terms of bed capacity and staff numbers are SSO-administered public hospitals, while the other two are smaller private hospitals (see Table 1 for details).

Hospital selection followed a maximum variation (maximum heterogeneity) approach—an approach often used for the selection of hospitals in health research, especially when, as in our case, a randomized sample is not feasible (Radević *et al.*, 2021; van Hoeven *et al.*, 2015). van Hoeven *et al.* (2015) show that this approach can even be superior to randomized selection (e.g. in the presence of small populations) and can lead to a lower prediction error. Moreover, evidence from other studies shows that such purposive sampling strategies can lead to representative samples (e.g. Morrison and Stone, 1998; Raaijmakers *et al.*, 2008). This sampling procedure resulted in the selection of the four hospitals referenced above, which differ in size (number of beds and number of staff) and cover two sectors.

The recruitment of healthcare professionals from these four hospitals conducted between November and December 2020 just as the third COVID-19 wave hit included both clinical and nonclinical staff, ranging from physicians and nurses to security guards and housekeepers (see Table 2 for detailed characteristics of participants). Because the two smaller hospitals had fewer than 500 staff members, we invited all HCWs to participate. In the two larger institutions, a random selection with their internal IT system was employed. Our point of contacts in each hospital organized the sampling with their IT centres that have access to all the employees' information. Having set the target sample size at 1688 (from an overall population of 4353 HCWs), we received 723 completed questionnaires for a response rate of 43%.

Survey questionnaire

Given the study objectives, the main survey questionnaire, driven from the eight-dimensional classification developed by SUSM (Shanafelt *et al.*, 2020), identifies and measures the HCWs' main sources of anxiety since the outbreak of the COVID-19 pandemic. It covers the following eight anxiety sources: (1) access to appropriate personal protective equipment (hereafter, PPE access), (2) workplace exposure to COVID-19 infection and potential transfer home to family members (workplace COVID exposure and family transmission), (3) access to rapid testing following COVID-19 symptom development and a concomitant fear of propagating infection at work (rapid testing access), (4) organizational support of personal and family needs following worker infection (post-infection organizational support), (5) access to child care during increased work hours and school closures (childcare access), (6) support for other personal and family needs from increased work hours and demands (food, hydration, lodging, transportation) (personal needs support), (7) ability to provide competent medical care if deployed to a new work area (e.g. non-ICU nurses having to function as ICU nurses) (competency transfer) and (8) access to up-to-date information and communication (information access).

The questionnaire assesses respondent experiences of these eight anxiety sources on a 5-point scale of (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree and (5) strongly agree, with (4) and (5) designating (high levels of) anxiety (see Figure A1 for questionnaire formatting). In addition to sociodemographic data (age, gender, marital status, number of children, educational level and

Table 1. Hospital information

Hospital	No. of beds	Sector	Total no. of HCWs	Targeted sample size	No. of responses	Response rate (%)
1	927	Public	2737	600	356	60
2	446	Public	1028	500	208	40
3	128	Private	325	Census	117	36
4	58	Private	263	Census	42	18
Total	1559		4353	1688	723	43

Table 2. Characteristics of participating HCWs

	Mean	SD
Female [0 = no; 1 = yes]	0.62	0.49
Married [0 = no; 1 = yes]	0.79	0.41
Number of children	1.08	0.95
Age	38.77	7.05
Years of experience	13.52	6.43
Education		
Diploma, Associate	0.27	0.44
Bachelor	0.57	0.50
Masters & PhD	0.17	0.37
Frontline help [0 = no; 1 = yes]	0.57	0.50
Increased work hours [0 = no; 1 = yes]	0.39	0.49
Staff group		
Nurse	0.48	0.50
Physician/surgeon	0.09	0.28
Ward supervisor	0.05	0.22
Other (medical)	0.13	0.34
Admin	0.25	0.43
Ward		
Inpatient general	0.30	0.46
COVID-19	0.06	0.23
Emergency	0.09	0.29
Surgery	0.24	0.43
Supportive	0.31	0.46
Hospital		
1	0.52	0.50
2	0.27	0.44
3	0.16	0.37
4	0.06	0.23

$N = 675$. Sample is based on regression for exposure.

years of experience), it also records work characteristics, including area of assignment (e.g. COVID-19 ward, general ward and surgical unit), whether staff position is clinical (surgeon/physician, ward supervisor, nurse or 'other') or non-clinical (e.g. clerk and housekeeper), whether a provider or non-provider of frontline healthcare services to COVID-19 patients, and whether the workload has increased.

To ensure the validity of the questionnaire, we followed a five-step procedure developed by Brislin (1986) which, besides translation, back translation, and congruency check, includes a pilot study and examination of respondents' feedback. Because the respondents' native language is not English, (1) the questionnaire was translated into Farsi after which (2) it was translated back into English, by two translators being bilingual. (3) A careful comparison of the versions for congruency between text and meaning then ensured a valid and reliable translation free of emotion-related semantic bias, especially with regard to the anxiety sources. Finally, (4) the questionnaire was pilot-tested and distributed to 17 HCWs who (5) checked the understandability and plausibility of the questionnaire. We obtained and examined respondents' feedback, and made minor adjustments.[1] Before these five steps, a group of experts verified the questionnaire (face validity).

Survey administration

To ensure more efficient data collection, we gave hospital authorities a choice of survey administration procedure, with distribution of paper questionnaires deemed infeasible for larger institutions whose risk of COVID-19 contagion is high. Consequently, workers in one public hospital completed the questionnaire via an internal online survey system, while those in the other participated in telephone interviews. In the two smaller private hospitals, once a contact point was established, all participants filled out paper questionnaires. Whichever the procedure, the questionnaire administered was identical and included both closed- and open-ended items.

To deepen researcher understanding of potential anxiety sources, survey administration at the largest participating hospital (hospital 1) included a supplemental open-ended questionnaire that allowed the respondents to describe anxiety sources or concerns in their own words uninfluenced by predefined response categories (Desai and Reimers, 2019).

Survey administration overall adhered to the World Medical Association code of ethics (Declaration of Helsinki) and received approval from the scientific ethics committee of the authors institute on 28 September 2020. Accordingly, all participants provided informed consent to participate after being fully briefed on study objectives and receiving guarantees of confidentiality and anonymity.

Methods

Our analysis consists of a quantitative and a qualitative part. In the first part, we generate descriptive statistics and illustrate the relative frequency distributions of response categories (i.e. levels of agreement) for each of the eight anxiety sources. These relative frequency distributions are then stratified by (1) staff type (clinical vs nonclinical) and (2) by the level of COVID-19 patient contact (frontline healthcare providers vs non-providers). In a subsequent multivariate analysis, we examine the determinants of the different anxiety sources. The estimation technique of our multivariate analysis is determined by the ordered categorical feature of the dependent variables (sources of anxiety). Because our dependent variables have five categories that have a logical sequential order, we apply ordered logistic regression models. The analysis is carried out using STATA 16.

In the second part, we apply a content analysis including thematic analysis to extrapolate all intended meaning from the 68 sets of open-ended responses (hospital 1). Because our qualitative data set was not large and the fact that the analysis of the qualitative data is a dynamic, intuitive and creative process that demands meticulous attention to language and

meaning of human experience, we apply the qualitative analysis manually in finding the link between the data and our research objective. After translating all commentary verbatim into a table, the process of content analysis starts with scanning the responses to fully grasp the overall meaning of the statements. In a next step, we highlight the keywords that represent important and recurring issues and concerns from HCWs' personal expressions. Highlighting keywords before coding leads to a higher trustworthiness (Hsieh and Shannon, 2005) as it decreases the bias in the coding process. Listing the keywords in a separate column, we subsequently label them with descriptive codes that reflect respondents' concern. For example, we assign the code 'depression' to all the highlighted keywords that respondents expressed their experience of depression such as 'depressed', 'severely depressed' and 'depression'. Similarly, the code 'stress' is assigned to the keywords expressing respondents' feeling of stress such as 'chronic stress', 'constant stress', 'feel stress' and 'stress' itself. We label the code 'emotional support' to all the keywords that respondents mentioned that they have not received adequate emotional support from their leaders (e.g. 'we need mental and emotional support', 'we need emotional support', 'no care from…' and 'we need more care'). The same process applies to other codes.

Based on the relation among codes, frequency and underlying concepts, we semantically and syntactically cluster these codes, resulting in 10 common categories. For instance, we form the category 'emotional/psychological symptoms' by grouping the codes representing matters related to respondents' psychological health such as depression, stress, anxiety and burnout. Likewise, we cluster the codes that describe participants' matters related to their physical health such as 'headache', 'physical pain', 'lack of physical energy' and 'not physically recovered' into the category 'physical symptoms'. We count the absolute and relative frequency of categories that provides information about the prominently expressed topics (Grbich, 2012). Finally, after development of 10 categories highlighting 8 prominent anxiety sources expressed in the HCWs' own voices, we compare the emergent anxiety sources to the SUSM classification to examine the extent to which our data are supportive of the SUSM classification.

We test the reliability of these outcomes by using Cohen's κ as a measure of inter-rater reliability. Giving a second rater the coding scheme and asking him to place codes into

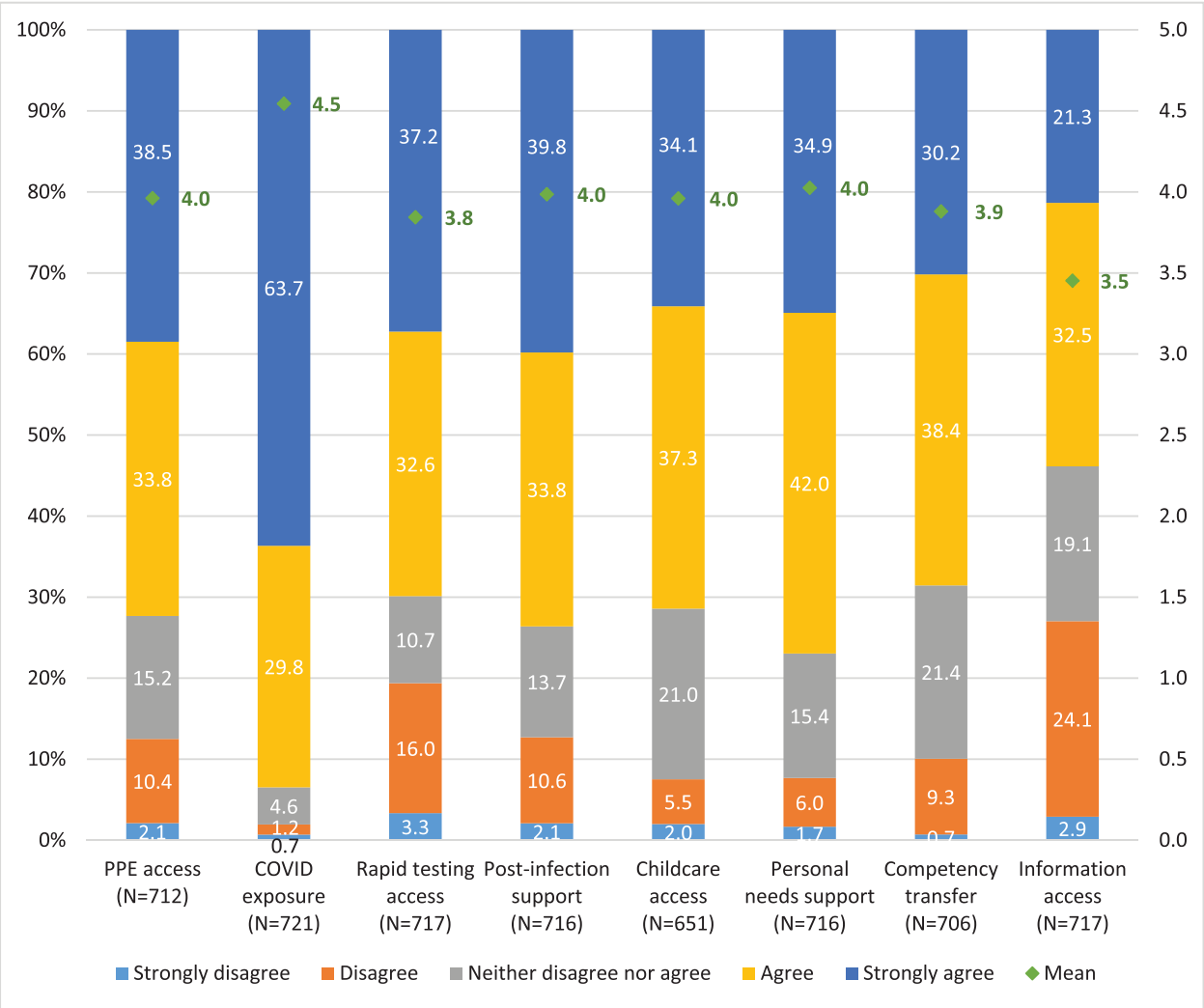

Figure 1. Sources of anxiety

the appropriate categories, we calculate Cohen's κ by measuring the level of agreement between rater placement and the initial categorization, which demonstrates the substantial level of agreement and consistency between the researchers, with Cohen's κ being equal to 91%, well above the 75% recommended for category reliability.

Results

Quantitative analysis

Our quantitative analysis first assesses the prevalence (respondent share) of anxiety by mapping the relative frequency distribution of response categories (i.e. levels of agreement) for each of the eight anxiety sources (see Figure 1). As the figure shows, COVID-19-related concerns are very pronounced for all anxiety sources, with 70% of respondents (strongly) agreeing with 7 of the 8 corresponding statements, and over 90% (strongly) admitting to fear of workplace COVID-19 exposure and family transmission, by far the most dominant concern. In contrast, only just over 50% of respondents report anxiety over information and communication access, the lowest ranging concern by a notable margin.

We then break this same distribution down by (1) staff type (clinical vs nonclinical) and (2) whether or not the respondent is a provider of frontline healthcare to COVID-19 patients. When stratified by staff type (see Figure 2), the respondent shares for most anxiety dimensions are substantially lower among nonclinical than among clinical staff, as much as 20, 18, 16 and 12 percentage points (pp) less for PPE access, organizational post-infection support, competency transfer and information access, respectively, although only 9, 6 and 3pp for rapid testing access, personal needs support and childcare access. On the other hand, both nonclinical and clinical staff is almost equally concerned about workplace COVID-19 contagion and family transmission, at 92% and 94%, respectively.

As a final step of our descriptive analysis, we differentiate providers and non-providers of frontline healthcare services by level of direct contact with COVID-19 patients, as represented by both professional position and area of assignment (see Figure 3). Although both providers and non-providers express substantial anxiety about workplace contagion and family transmission, at 94% and 93%, respectively, levels for other dimensions are lower for non-providers. More specifically, whereas 81%, 77%, 60% and 74% of frontline healthcare providers report anxiety over PPE access, rapid testing access, information access and competency transfer, respectively; the shares for non-providers are 20, 16, 15 and 13pp lower. The proportions of frontline healthcare providers reporting fear in the categories of personal needs support, post-infection organizational support and childcare access denote 81%, 77% and 74%, respectively, and are 10, 8 and 7 percentage points above those of non-providers.

Because our dependent variables (the eight anxiety sources) have five logically sequenced response categories, we select ordered logistical regression as the estimation technique for our multivariate analysis. As Table 3 illustrates, providing frontline help to COVID-19 patients is itself a source of anxiety, with positive coefficients for all dimensions that become significant for PPE access, personal needs support and competency transfer. A significant increase in work hours is also associated with a greater likelihood of higher anxiety over both PPE and rapid testing access. Especially notable is that when we divide the respondents into those who do and do not provide frontline healthcare to COVID-19 patients, a pattern emerges that contrasts starkly with that observed

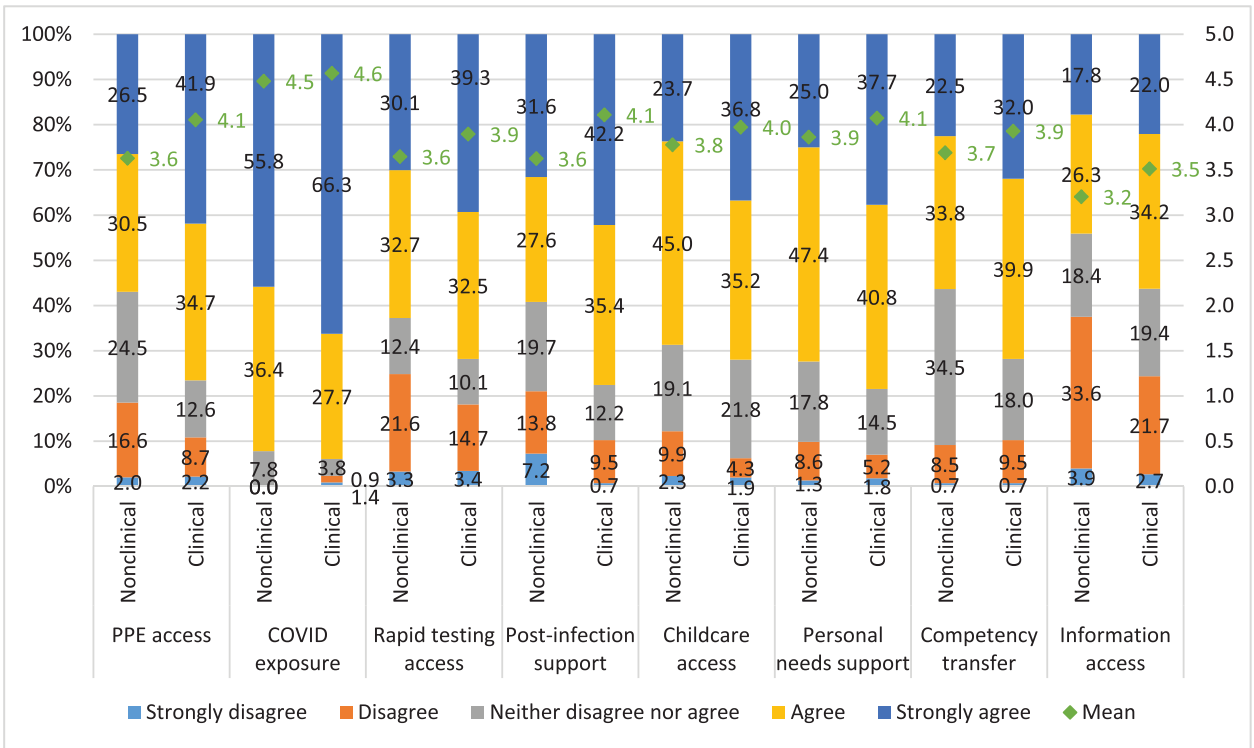

Figure 2. Sources of anxiety by staff type: nonclinical vs clinical

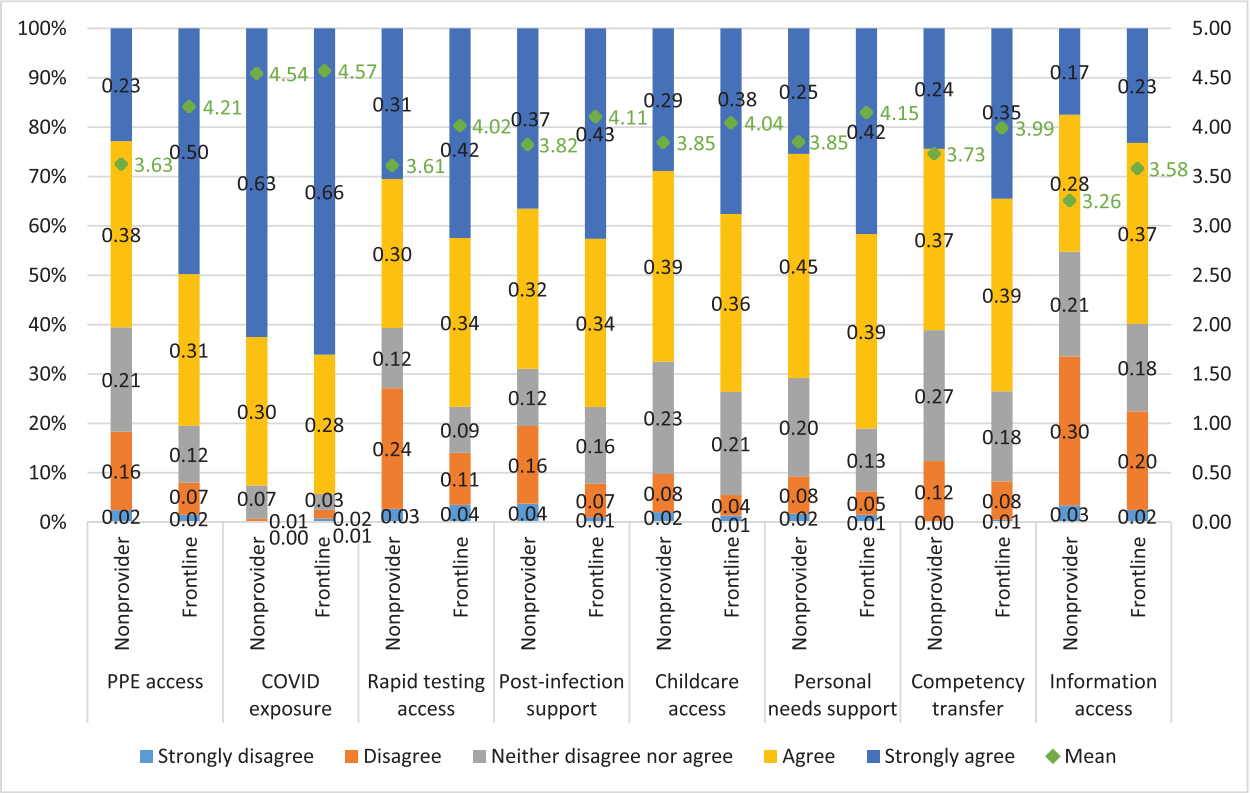

Figure 3. Anxiety sources by the level of COVID patient contact: frontline healthcare providers vs non-providers

when respondents are differentiated by medical vs nonmedical. That is, for all but one of the anxiety sources, the significant coefficients are negative (as opposed to positive), and significantly so for PPE access among 'other' medical and nonmedical staff, post-infection organizational support among ward supervisors and nonmedical staff, and information access among ward supervisors only. This observation implies that medical workers in these positions are less likely than nurses (the reference category) to report anxiety on these dimensions. The only exception is a significant ($P > 0.1$) positive coefficient for 'other' medical staff in the ordered logit regression with childcare access as the dependent variable.

Working on a COVID-19 ward—i.e. being in direct contact with COVID-19 patients—increases the likelihood of higher anxiety over PPE access, rapid testing access, post-infection organizational support, personal needs support and information access. On the other hand, the coefficient of COVID-19 exposure anxiety is insignificant, meaning that those working on the COVID-19 ward are no more worried about this dimension than those working on the inpatient general ward (the reference group). Significantly lower anxiety over workplace COVID-19 exposure (relative to the reference) is also associated with working in the emergency and support units, as is lower anxiety over PPE and information access in the surgery unit. Working in the surgery unit, on the other hand, although linked to lower anxiety over PPE and information access, is associated with higher anxiety over access to rapid testing.

The most notable insight from this multivariate analysis (see Table 3) is that females have higher anxiety levels than males on all dimensions except workplace COVID-19 exposure, whose regression coefficient is positive but insignificant. HCWs are also significantly more likely to show greater concern about workplace exposure and information access if they are married, although coefficients for the remaining anxiety sources, while positive, are insignificant. We also show that nurses express the highest levels of anxiety, probably because they constitute the largest proportion of health service human resources providing continuous care to COVID-19 patients. One particularly interesting finding is a far lower incidence of anxiety at the public hospital 2 and the private hospital 3: not only are the coefficients for all anxiety dimensions except exposure significantly negative for hospital 3, but for hospital 2 even the workplace COVID-19 exposure coefficient is significantly negative, as are those for post-infection organizational support, childcare access and personal needs support.

Qualitative analysis

The content analysis extrapolating the intended meaning from the 68 sets of open-ended responses identifies 10 common categories mapping onto 8 main anxiety sources expressed in the HCWs' own voices:

(a) PPE access (shortages, low quality)
(b) Workplace COVID-19 COVID exposure and family transmission
(c) Uncertainty about the post-infection organizational support
(d) Personal and family needs support (need for physical support + need for emotional support)
(e) Health (emotional + physical symptoms)
(f) Finances (low wages, lack of financial support)

Table 3. Determinants of the different anxiety sources

	PPE access		COVID exposure		Rapid testing access		Post-infection support		Childcare access		Personal needs support		Competency transfer		Information access	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Female [0 = no; 1 = yes]	0.483***	0.168	0.110	0.186	0.505***	0.165	0.533***	0.165	0.687***	0.174	0.507***	0.167	0.557***	0.165	0.290*	0.163
Married [0 = no; 1 = yes]	0.088	0.214	0.604**	0.236	0.119	0.209	0.251	0.207	0.210	0.232	0.284	0.211	0.275	0.210	0.369*	0.204
Number of children	−0.003	0.107	−0.052	0.118	0.024	0.101	−0.034	0.099	0.143	0.115	0.104	0.102	0.035	0.101	0.020	0.098
Age	−0.019	0.019	−0.071***	0.022	−0.026	0.018	−0.022	0.018	−0.038*	0.019	−0.020	0.019	−0.023	0.017	−0.008	0.016
Years of experience	−0.002	0.020	0.051**	0.022	0.019	0.019	0.017	0.019	0.026	0.020	0.000	0.019	0.017	0.019	0.010	0.018
Education [ref.: diploma, associate degree]																
Bachelor's	−0.113	0.194	0.542**	0.212	0.297	0.189	0.285	0.190	0.035	0.199	0.405**	0.192	0.786***	0.195	0.424**	0.188
Master's or doctorate	−0.124	0.304	0.057	0.331	−0.509*	0.296	−0.532*	0.301	−0.691**	0.323	−0.338	0.299	0.005	0.300	−0.107	0.301
Frontline worker [0 = no; 1 = yes]	0.671***	0.169	0.160	0.196	0.277	0.168	0.235	0.171	0.265	0.180	0.508***	0.172	0.434**	0.170	0.149	0.164
Increased work hours [0 = no; 1 = yes]	0.418**	0.170	0.310	0.194	0.388**	0.167	0.087	0.166	−0.018	0.172	0.212	0.168	−0.150	0.167	0.088	0.162
Staff group [ref.: nurse]																
Physician/surgeon	−0.191	0.395	0.229	0.437	0.373	0.389	0.223	0.402	0.016	0.404	0.242	0.394	0.122	0.391	−0.231	0.386
Ward supervisor	−0.392	0.365	−0.500	0.403	−0.218	0.347	−0.818**	0.346	−0.223	0.363	−0.461	0.368	−0.580	0.369	−0.621*	0.351
Other (medical)	−0.540**	0.242	0.373	0.298	0.155	0.244	−0.187	0.240	0.602**	0.272	−0.307	0.241	0.019	0.243	−0.284	0.237
Nonmedical	−0.575**	0.233	0.064	0.256	−0.066	0.227	−0.656***	0.227	0.042	0.245	−0.011	0.228	0.032	0.231	−0.273	0.222
Ward [Ref.: inpatient general]																
COVID-19	1.568***	0.486	−0.014	0.393	1.135***	0.379	0.606*	0.350	0.152	0.344	0.680*	0.371	0.482	0.352	0.723**	0.344
Emergency	−0.019	0.295	−0.540*	0.324	0.077	0.283	0.129	0.285	0.281	0.306	0.208	0.288	0.147	0.300	−0.109	0.280
Surgery	−0.443**	0.213	−0.165	0.248	0.348*	0.209	0.002	0.209	−0.113	0.220	−0.323	0.211	−0.068	0.203	−0.348*	0.201
Supportive	−0.280	0.229	−0.645**	0.266	0.507**	0.230	0.184	0.230	−0.410	0.250	−0.369	0.229	−0.055	0.230	−0.266	0.222
Hospital [ref.: 1]																
2	−0.234	0.208	−0.960***	0.232	−0.012	0.201	−0.570***	0.199	−0.703***	0.206	−0.970***	0.206	−0.024	0.197	0.333*	0.193
3	−1.388***	0.221	0.003	0.263	−1.913***	0.233	−1.048***	0.223	−1.086***	0.265	−0.609***	0.225	−1.130***	0.223	−1.493***	0.232
4	−0.336	0.335	0.084	0.381	−0.490	0.340	0.118	0.334	−0.338	0.365	−0.446	0.334	−0.192	0.376	−0.038	0.338
N	667		675		671		670		612		670		661		671	
Log-likelihood	−806.3		−543.8		−845.3		−842.3		−752.2		−798.2		−809.9		−909.7	
Chi^2	159.3		63.5		150.0		88.1		79.8		80.3		102.5		130.6	
Pseudo R^2	0.090		0.055		0.081		0.050		0.050		0.048		0.060		0.067	

Note: ***$P < 0.01$,
**$P < 0.05$,
*$P < 0.1$.

Table 4. Qualitative analysis

SUSM classification sources of anxiety/commentary	Associated category(s)	No. of respondents (%)	Statement frequency
(1) PPE access	Need for appropriate PPE	10 (15%)	10
'I feel stress due to lack of equipment in the ward'			
'Shortage of PPE'			
'Lack of PPE'			
'Masks and other PPE is of a very low quality'			
(2) Workplace COVID-19 exposure and family transmission	Fear of COVID exposure/ infection/propagation	12 (18%)	12
'I'm worried about my family, I have concerns and worries about lack of support for the personnel and our families from hospital authorities'			
'We are in direct contact with patients and infections'			
'Risk of getting infected by COVID-19'			
(3) Uncertainty about the Post-infection organizational support	Post-infection organizational support	11 (16%)	11
'We are infected by corona virus here in this system and then we should pay the costs of diagnosis and treatment by ourselves'			
'I got the Corona infection but didn't receive any support from the hospital'			
'I got infected with the COVID-19 virus and received no financial support from the hospital – not even for medicine'			
'I got COVID-19 and it was beyond my tolerance, unfortunately I haven't received any support from the hospital'			
(4) Personal and family needs support		18 (26%)	25
Support for physical needs:	Need for physical support		15
'Expecting equal opportunity to access hospital facilities'			
'Sick leaves requests are not accepted'			
Support for emotional needs:	Need for emotional support		10
'We need mental and emotional support'			
Newly identified sources of anxiety/commentary			
(1) Health		37 (54%)	58
– Emotional/psychological symptoms	Psychological symptoms		41
'Generally, the staff are under pressure and stress'			
'I feel extremely depressed'			
– Physical symptoms	Physical symptoms		17
'Musculoskeletal pain associated with spasm due to anxiety and stress at my work'			
(2) Finances	Financial worries	26 (38%)	35
'Main problems are too much stress and low wages'			
'I wish authorities were more thoughtful about medical staff's financial problems'			
(3) Workload	High and increased workloads	20 (29%)	27
'High workload and pressure as well as long working hours…'			
'… led to the significant increase in our workload'			
'Workload is too high'			
(4) Leadership acknowledgement	Need for acknowledgement and appreciation from leadership	26 (38%)	27
Not being seen and heard			
'Need to be seen by managers'			
'I want my problems to be understood'			
Not receiving gratitude			
'We don't even receive any thank you from managers'			
'We need that our work and efforts be appreciated verbally'			

Note: The analysis is based on respondent comments from the supplementary open-ended survey administered at hospital 1 ($n = 68$).

(g) Workload
(h) Leadership acknowledgement (feeling unseen, unheard, shown no gratitude)

Whereas the first four of these anxiety sources (PPE access, workplace COVID-19 exposure and family transmission, uncertainty about the post-infection organizational support and personal and family needs support) overlap with the SUSM classification used in the quantitative analysis, the remaining four suggest additional anxiety sources: health (physical and emotional), finances, workload and leadership.

Because the SUSM-defined anxiety sources appear explicitly in the commentary 56 times, a comparison of response shares from both the quantitative and qualitative surveys highlights four dimensions that predominate in both sets of findings. First, one-fourth of respondents allude more than once to personal and family needs support, both physical and psychological, with 26% stipulating the need for 'more emotional support'. This latter echoes and reinforces the quantitative finding that 77% of total survey respondents consider personal and family needs important. These same comments also specify the importance of proper break times,

sick leave and access to hospital facilities. Ranking second, at 18%, is the fear of workplace COVID-19 exposure and family transmission, a source of similar anxiety for 94% of the respondents overall. This latter is followed closely at 16% by uncertainty over the hospital's ability to provide sufficient individual and family support following a worker's COVID-19 diagnosis, a doubt that also worries 74% of the respondent pool. It is particularly worth noting that every respondent who commented on this concern had actually suffered a COVID-19 infection and failed to receive the proper organizational support. Finally, in fourth place at 15% is access to PPE, also a source of anxiety for 72% of total respondents.

In Table 4, we summarize the qualitative findings by matching the SUSM classification and the four additional anxiety sources identified above to corresponding excerpts from the hospital 1 commentary. In addition to tying each category and its accompanying commentary to the corresponding qualitatively derived anxiety source, the table gives the number of respondents and the number of statements for each category.

As regards our four additional anxiety sources of health, finances, (heavy) workload and leadership, the first is by far the most relevant self-reported COVID-19-related worry, with 58% of respondents expressing concern not only for their physical health but also for their emotional and psychological well-being. Whereas respondent comments allude 17 times to physical symptoms like intense headaches, lack of energy, and chronic tiredness, they make 41 references to acute stress symptoms, anxiety, depression, nervousness, disappointment and lack of motivation, as well as five mentions of 'burnout' or 'a high level of burnout'.

One of the most important anxiety sources, expressed 35 times by 38% of respondents, is concern over finances, including low wages, the general economic situation and the lack of financial support. A second source, reported 27 times by 30% of respondents, is a heavy workload with longer hours induced by both the large numbers of COVID-19 patients and a shortage of personnel. One of the most critical concerns, referenced 27 times by 26% of respondents, is a perceived lack of empathy, a distress over not feeling seen or heard by leadership, often accompanied by a concomitant perception of not receiving appropriate gratitude or recognition. Such distress is frequently expressed as 'I want my problems to be understood' or 'our voice is never heard'. In their comments, the HCWs appear to define leadership broadly within the hospital, referring not only to top administrators but also to ward managers, supervisors and senior physicians.

Discussion

Our main analysis reveals high levels of anxiety across the various sources, with the fear of COVID-19 exposure and family transmission being the most pronounced among both clinical and nonclinical staff (94% of total respondents), irrespective of whether providing care directly to COVID-19 patients or not. This finding is not surprising given the high spread of the infection in Tehran and the associated hospitalization and mortality rates, which are obviously likely to engender more aggravated concerns in HCWs than in the general population. In fact, even though HCWs may actually be more protected in the healthcare facility workplace than in the community (where the lack of PPE makes contagion far more likely), they must still interface directly with patient suffering and all other aspects of the high burden that the pandemic places on their hospitals.

Similarly unsurprising and in line with previous studies from China (Guo *et al.*, 2020; Liu *et al.*, 2020; Lu *et al.*, 2020), Italy (Gorini *et al.*, 2020) and Turkey (Hacimusalar *et al.*, 2020; Şahin *et al.*, 2020) is our observation of higher anxiety among nurses, who must shoulder heavy workloads under extraordinarily high levels of stress, frequently resulting in depression and burnout. Nonetheless, given the serious personnel shortages in Iran's entire healthcare sector, such concerns over high workloads are not restricted to nurses. As of 2018, the approximately 130 000 medical doctors and 170 000 nurses and midwives employed in this sector translated into a healthcare provision ratio of approximately 16 doctors (21 nurses and midwives) to 10 000 population, as compared to 37 (132), 42 (134) and 43 (178), respectively, in Australia, Germany and Switzerland (WHO, 2021). Achieving the global average of 38 nurses and midwives per 10 000 population would thus require 130 000 additional employees in this occupational group alone. Attenuating this shortage is the precarious funding of Iran's entire health system, which, since a steep drop in oil prices plummeted the oil revenues on which the country was formerly dependent to the lowest levels in recent decades (Behzadifar *et al.*, 2020), relies primarily on NGO funding. This latter, however, which finances about 25–30% of Tehran's hospital staff, is itself facing a crisis triggered by the pandemic (MEHR News Agency, 2021). It is hardly surprising, then, that across virtually all sources higher levels of anxiety occur more frequently in females than in males, especially those married with children. Female HCWs, in general, and nurses, in particular, must juggle heavy onsite workloads with household and childcare responsibilities, while females employed in other labour markets may be able to work from home. The former thus suffer a disproportionate effect from the pandemic.

Pandemic-related anxiety sources for HCWs, however, extend well beyond fear for personal and family safety to other important determinants of health and well-being. For example, given the severe pandemic-induced economic downturns across the globe and the closure and downsizing of many businesses, job security and associated financial certainty surface in our results as a major concern. In Iran, which was already suffering the burden of economic sanctions including the heavily devaluated currency (Salamati and Chaufan, 2019), the pandemic has not only decreased many household incomes but also directly depleted the finances of many healthcare institutions via both the costs of extra resources (e.g. PPE) and the loss of income from non-COVID-19 interventions (Behzadifar *et al.*, 2020). Although sanctions may have led to the shortage of drugs, PPE and equipment and led to strict financial controls, the management style, quality of work environment, communication frequency and quality are indeed margins for improvement that are independent of the factors that are highly affected by the embargo. Therefore, at such difficult times—especially in developing countries where resources are scarce and hospital disaster preparedness is weak (Djalali *et al.*, 2013)—leadership plays a particularly important role in enhancing HCWs' productivity and resilience in times of crisis and uncertainty. This importance is highlighted empirically by the significance that our

commentaries give to genuine expressions of gratitude from those in managerial positions.

Despite such important insights, however, our study is subject to two notable limitations: a cross-sectional design that prevents causal analysis and a response rate that, although relatively high, is insufficient to rule out selection bias. Whereas the first implies that HCWs on a certain ward may have pronounced unobservable characteristics that correlate with specific anxiety sources irrespective of the work environment, the second indicates that the existence of such a correlation will bias the results. On the other hand, given the population to sample ratios for the largest hospital surveyed—58–52% and 42–48% for females and males, respectively, and 83–78% and 17–22% for clinical and nonclinical staff—the responses based on these characteristics in this one institution at least seem sufficiently representative.

We also acknowledge that the SUSM classification has not yet been fully validated. Construct validity could be tested by checking whether the scales are related to other instruments, as predicted by theory (van Ommeren *et al.*, 1999). However, since the SUSM-defined anxiety sources are a new exploratory anxiety classification, establishing a link to other instruments was beyond the scope of our study.

It is thus worth noting the important implications of our findings for hospital policy and personnel administration. Whereas understanding the multiple anxiety sources among HCWs is essential to provision of targeted responses, in our setting, such a provision is especially challenging because the necessary financial resources—already limited in developing economies—are particularly constrained in Iran by US sanctions. Hence, although providing appropriate PPE and rapid testing may be the best means of mitigating fears of workplace COVID-19 contraction and family transmission, despite supposed exemptions for medicines and basic medical equipment, the sanctions' direct and indirect effects destabilize the country's health system and restrict access to diagnostic, therapeutic and preventative tools (Abdoli, 2020), particularly PPE (Dodangeh and Dodangeh, 2020).

Nonetheless, some less costly measures for alleviating worker anxiety, stress and burnout are attainable, including accelerated training on critical knowledge, appropriate access to experts and the creation of multiple input and feedback channels (e.g. listening groups and suggestion boxes). This latter would ensure the integration of HCW voices into the decision-making process, thereby addressing our respondents' concerns about not being heard or appreciated. Hospital administrators should also offer support for emotional and psychologic needs through such initiatives as counselling and conveniently scheduled support programs, including online seminars and services. Our finding of especially high anxiety levels among married female employees also underscores a need for targeted initiatives to assist professional working women maintain a healthy work life balance, thereby avoiding negative spillover effects and enhancing job retention. For instance, even though difficult during times of pandemic, managers should limit extended shifts and infuse as much flexibility as possible into their employees' schedules, while providing as much emotional and practical support as possible to decrease burnout. Above all, a compassionate leadership should provide its HCWs with genuine expressions of gratitude and appreciation (Shanafelt *et al.*, 2020) to alleviate overall anxiety and offer intrinsic reward when extrinsic compensation is constrained.

Conclusions

Developing effective approaches to HCW support is likely to require a thorough understanding of their sources of fear and anxiety. It is upon these specifics that support efforts should primarily focus rather than teaching generic approaches to stress reduction or resilience (Shanafelt *et al.*, 2020). According to our analysis, which uses a mixed-methods approach to measure COVID-19 pandemic-related anxiety sources among HCWs in Tehran, females, nurses and those working on the frontlines or in COVID-19 wards suffer the highest levels of anxiety and thus require targeted support programs to enhance their well-being and retention. These may include providing efficient communication with multiple input and feedback channels, emotional support (through counselling programs), physical support (through the provision of PPEs and other required equipment, flexible schedules and limiting extended shifts), access to appropriate experts and training on critical knowledge, financial support and facilitated COVID-19 services and medication for both HCWs and their families. The aforementioned interventions, in addition to genuine expressions of gratitude and appreciation, would mitigate the HCWs' anxiety during a pandemic.

Data availability statement

The data underlying this article are not publicly available to preserve participants' privacy.

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Conflict of interest statement. The authors declare that they do not have any conflict of interest.

Note

1. It is worth noting that a bilingual sample could be used for further evaluation of the translations. However, in our case, such a bilingual sample does not exist.

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Appendix

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I am worried about having access to appropriate personal protective equipment during the outbreak of the COVID-19 pandemic.	☐	☐	☐	☐	☐
2. I am worried about being exposed to COVID-19 at work and taking the infection home to my family.	☐	☐	☐	☐	☐
3. I am worried about not having rapid access to testing if they develop COVID-19 symptoms and concomitant fear of propagating infection at work.	☐	☐	☐	☐	☐
4. I feel uncertainty that the organization will support/take care of me and my family needs in case of developing COVID-19 infection.	☐	☐	☐	☐	☐
5. I am worried about access to childcare during increased work hours and school closures during the outbreak of the COVID-19 pandemic.	☐	☐	☐	☐	☐
6. I am worried about receiving support for other personal and family needs as work hours and demands increase during the outbreak of the COVID-19 pandemic (food, hydration, lodging, transportation).	☐	☐	☐	☐	☐
7. I am worried about my organization is able to provide competent medical care if deployed to a new area during the outbreak of the COVID-19 pandemic (e.g., non-ICU nurses having to function as ICU nurses).	☐	☐	☐	☐	☐
8. I am worried about access to up-to-date information and communication during the outbreak of the COVID-19 pandemic.	☐	☐	☐	☐	☐

Figure A1. Questionnaire: English version