



RESEARCH ARTICLE

Anxiety, pandemic-related stress and resilience among physicians during the COVID-19 pandemic

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Abstract

Background: Physicians play a crucial frontline role in the COVID-19 pandemic, which may involve high levels of anxiety. We aimed to investigate the association between pandemic-related stress factors (PRSF) and anxiety and to evaluate the potential effect of resilience on anxiety among physicians.

Methods: A self-report digital survey was completed by 1106 Israeli physicians (564 males and 542 females) during the COVID-19 outbreak. Anxiety was measured by the 8-item version of the Patient-Reported Outcomes Measurement Information System. Resilience was evaluated by the 10-item Connor–Davidson Resilience Scale. Stress was assessed using a PRSF inventory.

Results: Physicians reported high levels of anxiety with a mean score of 59.20 ± 7.95 . We found an inverse association between resilience and anxiety. Four salient PRSF (mental exhaustion, anxiety about being infected, anxiety infecting family members, and sleep difficulties) positively associated with anxiety scores.

Conclusions: Our study identified specific PRSF including workload burden and fear of infection that are associated with increased anxiety and resilience that is associated with reduced anxiety among physicians.

KEYWORDS

anxiety, COVID-19, mental health, resilience, stress

1 | INTRODUCTION

In December 2019, a novel coronavirus outbreak (COVID-19) emerged in Wuhan, China (Q. Li et al., 2020) and spread to many countries, including Israel, where the first case was diagnosed on February 20, 2020. The pandemic generated widespread anxiety in the general population and among healthcare workers. Physicians and other healthcare workers play a crucial frontline role in the management of the pandemic, and based on both research (Lai et al., 2020) and media reports (Gold, 2020; NHS under pressure:

voices from the frontline of the coronavirus crisis, n.d.), are facing increasing emotional burdens and levels of anxiety. Anxiety may interfere with physicians' functioning under stress, their decision-making abilities, and may have long-term effects on their well-being (Fahrenkopf et al., 2008; Gong et al., 2014). A better understanding of modifiable factors associated with anxiety related to the COVID-19 outbreak among physicians has become a matter of urgency.

A recent cross-sectional study examined mental health outcomes among healthcare workers treating patients with COVID-19 in China and reported a high prevalence of depression (50.4%), anxiety

(44.6%), insomnia (34.0%), and distress (71.5%; Lai et al., 2020). Nurses, women, workers in Wuhan, and frontline workers reported more symptoms on all measurements (Lai et al., 2020). Only 39.2% of the study participants were physicians, however, and the authors did not investigate modifiable factors that influence severe physicians' mental health.

Studies conducted during large-scale worldwide health crises (the Severe Acute Respiratory Syndrome [SARS] outbreak, the H1N1 pandemic [Goulia, Mantas, Dimitroula, Mantis, & Hyphantis, 2010; Imai et al., 2010], and Ebola [L. Li et al., 2015]) have shown that several factors are associated with increased psychological distress among healthcare workers. These included concerns of fear of infecting family members and friends (Goulia et al., 2010; Maunder et al., 2003), uncertainty about the health consequences of the disease (Goulia et al., 2010), perception of risk to themselves (Nickell et al., 2004; Styra et al., 2008), living with children (Nickell et al., 2004), being placed in quarantine (Bai et al., 2004), and stigmatization and social isolation (Bai et al., 2004; Can et al., 2005; Maunder et al., 2003; Nickell et al., 2004).

In addition to studying the effect of the above-mentioned factors on physicians' anxiety during the COVID-19 pandemic, we wished to examine the effect on the anxiety of another key factor, resilience. Resilience, defined as the act of coping, adapting, or thriving from adversity, is a protective factor against adversity, and it has been inversely associated with the experience of workplace stress and anxiety among physicians (Fletcher & Sarkar, 2013; Haddadi & Ali Besharat, 2010).

The present exploratory study aims to measure the level of anxiety among physicians during the COVID-19 outbreak and to identify potential anxiety associated with modifiable risk and protective factors.

2 | METHODS

2.1 | Participants

The first patient COVID-19 lab-confirmed patient in Israel was identified on February 20, 2020. The first COVID-19-related death in Israel was reported on March 20. We conducted a national cross-sectional survey of a nonprobability sample of physicians in Israel. The analytic sample for the current study included respondents who consented to participate in the survey between March 19 to March 22, 2020. During that time, the number of COVID-19-related cases in Israel grew from 153 (on March 19) to 264 (on March 22). We used a mixed-modes survey design in which separate or overlapping samples are approached with a combination of different modes. The primary mode was an internet survey of specifically named physicians, for which we used a list-based sampling frame of working email addresses of the Israel Medical Association (IMA). The other mode was posting the survey in physicians' forums on Facebook. While the mean age of the IMA membership and responders was similar (48.7 ± 16.9 vs. 46.1 ± 13.2 , respectively), the proportion of female

physicians among responders was somewhat higher compared with the study's source population (49.0% vs. 40.3%, respectively). Representation of medical specialties among responders was generally similar to that of the IMA membership (Table S1). We followed the standards and ethics of the American Association for Public Opinion Research reporting guidelines (The American Association for Public Opinion Research, 2016). The study protocol was approved by the Institutional Review Board of the Sheba Medical Center.

2.2 | Assessment

Self-administered anonymous questionnaires were answered digitally through a secured digital platform (Qualtrics). Responses were saved on a secured server at the Sheba Medical Center. The questionnaires consisted of four modules: (a) *Sociodemographic characteristics* included age, sex, living with children at home (yes/no), working at a hospital (yes/no), medical specialty, level of exposure to COVID-19 patients (direct contact with the confirmed patient, direct contact with nonconfirmed patients, no contact with patients), workload (more than usual, as usual, less than usual), being quarantined (yes/no); (b) *Anxiety* was assessed using the 8-item Hebrew version of the Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety Module (Cronbach's α coefficient .92, $p < .0001$), a well-accepted self-report tool developed by the National Institute of Health for measuring symptoms of anxiety (Schalet et al., 2016). Each item is rated from 1—"never" to 5—"always." Following the World Health Organization guidelines for the process of translation and adaptation of instruments, we adopted the well-established method of forward-translation and back-translation by bilingual mental health professionals, with the latter being blinded to the original English version of the PROMIS (Yardeni et al., 2020). (c) *Stress* was assessed using an inventory of pandemic-related stress factors (PRSF; Cronbach's α coefficient .73, $p < .0001$), compiled from questions that proved to be pertinent in previous research on the SARS and N1H1 pandemics (Imai et al., 2010). A 4-point Likert-type scale was used for item scoring (0—"never" to 3—"always"); (d) *Resilience* was assessed using the well-validated 10-item Connor-Davidson Resilience Scale (CD-RISC-; Cronbach's α coefficient .88, $p < .0001$), in which items are rated from 0 (not true at all) to 4 (true nearly all the time) (Campbell-Sills & Stein, 2007). We computed Cronbach's α coefficients to verify the internal consistency of the study's instruments as a measure of their internal reliability.

2.3 | Statistical analysis

We used descriptive statistics to present the sociodemographic characteristics, anxiety, resilience, and PRSF. We conducted multivariable linear regression with the PROMIS Anxiety score as a dependent variable to evaluate the crude association between anxiety, PRSF, and resilience and assessed its robustness when adjusted for age and sex. PRSF were chosen to be included in the model based on

the knowledge accrued through research of previous pandemics (Imai et al., 2010), nonnegligible crude correlation coefficient with anxiety, and low probability of random error. Several PRSF were not entered into the model due to multicollinearity with predictors of a similar construct (e.g., physical exhaustion, lack of knowledge about infectiveness, and virulence, etc.).

To assess the likelihood of type I error we tested for statistical significance with α set at .05. All tests were two-tailed. Statistical analysis was conducted with the IBM Statistical Package for the Social Sciences v.25 for Windows (IBM Inc., Chicago, IL).

3 | RESULTS

The survey responses to the sociodemographic characteristics, anxiety and resilience scores, and PRSF are presented in Table 1. The

sample included physicians from a broad array of medical specialties (Table 1). A total of 1,106 physicians (mean age 46.07 ± 13.20 years, range 25–88; 542 females, 49.0%) completed the study questionnaire during the first four days of the survey and were included in the analyses. Notably, among all the PRSF, only a small minority of the study sample felt protected by the national and local government ($n = 154$, 13.9%) and by hospital and healthcare systems ($n = 166$, 15.0%) during the pandemic. Moreover, the majority of physicians reported coming to work because they feel mission-driven to do so ($n = 701$, 63.4%). A higher rate of physicians reported anxiety about infecting family members rather than about being infected themselves (52.8% vs. 20.9%, respectively, $\chi^2(1) = 169.6$, $p < .0001$). The mean PROMIS Anxiety score of the entire sample was 59.20 ± 7.95 , and the mean CD-RISC score was 29.05 ± 6.28 .

The factors that were most strongly associated with anxiety in the multivariable linear regression were mental exhaustion, anxiety

TABLE 1 Sociodemographic characteristics, anxiety and resilience scores, and pandemic-related stress factors of the study sample ($N = 1,106$)

Characteristic	Mean \pm SD (range)	Sample, n (%)
Age, years	46.07 ± 13.20 (25–88)	
25–30		98 (8.9)
30–40		394 (35.6)
41–50		229 (20.7)
51–60		176 (15.9)
61–70		162 (14.6)
≥ 71		47 (4.2)
Female		542 (49.0)
Home quarantined		54 (4.9)
Living with children at home		704 (63.6)
Hospital employee		737 (66.6)
Physical contact with nonconfirmed cases		737 (66.6)
Exposed to confirmed COVID-19 cases		70 (6.3)
Medical specialty		
Medicine		323 (29.2)
Primary care and emergency medicine		286 (25.9)
Surgery		281 (25.4)
Pediatrics		133 (12.0)
Psychiatry and child and adolescent psychiatry		83 (7.5)
Outcome measures	Score mean \pm SD	
PROMIS Anxiety	59.20 ± 7.95	
CD-RISC	29.05 ± 6.28	
Pandemic-related stress factors	Score mean \pm SD	Often or always n (%)
Feeling mission-driven to work	2.85 ± 0.92	701 (63.4)
Anxiety about infecting family members	2.65 ± 0.90	584 (52.8)
Childcare burden	2.24 ± 1.21	422 (38.1)
Mental exhaustion	2.16 ± 0.94	393 (35.5)

(Continues)

TABLE 1 (Continued)

Pandemic-related stress factors	Score mean \pm SD	Often or always n (%)
Financial concerns	2.26 \pm 0.92	391 (35.3)
Physical exhaustion	1.97 \pm 0.88	282 (25.5)
Feeling of being isolated and shunned by others	1.92 \pm 0.94	274 (24.8)
Increased workload	1.91 \pm 0.89	255 (23.0)
Sleep difficulties	1.81 \pm 0.88	245 (22.1)
Anxiety about being infected	2.00 \pm 0.78	232 (20.9)
Lack of knowledge about infectiveness and virulence	1.82 \pm 0.85	229 (20.7)
Lack of knowledge about prevention and protection	1.81 \pm 0.83	221 (19.9)
Feeling of being protected by hospital or healthcare systems	1.81 \pm 0.78	166 (15.0)
Feeling obligated to go to work	1.62 \pm 0.81	156 (14.1)
Feeling of being protected by national and local government	1.70 \pm 0.78	154 (13.9)

Abbreviations: CD-RISC, Connor–Davidson Resilience Scale; CI, confidence interval; OR, odds ratio; PROMIS, Patient-Reported Outcomes Measurement Information System; SD, standard deviation.

about being infected, anxiety about infecting family members, and sleep difficulties. Those variables alone explained nearly half of the variance in PROMIS Anxiety scores (adjusted $R^2 = .43$). The model also showed that resilience was negatively associated with anxiety (β coefficient = -0.18 ; 95% confidence interval: -0.23 to -0.14 ; $p < .0001$; Table 2). The mean PROMIS Anxiety scores across PRSF (low vs. high levels) are presented in Figure 1.

4 | DISCUSSION

Physicians and other healthcare workers have a major role at times of large-scale public health crises, such as the current COVID-19

pandemic. We investigated the role of resilience and PRSF associated with physicians' anxiety during the pandemic. Understanding these factors has a heuristic value for public planning and interventions aiming to reduce physicians' anxiety and improving their ability to cope with the enormous challenges of treating patients during the COVID-19 pandemic.

Our findings of physicians reporting high levels of anxiety are in line with a recently published report on mental health outcomes among healthcare workers exposed to the COVID-19 pandemic in China (Lai et al., 2020), as well as to reports about the 2003 SARS epidemic (Bai et al., 2004; Chong et al., 2004).

We revealed an inverse association between anxiety and pre-pandemic resilience. Resilience refers to the act of coping, adapting,

Variable	B (95% CI)*	β (95% CI)*	p Value
Resilience	-0.24 (-0.30 to -0.18)	-0.18 (-0.23 to -0.14)	<.0001
Mental exhaustion	3.36 (2.50–4.23)	0.20 (0.15–0.26)	<.0001
Anxiety about being infected	3.69 (2.75–4.63)	0.19 (0.14–0.24)	<.0001
Anxiety about infecting family	2.98 (2.17–3.79)	0.18 (0.13–0.24)	<.0001
Sleep difficulties	2.35 (1.43–3.27)	0.12 (0.07–0.17)	<.0001
Feeling obligated to go to work	1.67 (0.62–2.71)	0.07 (0.02–0.12)	<.001
Lack of knowledge about prevention and protection	1.30 (0.40–2.21)	0.06 (0.02–0.11)	.005
Living with children	0.70 (-0.04 to 1.44)	0.04 (-0.00 to 0.09)	.063
Feeling mission-driven to work	0.68 (-0.07 to 1.43)	0.04 (-0.00 to 0.08)	.076
Financial concerns	0.44 (-0.29 to 1.17)	0.02 (-0.02 to 0.07)	.330
Feeling of being protected by hospital or healthcare systems	-0.62 (-1.57 to 0.33)	-0.02 (-0.07 to 0.02)	.200

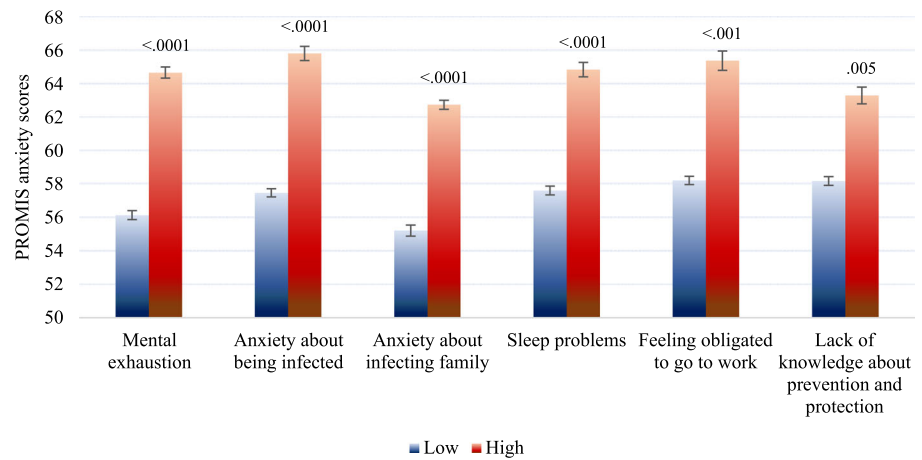
Note: $R = .721$, Adjusted $R^2 = .513$.

Abbreviations: B, unstandardized B coefficient; CI, confidence interval; β , standardized β coefficient.

*Adjusted for age and sex.

TABLE 2 Association between resilience, pandemic-related stress factors, and anxiety among physicians, in multivariable linear regression analysis with anxiety as dependent variable ($N = 1,006$)

FIGURE 1 Distribution of mean Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety scores across pandemic-related stress factors (low vs. high levels). Error bars represent standard errors



or thriving from adversity, and reflects a complex and dynamic interplay between individual, environmental, and sociocultural domain (Venegas, Nkangu, Duffy, Fergusson, & Spilg, 2019). Resilience has been shown to be a promotable protective factor against anxiety and work-related stress among physicians (Cleary, Kornhaber, Thapa, West, & Visentin, 2018).

We explored the effect of potentially salient PRSF on anxiety based on factors identified in previous research on pandemics (Bai et al., 2004; Goulia et al., 2010; Maunder et al., 2003; Nickell et al., 2004; Styra et al., 2008; Tam, Pang, Lam, & Chiu, 2004). Consistent with prior studies (Maunder et al., 2003; Tam et al., 2004), we found higher rates of anxiety among physicians about infecting family members than about becoming infected themselves (Chen et al., 2020). We believe that the unpredictable course of COVID-19 infection and uncertainty about the effectiveness of currently available treatment could provoke anxiety among healthcare workers caring for these patients. In addition, it is presumable that physicians may avoid close contact with their loved ones in an attempt to reduce the risk of infecting, which in turn might further increase mental burden and anxiety.

In line with recent studies conducted with healthcare workers in China during the COVID-19 pandemic (Wang et al., 2020; Wu & Wei, 2020; Zhang et al., 2020), we found a positive association between sleep difficulties and higher levels of anxiety among physicians. Of note, during the pandemic physicians were working long hours and were doing more night shifts which may have disrupted their circadian rhythm and led to insomnia and sleep difficulties. Addressing physician's sleep problems during the COVID-19 pandemic is important because of their negative effect on cognition, performance, and relations among workers (Goel, Basner, Rao, & Dinges, 2013; Swanson et al., 2011; Wada et al., 2008). It is also plausible that reported insomnia and sleeping problems were in fact secondary to anxiety (Oh, Kim, Na, Cho, & Chu, 2019; Soehner & Harvey, 2012).

The main strengths of our study include a sizable sample of physicians, real-time reporting which reduces the likelihood of recall bias, use of acceptable and well-validated tools for assessing anxiety and resilience, and low proportion of missing data. Another

advantage of our study stems from the fact that Israel is a geographically small country, whereupon the adversities of the current COVID-19 pandemic are experienced simultaneously nationwide, making the sample representative of the average exposure of the physicians' population.

This study also has several limitations that bear mention. First, its cross-sectional design limits the arrival at conclusions about directionality. Another limitation is the response rate. It is possible, that the physicians who participated in our study are different from nonresponders in terms of the outcome measures, which might introduce a selection bias that could potentially affect the internal validity of our results as well as limit their generalizability. Even if our findings are generalizable to Israeli physicians, they might not be fully applicable to physicians in other countries. Finally, there might be a potential reporting bias, since physicians might underreport their levels of anxiety at times of global crisis.

To the best of our knowledge, our study is the first to assess modifiable PRSF and resilience and their association with anxiety among physicians during a major global health crisis. Our findings offer an additional dimension of how physicians are facing such ex-cruciating challenges.

Future research should focus on developing better measures of resilience that would capture constructs that are unique to pandemics, and study the differential effect of protective processes on diverse populations at different levels of risk exposure (Ungar & Theron, 2019). Controlled trials of potential anxiety-reducing strategies such as focused resilience training, optimal workload management, and risk communication are also recommended (Goulia et al., 2010; Maunder et al., 2003; Ranney, Griffeth, & Jha, 2020). Finally, the effect of increasing the visibility of team leaders on strengthening team endurance during missions should also be tested (Hershkovich, Gilad, Zimlichman, & Kreiss, 2016; Shanafelt, Ripp, & Trockel, 2020).

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

All authors contributed, reviewed, and approved the final manuscript. M. M., N. H. P., I. M. P., A. A., A. Z., Y. K., D. G., and R. G. were responsible for conceiving and designing the study. M. M., N. M., and N. H. P. collected the data. N. H.P. conducted statistical analyses. M. M., N. H. P., S. D. I., R. G., and D. G. interpreted the data. M. M., N. H. P., S. D. I., R. G., and D. G. wrote the final manuscript.

DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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