

Risk Perception, Risk Vulnerability and COVID-19 Anxiety Predict Physical and Mental Health among Medical Students in Ibadan, Nigeria

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This study aimed to investigate the psychological factors that predict health-related quality of life (HRQoL) among medical students during the COVID-19 pandemic. Specifically, it examined the influence of risk perception, risk vulnerability, and COVID-19 anxiety on the physical and mental health components of HRQoL after controlling for demographic covariates such as gender and age. A total of 340 medical students completed an online questionnaire using relevant and appropriate measures. The results showed that risk perception and COVID-19 anxiety were negatively correlated with physical and mental health, while risk vulnerability was positively correlated with both components. Using hierarchical multiple linear regression, the study found that risk perception and vulnerability improved physical health, while COVID-19 anxiety reduced it. Additionally, risk perception and COVID-19 anxiety negatively impacted mental health, whereas risk vulnerability enhanced it. These findings suggest that different psychological factors influence HRQoL components and that reducing COVID-19-related anxiety could improve both physical and mental health among medical students.

Keywords: Risk perception, risk vulnerability, COVID-19 anxiety, physical/mental health

Introduction

The COVID-19 pandemic had a profound impact on healthcare professionals worldwide, including medical students who were on the frontlines of the fight against the disease. The unprecedented burden on healthcare professionals led to significant changes in their work and living modes, with a heightened emphasis on maintaining proper patient care and preventing the spread of the disease at all times (Turcu-Stiolica *et al.*, 2021; Trumello *et al.*, 2020). Frontline workers, including medical students, were under extreme duress, with long shifts and an ever-increasing chance of getting infected (Hadning *et al.*, 2021). This constant pressure to make life-saving decisions, manage their own physical and mental health, and balance their duty obligations as care providers may lead to a decline in their overall quality of life (Kandula and Wake, 2021). In Nigeria, medical students are often engaged as adjunct staff and interns to handle similar responsibilities under close supervision. This increased exposure to patients, some of whom

have already been infected but have not been tested, puts them at a higher risk of infection and may lead to increased anxiety, particularly among those who perceive themselves to be vulnerable to the infection (Young *et al.*, 2021). Consequently, their overall quality of life could be predicted by how they are able to manage the associated anxiety, and their perception of risk and vulnerability. However, there is very scant literature that have examined the relatedness of these variables. This study aims to investigate the relationship between risk perception, risk vulnerability, and COVID-19 anxiety on the physical and mental components of health-related quality of life (HRQoL) among medical students in Ibadan, Nigeria

Theoretical framework

The Health Belief Model served as the theoretical framework for this study (Rosenstock, 1966). The Health Belief Model (HBM) was developed to comprehend why people disregard preventive measures and screening procedures for the early

diagnosis of diseases. According to the model, a person's likelihood of adopting a recommended health behavior or action will be predicted by their perception of the personal or collective threat posed by a disease or illness, along with their perception of the efficacy of their behaviour. In other words, the behavioural health response to prevent or treat illness is dependent on the perception that the necessary actions are less costly, more beneficial, and preferable. The model holds that the desire to avoid illness or get well if already ill is dependent on the perception of risk and vulnerability to the illness. According to the Health Belief Model, which is relevant to the current study, people are more likely to take preventive action to avoid contracting COVID-19 if they presume it poses a serious health risk, believe they are personally susceptible and believe that there are fewer costs than benefits in doing so. Therefore, a central aspect of the Health Belief Model is that behavioral change interventions are more effective if they address an individual's specific perceptions about susceptibility, benefits, barriers, and self-efficacy.

Literature Review

Individuals' perceptions of infection risk and vulnerability are a central feature in many health-behavior theories because they influence how diseases spread (Schneider *et al.*, 2021). In the current study, the researcher pictured risk perception to be a factor that can help individuals avoid contracting the virus and promote physical and mental wellbeing. Therefore, the concept of risk perception is defined as an individual's subjective estimation of a threat associated with an event which then determines the person's response to such event. COVID-19 risk perception has a significant impact on the willingness to comply with preventive and control measures. An individual who perceives themselves to be at higher risk of getting infected will be more likely to take action that is defensive to protect their health by following the identified preventive and control guidelines. Actions preceding their perception of risk and vulnerability may result in reduced or enhanced HRQoL. To support this claim, Yildirim and Guler (2021) in their study agreed that people's perception of the risk of contracting the coronavirus significantly impacted how they engaged in activities that aid the management of their mental wellbeing. In addition, Cao *et al.* (2021) explored

the mediating effect of risk perception on the relationship between perception of time and mental health of college students participating in online classes during the lockdown. They found that risk perception partially mediated the relationship among different time perspective and the mental health of the students. The interpretation of this finding is that students that had experienced positive emotions in the past before the pandemic had more confidence and resilience to withstand the setbacks during the pandemic.

A considerable number of studies has shown that the coronavirus risk perception was negatively correlated with measures of well-being such as individual functioning (Germani *et al.*, 2020), subjective happiness (Yildirim & Guler, 2021), depression (Ding *et al.*, 2020), psychological wellbeing (Krok & Zarzycka, 2020), and anxiety (Liu *et al.*, 2020). These studies claimed that a higher perception of risk for the pandemic led to lower psychological wellbeing. However, two other studies reported a positive relationship between risk perception and measures of psychological distress (Orte *et al.*, 2020; Qian & Li, 2020). This means that the heightened level of risk perception increased anxiety and depression among the vulnerable groups of their study. It is considered that university students' vulnerability was increased by the coronavirus. According to Browning *et al.* (2021), these students are far more likely than the general population to have severe forms of anxiety, depression, substance consumption, and eating disorders because of the abrupt changes in their educational environment. On the other hand, Aristovnik *et al.* (2020) thought that students' worries about their futures, careers and social lives are escalating as the pandemic spreads. This means that the degree of risk susceptibility to the pandemic has a significant impact on how we should react to it.

Numerous research that has looked at the connection between coronavirus anxiety and health-related quality of life have been thoroughly documented. For instance, Tabrizi *et al.* (2022) discovered in their investigation the impact of pandemic-related worry on Iranian nurses' quality of life. They discovered that these nurses' quality of life suffered as a result of their elevated anxiety levels. This finding was supported by research by Hang and Zhao (2020), who found that nurses' COVID-19 anxiety levels were greater than those

of other health occupational groups and that these nurses were more susceptible to mental health problems. It is safe to conclude that exposure to a variety of stressors associated with the nature of their work may harm their overall quality of life. There is a plethora of studies on physical and mental health-related quality of life in the emergence of COVID-19 that has specifically focused on vulnerable age group such as children and adolescents (Mastorci *et al.*, 2021; Knorst *et al.*, 2021), the elderly (Banerjee, 2020; Armitage & Nellums, 2020), survivors or suspected cases of the disease (Chen *et al.*, 2020; Poudel *et al.*, 2021; Nguyen *et al.*, 2020), community-based study (Choi *et al.*, 2021; Algahtani *et al.*, 2021) and healthcare workers/professionals (Shaukat *et al.*, 2020; Kang *et al.*, 2020). Studies on health professionals appear to be the closest to the population considered in this study. Nonetheless, findings from these studies would not be sufficient to explain how the health-related quality of life of medical students is affected in the face of the pandemic. Hence, it is imperative to examine psychological factors that could influence the health-related Quality of Life of clinical medical year students in a teaching hospital that was used as an isolation center for COVID-19.

A study by Fu *et al.* (2022) found that higher self-perceived risk of COVID-19 infection was cross-sectionally associated with greater depressive symptoms, which negatively impacted mental health-related quality of life. Similarly, a study by Oyetunji *et al.* (2021) found that COVID-19-related risk perception, anxiety, and protective behaviors were significantly associated with mental health outcomes among Nigerian adults. Research suggests that risk perception, risk vulnerability, and COVID-19 anxiety do significantly predict physical health-related quality of life when controlling for demographic factors such as gender and age. For instance, a study by Yin *et al.* (2021) found that risk perception and vulnerability were positively related to physical health, while COVID-19 anxiety was negatively related to physical health among medical staff combating against COVID-19. Another study by Ning *et al.* (2020) found that knowledge, risk perception, emotion, and information significantly predicted protective behaviors, which in turn positively impacted physical health-related quality of life during the

COVID-19 pandemic. Further studies have consistently shown that risk perception, risk vulnerability, and COVID-19 anxiety significantly predict mental health-related quality of life when controlling for demographic factors such as gender and age. For example, a study by Xi *et al.* (2020) found that risk perception and COVID-19 anxiety were positively related to mental health symptoms, while risk vulnerability was negatively related to mental health among medical staff combating against COVID-19. Another study by Popescu Ljungholm and Olah (2020) found that socioeconomic disadvantages, including living alone and pre-existing economic challenges, and pre-existing mental health vulnerabilities, including recent exposure to violence and previous mental health problems, were associated with a higher level of psychological distress and lower life satisfaction, which negatively impacted mental health-related quality of life. These findings collectively suggest that risk perception, risk vulnerability, and COVID-19 anxiety are significant predictors of both physical and mental health-related quality of life, however, these variables have not been investigated among medical students. In light of this, the current study hopes to provide empirical answers to the following research questions raised;

- i. Would risk perception, risk vulnerability, and COVID-19 anxiety be significantly related to physical and mental health-related quality of life?
- ii. Would risk perception, risk vulnerability, and COVID-19 anxiety significantly predict physical health-related quality of life when gender and age are statistically controlled for?
- iii. Would risk perception, risk vulnerability, and COVID-19 anxiety significantly predict mental health-related quality of life when gender and age are statistically controlled for?

Method

Design and sampling method

In this study, a cross-sectional study research design was used to describe an already occurred event (HRQoL) without any form of interference. As a result, the researchers gathered the necessary data on existing facts to conclude these variables concerning the outcome variable. In addition, the

participants were chosen using a purposive sampling technique. The participants' availability, who met the criteria for participation (Final year medical students of the University College of Medicine, University of Ibadan), and feasibility of the students given the nature of the participants' activities, as well as compliance to the COVID-19 prevention and control guidelines, influenced the method of selection. Risk perception, risk vulnerability, and COVID-19 anxiety are the independent/predictor variables of the study while the dependent/criterion variable is the physical and mental health-related quality of life. These variables were selected because the authors believed that students' perception of risk and vulnerability to the disease as well as their behavioural responses is important to understanding and managing the disease.

Setting and participant

This research focused on final-year medical students at the University of Ibadan's College of Medicine, which is housed in the University College Hospital (UCH) the first teaching hospital in Nigeria. It is the University of Ibadan medical school with 2,156 medical students studying Basic Medical Sciences, Clinical Sciences, Dentistry, and Public Health (University of Ibadan Medical Students Association, UIMSA). As a result, the participants were chosen based on their broad coverage and accessibility to the researchers. The study's sample size was calculated at 337 using the Slovin formula (Slovin, 1960) for a population of 2,156 people, assuming a maximum variability of 50% and a 95 percent confidence level of ± 5 precision. This study included 340 clinical year medical students, with an average age of 21.92 ± 2.86 . One hundred and ninety-nine (58.2 percent) are females, while 142 (41.8 percent) are males. Eighty-six (25.1 percent) of the participants were from the Dentistry department, 115 (33.6 percent) were from the Medicine and Surgery department, 37 (10.8 percent) and 104 (30.4 percent) were from Nursing and Physiotherapy respectively.

Instrument

Risk perception:

The COVID-19 Own Risk Appraisal Scale (CORAS) developed by Jaspal *et al.* (2020) as a

measure of perceived personal risk of contracting the disease was used to assess COVID-19 risk perception. The CORAS is a 6-item questionnaire that assesses the probability of one's COVID-19 infection. With two items reversed, response options are scored from 1 (strongly disagree) to 5 (strongly agree). The scale adopted the Perceived Risk of HIV Scale (Napper *et al.*, 2012) as the basis for the development of this scale partly because the risk of getting infected with HIV and COVID-19 are similarly influenced by modification of one's behaviour. In addition, the authors believed that there are emerging findings that suggest that people think about their risk of coronavirus in both analytic and intuitive ways. This consequently led the authors to develop items that are intuitive and analytical about one's risk appraisal of COVID-19. Items that measure risk perception include: "I am certain I will NOT become infected with COVID-19; I believe I am unlikely to become infected with COVID-19. A higher score indicates a higher perception of the risk of COVID-19 and vice versa. The authors of the scale reported a reliability value of 0.87.

Risk vulnerability

The Perceived Vulnerability to Disease (PVD) Scale developed by Duncan, Schaller, and Park (2009) was used to assess risk vulnerability. There are a total of 15 items on the scale. Each item was graded on a seven-point scale (1: strongly disagree, 7: strongly agree). Items 3, 5, 11, 12, 13, and 14 were reverse scored. The scaled items were scored in such a way that a higher score indicates a higher risk of COVID-19 infection and vice versa. The Cronbach alpha in this study was 0.45, which is considered moderate.

Coronavirus Anxiety Scale:

Coronavirus Anxiety was assessed using Lee's COVID-19 Anxiety Scale (CAS) (2020). The CAS is a brief mental health screener that can be used by health professionals and researchers to assess the dysfunctional anxiety associated with COVID-19. The five items cover the five main symptoms of coronavirus-related anxiety: sleep difficulty, freezing-out, digestive problems, poor appetite, and light-headedness with each measure using a five-point Likert scale (0=Never to 4=Everyday). The items' scores were summed up

such that a higher score is indicative of greater COVID-19-related anxiety and vice versa. The author reported an internally consistent reliability value of 0.93 and content validity that represent physiological arousal symptoms associated with anxiety disorders.

Health-related Quality of Life:

The Short Form 12 Scale, developed by Medical Outcomes Study, was used to assess COVID-19 HRQoL. It is a widely used metric for determining one's health-related quality of life. The SF-12 is a condensed version of the SF-36, which was created as part of the Medical Outcomes Study. The scores from the twelve questions are combined to create Physical and Mental Health Composite Scores (PCS & MCS). The PCS scores include items on general health perception, physical functioning, and reduction in physical activities while items on MCS include social functioning, vitality, and emotion. A lower score on any of the components and the overall scale is indicative of a lower level of HRQoL and a higher score is indicative of a higher level of overall HRQoL and the components of the scale. Internal consistency was found to be high in this study, with a score of .87.

Research procedure

Following best practices, ethical approval was sought from the Faculty of the Social Science,

University of Ibadan Ethical Review Board, and following approval, the researcher set out to collect data using a structured questionnaire containing information for the study, informed consent, confidentiality, and anonymity. Data for the study was collected online using Google Forms and was sent directly to the students' contact obtained through their department representatives. This method of data collection was chosen in other to comply with the preventive measure to curtail the spread of COVID-19. The link to the online research was made available to the various departments' group coordinators and class representatives. Those who consented to take part in the study followed the link and completed the questionnaire, while those who were not willing to participate were told to ignore the link while assuring them that there is no harm in not participating.

Data analysis

Data gathered from the survey were subjected to statistical analysis using the Statistical Package for the Social Sciences (SPSS v26). Descriptive statistics such as frequency, mean, standard deviation and percentage distribution were used to describe the participants' demographic characteristics while Pearson product moment correlation and hierarchical multiple regression analysis were used to test the relationship and prediction respectively.

Results

Table 1: Summary of correlation matrix table showing the relationship among risk perception, risk vulnerability, COVID-19 anxiety, health-related quality of life, and its components

Variables	Mean	SD	1	2	3	4	5	6
Risk Perception	18.96	2.58	--					
Risk Vulnerability	53.36	9.01	-.36**	--				
COVID-19 Anxiety	8.94	2.51	-.37**	-.44**	--			
Physical HRQoL	14.46	1.63	-.13*	.50**	-.46**	--		
Mental HRQoL	22.78	2.97	-.23**	.39**	-.49**	.73**	--	
Overall HRQoL	37.24	4.31	-.21**	.46**	-.51**	.88**	.77**	--

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed)

Research Question 1: Would risk perception, risk vulnerability, and COVID-19 anxiety be significantly related to physical and mental health-related quality of life?

The result from table 1 revealed a negative relationship between risk perception and vulnerability ($r=-.36, p<.01$) indicating that participants with higher risk perception shown to have lower risk vulnerability, a negative relationship was also observed between risk perception and COVID-19 anxiety ($r=-.37, p<.01$) implying that those participants who reported higher risk perception shown to have less anxiety related to COVID-19. Further, risk perception shows a negative relationship with the physical component ($r=-.13, p<.05$), mental component ($r=-.23, p<.01$), and the overall health-related quality of life ($r=-.21, p<.01$). This correlation means that those participants who reported higher risk perception had a lower physical and mental health-related quality of life. In addition, risk vulnerability revealed a

significant negative relationship with COVID-19 anxiety ($r=-.44, p<.01$) which is indicative that those participants who reported higher vulnerability showed to have less coronavirus anxiety. Conversely, risk vulnerability showed a positive relationship with physical ($r=.50, p<.01$), mental ($r=.39, p<.01$), and overall health-related quality of life ($r=.46, p<.01$). The correlation implies that those participants who reported higher risk vulnerability had better physical, mental and overall health-related quality of life. Furthermore, anxiety related to COVID-19 was found to be negatively correlated with physical ($r=-.46, p<.01$), mental ($r=-.49, p<.01$), and overall health-related quality of life ($r=-.51, p<.01$) found to be negatively associated with overall health-related quality of life. This correlation simply implies that those participants with higher coronavirus anxiety have a lower physical and mental health-related quality of life and vice versa.

Table 2: Summary of Hierarchical Multiple Regression analysis showing the independent and joint prediction of risk perception, risk vulnerability and COVID-19-related anxiety on the Physical component of Health-related Quality of Life

Predictor	β	T	Sig	R	R ²	ΔR^2	F	p
Model 1 Sex	.23	4.46	<.001					
Age	.28	5.57	<.001	.39	.15	.15	29.16	<.001
Model 2 Sex	.01	.25	>.05					
Age	.19	4.21	<.01					
Risk perception	.11	2.20	<.05	.61	.37	.22	38.46	<.001
Risk Vulnerability	.39	7.56	<.001					
COVID-19 Anxiety	-.27	-4.88	<.001					

Research Question 2: Would risk perception, risk vulnerability, and COVID-19 anxiety significantly predict physical health-related quality of life when gender and age are statistically controlled for?

The first model showed sex and age to be significant independent and joint covariates of physical HRQoL ($F_{(2,336)}=29.16, R=.39, R^2=.15, \Delta R^2=.15, p<.001$) by jointly accounting for 15% variation in physical HRQoL. In the second model predictor variables of risk perception, risk vulnerability, and COVID-19 anxiety were added, and the result revealed significant joint prediction

of these variables on the physical component of HRQoL ($F_{(5,333)}=38.46, R=.61, R^2=.37, \Delta R^2=.22, p<.001$). The R² change associated with this model increased by 22% as the variables in this model jointly accounted for 37% of the total variation observed on physical HRQoL. Independently, risk perception ($\beta= .11, t= 2.20, p<.05$), risk vulnerability ($\beta= .39, t= 7.56, p<.001$) and COVID-19 anxiety ($\beta= -.27, t= -4.88, p<.001$) predicted the physical component of HRQoL. Although, risk perception and risk vulnerability were associated positively with physical HRQoL indicating that the more perception of risk and vulnerability to

COVID-19 the better the physical health-related quality of life, an inverse relationship was observed for COVID-19 anxiety implying that those that

were more anxious about COVID-19 had a poorer physical component of HRQoL.

Table 3: Summary of Hierarchical Multiple Regression analysis showing the independent and joint prediction of risk perception, risk vulnerability, and COVID-19-related anxiety on the Mental component of Health-related Quality of Life

Predictor	β	T	Sig	R	R ²	Δ R ²	F	p
Model 1 Sex	.41	8.50	<.001					
Age	.23	4.84	<.001	.39	.15	.15	29.16	<.001
Model 2 Sex	.30	6.04	<.001					
Age	.16	3.53	<.001					
Risk perception	-.12	-2.37	<.05	.61	.37	.13	39.57	<.001
Risk Vulnerability	.15	2.86	<.01					
COVID-19 Anxiety	-.23	-4.12	<.001					

Research Question 3: Would risk perception, risk vulnerability, and COVID-19 anxiety significantly predict mental health-related quality of life when gender and age are statistically controlled for?

The first model showed sex and age to be significant independent and joint covariates of physical HRQoL ($F_{(2,335)} = 53.81$, $R = .49$, $R^2 = .24$, $\Delta R^2 = .24$, $p < .001$) by jointly accounting for 24% variation in mental component of HRQoL. In the second model predictor variables of risk perception, risk vulnerability, and COVID-19 anxiety were added, and the result revealed significant joint prediction of these variables on the mental component of HRQoL ($F_{(5,333)} = 39.57$, $R = .61$, $R^2 = .37$, $\Delta R^2 = .13$, $p < .001$). The R^2 change associated with this model increased by 13% as the variables in this model jointly accounted for 37% of the total variation observed on the mental component of HRQoL. Independently, risk perception ($\beta = -.12$, $t = -2.37$, $p < .05$), risk vulnerability ($\beta = .15$, $t = 2.86$, $p < .01$) and COVID-19 anxiety ($\beta = -.23$, $t = -4.12$, $p < .001$) predicted the mental component of HRQoL. Although, risk perception and COVID-19 anxiety are inversely associated with the mental component of HRQoL indicating that the more perception of risk and anxiety about COVID-19, the lower the mental health-related quality of life while, a positive relationship was observed for risk vulnerability implying that medical students who perceived themselves to be more vulnerable to the infection reported better HRQoL in the mental component.

Discussion

The current study investigated the relationship between risk perception, risk vulnerability, and COVID-19 anxiety on the physical and mental components of health-related quality of life (HRQoL) among medical students at the University of Ibadan in Nigeria.

The findings of this study provide valuable insights into the psychological factors that influence the HRQoL of medical students during the pandemic. The negative correlation between risk perception, COVID-19 anxiety, and overall HRQoL suggests that as medical students perceive a higher risk of contracting the virus and experience increased anxiety related to the infection, their overall quality of life suffers. This is consistent with previous research that has found a link between risk perception, anxiety, and mental health outcomes among healthcare professionals and the general population during the pandemic (Fu *et al.*, 2022; Oyetunji *et al.*, 2021). Interestingly, the study found a positive correlation between risk vulnerability and overall HRQoL, indicating that as medical students perceive themselves as more vulnerable to COVID-19, their physical and mental health-related quality of life improves. This finding suggests that acknowledging one's vulnerability to the virus may lead to increased precautionary measures and a greater sense of preparedness, which in turn positively impacts HRQoL. However, it is important to note that excessive vulnerability perception can also lead to increased anxiety and stress, which may have negative consequences for

mental health (Xi *et al.*, 2020). The negative correlation between risk perception, COVID-19 anxiety, and the physical and mental components of HRQoL highlights the importance of addressing these psychological factors in order to support the well-being of medical students during the pandemic. Interventions aimed at reducing risk perception and anxiety, such as providing accurate information about the virus and promoting healthy coping strategies, may help to mitigate the negative impact on HRQoL (Ning *et al.*, 2020).

Although, risk perception and vulnerability to COVID-19 significantly enhanced the physical health of medical students, on the contrary, anxiety related to COVID-19 reduced the physical health-related quality of life of the students. Furthermore, we tested the predictive influence of risk perception, risk vulnerability, and COVID-19 anxiety on the mental component of health-related quality of life. For the third research question, risk perception, risk vulnerability, and COVID-19 anxiety significantly independently and jointly predicted mental health-related quality of life after gender and age were controlled for. Although, risk perception and COVID-19 anxiety negatively influenced mental health while vulnerability to the illness enhanced mental health-related quality of life. These findings are consistently supported by the meta-analytical findings by Kang *et al.* (2020) that psychological distress, stress, sleep, and post-traumatic stress disorder are various consequences that influenced the physical and mental health of healthcare workers during the COVID-19 pandemic.

Limitations of the study

Notwithstanding, this study is not without its limitation, a major limitation is the channel through which data was collected (online), which limited the researchers' control of who should participate in the study, though measures like reaching the participants through their class representative and their WhatsApp platform was taken to reduce this effect. However, this may not have taken care of who is eligible to participate in the study. Another setback to the outcome of this study is that not all medical fields were involved in this study. This could limit the generalization of the findings of this study. Hence, future studies should endeavor to replicate this study, include other medical students, improve the mode of data

collection, and include other psychological factors that are capable of impacting the components of Health-Related Quality of Life.

Conclusion

In conclusion, the findings of this study underscore the importance of considering the psychological factors that influence the health-related quality of life of medical students during the COVID-19 pandemic. By addressing risk perception, vulnerability, and anxiety, healthcare institutions and educational institutions can better support the well-being of these frontline workers and ensure that they are able to provide high-quality care to their patients while also prioritizing their own health and well-being.

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