



## Research article

# Effects of COVID-19 safety protocols on health workers' quality of life; the mediating role of mental health and physical health; a retrospective study

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## ABSTRACT

This study conducts an empirical retrospective examination of the effect of COVID-19 protocols on Health workers' quality of life during the pandemic. Data from a survey respondent of 330 health workers were analyzed through structural equation modeling. Results indicated COVID-19 protocols specifically hand hygiene, personal protective equipments, and physical distancing had a significant effect on the quality of life of health workers during the COVID-19 era. However, the results did not follow the expected literature trend. Analysis indicated a direct significant positive relationship between hand hygiene and quality of life and also highlighted a negative relationship between physical distancing and protective equipments and quality of life. Detailed analysis in an attempt to explain this development highlighted the significant role physical and mental health play in the relationship between COVID-19 safety protocols and quality of life. The findings of the study suggest implications and suggestions for future research.

## 1. Introduction

Coronavirus disease 2019 (COVID-19) is an acute respiratory infection that is potentially severe and life-threatening, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In December 2019, the virus was discovered in Wuhan City, Hubei Province, China, as the source of an outbreak of pneumonia with no known etiology [1]. This novel coronavirus was initially identified as 2019-nCoV. However, it was later designated as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2], and the disease it causes is now known as Coronavirus Disease-2019 (COVID-19) by the WHO (World Health Organization). The COVID-19 outbreak was deemed a public health emergency of worldwide concern by the WHO on January 30, 2020, posing a significant risk to nations with weak health systems. The acceleration of this outbreak prompted the WHO to formally recognize it as a pandemic on March 11, 2020 [1,3].

COVID-19 did not leave without inflicting its fair share of harm. There were more than 7 million deaths globally resulting from COVID-19, and the pandemic infected over 600 million people [4]. One profession that was hit hard the most by the pandemic was the

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health sector. A considerable number of people were sent to health centers all over the globe seeking a cure for a virus whose nature and mode of action were not fully comprehended by scientists. This took a toll on health workers as they were physically exhausted by the overwhelming number of cases and mentally confounded by the lack of a direct and appropriate way to deal with the virus as well as the protective measures put in place [5–9]. As posited by previous research, health workers (HWs) faced the risk of being infected or infecting their family and friends, and this increased their sense of isolation and stigmatization [10,11] and raised concerns about affecting their mental health [12]. This led to the introduction of several safety protocols to attenuate the COVID-19 effect on the quality of life (QoL) of HWs.

Different countries, institutions, and centers proposed different strategies with the aim of improving the quality of life during COVID-19 among HWs and the general population at large [9]. Researchers, therefore, took it upon themselves to evaluate how these protocols affected the mental and physical health of HWs and their overall QoL [13–17]. The toll of COVID-19 safety protocols on the mental health of health workers is profound. The relentless combination of heightened stress, the constant specter of exposure, and the emotionally draining experience of witnessing patient suffering and loss have precipitated soaring levels of anxiety, frustration, and burnout within their ranks. Moreover, the perpetual donning of personal protective equipment (PPE) not only induces physical discomfort but also erects an emotional barrier between health workers and their patients, hindering the cultivation of meaningful connections. The fluidity of protocols and guidelines amid the pandemic's pervasive uncertainty further amplifies these sentiments, creating a breeding ground for heightened distress. While these measures, including stringent hygiene protocols and the use of personal protective equipment (PPE), have been vital in minimizing the risk of infection, they also present challenges. Prolonged and intensive use of PPE can lead to discomfort, skin irritation, and dehydration among health workers. Further, While these measures are crucial for protecting both healthcare professionals and patients from the virus, they have introduced various challenges and stressors that affect multiple aspects of their lives.

Fast forward, COVID-19 is no longer a global threat, and this calls for the need for retrospective studies on how these protocols affected the overall QoL of HWs. However, there has not been enough research that looks back to analyse how these protocols affected the QoL of HWs. This need for a retrospective study leads us to ask these questions: 1) *what impact did the COVID-19 safety protocols have on the mental health of health care workers?* 2) *How did the COVID-19 safety protocols affect the physical health of healthcare workers?* 3) *What was the effect of the COVID-19 safety protocols on the overall quality of life of healthcare workers?*

To answer these questions, the research aims to conduct a retrospective study on how COVID-19 safety protocols affected the QoL of HWs through structural equation model analysis. The study further analyzes the mediating role of physical and mental health on this relationship. The safety protocols were grouped into three main categories, namely Physical Distancing (PD), Hand Hygiene (HH), and Personal Protective Equipments (PPEs). The study used the social cognitive theory to explore how the protocols affected the quality of life of health workers through their mental and physical well-being. A retrospective study will give researchers insight into past events and pave the way for future adjustments when attempting to improve the quality of life of health workers in times of a pandemic. The study further proposes some managerial implications which will help in the face of a pandemic.

## 2. Theoretical review and hypotheses development

### 2.1. Social cognitive theory (SCT)

The Social Cognitive Theory (SCT), formulated by Albert Bandura, emphasizes the significant impact of observational learning on acquiring and sustaining habits in a social setting [18]. This theory explains the complex and mutual relationship between human variables, actions, and the environment, referred to as triadic reciprocity or reciprocal determinism [19]. Social Cognitive Theory's comprehensive framework emphasizes that people learn not just from their own experiences but also considerably by seeing the activities, consequences, and behaviors of others [20]. This viewpoint is important for understanding how behaviors are acquired and continued in different social settings, providing insight into behavior modification and preservation via the concepts of modeling and imitation. In addition, SCT has offered significant insights into health behavior research, particularly in elucidating how people acquire and embrace health-related habits from their social environment [21]. The theory outlines four essential stages of observational learning: attention, retention, reproduction, and motivation, which are crucial for learning and maintaining health practices [22]. SCT provides a solid framework to study how health workers (HWs) learn and adopt COVID-19 safety protocols like Personal Protective Equipment (PPE) use, physical distancing (PD), and hand hygiene (HH) by observing their peers and receiving formal training. Highlighting observational learning stresses the need to demonstrate positive behaviors in healthcare environments to improve the implementation of essential safety practices in reducing the spread of COVID-19.

Furthermore, SCT includes many variables that are crucial for comprehending health professionals' compliance with COVID-19 safety measures. These components consist of observational learning, result expectancies, self-efficacy, behavioral competence, and the impact of contextual conditions [22]. Health workers' compliance with Personal Protective Equipment (PPE), Personal Disinfection (PD), and Hand Hygiene (HH) protocols can be greatly impacted by their assessment of the efficacy of these behaviors, their confidence in carrying them out (self-efficacy), and their belief in the positive results linked to these behaviors (outcome expectations). Moreover, having the necessary knowledge and abilities to perform these activities (behavioral competence), together with supporting contextual elements like the presence of PPE and institutional safety rules, are essential in promoting adherence [23]. Together, these constructs demonstrate how SCT offers a thorough lens through which the intricate interaction of behavioral, environmental, and individual factors influencing health workers' adherence to COVID-19 safety protocols can be understood. This perspective is helpful in developing interventions that aim to improve the quality of life and health outcomes of these workers.

## 2.2. Safety protocols and health workers QoL

Adherence to COVID-19 safety protocols, such as personal protective equipment (PPE) usage, physical distancing (PD), and hand hygiene (HH), is crucial for protecting the health and well-being of health workers, and it is important to understand how these protocols influence their QoL. Through the lens of social cognitive theory (SCT), there can be a comprehension of how adherence to safety protocols can improve the quality of life (QoL) of health workers. SCT is a theory of human behavior that emphasizes the role of cognitive, behavioral, and environmental factors in learning and change, which was developed by Bandura [18]. Individuals' ideas, beliefs, and the things they observe in others affect their actions and the results they get. Specifically, health workers who have a greater conviction in their competence to comply with COVID-19 safety regulations are more likely to adopt the essential behaviors continuously. Health workers can protect themselves and their patients from infection, calm their nerves, and feel more secure in their surroundings if they follow established safety procedures. Previous studies have explored the relationship between adherence to safety protocols and the QoL of health workers. For instance, a study by Tran, Vo, Hoang, Hoang, Tran and Colebunders [24] assessed the adherence to COVID-19 preventive measures, including the use of personal protective equipment (PPE), physical distancing (PD), and hand hygiene (HH), on the QoL of health workers during the pandemic. Their research found a link between adherence to safety procedures and quality of life, showing that health professionals who regularly followed these guidelines reported greater levels of general well-being, job satisfaction, and life satisfaction. This shows that following the COVID-19 safety guidelines might improve the quality of life for health workers.

Adherence to PPE protocols can enhance health workers' sense of protection, reduce the fear of infection, and increase their perceived control over the work environment. Hakim and Abouezz [25] defined PPEs as a barrier between the user and microorganisms that prevents the dissemination and infection of microorganisms by the healthcare provider. Inadequate use of PPE and infection control measures may increase the transmission of infectious diseases from patients, their attendants, and healthcare professionals. According to WHO practical guidelines for infection control, all medical personnel and health attendants, laboratory staff, supporting staff, and family members who care for patients must wear PPE, such as gloves, masks, goggles, an apron, a gown, footwear, and a head covering [26]. In 2023, a systematic review explored whether physical interventions could reduce the transmission of respiratory viruses. They found that adhering to PPE protocols, such as wearing gloves, gowns, and masks, could reduce the spread of disease and, hence, enhance the well-being of health workers [27]. These suggest that adherence to PPE protocols significantly influences the QoL of health workers positively.

Physical distancing is another safety protocol that is seen as a key preventive measure in minimizing the spread of COVID-19. Adhering to physical distancing protocols, both within and outside of healthcare settings, reduces the risk of exposure to the virus. Health workers who observe their colleagues and other individuals consistently practicing physical distancing are more likely to adopt and maintain these behaviors. Research has also looked at the connection between health workers' QoL and PD protocol adherence. In 2020, published research looked at how social distancing policies affected the quality of life (QoL) of healthcare professionals throughout the pandemic [28]. The findings demonstrated that health workers who followed the PD guidelines were able to protect themselves and their loved ones from COVID-19, hence experiencing greater levels of QoL, including enhanced emotional well-being, less stress, and higher levels of job satisfaction. This indicates that following PD standards has a considerable beneficial impact on the quality of life of healthcare professionals.

According to the World Health Organization, hand hygiene, including frequent handwashing or the use of hand sanitizers, is a critical practice for preventing the transmission of COVID-19 [29]. Previous studies have investigated the relationship between adherence to HH protocols and the QoL of health workers. For instance, the effect of hand hygiene practices on healthcare professionals' quality of life was investigated in a study by Musu, Lai, Mereu, Galletta, Campagna, Tidore, Piazza, Spada, Massidda and Colombo [30]. The results showed that health professionals who consistently followed HH guidelines experienced greater levels of QoL, including better physical health and less sickness. This implies that following HH procedures considerably improves the QoL of healthcare professionals. Based on the above perspectives, it is hypothesized that.

**H1a.** Adherence to PPE protocols has a significant positive influence on HWs QoL

**H1b.** Adherence to PD protocols has a significant positive influence on HWs QoL

**H1c.** Adherence to HH protocols has a significant positive influence on HWs QoL

## 2.3. Safety protocols and mental health of health workers

Health workers have faced a higher risk of occupational exposure to the virus during the COVID-19 pandemic. Health workers encounter serious mental health difficulties as a result of the pandemic, in addition to the physical health dangers they are exposed to. According to Khanal, Devkota, Dahal, Paudel and Joshi [31], health workers who treat COVID-19 patients are more likely to suffer from anxiety, sleeplessness, depression, and severe stress responses. The constant worry of contracting an infection, seeing patients suffer and die, wrestling with moral issues like sharing resources and ventilators, putting in long hours, and worrying about the safety of their loved ones are just a few causes of these mental health problems [32]. Because of the overwhelmingly high demands of the pandemic and the resulting heightened burnout and demoralization, the mental health burden on healthcare personnel is further exacerbated. Following the COVID-19 safety guidelines is a vital step in addressing and reducing these mental health issues. There are several ways in which healthcare professionals' mental health might benefit from strict adherence to COVID-19 safety measures. First, healthcare workers are less likely to get sick if they follow safety rules like wearing personal protective equipment, washing their

hands, and keeping a safe distance. Health workers may concentrate on their work without being distracted by additional stress and worry about their health because of this lowered risk of infection. As a result, we hypothesized that.

**H2a.** Adherence to PPE protocols positively influences the mental health of HWS

**H2b.** Adherence to PD protocols positively influences the mental health of HWS

**H2c.** Adherence to HH protocols positively influences the mental health of HWS

#### 2.4. Safety protocols and physical health of health workers

A crucial component of protecting the physical health of healthcare professionals is adherence to COVID-19 safety measures. Adherence to these protocols has been shown to have a favorable effect on the well-being of healthcare practitioners in previous research and literature. Wearing the proper personal protective equipment (PPE) is essential for lowering the risk of COVID-19 transmission among healthcare workers, according to research by Park [33]. Similar findings were made by Schoberer, Osman-covic, Reiter, Thonhofer and Hoedl [34] in their rapid review and meta-analysis of the literature. They discovered that following infection prevention and control guidelines, such as maintaining good hand hygiene and using masks appropriately, significantly decreased the risk of respiratory infections among healthcare workers. Additionally, a WHO report points out that strong adherence to safety procedures, such as physical distancing and isolation measures, significantly decreased the risk of COVID-19 infections among healthcare workers [26]. The report also stressed the value of ongoing training and education programs to encourage safe healthcare practices. Health professionals may minimize their exposure to the virus, lower the risk of transmission to others, and foster a healthier work environment by adhering to established guidelines, including the right use of PPE, practicing good hand hygiene, and keeping physical distance. Following safety procedures can also lessen the severity of an infection-related sickness. Additionally, health professionals who put safety procedures first set a good example for others, encouraging group efforts to stop the virus's spread and promote physical health.

**H3a.** Adherence to PPE protocols positively influences the physical health of HWS

**H3b.** Adherence to PD protocols positively influences the physical health of HWS

**H3c.** Adherence to HH protocols positively influences the physical health of HWS

#### 2.5. Mental health and health workers' QoL

The mental health of health workers has emerged as a critical factor influencing their overall well-being and quality of life. Previous studies have investigated the relationship between mental health and quality of life among health professionals, offering insightful information on this subject. For example, a study conducted by Manh, Minh, Trung, Phu, Ngo, Thu, Thu, Huyen, Van and Xuan [35] examined the mental health and health-related quality of life outcomes among frontline health workers during the peak of the COVID-19 outbreak and reported a moderate rate of psychological distress and lower HRQoL outcomes. According to their study, during the COVID-19 epidemic, frontline healthcare professionals were subjected to a considerable lot of stress, including the possibility of getting the virus, the emotional strain of caring for sick patients, and the long hours and challenging working circumstances. Anxiety, sadness, and post-traumatic stress disorder are just a few of the mental health issues that these pressures can bring on. Their study also indicated that health workers working in COVID-19-designated hospitals had a significantly higher rate of mental health problems and a lower HRQoL outcome than those working in non-COVID-19-designated hospitals.

Moreover, a 15-year longitudinal research by Mahmood, Grotmol, Tesli, Moum, Andreassen and Tyssen [36] explored the mental health and QoL of physicians, revealing a similar positive relationship. Physicians with better mental health were more likely to report greater life satisfaction, improved work-life balance, and enhanced personal relationships. The findings of this study emphasize how crucial physician mental health is. When physicians have excellent mental health, they are more likely to be content with their careers, have a better work-life balance, and have healthier personal connections. This might result in better patient care and a higher quality of life for physicians.

**H4.** HWS' mental health have a positive significant effect on their QoL

#### 2.6. Physical health and health workers' QoL

The overall well-being and quality of life (QoL) of individuals are greatly influenced by their physical health. Improved physical health enhances vitality, work performance, and overall life satisfaction. Maintaining excellent physical health enables individuals to effectively carry out their responsibilities, meet the demands of their jobs, and live fulfilling personal lives. Examining the relationship between physical health and quality of life among health workers will provide valuable insight into the factors that contribute to their well-being as a whole. Previous studies have examined this association, confirming the existence of a positive relationship between physical health and quality of life. A study by Hadning and Qurrotu'Ainii [37] analyzed health workers' quality of life in Indonesia during the COVID-19 pandemic and found that health workers in Indonesia had good scores for their physical health, which resulted in a better overall quality of life during the COVID-19 pandemic. Furthermore, a systematic review by Bize, Johnson and Plotnikoff [38] reviewed the literature on the relationship that exists between physical health and quality of life. Their result showed that a significant

positive correlation exists between them. These studies provide consistent evidence supporting the positive relationship between physical health and QoL. Therefore, we propose that better physical health will enable health workers to effectively manage the demands of their work, experience fewer physical symptoms, and have a greater sense of well-being, leading to improved overall QoL.

**H5.** HWs' physical health has a positive significant effect on their QoL

2.7. *The mediating role of mental health and physical health*

The mental health of health workers plays a crucial role in their overall quality of life, especially during the COVID-19 pandemic. Research has shown that the mental health of health workers is significantly impacted by their adherence to COVID-19 safety protocols [31]. Health workers who adhere to COVID-19 safety protocols are more likely to experience better mental health, which in turn positively affects their quality of life [35]. Also, multiple studies have demonstrated the negative impact of the COVID-19 pandemic on patients' physical and mental health, leading to a lower quality of life. For instance, a recent scoping review conducted by Shaukat, Ali and Razzak [39] highlighted the physical and mental health impact of COVID-19 on healthcare workers. Therefore, it is hypothesized that.

**H6.** HWs' mental health positively mediates the relationship between the adherence to COVID-19 safety protocols and the QoL of HWs.

Compliance with COVID-19 safety protocols does not only influence mental health but also has direct implications for the physical health of health workers. Previous studies have emphasized the significance of safety protocols in minimizing the risk of infection and maintaining health workers' physical well-being. For instance, a study by Park [33] demonstrated that the proper use of PPE and adherence to infection control measures significantly reduced the likelihood of COVID-19 transmission among healthcare workers. Also, it is well-acknowledged that physical health and quality of life are related. Physical health is a crucial aspect of well-being and is known to impact numerous aspects of quality of life. Consistently, research has demonstrated that individuals with improved physical health report higher QOL. For example, a systematic review by Ref. [38] highlighted the positive association between physical health and QoL across different populations. Given the literature supporting the influence of physical health on QoL and the direct impact of adherence to safety protocols on physical health, we hypothesized that.

**H7.** HWs' physical health positively mediates the relationship between the adherence to COVID-19 safety protocols and the QoL of HWs.

2.8. *Physical health and mental health*

The connection between physical and mental health is well-established in the literature, demonstrating how closely related the two are. Previous studies have shown that physical health has a positive impact on mental health. For instance, a systematic review and meta-analysis by Wang, Cai, Jiang, Fang, Sun and Wang [40] identified a high correlation between physical activity and improved mental health outcomes, such as less depressive and anxious symptoms. Regular physical activity and exercise have been demonstrated to increase endorphin release, mood, and general mental health. Moreover, physical health issues have been repeatedly proven to have

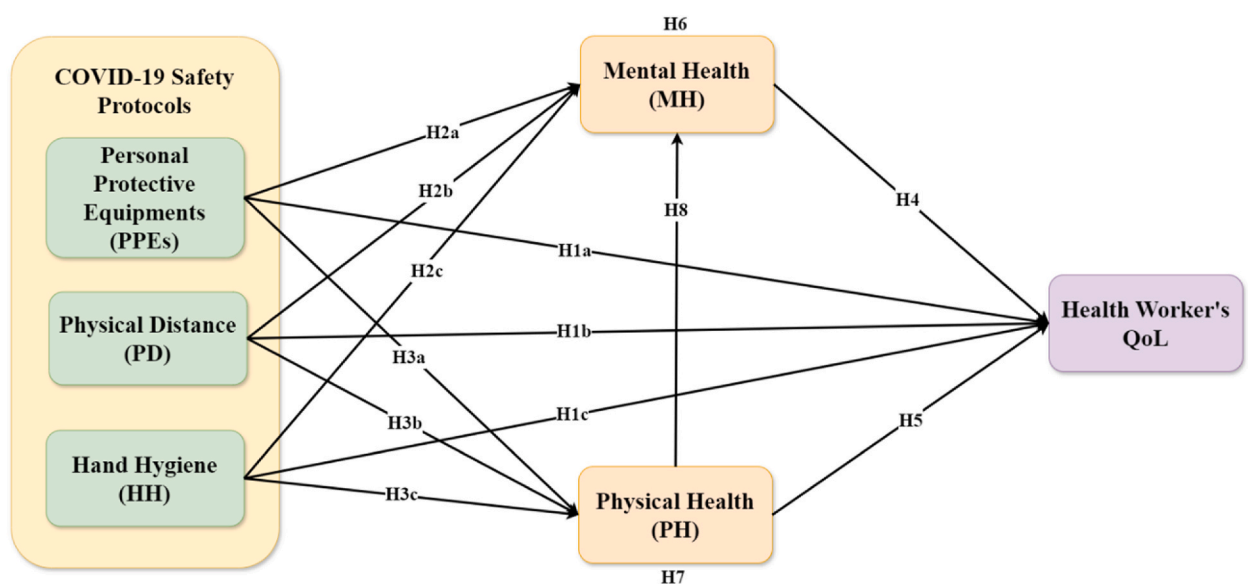


Fig. 1. Conceptual framework.

a substantial impact on mental health. Chronically ill or disabled people frequently have a higher incidence of mental health conditions like depression and anxiety. A systematic review and meta-analysis by Kandola, Ashdown-Franks, Stubbs, Osborn and Hayes [41] revealed a significant association between physical health conditions (e.g., cardiovascular disease, diabetes) and the incidence of mental health disorders. Physical suffering can increase stress, lower self-esteem, and disrupt daily life, which can all contribute to the emergence of mental health problems. The above literature consistently demonstrates that the presence of physical health conditions can negatively impact mental health. Therefore, we hypothesize that.

**H8.** Physical health has a positive effect on the mental health of health workers

Based on the above hypotheses, we propose the conceptual framework as presented in Fig. 1.

### 3. Materials and methods

#### 3.1. Data collection

The data for the study was collected from health workers in selected hospitals in Ghana through a structured questionnaire. A structured questionnaire was used because it creates room for faster data collection in large samples. The first part of the questionnaire gathered data on the respondents' demographics, and the second part addressed the research hypothesis. Since the main focus was on hospitals that treated the majority of COVID-19 cases, we used a purposive sampling technique to gather data from specific hospitals. The sample consisted of health workers (Nurses, Doctors, and other health workers) who were mostly in charge of COVID-19 patients and isolation centers. A total of 357 questionnaires were gathered, and 330 valid responses were obtained from the sample. Physical Distancing (PD) and Personal Protective Equipment (PPE) were measured using three items each, while Hand Hygiene (HH), Physical and Mental Health, and Quality-of-Life measures had four items each. The measurement items were adapted from past studies and modified to suit the needs of the current studies. Fellow Doctoral students and two professors reviewed the questions for validation purposes.

#### 3.2. Control variables

In our study examining the impact of COVID-19 safety protocols on health workers' quality of life (QoL), incorporating gender, profession, and educational level as control variables is pivotal for enhancing the precision and relevance of the findings [42]. Gender considerations ensure the research accounts for varied experiences and coping mechanisms across male and female health workers, recognizing differences in stress responses and societal roles [43]. Profession-specific controls acknowledge the distinct roles, responsibilities, and exposure levels of registered nurses, doctors, and other hospital staff, tailoring insights to address unique occupational demands and risks. Furthermore, including educational level as a variable captures the influence of knowledge, attitudes, and resource access on the adoption and perceived impact of safety measures, ensuring the study's recommendations are applicable across a spectrum of educational backgrounds [44]. Together, these controls allow for an analysis that can identify differential impacts of COVID-19 safety protocols, leading to targeted, equitable interventions designed to improve the QoL for all segments of the healthcare workforce.

#### 3.3. Data analysis

The analysis of respondents' demographics was done using SPSS (Statistical Package for Social Sciences) version 25, and the measurement model and structural model analysis were done using AMOS (Analysis of Moment Structures) 22.

#### 3.4. Respondents demographic information

A total of 330 health practitioners were involved in this research. The results indicated that the majority of these practitioners were females (76.1 %), while the remaining were males (23.9 %). Out of the respondents, 62.4 % were registered nurses, constituting a simple majority. Educationally, the breakdown indicated a diverse range, with majority (40.3 %) holding a bachelor's degree. Table 1. Gives further details on the respondents' demographics.

**Table 1**  
Demographic characteristics.

| ITEM              | CATEGORIES                    | FREQUENCY | PERCENTAGE |
|-------------------|-------------------------------|-----------|------------|
| Gender            | Male                          | 79        | 23.9       |
|                   | Female                        | 251       | 76.1       |
| Profession        | Registered Nurses             | 206       | 62.4       |
|                   | Doctors                       | 35        | 10.6       |
|                   | Other Hospital Health Workers | 89        | 27.0       |
| Educational Level | Bachelors                     | 102       | 40.3       |
|                   | Diploma                       | 133       | 30.9       |
|                   | Master                        | 95        | 28.8       |

### 3.4.1. Measurement model

This section dealt with the validity and reliability of the data. The Kaiser-Meyer Oklin (KMO) test for sampling adequacy was 0.831 and significant at  $p$ , which is an indication that the data is adequate for further analysis. This Bartlett's Test was also significant at the 0.01 significance level, see Table 3. The final measurement model fit the data well with  $\chi^2(98) = 384.237, P < .001$ , CFI = 0.947, GFI = 0.908, AGFI = 0.864, NFI = 0.921. The obtained values are within the limits of specification and demonstrate a satisfactory fit for the hypothesized model with the data. First, we assessed the composite reliability (CR), Cronbach alpha ( $\alpha$ ), and the indicator loadings of the instrument to test the internal reliability of the scale. All the constructs exhibited good internal consistency, as indicated by the results from their respective composite reliabilities, which ranged from 0.817 to 0.878. The alpha values were all above the 0.7 thresholds proposed by Ref. [45]. Regarding the convergent validity [46] suggested that the Average Variance Extracted (AVE) should be larger than 0.50. All constructs have an AVE value above 0.50, which indicates adequate convergent validity. Table 4 gives further details of the reliability and validity measures. For discriminant validity, the square roots of the AVE's were above all other cross-correlations (see Table 5), thus indicating good discriminant validity [45]. Table 2 provides details of the descriptives.

### 3.5. Structural model report

The study used the SPSS AMOS 22 version to calculate the direct effects in the model. Moderation effects were calculated using the mean centering approach in SPSS and AMOS22. Results obtained indicated an overall model fit with  $\chi^2(98) = 927, P < .000$ . Model fit indices were found to be within the acceptable range with CMIN/DF = 3.921, CFI = 0.917, GFI = 0.973, NFI = 0.962, and RMSEA = 0.044.

First, the study tested the main effect model by estimating the direct relationship between the explanatory variable (Social Distancing, Personal Protective Equipment, and Hand Hygiene) and the explained variable (Quality of Life). Hadi, Abdullah and Sentosa [47] recommended that when dealing with the structural equation model (SEM), it is important to first test the direct relationship between the main effect (effect of platform language ease of use on the online consumer repurchase decision) before adding mediating variables. With this in mind, the impact of COVID-19 safety protocols on health workers' quality of life was measured. Fig. 2 shows the direct effect model only and Table 6 gives a detailed description of the main effect model. Obtained results indicate that Hand Hygiene has a significant positive influence on the Quality of life of health workers whiles Social distancing and Personal protective equipment had a significant but negative impact on health workers' quality of life. This result supports our hypotheses H1, H2, and H3.

That is, a unit increase in hand hygiene among health workers increases their quality of life by 27 % whereas a unit increase in the health workers' social distancing and use of personal protective equipment has the probability of decreasing their quality of life by 19 % and 14 % respectively. The effect size of the three direct effects on the health worker quality of life indicates that hand hygiene has a higher effect on health workers' quality of life than PPEs and social distancing.

**Table 2**  
Mean, standard deviation, skewness, and kurtosis of constructs.

|                                      | Mean | Std. Deviation | Skewness | Kurtosis |
|--------------------------------------|------|----------------|----------|----------|
| Physical Distance (PD)               |      |                |          |          |
| PD1                                  | 3.81 | 1.268          | -0.825   | -0.435   |
| PD2                                  | 4.20 | 1.010          | -1.290   | 1.136    |
| PD3                                  | 4.08 | 1.044          | -0.986   | 0.217    |
| Personal Protective Equipments (PPE) |      |                |          |          |
| PPE1                                 | 3.98 | 1.108          | -0.950   | 0.231    |
| PPE2                                 | 4.17 | 0.892          | -0.954   | 0.681    |
| PPE3                                 | 4.19 | 0.931          | -1.140   | 1.015    |
| Hand Hygiene (HH)                    |      |                |          |          |
| HH1                                  | 3.41 | 1.043          | -0.388   | -0.149   |
| HH2                                  | 3.54 | 1.080          | -0.488   | -0.165   |
| HH3                                  | 3.60 | 1.068          | -0.504   | -0.223   |
| HH4                                  | 3.47 | 1.075          | -0.490   | -0.090   |
| Physical Health (PH)                 |      |                |          |          |
| PH1                                  | 3.12 | 1.157          | -0.221   | -0.594   |
| PH2                                  | 3.41 | 1.130          | -0.409   | -0.450   |
| PH3                                  | 3.01 | 1.142          | -0.190   | -0.580   |
| PH4                                  | 3.17 | 1.116          | -0.241   | -0.435   |
| Mental Health (MH)                   |      |                |          |          |
| MH1                                  | 3.48 | 1.203          | -0.520   | -0.513   |
| MH2                                  | 3.35 | 1.165          | -0.364   | -0.605   |
| MH3                                  | 3.27 | 1.112          | -0.295   | -0.457   |
| MH4                                  | 3.63 | 1.112          | -0.592   | -0.197   |
| Quality of Life (QOL)                |      |                |          |          |
| QOL1                                 | 3.67 | 0.999          | -0.355   | -0.393   |
| QOL2                                 | 4.08 | 0.938          | -0.792   | 0.008    |
| QOL3                                 | 4.06 | 0.894          | -0.608   | -0.269   |
| QOL4                                 | 3.88 | 1.030          | -0.678   | -0.055   |

**Table 3**  
KMO and Bartlett's test.

| Kaiser-Meyer-Olkin Measure of Adequacy. |                   | Sampling 0.831 |
|---|-------------------|----------------|
| Bartlett's Test of Sphericity           | Approx. Square Df | Chi-4638.123   |
|   | Sig.              | 0.000          |

**Table 4**  
Reliability and validity measures.

| Factor Items | Loadings | $\alpha$ | CR    | AVE   |
|--------------|----------|----------|-------|-------|
| PD1          | 0.559    | 0.717    | 0.817 | 0.607 |
| PD2          | 0.864    |          |       |       |
| PD3          | 0.873    |          |       |       |
| PPE1         | 0.670    | 0.856    | 0.878 | 0.710 |
| PPE2         | 0.923    |          |       |       |
| PPE3         | 0.911    |          |       |       |
| HH1          | 0.600    | 0.804    | 0.867 | 0.625 |
| HH2          | 0.840    |          |       |       |
| HH3          | 0.819    |          |       |       |
| HH4          | 0.874    | 0.827    | 0.809 | 0.516 |
| PH1          | 0.652    |          |       |       |
| PH2          | 0.780    |          |       |       |
| PH3          | 0.633    | 0.830    | 0.863 | 0.613 |
| PH4          | 0.794    |          |       |       |
| MH1          | 0.813    |          |       |       |
| MH2          | 0.799    | 0.863    | 0.866 | 0.620 |
| MH3          | 0.801    |          |       |       |
| MH4          | 0.714    |          |       |       |
| QOL1         | 0.630    | 0.863    | 0.866 | 0.620 |
| QOL2         | 0.881    |          |       |       |
| QOL3         | 0.827    |          |       |       |
| QOL4         | 0.790    |          |       |       |

**Table 5**  
Correlation and discriminant validity.

|             |     | SD           | PPE          | HH           | PH           | MH           | QoL          |
|-------------|-----|--------------|--------------|--------------|--------------|--------------|--------------|
| Correlation | PD  | <b>0.779</b> |              |              |              |              |              |
|             | PPE | 0.548        | <b>0.842</b> |              |              |              |              |
|             | HH  | 0.532        | 0.487        | <b>0.790</b> |              |              |              |
|             | PH  | 0.400        | 0.529        | 0.617        | <b>0.718</b> |              |              |
|             | MH  | 0.432        | 0.489        | 0.333        | 0.598        | <b>0.782</b> |              |
|             | QoL | 0.311        | 0.243        | 0.441        | 0.195        |              | <b>0.787</b> |

\*\*Bold items represent the square root of the AVE.

Further, the study employed the 95 percent confidence interval standard bootstrapping method with 5000 sample size for the mediation analysis. Results of the structural relationship for the mediating model indicated good model fit indices with  $\chi^2(98) = 1103$ ,  $p < .000$ , CFI = 0.962, GFI = 0.980, AGFI = 0.965 and RMSEA = 0.024. The model fit indices were within the acceptable ranges. Social distancing had a significant negative effect  $\beta = -.210$ ,  $p < .001$  on mental health but its effect on physical health was observed to be insignificant. Personal protective equipment had a significant negative effect on the mental health of health workers ( $\beta = -.20$ ,  $p < .001$ ) and also had a significant positive effect on physical health ( $\beta = .24$ ,  $p < .001$ ). Hand hygiene has a significant positive effect on both physical ( $\beta = .470$ ,  $p < .001$ ) and mental health ( $\beta = .100$ ,  $p < .05$ ). Comparatively, hand hygiene has a larger effect size  $\beta = .470$  on physical health than on mental health ( $\beta = .100$ ). This indicates hand hygiene has a high impact on health workers physical health than their mental health. There was a significant positive direct relationship between physical health and mental health ( $\beta = .483$ ,  $p < .001$ ). This implies an increase in the physical health of health workers increases their mental health by 48 %. Mental health mediated the relationship between physical health and the quality of life of health workers during the COVID pandemic. Both physical health and mental health have a significant positive impact on health workers' quality of life with a positive coefficient of  $\beta = .063$  and  $\beta = .482$  respectively at  $p < .001$ . However, the effect size of health workers' mental health on their quality of life ( $\beta = .482$ ) is far greater than that of their physical health on quality of life ( $\beta = .062$ ). This implies health workers' mental health has more influence on their quality of life compared to their physical health. Detailed results is presented in Fig. 3 and Table 7.



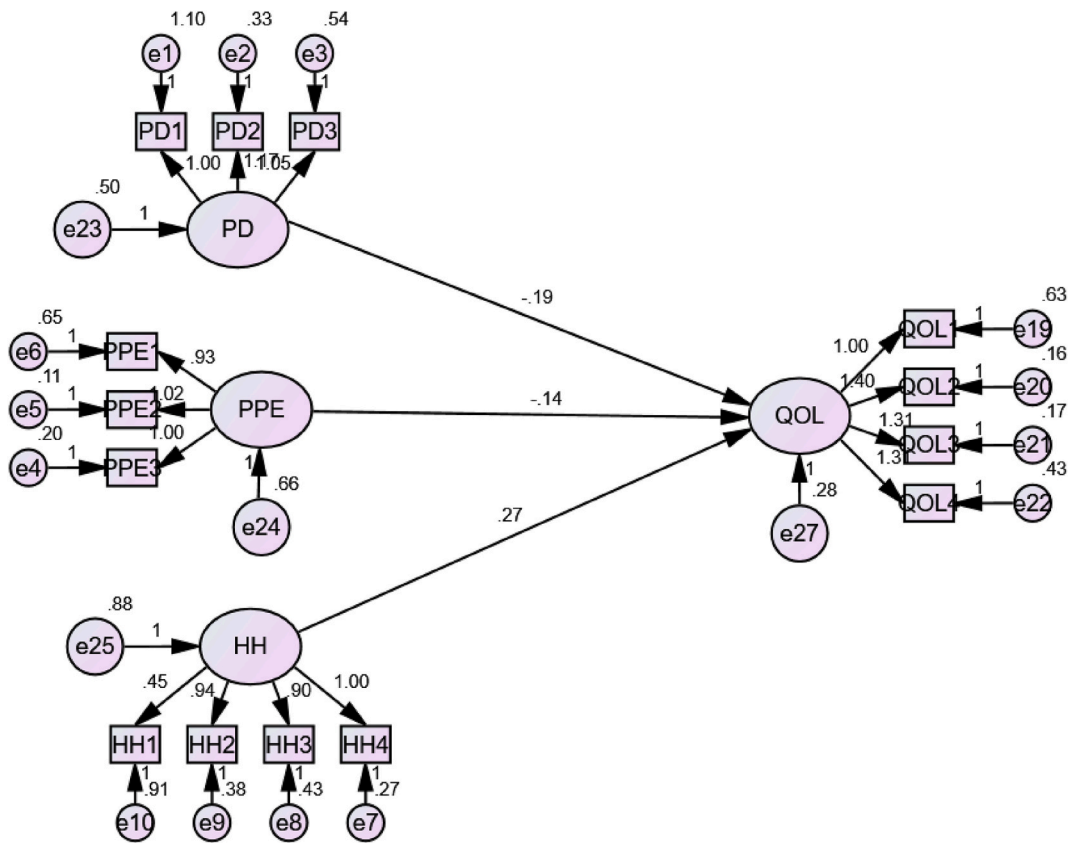


Fig. 2. Direct effect model.

Table 6  
Direct effect model results.

|     |    |     | Estimate | S.E.  | C.R.   | P   |
|-----|----|-----|----------|-------|--------|-----|
| QOL | <— | PD  | −0.194   | 0.056 | −3.486 | *** |
| QOL | <— | PPE | −0.144   | 0.042 | −3.421 | *** |
| QOL | <— | HH  | 0.270    | 0.042 | 6.433  | *** |

### 3.6. Post hoc tests

In our study, we initially posited that the causal relationships within our model flowed in one direction. To address any potential concerns regarding reverse causality, we implemented a test where we inverted all the pathways in our model. The outcomes of this inversion showed insignificant path estimates and a notable decrease in the model’s fit. Specifically, the Root Mean Square Error of Approximation (RMSEA) worsened, moving from 0.025 to 0.13, and the chi-square statistic notably shifted from 1103(98) with a p-value of 0.000–138(98) also at  $p = 0.000$ . These marked changes in the model’s fit metrics robustly indicate that reverse causality is unlikely to be a valid concern in our study context.

Furthermore, we conducted a sensitivity analysis by excluding the control variables from our model to examine their impact. The results of this analysis were consistent with our main model, indicating that the removal of control variables did not materially influence the significance or direction of the variable coefficients. This consistency supports the robustness of our findings, affirming that our conclusions are not dependent on the inclusion of control variables and reinforcing the validity of our original model and its interpretations.

## 4. Discussion

This study of Quality of Life is a growing research area that has gained much attention in recent years [24]. Adherence to COVID-19 safety protocols, such as personal protective equipment (PPE) usage, physical distancing (PD), and hand hygiene (HH), is crucial for protecting the health and well-being of health workers. It is important to understand how these protocols influence their QoL so that

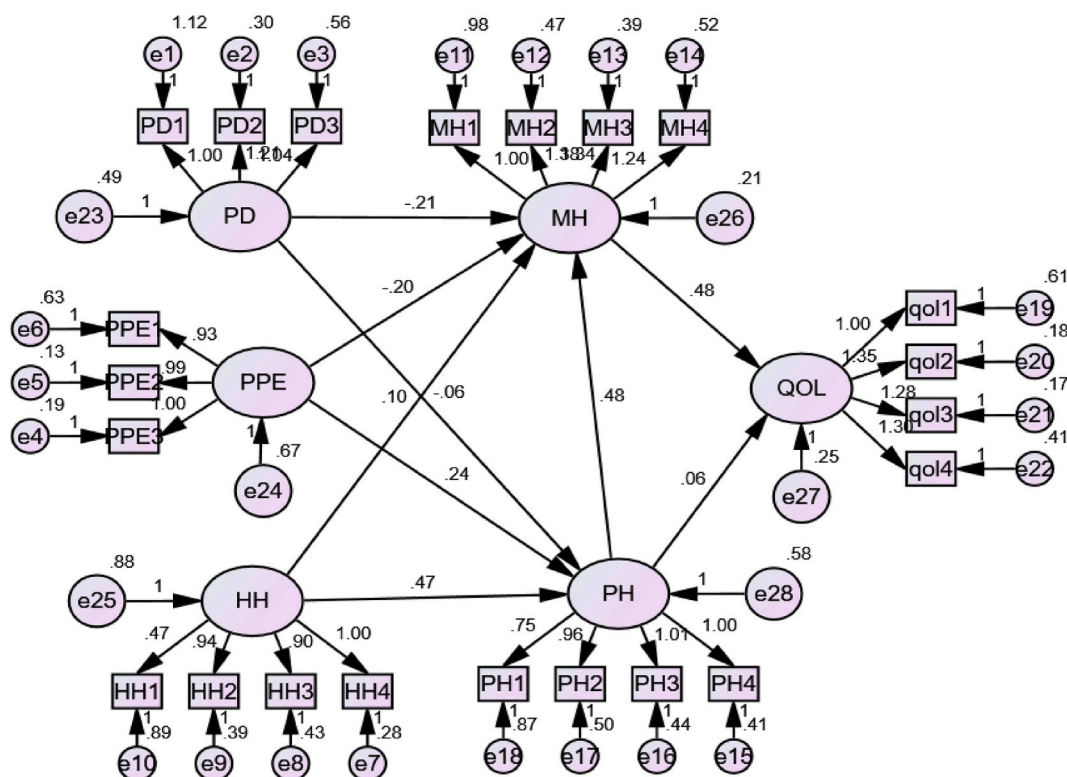


Fig. 3. Main and mediating effect model.

Table 7  
Main and mediating effect model.

|                 | Estimate | S.E.  | C.R.   | P      |
|-----------------|----------|-------|--------|--------|
| HH → PH         | 0.472    | 0.059 | 7.988  | ***    |
| PPE → PH        | 0.239    | 0.062 | 3.869  | ***    |
| PD → PH         | -0.061   | 0.077 | -0.792 | 0.428  |
| PD → MH         | -0.214   | 0.057 | -3.736 | ***    |
| PPE → MH        | -0.204   | 0.046 | -4.469 | ***    |
| HH → MH         | 0.102    | 0.044 | 2.283  | 0.022  |
| PH → MH         | 0.483    | 0.065 | 7.457  | ***    |
| MH → QoL        | 0.482    | 0.087 | 5.536  | ***    |
| PH → QoL        | 0.063    | 0.053 | 1.182  | ***    |
| Indirect effect | Estimate |       | LL     | UL     |
| PD → PH → QoL   | -0.036   |       | -0.097 | -0.004 |
| PD → MH → QoL   | -0.101   |       | -0.226 | -0.054 |
| PPE → PH → QoL  | 0.144    |       | 0.029  | 0.311  |
| PPE → MH → QoL  | -0.096   |       | -0.211 | -0.010 |
| HH → PH → QoL   | 0.028    |       | 0.007  | 0.088  |
| HH → MH → QoL   | 0.048    |       | 0.002  | 0.102  |

future adjustments can be made when attempting to improve HW’s QoL. It is necessary to validate the linkage between the COVID-19 protocols and health workers’ quality of life during the COVID era.

The study revealed a significant relationship between adherence to COVID-19 safety protocols and the health worker’s quality of life. Hand hygiene procedures had a significant positive relationship with the health worker’s quality of life. This finding is in line with previous research [30]. Physical distancing and PPEs such as nose masks were found to have a significant negative effect on the health worker’s quality of life. Physical distance involves frontline health workers not coming into close contact with their family and friends after a hard day of exhausting work. This, in some way, had a toll on their quality of life and hence led to a significant negative effect on their quality of life.

Results of the mediating model indicated a significant effect between the various protocols and the mental and physical health of health workers. Hand hygiene and PPEs had positive effects on the physical health of health workers. Not only did HH protect workers from acquiring the COVID-19 virus, but it also protected them from other germs on pieces of equipment, patients, and people they meet

and shake in the course of their work duties. As such, hand hygiene undoubtedly increases an individual's physical health. Also, protective equipment like the nose mask prevents the health worker from breathing in not only the COVID-19 virus but also other infectious diseases that are rampant in the health center. Therefore, PPEs improve health workers' physical health. This finding has been supported by extant literature on quality of life<sup>34</sup>. The study found no significant effect on the relationship between physical distancing and physical health. This finding is also supported by literature [48].

Hand hygiene indicated a significant positive effect on the mental health of health workers. Literature posits that personal hygiene increases a person's perception of mental health [49]. As such, the findings of this study are supported by literature, and the relationship between hand hygiene and mental health is justified. Physical distancing had a negative significant effect on the mental health of health workers. This is because health workers during the COVID-19 era were the most exposed people to the virus [50]. Physical distancing prevented health workers from finding solace in family, friends, and colleagues after a tedious day at work. This definitely has a toll on the mental health of health workers. The wearing of nose masks and other protective equipment contributed negatively to the mental health of health workers during the COVID-19 pandemic, as stated by [51]. Instances were recorded where these protective wears suffocated health workers and made some uncomfortable [52].

Physical health also had a significant positive effect on mental health. This highlights the importance of the health workers' physical health on their general quality of life. Good physical health will give an even better mental health [40]. Both physical and mental health had a positive effect on quality of life. This means increasing the physical and mental health of health workers during the COVID-19 period improved their quality of life. However, the health worker's mental health was found to have a larger effect size on their quality of life as compared to their physical health. Since the health worker's physical health has a significant effect on their mental health, the effect of mental health on quality of life will be greater, especially since mental health also plays a mediating role between physical health and quality of life.

#### 4.1. Theoretical contribution

The study's utilization of SCT provides a framework for understanding how health workers' behaviors, influenced by social, environmental, and personal factors, interact with COVID-19 safety protocols to impact their quality of life. This integration highlights the importance of considering cognitive, behavioral, and environmental factors in interventions aimed at improving health workers' well-being during pandemics. Additionally, by examining the mediating effects of physical and mental health on the relationship between COVID-19 protocols and quality of life, the study contributes to a deeper understanding of the mechanisms through which these protocols influence health workers' well-being. This highlights the importance of considering both physical and mental health outcomes when evaluating the effectiveness of safety protocols. Further, the study's discovery of diverse effects from different COVID-19 protocols on health workers' quality of life challenges traditional thinking, emphasizing the necessity for a detailed approach to protocol implementation. Recognizing the differing impacts of measures like hand hygiene, physical distancing, and PPE usage can guide customized interventions aimed at reducing adverse effects and improving overall well-being. Insights from this study can inform the design of interventions aimed at improving health workers' well-being during public health crises. By identifying specific factors that influence quality of life, such as hand hygiene practices and social support networks, interventions can be tailored to address these factors and promote resilience among health workers.

#### 4.2. Managerial implications

The study's findings highlight the critical relationship between adherence to COVID-19 safety protocols and the quality of life (QoL) of health workers, revealing both positive and negative impacts. Hand hygiene emerged as a significant positive factor, enhancing both physical and mental health, suggesting that comprehensive hand hygiene programs are essential. These programs should ensure easy access to supplies, reinforce proper practices, and promote a culture of cleanliness and infection control.

Conversely, physical distancing and the use of personal protective equipment (PPE) were found to affect health workers' quality of life negatively. The discomfort and isolation caused by these measures underscore the need for healthcare management to address these issues proactively. For PPE, this implies investing in the development of more comfortable, breathable options and providing training to minimize discomfort. For physical distancing, creating virtual communication tools and mental health services can help mitigate feelings of isolation.

Moreover, the study underlines the importance of mental health services as part of workplace safety protocols. Regular mental health check-ins, on-site psychological support, and dedicated stress reduction programs should be integrated into health workers' safety measures. Additionally, redesigning PPE to improve comfort without compromising safety and developing comprehensive well-being programs that address both physical and social needs are vital steps. These programs should include safe spaces for interaction, virtual meetups to reduce isolation, and accessible physical wellness programs.

To implement these recommendations effectively, healthcare organizations must prioritize the mental and physical well-being of their workforce. This involves continuous assessment and adaptation of health and safety protocols to ensure they protect against physical health risks while also supporting mental health and overall quality of life. By doing so, healthcare managers can enhance the resilience and well-being of their workforce, ultimately improving the quality of care provided to patients.

#### 4.3. Limitation

Our study employed a convenient sampling method for data collection, primarily focusing on health workers within Ghana. While

this approach facilitated efficient data gathering within a specific context, it inherently limits the generalizability of our findings. The sample's geographical and professional concentration may not fully represent the diverse experiences and impacts of COVID-19 safety protocols on health workers globally. Consequently, the insights derived might not be directly applicable to health workers operating in different healthcare systems, cultural contexts, or epidemiological conditions. Future research could benefit from employing a more diverse sampling strategy, potentially incorporating a stratified or random sampling approach to encompass a broader demographic and professional spectrum of health workers. Such an expansion would enhance the generalizability of findings and provide a more comprehensive understanding of the safety protocols' impacts across various settings.

Additionally, our investigation concentrated exclusively on the quality of life (QoL) implications of COVID-19 safety protocols for health workers without considering the broader societal implications. This focus was chosen due to the critical role health workers play in the frontline defense against the pandemic and the unique challenges they face. However, it is essential to recognize that COVID-19 safety protocols have also significantly impacted the quality of life of the general population. These impacts may vary widely, influenced by factors such as occupation, socioeconomic status, and access to healthcare resources. Future studies could explore these dynamics, examining how different segments of the population have been affected by the implementation of safety protocols. Such research could provide valuable insights into the protocols' broader social implications, informing more holistic public health strategies that consider the well-being of both healthcare professionals and the communities they serve. By addressing these limitations, future research can build on our work to offer more generalized and comprehensive insights into the effects of COVID-19 safety protocols on the quality of life, extending beyond the healthcare workforce to include the wider population.

## 5. Conclusion

During the COVID-19 pandemic, lots of protocols were put in place by different authorities in an attempt to improve the quality of lives of health workers. Hand hygiene, personal protective equipments, and physical distancing are three major protocols that were used all over the world to curb the spread of the virus and improve the quality of life of individuals during the pandemic. Hand hygiene (HH) emerged as the most positively adapted protocol. This practice not only significantly enhances physical health by preventing the spread of COVID-19 and other germs but also positively affects mental health, improving health workers' overall perception of their well-being. The pandemic is now a thing of the past, and countries all over have gone back to their normal routine duties. This study aims to fill that gap. Knowledge of this will help health organizations to improve their strategies for improving quality of life should there be any future pandemic.

### Informed consent

It was verbally communicated to participants that their consent to partake in the research was implied by responding to and returning the questionnaire. They were provided the opportunity to withdraw at any point. All the respondents willingly participated in this study and were informed about the aim of the study. They were also assured of optimum anonymity and confidentiality of their responses. The respondents were made aware that their responses were for only academic exercise.

### Ethical approval

Ethical approval was obtained before the conduction of this study and was first delivered by the Academic Research Board of Jiangsu University; with the approval number JU-EBR: 15/12/22. Besides, the selected hospitals' ethics and internal review boards also gave their permission and support for the data collection.

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### Data availability statement

Corresponding author can provide access to the dataset used in this study upon request.

### CRediT authorship contribution statement

**Adams Yunus:** Writing – review & editing, Writing – original draft, Project administration, Conceptualization. **Lulin Zhou:** Supervision, Funding acquisition. **Stephen Addai-Dansoh:** Writing – review & editing, Writing – original draft. **Evelyn Agba Tackie:** Writing – review & editing, Software, Formal analysis. **Owusu Esther Agyeiwaa:** Writing – review & editing, Investigation. **Sufyan Sannah Gbolo:** Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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