



# Physical Burden and Perceived Stress of Personal Protective Equipment During COVID-19 Pandemic: A Retrospective Study in the United Arab Emirates

SAGE Open Nursing  
Volume 9: 1–8  
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DOI: 10.1177/23779608231186754  
journals.sagepub.com/home/son



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## Abstract

**Introduction:** Over the course of the COVID-19 pandemic, personal protective equipment (PPE) has become necessary. According to published research, PPE-related physical impacts were probably underreported during the pandemic.

**Objective:** To examine the physical burden and perceived stress associated with prolonged PPE wearing among nurses during the COVID-19 pandemic in the United Arab Emirates (UAE).

**Methods:** This was a cross-sectional retrospective study of 209 nurses working in two hospitals in the UAE. A convenience sampling technique was applied, and the data were collected using an online questionnaire. Data collection was completed within three months (April 2022 to June 2022). The completed questionnaires were analyzed using SPSS version 21. Chi-square statistics was used to test the association of categorical variables at a 5% level of significance.

**Results:** A total of 209 nurses had a mean age of  $38.4 \pm 8.7$  years. More than 65.1% wore PPE continuously for 4 hrs per day. The most common physical burdens reported were difficulty in breathing (62.2%), excessive thirst (41.6%), and facial itchiness (39.2%). Most participants (95.2%) reported high-stress levels. There was no significant association between the level of stress and the duration of wearing PPE ( $p = .43 > .05$ ). However, the authors found a statistically significant association between breathing difficulty with face masks and the duration of wearing them ( $p < .05$ ). In addition, itchiness/rash related to gloves was significantly associated with wearing duration ( $p < .05$ ).

**Conclusion:** Findings show that nurses experienced adverse effects from PPE use, which increased with the number of hours of wearing. Further studies with a larger sample size will allow for generalization of the study results.

## Keywords

physical burden, personal protective equipment, COVID-19 pandemic, United Arab Emirates

Received 2 April 2023; Revised 18 June 2023; accepted 20 June 2023

## Introduction/Background

Personal protective equipment (PPE) has become an important subject during the COVID-19 pandemic, owing to the high transmissibility of severe acute respiratory syndrome-coronavirus 2 infections (Galani et al., 2021). Nurses and other healthcare workers (HCWs) provided care to patients in high-risk care settings, including isolation wards, intensive care units (ICUs), emergency rooms, and general medical and surgical wards (Galani et al., 2021); therefore, they

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were obliged to wear PPE (respiratory and eye protection, gowns, and gloves) to interrupt infection transmission.

N95 masks, surgical masks, goggles or face visors, gloves, aprons, and gowns were recommended by the World Health Organization as essential PPE, while alcohol-based disinfectants and soap are advised to maintain good hand hygiene (World Health Organization, 2020). Concerns have been expressed about the rising incidence of occupationally caused adverse effects due to the prolonged duration that HCWs are required to wear PPE while delivering care during the COVID-19 pandemic (Gheisari et al., 2020; Lan et al., 2020; Navarro-Triviño & Ruiz-Villaverde, 2020). It is important to note that various research studies on COVID-19 have been conducted among healthcare professionals in the United Arab Emirates (UAE). Ilesanmi et al. (2021) reported an increased burden of caregiving among nurses in the region. However, to the best of the researchers' knowledge, there seems to be a dearth of studies on the consequences of prolonged PPE use by healthcare personnel in this region.

## Literature Review

A review of the published literature suggests that wearing PPE for an extended period of time increases the risk of skin irritation as well as other symptoms such as burning, discomfort, blisters, skin tears, acne, abrasions, eczema/atopic dermatitis, and allergic responses (Agarwal et al., 2020; Aloweni et al., 2022; Daye et al., 2020; Vidua et al., 2020). In addition to the physical symptoms, nurses practicing in high-workload departments such as Emergency Departments (EDs) and ICUs reported considerable mental burdens, including communication problems, depression, anxiety, isolation, and sadness (Xia et al., 2020). A study conducted in Italy by Vidua et al. (2020) noted that nurses reported facial bruises and falling asleep over workstations due to the constant wearing of PPE. Additionally, Unoki et al. (2021) observed several negative consequences, including pressure ulcers, heat exhaustion, thirst, and inability to use the restroom, in a scoping review of the literature on the impact of PPE among healthcare professionals in ICUs during the COVID-19 pandemic. Similarly, Tabah et al. (2020) in Australia revealed that 49% ( $n = 211$ ) of healthcare professionals in the ICU experienced at least one negative consequence of wearing PPE in a cross-sectional web-based survey (PPE-SAFE).

Xia et al. (2020) examined the psychological and physical effects of PPE on 279 HCWs in Wuhan, China. According to the authors, 81.8% of the study participants reported face mask-related retroauricular pain as the most common adverse event. The authors also noted chest pain and dyspnea, lightheadedness, and pressure sores on the face around the nose (81%), cheeks (66.5%), forehead (45.1%), and retroauricular areas (43.6%).

According to Vidua et al. (2020), healthcare professionals have trouble working on PPE for extended periods of time because of headaches, dehydration, and urine retention. Also reports from China and Europe, showed that the extended PPE time has a number of issues (Lan et al., 2020). For example, China has a more distinct winter season, whereas European nations are typically distinguished by their temperate climates, which feature colder temperatures and drier conditions throughout the summer months (Lan et al., 2020). Yokomichi et al. (2021) noted that atopic dermatitis might also be more common in hot, humid settings. One theory to explain this phenomenon is that increased sweating under humid conditions impairs the barrier function of the skin, which promotes cellular turnover, resulting in an increased incidence and severity of atopic dermatitis in susceptible individuals (Kim & Leung, 2018). This retrospective study was conducted to examine the physical implications and perceived stress experienced by nurses during the COVID-19 pandemic.

## Methods

**Design:** This study was a retrospective cross-sectional survey of nurses working in ICUs and ED of two designated COVID-19 isolation hospitals: Obaidullah Geriatric Hospital and Ibrahim Bin Hamad Obeidallah Hospital, UAE.

### Research Questions

What are the types of physical burdens experienced by nurses from prolonged use of PPE?

What is the level of perceived stress associated with prolonged PPE use among nurses?

What is the association between the type of physical burden and hours of wearing PPE?

**Sample Size Calculation:** Raosoft online calculator was used to determine a sample size of 209 out of 300 nurses in the hospitals, with a 5% margin of error and 95% confidence level (Raosoft, Sample Size Calculator, Inc., 2004; <http://www.raosoft.com/samplesize>).

The convenience sampling technique was used to select the participants.

**Inclusion/Exclusion Criteria:** Only nurses who had worked for at least three months in the hospital and directly cared for patients with COVID-19 were included in the study.

**Data Collection Tool:** Data was gathered using two structured survey tools. A thorough assessment of the literature served as the foundation for the survey instrument on the physiological effects of PPE, which was then subjected to content validity testing by qualified researchers and nurses working in infection control departments in the hospitals. Questionnaire 1 was a six-item multiple-choice question examining the physiological consequences of various forms of PPE.

The Cohen’s Perceived Stress Scale (PSS; Cohen et al., 1983) is a validated tool with approved psychometrics and a 10-item scale to assess participants’ perceptions of their degree of stress (Questionnaire 1). Each participant provided feedback on each item on a Likert scale ranging from 0 to 4 (0 = never, 1 = practically never, 2 = seldom, and 3 = fairly). The total PSS score was calculated and categorized as low (0–13), moderate (14–26), or high (27–40). However, as indicated by content validity experts, certain statements were rephrased to better fit the study’s aims. Each item’s computed Item Content Validity Index score fell between a range of 0.8 and 1, indicating that all of the items were suitable and had high validity. The Score-Content Validity Index was 0.91. The interrater reliability coefficient is 0.92. The participants responded to a Google Form-powered online survey. A brief description of the study’s goals and advantages was provided to the participants as part of an introduction to the online survey.

**Data Analysis:** Data from Microsoft Excel were entered into SPSS version 21.0. Chi-square statistics was used to test the association of categorical variables at a 5% level of significance.

**Results:** The respondents’ sociodemographic characteristics are shown in Table 1. According to the table, the participants’ average age was 38.44 ± 8.67, with 88% of the total population being female (184). The majority of participants (58.4%) had Bachelor of Science in Nursing degrees, 85

(40.6%) worked in ICUs, and 53 (25.3%) worked in the ED. There were 156 (74.6%) employees who worked 12 hrs per day and 86 (41.1%) who worked four days per week.

**Categories for the PSS, Average PPE Wear Time, and Different Types of Masks**

The findings indicated that the disposable surgical mask 146 (69.9%) was the most popular face mask worn by nurses during work. However, 63 (30.5%) participants wore a respirator with an N95 filtering facepiece respirator (FFPR). Only 31 (14.8%) nurses reported an average PPE-wearing time of 12 hrs, while the majority of nurses 136 (65.1%) reported an average time of 4 hrs of wearing the PPE. The findings showed that 199 (95.5%) patients reported high levels of stress related to PPE (Table 2).

**Physical Burden of Prolonged Facemask:** From Figure 1, 130 (62.2%) experienced breathing difficulty and 87 (41.6%) reported excessive thirst and dry mouth. Other symptoms included facial itchiness/rash (39.2%) and headache (32.1%). However, only 29 (13.9%) nurses reported visual problems.

**Physical Effects of Prolonged Gloving:** From the findings in Figure 2, the common skin problems due to prolonged gloving included dryness 151 (72.2%), itching/rash 102 (48.8%), and skin chapping 33 (15.8%).

**Physical Effects of Wearing Coveralls:** The findings indicated that 162 (77.5%) participants experienced excessive sweating due to wearing coveralls, mask soaking (37.8%), and inability to urinate (40.2%). Furthermore, 63 (30.1%) patients reported headaches, skin rashes (16.3%), and claustrophobia (12.4%).

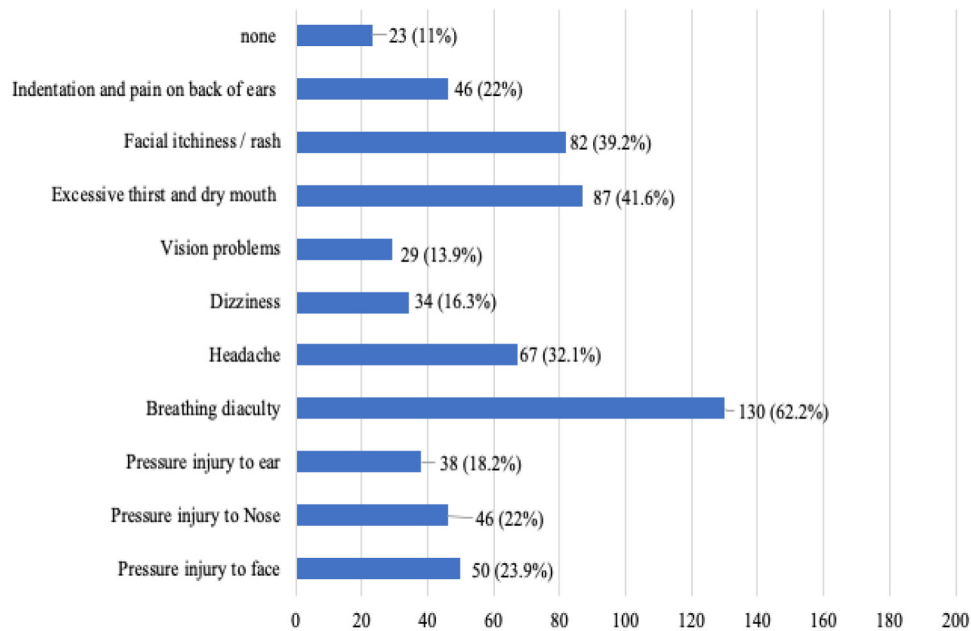
**Table 1.** Demographic Characteristics.

Variable	Frequency	Percent (%)
<b>Age (<math>\bar{x} \pm SD</math>)</b>	38.44 ± 8.67	
<b>Gender</b>		
Male	25	12
Female	184	88
<b>Educational level</b>		
Diploma	67	32.1
Bachelor degree	122	58.4
Higher degree (MSN, PhD) degree	20	9.6
<b>Unit of work</b>		
ICU 1 and ICU 2	85	40.6
Emergency department	53	25.3
Male wards 1 and 2	71	33.9
<b>Working hours per day</b>		
8 hr	53	25.4
12 hr	156	74.6
<b>Days of work per week</b>		
3 days	65	31.1
4 days	86	41.4
5 days	48	27.8
<b>Designation</b>		
Staff nurse	163	78
Ward charge	15	7.2
Nurse supervisor	11	5.3

**Table 2.** Categories for the PSS, Average PPE Wear Time, and Different Types of Masks (n = 209).

Types of mask	
Disposable surgical mask	146 (69.9%)
N95 FFPR	63 (30.5%)
<b>Average wearing time of PPE</b>	
4 hr	136 (65.1%)
6 hr	9 (4.3%)
8 hr	24 (11.4%)
12 hr	31 (14.8%)
Other	9 (4.4%)
<b>PSS categories</b>	
Low (0–13)	2 (1.0%)
Moderate (14–26)	8 (3.8%)
High (27–40)	199 (95.2%)

Note. FFPR = filtering facepiece respirator; PPE = personal protection equipment; PSS = perceived stress scale.



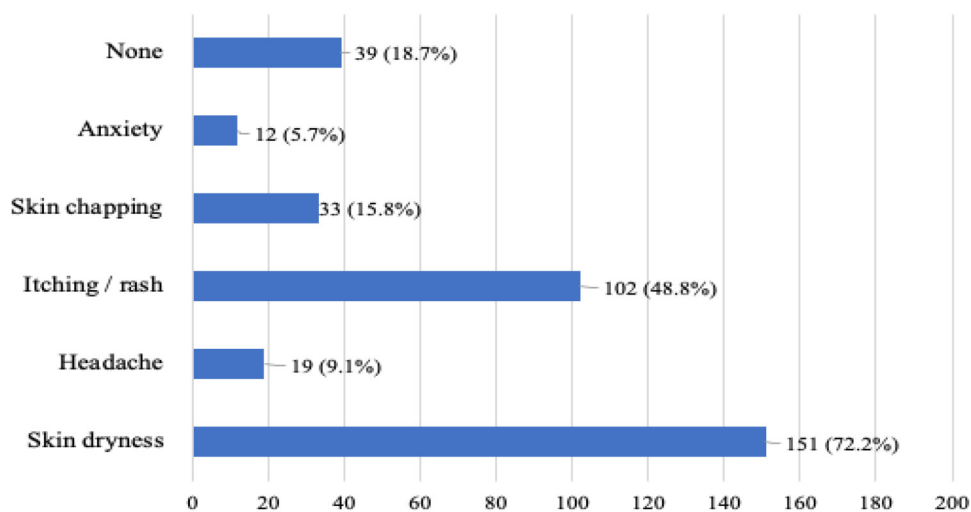
**Figure 1.** Physical burden of a facemask.

As shown in Table 3, the majority of the nurses (103) reported a high level of stress with an average of 4 hrs of continuous wearing time of PPE. In addition, 25 reported a high-stress level with an average 8 hrs PPE-wearing time. However, the findings showed no significant association between the average PPE-wearing time and the level of stress among nurses ( $X^2 = 7.423$ ,  $p = .43$  and  $>.05$ ).

As shown in Table 4, breathing difficulty was significantly associated with prolonged use of facial masks ( $p = .00$  and  $<.05$ ). In addition, itching and rashes were statistically associated with prolonged glove use ( $p = .04$  and  $<.05$ ).

## Discussion

Protecting HCWs from infection through appropriate infection prevention protocols is critical. PPE plays a fundamental role in achieving this objective, although the literature is consistent with the fact that prolonged PPE is associated with physical and mental burdens. This study aimed to investigate the physical burden of prolonged PPE, including nurses' perception of stress during the COVID-19 pandemic. In this survey, more than 65.1% of the nurses said that they continuously wore PPE for 4 hrs each day. Breathing difficulties (62.2%), facial itching (32.1%), indentation and soreness behind the ears, and pressure injuries to the ear (18.2%),



**Figure 2.** Effect of prolonged gloving.

**Table 3.** Analysis of Association Between Wearing Time of Personal Protection Equipment (PPE) With Perceived Level of Stress.

		Categorized Scores			Total	Chi-Square Value	P-Value
		High Stress	Low Stress	Moderate Stress			
Average PPE-wearing time	4	103	2	2	107	7.423	.43
	6	13	0	1			
	8	25	0	0			
	12	21	0	1			
	Other	37	0	4			
Total	199	2	8	209			

nose (22%), and face (23.9%) were among the physical burdens mentioned by the survey participants. These findings are consistent with those of a study conducted in Singapore by Aloweni et al. (2022). The authors stated that 53.8% ( $N=592$ ) of participants had PPE-related side effects, which supports the findings from other earlier studies, showing a high prevalence of pressure injuries and acne flare-ups when wearing face masks (Abiakam et al., 2021; Bambi et al., 2021; Chiriach et al., 2020; Han et al., 2020; Yaqoob et al., 2021). According to Han et al. (2020), prolonged usage of masks may cause acne to flare up more frequently due to increased temperature and humidity on the face, secondary to stale air and perspiration.

In the current study, there was a statistically significant association between time spent on gloves and skin itchiness ( $p < .05$ ). A study by Daye et al. (2020), who assessed the skin issues in HCWs wearing PPE during the COVID-19 pandemic, supports the current findings. Accordingly, scientists have claimed that lichenification, dryness, itching, cracking, burning, flaking, and scabbing are the most common skin issues (Daye et al., 2020). Maintaining skin integrity is crucial for infection prevention because the skin serves as the body’s main line of defense against infection. According to Pei et al. (2020), the use of PPE (goggles, masks, and protective garments) can compromise skin integrity. Therefore, attention should be paid to dermatological issues. Atzori et al. (2020) discovered that dryness, irritation, and burning were most prevalent among HCWs. The most frequently affected areas were the bridges of the nose, palms, cheeks, and periocular and perioral regions. In the current study, nasal and facial injuries were reported in 22% and 23.9% of participants, respectively. Furthermore, Daye et al. (2020) found that female HCWs were more likely to have skin issues than male HCWs. However, the authors of the current study did not make connections between incidence and sex.

Similarly, Lan et al. (2020) reported that wearing N95 masks and goggles caused substantial levels of cutaneous irritation. These skin issues may affect the nurses’ quality of life in terms of dermatology. In the current study, 55.5% of the nurses wore an N95 FFP2 mask, which also caused pressure injuries to the nose (22%), ears (18.2%), facial rashes, and itching (39.2%). Evidently, other studies have

found that using the N95 mask increases the severity of asthma attacks and that doing so causes cognitive impairment that results in serious mistakes when executing tasks (AlGhamri et al., 2013; George et al., 2022). In this study, the wearing time of face masks was significantly associated with breathing difficulty ( $p < .05$ ).

Regarding stress levels, the majority of nurses (95.5%) reported having a high degree of stress as a result of wearing PPE for an extended period. Similarly, a study of the relationship between PPE and nursing staff stress during the COVID-19 pandemic (Hoedl et al. (2021) revealed that 56% ( $n = 1404$ ) of nurses who used gloves experienced moderate levels of stress. These data corroborate the findings of this current study. However, there was no statistically significant correlation between stress and the use of face masks, eyewear, gloves, or gowns. This suggests that the stress levels in the study cohort were unaffected by the use of PPE. Similarly, the findings from this study revealed no connection between high-stress levels and longer PPE duration ( $p > .05$ ). Hoedl et al. (2021) explained that, because nurses are fully aware of the significance of utilizing PPE, as it constitutes the only option to ensure safety for both themselves and their patients. This may explain these findings. The authors further explained that the use of PPE itself was not linked to the stress felt by nursing personnel. This could be due to their knowledge of contagious viruses. The reported issues with using a face mask were breathing difficulties, lightheadedness, and cloudy vision. The researchers believe that the high degree of stress experienced by nurses in the current study may have been influenced by the fact that wearing a facemask continuously for 4 hrs or more is linked to physical symptoms, such as migraines (Ong et al., 2020). This finding suggests the need for nursing management techniques to reduce the impact of PPE. Desai et al. (2020), in a similar analysis, proposed that routine cleaning, skin moisturization with emollients at least an hour before applying facial PPE, proper wearing of facial PPE, and selecting the appropriate sizes could minimize adverse events connected to facial PPE.

Another essential PPE used during the pandemic was coveralls. Findings from the current study indicated that nurses reported physical loads such as excessive perspiration (77.5%), mask soaking (37.8%), difficulty urinating

**Table 4.** Association of Wearing Time of Facemask and Gloves With Physical Burden.

Physical burden	Yes/No	Hours of Wearing Personal Protection Equipment (PPE) Continuously in a Day					Chi-Square Test (p)
		4 hr	6 hr	8 hr	12 h	Other	
<b>I. Face mask</b>							
Pressure injury:							
Face	Yes (50)	17 (34%)	3 (6.0%)	15 (30%)	3 (6.0%)	12 (24.0%)	4.99 (.29)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Nose	Yes (46)	15 (32.6%)	4 (8.6%)	8 (17.3%)	4 (8.6%)	15 (32.6%)	0.81 (.90)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Ear	Yes (38)	16 (42.1%)	3 (7.8%)	11 (28.9%)	3 (7.8%)	5 (13.1%)	6.50 (.16)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Breathing difficulty	Yes (130)	30 (23.0%)	8 (6.15%)	30 (23.0%)	60 (46.1%)	2 (1.5%)	16.43 (.00)*
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Headache	Yes (67)	16 (23.8%)	5 (7.4%)	14 (20.8%)	11 (16.4%)	20 (29.8%)	4.29 (.36)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Dizziness	Yes (34)	7 (20.5%)	5 (14.7%)	7 (20.5%)	5 (14.7%)	10 (29.4%)	4.46 (.34)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Vision problem	Yes (29)	8 (27.5%)	3 (10.3%)	3 (10.3%)	8 (27.5%)	7 (24.1%)	4.15 (.38)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Excessive thirst and dry mouth	Yes (87)	32 (36.7%)	9 (10.3%)	14 (16.0%)	18 (20.6%)	14 (16.0%)	1.26 (.86)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Facial itchiness rash	Yes (82)	28 (34.1%)	5 (6.1%)	8 (9.7%)	13 (15.8%)	28 (34.1%)	5.49 (.23)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
Indentation and pain in the back of the ears	Yes (46)	13 (28.2%)	7 (15.2%)	3 (6.5%)	10 (21.7%)	13 (28.2%)	6.77 (.14)
	No (23)	10 (43.4%)	2 (8.6%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	
<b>II. Gloves</b>							
Skin chapping	Yes (33)	5 (15.1%)	6 (18.1%)	7 (21.2%)	10 (30.3%)	5 (15.1%)	1.58 (.81)
	No (39)	10 (25.6%)	6 (15.3%)	6 (15.3%)	10 (25.6%)	7 (17.9%)	
Itching/rash	Yes (102)	10 (9.8%)	25 (24.5%)	28 (27.4%)	30 (29.4%)	9 (8.8%)	9.97 (.04)*
	No (39)	10 (25.6%)	6 (15.3%)	6 (15.3%)	10 (25.6%)	7 (17.9%)	

\* $p > 0.05$ 

(40.2%), headache (30.1), claustrophobia (12.4%), and skin injury (7.7%). These results are consistent with those of George et al. (2022), who investigated the physiological risks of PPE use among HCWs in central India. According to the authors, the main issues with wearing coveralls or other protective garments during the pandemic were excessive sweating, skin rash with itching, and dry skin. According to the literature, frequently changing protective garments could be an excellent way to solve this issue (Hu et al., 2020). In addition, several PPE users have reported long-term stress, anxiety, and psychological claustrophobia (George et al., 2022).

**Strength and Limitations:** To the best of the researchers' knowledge, this is the first study conducted in the UAE that looks at how prolonged PPE use affected nurses working in COVID-19 isolation hospitals physically and how stress was perceived. However, data were gathered retrospectively, adding to the study's limitations because it is probable that the reported impressions did not exactly match those at the peak of the pandemic. Second, participants were recruited

from two hospitals in only one of the seven Emirates. This narrow scope may limit the generalizability of the findings.

**Conclusion:** This study aimed to investigate the physical issues and perceived stress experienced by nurses wearing PPE for an extended period of time. The results of this study clearly demonstrate the relationship between device-related injuries and duration of use. As a result, the authors recommend that nurse managers provide frequent opportunities for workers wearing PPE to take breaks and ensure that the nursing staff have access to the proper sizes of PPE. In addition, the majority of the nurses had high levels of stress due to prolonged PPE. These results highlight the need for special policies and procedures to reduce these effects.

**Implications for Nursing:** The authors recommend that nurse managers create detailed protocols to reduce the amount of time PPE is worn. Additionally, proper instruction and encouragement, along with feedback from nurses, would help reduce the negative effects of chronic PPE use. To lessen the negative impacts, managers can also think about

allowing nurses to take PPE breaks during an 8 hr shift. Furthermore, the authors recommend a multicenter study with a larger sample size to allow the generalization of the study results.

## Ethical Considerations

Two institutional boards, the Research and Ethics Committee at RAK Medical and Health Sciences University, and the Ministry of Health and Prevention Research and Ethics Committee (202213-2022-PG-N, 117-202122-PG-N) granted ethical approval for the conduct of the study. Nurses were informed of the study's goals and advantages and an online poll was used to request their agreement to participate in the study. Each potential participant was expected to click "yes" or "no" to express their consent or otherwise on the consent form, which clearly stated the purpose of the study. The survey form was opened by selecting "yes." To safeguard the privacy and confidentiality of participants, codes were assigned to each respondent's data-gathering tool.

## Acknowledgements

The authors acknowledge the support of the nurse managers in the selected hospitals, as well as the nurses who participated in the study.

## Authors Contribution

All authors participated sufficiently and take responsibility for the content, concept, design, analysis, writing, or revision of the manuscript. Mariam Mohamed Hasan: Conceptualized the study, participated in the data collection, and reviewed and edited the manuscript. Rose Ekama Ilesanmi: Conceptualized the study design, provided the resources (instruments) for the data collection, and interpretation, and prepared the initial draft, revision, and editing of the manuscript. Eman Abdelaziz Rashad Dabou: Participated in data acquisition, conducted the formal analysis, data synthesis, and interpretation, and revised the manuscript.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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