Adverse Effects Associated with Personal Protective Equipment (PPE) among Critical Care Nurses during COVID-19 Outbreak

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Abstract

***Background**: COVID-19 spreads through direct human-to-human or droplet transmission, and healthcare workers are required to wear personal protective equipment to prevent infection spread and safeguard their health. However, it poses various adverse effects when used inappropriately and for a long time. **Objective**: to identify the adverse effects associated with personal protective equipment use among critical care nurses during the COVID-19 outbreak. **Setting**: ICUs at Alexandria New University Hospital and four hospitals affiliated to Ministry of Health, all dedicated to COVID-19 patient care. **Subject**: The study involved 170 nurses from various ICUs. **Tool**: The study utilized a tool called "Nurses' Personal Protective Equipment Related Adverse Effects Assessment". The tool included two parts: nurses' data and adverse effects related data. **Results**: A study found that wearing personal protective equipment impairs critical care nurses' perceptions, leading to weariness, discomfort, and respiratory effects. Most of nurses report discomfort-fitting personal protective equipment. Factors like prior work in isolation ICU, patient assignment, and PPE training contribute to these effects. **Conclusion**: Critical care nurses face adverse effects from wearing personal protective equipment, including fatigue, discomfort, and skin problems, which negatively impact their performance, physiological needs, and senses. **Recommendations**: The study recommends adjusting work shifts, nursing hours, and nurse-patient ratios for ICU nurses to minimize personal protective equipment effects. It also emphasizes personal protective equipment training, occupational hazards exposure management, and proper donning and doffing techniques.*

Keywords: Adverse effects, critical care nurses, Personal protective equipment, COVID-19 outbreak.

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Introduction

Coronavirus disease (COVID-19) is a very contagious disease that developed in China by the end of 2019 (Ong et al., 2020). It has been called a pandemic by the World Health Organization on March 2020 (Ramphul & Mejias, 2020). The seriousness of its manifestations is summarized in the rapid development of symptoms to pneumonia in approximately 5 days, and almost 7 to 12 days to severe hypoxemia, which results in intensive care unit admission (Chauhan et al., 2020).

COVID-19 can be transmitted through direct human-to-human or droplet transmission, as well as indirect methods like contaminated objects and aerosol particles, maintaining its contagious nature for up to three hours (Chan et al., 2021; World Health Organization, 2020a). Therefore, the WHO emphasizes the significance of implementing preventive strategies like hand hygiene,

avoiding face contact, respiratory hygiene, wearing masks, and maintaining social distance (Girum et al., 2020; WHO, 2021b).

The WHO recommends additional precautions for healthcare workers (HCWs), including wearing various levels of personal protective equipment (PPE), including respiratory, eye, body, hand, disposable coveralls, and footwear, based on exposure assessment and activities (World Health Organization, 2021; Adeleye et al., 2020).

Intensive care unit (ICU) nurses are highly skilled in handling crises, dealing with stress, working hours, resource inadequacy, and uncertainty, demonstrating exceptional commitment to duty (Murat et al., 2021). Shin et al., 2018 study revealed a significant correlation between the number of ICU nurses to patients and their working hours, leading to job dissatisfaction and burnout.

The ICU environment is considered the highest risk for occupational hazards (Arora Charpe & Joshua, 2020), determined by the uniqueness of ICU physical environment, and various contributing factors such as ergonomic, biological, chemical, and psychosocial factors. Moreover, COVID-19 itself poses more hazards (Esin & Sezgin, 2017), such as being isolated, increased working hours, risky procedures and compliance with PPE (Surya et al., 2021).

Previous epidemics highlighted the importance of PPE in preventing infection spread and safeguarding HCWs, emphasizing the necessity of adequate provision and proper training (Hu et al., 2020; Ruiz-Fernández et al., 2020). PPE is crucial for COVID-19 infection control, but its adverse effects vary across countries and organizations, and can be harmful when used improperly or for extended periods (Tabah et al., 2021).

Previous studies have shown that prolonged use of PPE on HCWs can lead to physical consequences such as headaches, pain, increased workload, and increased stress levels (Hoedl et al., 2021). Previous studies have shown that prolonged use of PPE on HCWs can lead to physical consequences such as headaches, pain, increased workload, and increased stress levels (Choudhury et al., 2020).

Aim of the Study

This study aims to identify the adverse effects associated with PPE use among critical care nurses during the COVID-19 outbreak.

Research Question:

What are the adverse effects associated with PPE use among critical care nurses during the COVID-19 outbreak?

Materials and Method

Materials

Design: A descriptive research design was utilized in this study.

Settings: This study was carried out at the ICUs of Alexandria New University Hospital and four hospitals affiliated to the Ministry of Health. All of them were dedicated to care for COVID-19 patients.

Subjects: A convenience sample of all nurses working in the ICUs of the above-mentioned settings and providing direct care for COVID-19 patients (approximately 170 nurses) was included in this study.

Tools: In order to collect the necessary data for the study one tool was used:

"Nurses' Personal Protective Equipment Related Adverse Effects Assessment". This tool included two parts, it was developed by the researcher after reviewing the related literature (Çiriş Yildiz et al., 2022; Hignett et al., 2021; Ruskin et al., 2021; Xia et al., 2020; Jiang et al., 2020)**.**

Part I: "Nurses' sociodemographic and professional Characteristics"

This part was designed to identify nurses' demographic and job-related data. The nurses' demographic data include age, sex, marital status, and chronic illness. The job-related data include educational level, years of work experience, previous working experience with pandemic diseases, previous working in isolation ICU and its duration, shift working system, numbers of patients assigned per shift, previous screening for COVID-19, and previous training in wearing PPE.

Part II: "Physical Adverse Effects Associated with Using Personal Protective Equipment"

This part used to assess the critical care nurses for the presence of physical adverse effects associated with using of PPE. It is divided into three subcategories; adverse effects associated with the use of senses, these included six questions; adverse effects that cause discomfort and general fatigue that included seven questions and adverse effects on basic physiological needs that included five questions. The responses of nurses rated and recorded on a dichotomous scale; as Yes = 1 / No = 0

Method

The research involved approval from the Research Ethics Committee at Alexandria University and hospital administrative authorities. A tool was developed to collect data on nurses' demographic and job-related data and physical adverse effects associated with PPE. The tool was tested for content validity by experts and reliability using the Cronbach Alpha test (r =0.7) which was acceptable. A pilot study was conducted on 17 nurses to test the tool's clarity, applicability, feasibility, and relevance. Data was collected over two months from January to February 2022.

Data collection:

The study involved ICU nurses providing direct patient care for critically ill COVID-19 patients and their use of personal protective equipment (PPE). Data was collected through interviews during break time and outside the ICU. The researcher assessed demographic and job-related data, and asked about physical adverse effects associated with PPE use. The score was calculated based on subject responses.

Statistical Analysis:

The data was analyzed using SPSS Version 25.0, with qualitative data described as number and percent, and quantitative data as mean ± standard deviation, with P-values of 0.05 or less considered statistically significant.

Ethical Considerations:

Informed written consent was obtained from each nurse after an explanation of the aim of the study. The right to refuse to participate in the study was emphasized to the nurses before participation in the study; and the right to withdraw from the study at any time. The anonymity and privacy of the participated nurses; and the confidentiality of the collected data were maintained.

Results

Table 1 reveals that over 75% of critical care nurses are female, with 42.3% aged 25-35, half single, and 77.6% without chronic diseases. Nearly half are nurse's technicians, and 77.6% have no chronic diseases.

Table 2 shows that over one-third of the studied critical care nurses have less than five years of experience in the ICU, with a mean of 11.08 years. Most have experience dealing with infectious diseases and epidemics, with nearly half caring for less than five patients. 100% use face masks, gloves, and gowns in isolation ICUs, with

shift schedules alternating between day and night. Most have been vaccinated and have previous training on donning and doffing PPE.

Table 3 reveals that critical care nurses' physical effects of wearing PPE, including vision, hearing, recognizing, and touching, are negatively impacted. Vision is the most affected, with over two-thirds experiencing vision problems. Other senses include communication, hearing, and touch. One-third experience smell issues.

The same table reveals that most critical care nurses experience discomfort and fatigue, with excessive sweating, heat stress, exhaustion, dizziness, headaches, and movement changes being the most common discomforts. Most nurses reported poorly fitted and sized PPE, with larger-sized PPE being the most common. The least discomfort was nausea or the need to vomit. Half of the nurses tolerate wearing full PPE for 2 to less than 4 hours, while only 10% can tolerate it for 6 to 8 hours.

As regards the basic physiological needs, it was found that critical care nurses often experienced negative respiratory and breathing effects while wearing PPE, including chest tightness and dyspnea. They also reported feelings of thirst, urgency to urinate, sleep changes, and hunger, with a total of 92.9% experiencing these effects.

Table 4 shows that over half of the critical care nurses experienced physical adverse effects of PPE, with over three-quarters experiencing general discomfort and fatigue. Basic physiological needs were the second adverse effect (66.25%), with two-thirds reporting high levels. The third adverse physical effect was the senses effect (53.83%), with effects ranging from moderate to high.

Table 5 demonstrates the association between the physical adverse effects of using PPE and the characteristics of the study sample. It was explored using binary logistic regression analysis (Enter method) with adverse effects as the dependent variable. The R square value is 0.495, which means that 49.50% of the variability in the effects is explained by the studied critical care nurse's characteristics in the model with an overall model significance of (P = 0.000). This table indicates that two variables were found to be predictors of the factors associated with physical adverse effects, namely: the presence of respiratory diseases (bronchial asthma) (P = 0.031), and previous work in the isolation ICU (P = 0.045).

Discussion

The COVID-19 pandemic has significantly impacted healthcare professionals, particularly ICU nurses, who require extended PPE use due to patient load and care demands. Quality and accessibility of PPE have become critical issues to maintain their job in isolation.

The study surveyed critical care nurses; mainly females aged 25-35, with less than five years of experience. The shortage may be due to younger nurses' perceived lack of influence, with half being single and rotating shifts. Most had experience in isolation ICUs and PPE training.

The current study reveals a high prevalence of the physical adverse effects of PPE among the studied critical care nurses. PPE used significantly affected the studied critical care nurses' senses, general comfort, and basic physiological needs.

The research shows that PPE, particularly face shields and goggles, can impact the senses, particularly vision, leading to difficulty seeing due to fogging. This can be particularly problematic for critical care nurses who need constant patient visibility.

This is in line with Choudhury et al., (2020), Sn et al., (2021), and Thiagarajan et al., (2021), they reported that all healthcare workers suffered from fogging. Contrary to the current results Swaminathan et al.,(2022) found a low prevalence of vision problems when using goggles and face shields.

Consequently, over half of critical care nurses face communication issues due to wearing PPE, which can impede their ability to hear sounds and speech. Mask N95 and jumpsuits create muffled conversations and physical barriers, causing confusion and difficulty distinguishing objects during shifts.

Along the same line, Bandaru et al., (2020), Paz et al., (2021) and Swaminathan et al., (2022) showed a high prevalence of communication difficulties. Parush et al., (2020) stated that full PPE is correlated with auditory perception and speech understanding difficulties which eventually linked to hinders the situational awareness and decision-making. In contrast, Silman, (2014) noted that a face shield in comparison with eye goggles is better than goggles.

Critical care nurses wearing double-layered gloves may experience reduced sense of touch, making fine motor activities more challenging. This can lead to difficulty in determining the appropriate depth or angle for insertion, as well as impede sensation in these critical skills.

The current result goes with Hignett et al., (2021), Hoernke et al., (2021), and Xia et al., (2020), they found that touch was becoming more difficult and inconvenience in vein punctures. While Vaidiyanathan et al., (2023) stated in their research that 60% of HCWs complain difficulties with the insertion of the cannula and blood sampling.

Critical care nurses reported excessive sweating after wearing PPE, heat stress, headaches, movement changes, and poorly fitted and sized PPE. This is possibly due to multiple layers of PPE. This is in line with a worldwide survey done by Tabah et al., (2021), stated that PPE-associated complaints increased as much over time. Moreover, Jose et al., (2021), and Vaidiyanathan et al., (2023) reported that PPE discomfort and restlessness result in moisture and heat occurrence when wearing it for a long time. Furthermore, a meta-analysis by Galanis et al., (2021), stated that as much as wearing PPE, more sweating occurs and, secondly, leads to skin itching, redness, and pain. In contrast, Çağlar et al.,(2022), stated that the HCWs don't suffer from heat stress-related symptoms, because of the cold weather.

Feel discomfort while PPE wearing is most prevalent, as exhaustion, and vertigo. It results from excessive sweating without compensating for this fluid loss. Similarly, Moradi et al., (2021a), Tabah et al., (2021), Jegodka et al.,(2021), Swaminathan et al., (2022)and Shalaby & El-kurdy,(2023) showed a high percentage of feeling extreme exhaustion among HCWs.

Headache can be caused by dehydration, mask pressure, a tight mask cover, a face shield, eye goggles, forehead pressure, and respiratory compromises from the mask. Various studies were in the same line as Thiagarajan et al., (2021) study in which headaches were reported by surgeons. Moreover, Choudhury et al., (2020), and Çağlar et al., (2022), reported that headaches increased with spending more time wearing PPE. Moreover, Xia et al., (2020), and Paz et al., (2021) reported that staff suffered from retro auricular pain linked to mask-related pressure.

Furthermore, PPE wear causes discomfort, inconsistent walking, and depersonalized sizing, especially during outbreaks. Shortages and lack of supplies can lead to stopover manufacturing and importation during lockdowns.

Jose et al., (2021), and Hignett et al., (2021) agreed on PPE size inappropriateness was the major reported problem. Also, nurses risk contamination catching by PPE excess materials dragging. On the other hand, Kang et al., (2018) stated that the HCWs reported that only one sized PPE was available.

Even nausea and vomiting were the least reported discomforting manifestations in current research, but they cannot have ignored after all; it may result from heat exhaustion and CO_2 retention. Close to the current result, Xia et al., (2020) were more likely to have nausea and vomiting by 42.1% in their survey. Contradicting current research, the study of Yuan et al., (2020), Jose et al., (2021) had no significance, also İpek et al., (2021) and

responders had a very low percentage of nausea.

Critical care nurses reported a tolerability time of less than four hours to prolong PPE working hours and avoid adverse effects, unless they appear immediately. Choudhury et al., (2020) reported 3 hours as a mean tolerance time. Another survey by Tabah et al., (2021),and Baklouti et al., (2023) confirmed the same result. On the other hand, Xia et al., (2020) pointed out that the majority of their responder can tolerate PPE for 4 to 6 hours.

The study reveals that PPE significantly affects critical care nurses' physiological needs, leading to respiratory issues like chest tightness and dyspnea, especially with N95 masks due to their tight seal and warm, humid environment.

In the same line, Jegodka et al., (2021), found that the responders experienced breathing difficulties. Moreover, Çağlar et al., (2022) and Tume et al., (2022) reported that the using of mask N95 produced CO_2 that may cause breathing problems. Thiagarajan et al., (2021), and Galanis et al., (2021), documented a high percentage of breathing problems, especially for those wearing an N95 mask. On the other hand, Choudhury et al., (2020) stated that respiratory process is influenced high temperatures and humid weather that produced respiratory resistance.

Contrary to the current results, Rebmann et al., (2013) found that nurses can tolerate N95 masks for extended periods, but experienced increased complaints when using them with surgical masks. Another study done by Paz et al., (2021) also reported a low prevalence of dyspnea. On the other hand, İpek et al., (2021) noted hypocarbia and respiratory alkalosis from one to at least four hours as a maximum.

In the current study, critical care nurses are experiencing dehydration due to prolonged PPE wear, limited access to water, and withheld bathroom needs, exacerbated by increased waste of PPE due to the COVID-19 pandemic.

Paz et al., (2021) supported the current results, they stated that the half of the responders struggled with thirst feeling as time increases, Furthermore, Xia et al., (2020), and Çiriş Yildiz et al., (2022) stated that about 60% of responders suffered from a dry throat or thirst. Another, research done by Vaidiyanathan et al., (2023), who stated that near to 100% of the respondents had thirst. Contrary with the current study, Thiagarajan et al., (2021) reported low percentage of dry mouth.

The study found that critical care nurses' sleeping patterns have significantly changed due to unclear disease scenarios, and high disease mortality rates. The study by Paz et al., (2021) reported a high percentage of sleep disturbances. On the contrary Swaminathan et al.,(2022) had a low prevalence of insomnia occurrence.

The study identifies four predictor variables: respiratory diseases, experience managing infectious diseases, previous ICU work, and patient assignment. Pre-existing respiratory conditions can cause discomfort, while prior ICU experience increases stress and anxiety. Patients with pre-existing anxiety or depression are more vulnerable to negative psychological effects.

Similar to current research, Baklouti et al., (2023) and a meta-analysis done by Galanis et al.,(2021), reported that the risk of symptoms from PPE is similar to pre-existing chronic diseases, but Baklouti's results show different variables, including COVID-19 infection, disinfectant use, prolonged PPE use, and female gender. Furthermore, Galanis et al., (2021), agree on the female gender, previous headaches, obesity, younger age, PPE wearing for long periods, and smoking. Unlike current research Çağlar et al., (2022) reported factors that may contribute to adverse effects such as smoking, and obesity.

Last, the study suggests that identifying critical care nurses with predictor variables can help reduce the negative impact of PPE use on their physical well-being.

Conclusion

The study reveals that critical care nurses wearing PPE experience discomfort, fatigue, and vision problems due to excessive sweating and heat stress. Factors such as respiratory disease, chronic disease history, isolation ICU experience, patient assigned staff, and PPE training could predict these adverse effects.

Recommendations

The study suggests adjusting work shifts for ICU nurses, providing regular PPE training, and developing a reporting system to minimize adverse effects, and suggests future research to identify best practices for preventing PPE adverse effects.

Table 1: Distribution of the Studied Critical Care Nurses According to the Demographic Data.

Nurses' demographic characteristics		Total (N= 170)	
		No.	%
Sex	▪ Male	41	24.1
	▪ Female	129	75.9
Age (years)	▪ Less than 25 years	58	34.1
	▪ From 25 years to less than 35 years	72	42.3
	▪ From 35 years to less than 45years	28	16.5
	▪ More than 45 years	12	7.1
Min -Max 22.0 - 48.0	Mean ± SD 26.53 ± 4.034		
Marital status	▪ Single	85	50.0
	▪ Married	78	45.9
	▪ Divorced	5	2.9
	▪ Widowed	2	1.2
Presence of chronic diseases	▪ Yes	38	22.4
	▪ Diabetes mellitus	20	52.6
	▪ Hypertension	8	21.1
	▪ Bronchial asthma	10	26.3
	▪ No	132	77.6
Level of education	▪ Secondary School of Nursing diploma	29	17.0
	▪ Technical Institute of Nursing diploma	79	46.5
	▪ Bachelor's degree in nursing	60	35.3
	▪ Master in Nursing	2	1.2

Table 2: Distribution of the Studied Critical Care Nurses According to The Job-related Data

Nurses' job-related data		Total (N= 170)	
		No.	%
Years of experience	▪ Less than 5 Years	69	40.6
	▪ From 5 Years to less than 10 Years	42	24.7
	▪ From 10 Years to less than 15 Years	36	21.2
	▪ More than or equal to 15 Years	23	13.5
Min -Max 4.0 - 31.0	Mean ± SD 11.08 ± 1.077		
Experience in dealing with infectious diseases and epidemics	Yes#	128	75.3
	▪ Respiratory tract infections	122	95.3
	▪ Blood born infections	117	91.4
	▪ Food/water-borne infections	111	86.7
	▪ No	42	24.7
Type of personal protective equipment used in dealing with previous cases of infectious diseases#	▪ Face mask	128	100.0
	▪ Gloves	128	100.0
	▪ Gown	128	100.0
	▪ Overhead	37	28.9
	▪ Overshoes	29	22.6
Number of previous patients who dealt with infectious diseases	▪ < 5	60	46.9
	▪ 5-	46	35.9
	▪ 10-	20	15.6
	▪ 15-20	2	1.6
Min -Max 2.0 - 20.0	Mean ± SD 4.340 ± 1.681		

		N= 170	
Previous work in isolation intensive care units (ICU)	▪ Yes ▪ No	126 44	74.1 25.9
Type of personal protective equipment used in isolation ICU#	▪ Face mask ▪ Gloves ▪ Gown ▪ Overhead ▪ Overshoes	170 170 170 152 138	100.0 100.0 100.0 89.4 81.2
The working shift in isolation ICU	▪ Fixed morning ▪ Fixed night ▪ Morning/evening ▪ Alternating	12 22 18 118	7.1 12.9 10.6 69.4
Number of patients assigned to each nurse	▪ 1-2 ▪ 3-4 ▪ 5-6 ▪ ≥7	52 90 16 12	30.6 52.9 9.4 7.1
Min -Max 1.0 - 14.0	Mean ± SD 3.710 ± 2.382		
Previous vaccination for COVID 19	▪ Yes ▪ One dose ▪ Two doses ▪ No	133 27 106 37	78.2 20.3 79.7 21.8
Previous training on using PPE	▪ Yes ▪ Once ▪ Twice ▪ Three times ▪ Four times and more ▪ No	152 70 38 17 27 18	89.4 46.0 25.0 11.2 17.8 10.6

 # Multiple answers were allowed

Table 3: Distribution of the Studied Critical Care Nurses According to the Physical Effects of PPE

Physical effects of PPE		**Total (N= 170)**	
		No.	**%**
Uses of senses	– Unable to read clearly while wearing PPE	64	37.6
	– Experiencing vision problems as a result of using PPE	117	68.8
	▪ Reducing the field of view	38	32.5
	▪ Reducing the side field of view	18	15.4
	▪ Reducing side vision	27	23.1
	▪ Difficulty seeing due to fogging	88	75.2
	– Interpretation or recognition of things differs through touch	76	44.7
	– Difficulty hearing sounds and speech	90	52.9
	– Communication difficulties with the patient /colleagues	95	55.9
	– Difficult to know each other while wearing PPE	86	50.6
	– Have a problem with smell while wearing full PPE	62	36.5

General discomfort and fatigue	– PPE poorly fitted and sized	105	61.8
	▪ Larger size	85	80.9
	▪ Smaller size	23	21.9
	– Feel discomfortable while wearing full PPE	140	82.4
	▪ Exhausted/tired	97	69.3
	▪ Tachycardia/palpitation	47	33.6
	▪ Dizziness	65	46.4
	▪ Vertigo	49	35.0
	– Feel hot or experience heat stress	143	84.1
	– Have excessive sweating after wearing PPE	152	89.4
	– Have headaches while wearing PPE	134	78.8
	– Feel nausea or need to vomit while wearing PPE	83	48.8
	– Change in movement while wearing your PPE	131	77.1
	▪ Feel heavy	87	66.4
	▪ Uncomfortable walking	78	59.5
	▪ Incompatible /inconsistent walking way	51	38.9
	– Tolerability of wearing PPE (hours)		
	▪ <2	36	21.2
	▪ 2-	78	45.9
	▪ 4-	39	22.9
	▪ 6-8	17	10.0
Basic physiological needs	– Have respiratory/breathing effects while wearing PPE	158	92.9
	▪ Tachypnea	32	20.3
	▪ Bradypnea	14	8.9
	▪ Chest tightness	86	54.4
	▪ Dyspnea	74	46.8
	– Feel thirst while wearing PPE at work	145	85.3
	– Feel hungry while wearing PPE	72	42.4
	– Feel urgency to urinate while wearing PPE	126	74.1
	– Changing sleeping patterns	107	62.9

Table 4: Levels and Mean Scores of Adverse Physical Effects of PPE among the Studied Critical Care Nurses.

Items		Total (N= 170)		Min - Max	Mean ± SD	Mean Percent score
		No.	%			
General discomfort /fatigue	▪ Low	7	4.1	0.0-7.0	5.22±1.401	74.57%
	▪ Moderate	37	21.8			
	▪ High	126	74.1			
Uses of senses	▪ Low	5	2.9	1.0-6.0	3.35±1.127	55.83%
	▪ Moderate	93	54.7			
	▪ High	72	42.4			
Basic physiological needs	▪ Low	29	17.1	0.0-4.0	2.65±1.143	66.25%
	▪ Moderate	43	25.3			

	▪ High	98	57.6			

Table 5: Factors associated with the physical adverse effects of PPE use among the studied critical care nurses.

Sociodemographic and job related factors	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	11.966	1.796		6.662	0.000
Sex	0.104	0.553	0.014	0.188	0.851
Age	0.301	0.367	0.082	0.819	0.414
Education	-0.526	0.334	-0.120	-1.574	0.118
Marital status	-0.115	0.410	-0.022	-0.281	0.779
History of chronic diseases	-0.635	0.722	-0.082	-0.879	0.381
Presence of respiratory disease (BA)	0.524	0.240	0.196	2.181	0.031*
Years of experience	0.374	0.304	0.124	1.233	0.220
Experience management of infectious diseases	-0.472	0.948	-0.063	-0.498	0.619
Previous work in isolation ICU	0.092	0.046	0.172	2.010	0.045*
Type of PPE used	1.890	0.000	0.025	0.366	0.715
Number of patients assigned	0.004	0.069	0.005	0.056	0.956
Duration of work in ICU	-0.530	0.678	-0.072	-0.783	0.435
Type of working shift	0.225	0.225	0.067	1.000	0.319
Number pts assigned for staff	0.110	0.092	0.081	1.194	0.234
Previous COVID-19 vaccination	-0.405	1.238	-0.051	-0.327	0.744
Number of COVID-19 vaccine doses	-0.287	0.653	-0.073	-0.439	0.661
Previous training about PPE	-0.036	0.763	-0.003	-0.047	0.962
Number of training about PPE	0.057	0.147	0.030	0.388	0.699

Model Summary				
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**ANOVA**
0.703	0.495	0.394	2.532	4.931 P= 0.000

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