



Effect of educational intervention on the use of personal protective equipment in nursing staff

Efeito de intervenção educacional no uso de equipamentos de proteção individual por profissionais de enfermagem

Efecto de la intervención educativa sobre el uso de equipo de protección personal en el personal de enfermería

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ABSTRACT

Introduction: In the context of the COVID-19 pandemic, specific care in the use of Personal Protective Equipment (PPE) is crucial for patient care. **Aim:** To evaluate the impact of an educational intervention on the self-reported use of PPE by nursing professionals. The primary question guiding this research was: What is the effect of an educational intervention on the self-reported use of PPE by nursing professionals? **Design:** This quasi-experimental study used a before-and-after design and involved 98 nursing professionals. **Results:** It was found that 78.30% of nursing technicians reported absences from work due to COVID-19. Among these professionals, 82.27% reported having access to PPE during the pandemic, yet only 78.4% had received training on its usage. Notably, before the educational intervention, 53.2% of nursing technicians and 57.8% of nurses correctly performed PPE placement. After the intervention, these figures changed to 45.5% and 36.8%, respectively. Regarding the correct sequence of PPE removal, before the intervention, 32.9% of nursing technicians and 57.8% of nurses reported accuracy; these numbers slightly changed post-intervention to 34.1% and 52.6%, respectively. **Implications:** The educational intervention resulted in significant improvements in the correct removal of PPE, particularly among technical-level professionals. This outcome underscores the importance of ongoing training programs, tailored to the specific needs and experience levels of healthcare professionals, to enhance adherence to safety practices and optimize protection in high-risk environments.

DESCRIPTORS

Universal Precautions; Nurse Practitioners; Cross Infection; Personal Protective Equipment; COVID-19.

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INTRODUCTION

In the early stages of the COVID-19 pandemic, several countries experienced a critical shortage of Personal Protective Equipment (PPE). The surge in demand led to material shortages in producing nations,¹ exacerbating the challenge of managing the SARS-CoV-2 response, particularly in hospitals treating COVID-19 patients. This scarcity was felt differently across affluent, developing, and underdeveloped nations.²⁻³

During the pandemic, recommendations for PPE usage evolved as new evidence about transmission routes emerged. For instance, the widespread use of surgical masks in institutions proved effective in reducing transmission rates. PPE usage guidelines vary by country, depending on the perceived risk of exposure to biological materials for healthcare workers, ranging from standard to specific precautions, including those for treating COVID-19 patients.⁴⁻⁵

The prevailing guidance advises using contact and droplet precautions for all suspected or confirmed COVID-19 cases, along with aerosol precautions in certain scenarios. Additionally, it is recommended that gloves should not be doubled (overlapping), and eye protection or face shields should be used exclusively by one professional and cleaned immediately after use.⁶

Given that SARS-CoV-2 primarily spreads through respiratory droplets, wearing masks and practicing hand hygiene are crucial preventive measures.⁷ The rapid spread of SARS-CoV-2 necessitated a global emergency reorganization of health services, including the creation of new protocols, revision of workflows, procurement of supplies such as 70% alcohol gel, respirators, PPE, and training of health professionals to handle the influx of infected individuals. Notably, even before the pandemic, the familiarity and use of PPE were already low in many countries, and studies indicate that this situation persisted throughout the pandemic. Most health systems were unprepared for

the pandemic, facing shortages of supplies, ICU beds, respirators, and healthcare workers, further enabling cross-transmission of the virus in healthcare settings.⁸⁻⁹

A systematic review aimed at analyzing research on mask use for protection during the pandemic revealed that the effectiveness of personal protective equipment is not fully understood.¹⁰ Another review conducted in the United Kingdom highlighted a lack of scientific evidence in high-quality studies concerning the effectiveness of respiratory protective equipment against SARS-CoV-2.¹¹

Thus, in light of the COVID-19 pandemic, which necessitates specific PPE use for treating patients with or suspected of having COVID-19, and the need to protect healthcare professionals while minimizing waste and misuse of PPE, this study addresses the following guiding question: What is the effect of an educational intervention on the self-reported use of PPE by nursing professionals? The study aims to evaluate the impact of an educational intervention on the use of personal protective equipment among nursing professionals.

METHOD

Design

This research adhered to the ethical guidelines stipulated in Resolution Nos. 466/2012¹² and 510/2016¹³ of the National Health Council (CNS), which set forth the guidelines and regulatory standards for research involving human subjects. The study received approval from the Research Ethics Committee of the Federal University of Mato Grosso do Sul (UFMS), documented in Opinion No. 4,218,227.

Study Type

This is a descriptive study that incorporates a before-and-after educational intervention.

Study Site

The study was derived from a master's thesis¹⁴ conducted at a hospital that serves as a reference center for 10 municipalities in the eastern region of Mato Grosso do Sul, Brazil. The hospital has 166 beds, 90% of which are dedicated to providing free care through the Unified Health System (SUS).

Population and Sample

The sample was non-probabilistic and included 98 nursing professionals (nurses and technical-level nursing professionals) working at the institution. Those who did not have direct contact with COVID-19 patients during the data collection period were excluded. Sample representativeness was assessed using G Power software, considering 98 participants, an alpha error of 0.05, a two-tailed distribution, and an effect size of 0.40. The analysis yielded a power of 97.2%.

Instruments

The research instruments were administered in various departments, including inpatient units, the Intensive Care Unit (ICU), emergency department, and hemodialysis units. Other sectors not specified by the professionals were also included. The instruments consisted of a sociodemographic characterization tool and another focused on PPE usage during the COVID-19 pandemic, applied to the 98 professionals who provided direct care to COVID-19 patients.¹⁵

Methodological Procedure

The framework for this study was inspired by Seki's research,¹⁶ which implemented an educational intervention with healthcare professionals concerning standard precautionary measures. The intervention was structured into five distinct phases.

Phase 1: Presentation of the Informed Consent Form and Application of the Instruments

The study commenced with the distribution of the Informed Consent Form (ICF) to the professionals

who agreed to participate, along with a detailed explanation of the study's objectives. The sociodemographic characterization tool developed by Diniz¹⁵ and the instrument for evaluating PPE usage during the COVID-19 pandemic were then administered. This initial data collection occurred in February and March 2022. The educational intervention was conducted in April, followed by a second round of questionnaires in May and June 2022. It is important to note that during this period, the World Health Organization (WHO) still classified the situation as a pandemic, although social isolation and mask mandates were no longer in place.

Phase 2: Analysis of Responses and Construction of the Educational Intervention

The educational materials were developed in accordance with CDC (2016) guidelines and the Ministry of Health's recommendations for the care of COVID-19 patients. This phase also included the creation of a validated educational video.¹⁷

Phase 3: Educational Intervention

The educational intervention occurred over three days in April 2022, covering all work shifts at the institution. The content was prepared using virtual databases and PowerPoint to ensure organized and effective information delivery. Topics covered included infection control in healthcare settings, patient safety, standard precautions, and specific PPE protocols for the care of COVID-19 patients, emphasizing the correct procedures for donning and doffing PPE. Prior to the intervention, the material was reviewed and approved by the Hospital Infection Control Commission (CCIH) and the institution's continuing education department, ensuring compliance with existing hospital norms.

Phase 4: Reapplication of the PPE Instrument

Following the educational intervention, the PPE usage questionnaire was administered again to evaluate the impact of the intervention. Notably, the

hospital's isolation sector was inactive at this time, reflecting a decrease in severe cases, likely due to increased vaccination coverage and ongoing societal preventive measures.

Phase 5: Comparative Analysis of Data

In the final phase, a comparative analysis was conducted between the initial and final assessments to measure changes in PPE usage before and after the educational intervention. This comparison aimed to quantify the effectiveness of the intervention in improving safe practices among nursing professionals.

Statistical Analysis

The scores obtained before and after the intervention were represented with mean and standard deviation. The Wilcoxon test was performed to evaluate possible significant differences. The number of correct answers per question was evaluated according to the nominal variable "right" or "wrong". To evaluate possible differences in the proportion of each item in the questionnaire, the Cochran Q test was performed. The Statistical Package for the Social Science (SPSS) software, version 20.0, was used. The significance level was set at 0.05. Categorical variables were represented according to absolute and relative frequencies. To assess the difference between responses before and after the intervention, the McNemar-Bowker test was performed.

RESULTS

In this study, a total of 98 participants were included, with the majority being female (85.9%), under the age of 40 (71.9%). The sample comprised 79 nursing technicians and 19 nurses. It appears that 88.8% of the professionals have, on average, 10 years of work in the hospital. Regarding workload, it is observed that 71.4% work 44 hours a week. Regarding

the sector of work, the majority (51%) of these professionals worked in critical sectors of hospitals (ICU, Emergency Room, hemodialysis sector).

Table 1 presents findings into the experiences of nursing professionals during the COVID-19 pandemic. The majority of professionals had contact with COVID-19 patients, and a significant number of them had to take time off work due to contracting the virus. Access to necessary PPE was generally good, but there were some concerns about the quality and comfort of the provided equipment. Training on PPE use was generally high among the participants, with nurses receiving training in 100% of cases, which is crucial in ensuring their safety and the safety of patients during the pandemic. The variable number of nursing technicians who did not have knowledge or confidence in answering the main questions stands out.

Before the intervention, when asked about the correct order to put on the PPE, which includes first the use of an apron, followed by a surgical mask and/or respiratory protection mask, goggles or face shield and, finally, a cap or hood and gloves, among nursing technicians, 53.2% (42 individuals) answered correctly, and among nurses, 57.8% (11 individuals) informed the correct order of removal of PPE. With regard to the correct order of removal of PPE, which involves the removal of gloves, apron, cap or hood, glasses, surgical mask and respiratory protection mask, among nursing technicians the percentage of correct answers was 32.9% (26 individuals), and among nurses the percentage of correct answers was 57.8% (11 individuals). There were no statistically significant differences between nursing technicians and nurses in understanding the correct order of putting on and taking off PPE before the educational intervention ($p=0.22$; and $p=0.35$).

Table 1. Description of access, quality, comfort, and self-reported training regarding PPE among nursing professionals during care for patients with COVID-19. Três Lagoas, MS, Brazil, 2022.

	Nursing Technicals		Nurses	
	N	%	N	%
Have you had or are you having contact with a patient with COVID-19?				
I don't know/Prefer not to answer	8	10,1	-	-
No	10	12,6	-	-
Yes	61	77,2	19	100
Did you have to take time off work because you contracted COVID-19				
I don't know/Prefer not to answer	13	16,4	-	-
No	30	37,9	9	47,4
Yes	36	45,5	10	52,6
In this hospital, were all necessary PPE available to protect yourself?				
I don't know/Prefer not to answer	0	0	-	-
No	14	17,7	-	-
Yes	65	82,27	19	100
In this hospital, do you consider the provided PPE to be of good quality?				
I don't know/Prefer not to answer	12	15,1	-	-
No	6	7,5	7	36,8
Yes	61	77,2	12	63,2
In this hospital, did you feel any discomfort when using PPE?				
I don't know/Prefer not to answer	12	15,18	-	-
No	43	54,4	5	26,3
Yes	24	30,3	14	73,7
Have you received any training on the correct use and sequence of putting on and taking off PPE when in contact with a patient with COVID-19?				
I don't know/Prefer not to answer	14	17,7	-	-
No	3	3,7	-	-
Yes	62	78,4	19	100

Legend: PPE - Personal Protective Equipment.

Source: The authors (2024).

Table 2. List of responses obtained before the educational intervention in relation to attire by professional category. Três Lagoas, MS, Brazil, 2022.

	Professional Category				p-value*
	Nursing Technicals		Nurses		
	N	%	N	%	
Check the option that includes the correct order of placement of PPE:					
I don't know/Prefer not to answer	14	17,7	-	-	0,22
Apron, surgical mask and/or respiratory protection mask, protective goggles or face shield, cap or hood, gloves	42	53,2	1	57,8	
Apron, surgical mask, protective goggles or face shield, gloves ‡	6	7,6	4	21,1	
Surgical mask, apron, protective goggles or face shield, cap or hood, gloves	17	21,5	4	21,1	
Check the option that includes the correct order of removal of PPE					
I don't know/Prefer not to answer	15	18,9	-	-	0,35
Apron and gloves at the same time, goggles or face shield, mask	23	29,1	5	26,3	
Gloves, apron, cap or hood, goggles, surgical mask, respiratory protection mask ‡	26	32,9	1	57,8	
Gloves, goggles or face shield, apron, mask	6	7,6	1	5,3	
Surgical mask, gloves, cap or hood, goggles or face shield, apron	9	11,4	2	10,5	

Legend: ‡ Correct/Appropriate Answer; *Significance level was set at 0.05; PPE - Personal Protective Equipment

Source: The authors (2024).

After the educational intervention, 45,5% (36 individuals) reported the correct order of PPE placement, while among nurses, 36,8% (7 individuals) provided the correct PPE placement order. With regard to the removal of PPE, 34.1% (27 individuals) provided the correct order of removal of PPE and among nurses, 52,6% (10 individuals). The p values provided in the table indicate that there were no statistically significant differences between nursing technicians and nurses in understanding the correct order of putting on and taking off the PPE, even after the educational intervention. The findings suggest that the educational intervention had a positive

impact on improving the technicians' knowledge regarding PPE removal. However, there was no improvement in the correct answers for the category of nurses regarding the placement or removal of PPE after the educational intervention. It draws attention before the educational intervention, among technical nursing professionals, that 17,7% in the question about the placement of PPE's and 18,9% in the question about the removal of PPEs of technical level professionals preferred not to answer the questions, and only after the educational intervention did, they choose to mark one of the answers, dropping the percentage to 13,9% of professionals.

Table 3. List of responses obtained after educational intervention in relation to clothing and undressing by professional category. Três Lagoas, MS, Brazil, 2022.

	Professional Category				p-value*
	Nursing Technicians		Nurses		
	N	%	N	%	
Check the option that includes the correct order of placement of PPE:					
I don't know/Prefer not to answer	11	13,9	1	5,2	0,513
Apron, surgical mask and/or respiratory protection mask, protective goggles or face shield, cap or hood, gloves	36	45,5	7	36,8	
Apron, surgical mask, protective goggles or face shield, gloves ‡	8	10,1	3	15,7	
Surgical mask, apron, protective goggles or face shield, cap or hood, gloves	24	30,3	8	42,1	
Check the option that includes the correct order of removal of PPE					
I don't know/Prefer not to answer	11	13,9	1	5,2	0,636
Apron and gloves at the same time, goggles or face shield, mask	29	29,1	5	26,3	
Gloves, apron, cap or hood, goggles, surgical mask, respiratory protection mask ‡	27	34,1	10	52,6	
Gloves, goggles or face shield, apron, mask	5	6,3	1	5,2	
Surgical mask, gloves, cap or hood, goggles or face shield, apron	7	8,8	2	10,5	

Legend: ‡ Correct/Appropriate Answer; *Significance level was set at 0.05; PPE - Personal Protective Equipment

Source: The authors (2024).

DISCUSSION

Regarding the removal of PPE, the study showed that nursing technicians had a higher level of knowledge about correct undressing, resulting in a higher percentage of correct answers after the educational intervention. This can be attributed to the higher proportion of nursing technicians involved in direct patient care compared to nurses.¹⁸

With regard to nurses, it appears that there was a decrease in correct answers after the educational intervention, both for the order of placement and removal of PPE. It is believed that

some factors may have influenced these findings, such as the fact of having to answer the same questionnaire twice before and after the intervention, linked to the high weekly workload of 44 hours. However, it is important to highlight that the correct dressing order includes apron, surgical mask and/or respiratory protection mask, eye protection or face shield, cap or hood, and gloves. To undress, follow the reverse order. Knowledge of how to dress and undress properly is crucial in the health field, as it helps to prevent preventable incidents.¹⁹

With regard to staff training in the use of PPE before the educational intervention, 100% of the

nurses said they had received some training. These data are in disagreement with a study carried out in India, where only 44.1% of professionals received some type of guidance/prior training for the correct use of PPE.²⁰ We know the importance of the correct use of PPE and also the need for professionals to be aware of which type of precaution to use in different types of situations. The correct use of PPE does not prevent accidents at work, but it can minimize the severity of professional exposure when in contact with different types of microorganisms.²¹

Non-adherence to PPE can be attributed to several factors, such as frequent changes in care protocols, ambiguity in the available materials, differences between national and international guidelines, and high workload. The use of PPE may be directly influenced by challenges in understanding local protocols, timely and clear communication, and adequate training on infection prevention.^{21,4}

Given the complexity of the COVID-19 pandemic, nursing professionals require greater physical and emotional support. It is essential to prioritize their occupational health and safety, considering their physical, psychosocial, and ergonomic well-being. Occupational illness and emotional exhaustion can contribute to iatrogenesis and ineffective nursing care.²² Additionally, the increased severity of COVID-19 cases has resulted in higher workloads for nursing professionals. Inadequate staffing has forced them to make difficult decisions based on clinical priorities and, at times, make ethically challenging choices regarding which patients to prioritize for intensive respiratory support.²²

The rapid spread of pathogens among people, environments, and inanimate objects has significantly impacted the vulnerability experienced by nursing professionals. This has led to various emotions, such as fear of mortality, anxiety, and concerns about transmitting invisible microorganisms to their families and others. Addressing these issues through comprehensive support systems and effective training

is crucial to ensure the well-being and safety of healthcare workers during the pandemic.²³⁻²⁵

Study Limitations

The study had certain limitations. It was conducted in a single hospital institution, albeit one that serves as a reference for 10 municipalities in the state of Mato Grosso do Sul, providing care across different levels of complexity. However, it is important to acknowledge that self-reporting may introduce potential influences or divergences from the actual experiences of the professionals.

Implications for practice

The study offers support for reflection on continuing education actions with nursing professionals, highlighting that the effectiveness of actions can trigger different impacts between secondary and higher education professionals. Furthermore, the study demonstrates the relevance of developing continuous educational actions among professionals.

CONCLUSION

The educational intervention showed an improvement in the correct removal of PPE, only among mid-level nursing professionals. Furthermore, all nursing professionals reported having access to PPE, although not all received adequate training on its proper use, highlighting the need for ongoing training programs.

This study also provided valuable information about the use of PPE by nursing professionals during the COVID-19 pandemic. Ultimately, it is hoped that the results of this study will serve as inspiration for the development of new strategies that aim to strengthen adherence and appropriate use of PPE.

RESUMO

Introdução: No contexto da pandemia de COVID-19, o cuidado específico no uso de Equipamentos de Proteção Individual (EPI) é crucial para o atendimento ao paciente. **Objetivo:** Avaliar o impacto de uma intervenção educacional sobre o uso auto-relatado de EPI por profissionais de enfermagem. A principal questão que guiou esta pesquisa foi: Qual é o efeito de uma intervenção educacional sobre o uso auto-relatado de EPI por profissionais de enfermagem? **Delineamento:** Este estudo quase-experimental utilizou um desenho antes e depois e envolveu 98 profissionais de enfermagem. **Resultados:** Foi constatado que 78,30% dos técnicos de enfermagem relataram ausências no trabalho devido à COVID-19. Entre esses profissionais, 82,27% relataram ter acesso a EPI durante a pandemia, porém apenas 78,4% receberam treinamento sobre seu uso. Notavelmente, antes da intervenção educacional, 53,2% dos técnicos de enfermagem e 57,8% dos enfermeiros realizaram corretamente a colocação de EPI. Após a intervenção, esses números mudaram para 45,5% e 36,8%, respectivamente. Quanto à sequência correta de remoção de EPI, antes da intervenção, 32,9% dos técnicos de enfermagem e 57,8% dos enfermeiros relataram precisão; esses números mudaram ligeiramente após a intervenção para 34,1% e 52,6%, respectivamente. **Implicações:** A intervenção educacional resultou em avanços significativos na correta remoção dos EPI, especialmente entre os profissionais de nível técnico. Este resultado sublinha a importância de programas de formação contínua, adaptados às necessidades específicas e aos níveis de experiência dos profissionais de saúde, para melhorar a aderência às práticas de segurança e otimizar a proteção em ambientes de alto risco.

DESCRIPTORIOS

Precauções Universais; Profissionais de Enfermagem; Infecção Hospitalar; Equipamento de Proteção Individual; COVID-19.

RESUMEN

Introducción: En el contexto de la pandemia de COVID-19, el cuidado específico en el uso de Equipos de Protección Individual (EPI) es crucial para la atención al paciente. **Objetivo:** Evaluar el impacto de una intervención educativa sobre el uso autoinformado de EPI por parte de profesionales de enfermería. La principal pregunta que guió esta investigación fue: ¿Cuál es el efecto de una intervención educativa sobre el uso autoinformado de EPI por parte de los profesionales de enfermería? **Delineación:** Este estudio cuasi-experimental utilizó un diseño antes y después e involucró a 98 profesionales de enfermería. **Resultados:** Se encontró que el 78,30% de los técnicos de enfermería informaron ausencias en el trabajo debido a COVID-19. Entre estos profesionales, el 82,27% reportó tener acceso a EPI durante la pandemia, sin embargo, solo el 78,4% recibió capacitación sobre su uso. Notablemente, antes de la intervención educativa, el 53,2% de los técnicos de enfermería y el 57,8% de los enfermeros realizaron correctamente la colocación de EPI. Después de la intervención, estos números cambiaron a 45,5% y 36,8%, respectivamente. En cuanto a la secuencia correcta de remoción de EPI, antes de la intervención, el 32,9% de los técnicos de enfermería y el 57,8% de los enfermeros reportaron precisión; estos números cambiaron ligeramente después de la intervención a 34,1% y 52,6%, respectivamente. **Implicaciones:** La intervención educativa resultó en avances significativos en la correcta remoción de los EPI, especialmente entre los profesionales de nivel técnico. Este resultado subraya la importancia de programas de formación continua, adaptados a las necesidades específicas y a los niveles de experiencia de los profesionales de la salud, para mejorar la adhesión a las prácticas de seguridad y optimizar la protección en ambientes de alto riesgo.

DESCRIPTORES

Precauciones Universales; Enfermeras Practicantes; Infección Hospitalaria; Equipo de Protección Personal; COVID-19.

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COLLABORATIONS

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AVAILABILITY OF DATA

Available upon request to the corresponding author.

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There are no conflicts of interest to declare.