

PERSONAL PROTECTIVE EQUIPMENT IN HOSPITAL NURSING CARE: A SCOPING REVIEW

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ABSTRACT

Objective: to analyze the scientific production on the use of Personal Protective Equipment by Nursing professionals during the care provided in the hospital environment.

Method: this is a scoping review, based on the 2020 Joanna Briggs Institute Manual and guided by PRISMA-PCR. PUBMED, EMBASE, CINAHL, LILACS, BDENF, SCOPUS and WEB of SCIENCE were used as databases, choosing a search period corresponding to the last 20 years. Data collection took place from September to October 2021. The study protocol is available in the Open Science Framework: <https://osf.io/7d8q9/files/>. Studies on the use of Personal Protective Equipment in direct care provided by the Nursing team in hospitals were included; and those that addressed reviews, theses and dissertations in other settings were excluded, as well as studies not available in full.

Results: the sample consisted of 26 documents. The items most cited and with the highest adherence in the studies were procedure gloves, while use of goggles was the least mentioned. The following stand out among the factors that facilitate PPE use by nurses: interpersonal relationships, knowledge, workload, standardization of guidelines, and participation of the care team in management decisions.

Conclusion: the need to educate the professionals using behavioral knowledge as a strategy, as well as maintenance of communication in the sectors to avoid contamination, the influence of workload and the standardization of guidelines are necessary in the hospital health services to increase health professionals' engagement towards the biosafety practices.

DESCRIPTORS: Personal protective equipment. Professional practice. Health personnel. Nursing. Precaution. Occupational risks. Occupational health.

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EQUIPAMENTOS DE PROTEÇÃO INDIVIDUAL NA ASSISTÊNCIA HOSPITALAR DE ENFERMAGEM: REVISÃO DE ESCOPO

RESUMO

Objetivo: analisar a produção científica sobre o uso de equipamento de proteção individual pelos profissionais da enfermagem durante a assistência no âmbito hospitalar.

Método: trata-se de uma revisão de escopo, baseada no Manual *Joanna Briggs Institute* de 2020 e norteado pelo PRISMA-PCR. Utilizou-se como base de dados PUBMED, EMBASE, CINAHL, LILACS, BDNF, SCOPUS e WEB of SCIENCE, sendo o período de busca escolhido nos últimos 20 anos. A coleta de dados ocorreu de setembro a outubro de 2021. Protocolo de estudo disponível em *Open Science Framework*: <https://osf.io/7d8q9/files/>. Foram incluídos estudos sobre o uso dos Equipamentos de Proteção Individual na assistência direta da equipe de enfermagem nos hospitais e excluídos aqueles que abordassem em outros cenários, revisões, teses, dissertações e estudos não disponíveis na íntegra.

Resultados: a amostra foi composta por 26 documentos. O equipamento mais citado e com maior adesão nos estudos foi as luvas de procedimento, enquanto que o uso dos óculos foi o menor. Dos fatores que facilitam o uso dos EPIs pelos enfermeiros destacam-se as relações interpessoais, conhecimento, carga de trabalho, padronização das diretrizes e participação da equipe assistencial nas decisões gerenciais.

Conclusão: a necessidade de educação dos profissionais utilizando como estratégia o conhecimento comportamental, a manutenção da comunicação nos setores para evitar a contaminação, a influência da carga de trabalho, a padronização das diretrizes são necessárias nos serviços de saúde hospitalar para aumentar o engajamento dos profissionais de saúde às práticas de biossegurança.

DESCRITORES: Equipamentos de proteção individual. Prática profissional. Pessoal de saúde. Enfermagem. Prevenção. Riscos ocupacionais. Saúde do trabalhador.

EQUIPO DE PROTECCIÓN PERSONAL EN LA ATENCIÓN HOSPITALARIA DE ENFERMERÍA: REVISIÓN DE ALCANCE

RESUMEN

Objetivo: analizar la producción científica sobre el uso del Equipo de Protección Personal en profesionales de Enfermería durante la atención provista en el ámbito hospitalario.

Método: revisión de alcance basada en el Manual del *Joanna Briggs Institute* de 2020 y guiada por PRISMA-PCR. Se utilizaron las bases de datos PUBMED, EMBASE, CINAHL, LILACS, BDNF, SCOPUS y WEB of SCIENCE, eligiéndose los últimos 20 años como período de búsqueda. Los datos fueron recolectados de septiembre a octubre de 2021. El protocolo del estudio se encuentra disponible en *Open Science Framework*: <https://osf.io/7d8q9/files/>. Se incluyeron estudios sobre el uso del Equipo de Protección Personal en la atención directa provista por el equipo de Enfermería en hospitales y se excluyó a los que tenían como tema revisiones, tesis y disertaciones en otros ámbitos, al igual que estudios no disponibles en formato de texto completo.

Resultados: la muestra estuvo compuesta por 26 documentos. Los elementos de protección más citados y con mayor adhesión en los estudios fueron los guantes de procedimiento, mientras que las gafas protectoras fueron las menos mencionadas. Entre los factores que facilitan el uso del PPE en los profesionales de Enfermería se destacan las relaciones interpersonales, el conocimiento, la carga de trabajo, la estandarización de las pautas y la participación del equipo asistencial en las decisiones gerenciales.

Conclusión: la necesidad de educar a los profesionales empleando como estrategia el conocimiento conductual, mantener la comunicación entre los sectores para evitar la contaminación, la influencia de la carga de trabajo, y la estandarización de las pautas son medidas necesarias en los servicios de salud hospitalaria para mejorar el nivel de compromiso de los profesionales de la salud con las prácticas de bioseguridad.

DESCRITORES: Equipo de protección personal. Práctica profesional. Personal de salud. Enfermería. Precaución. Riesgos ocupacionales. Salud laboral.

INTRODUCTION

Occupational Health is a field that seeks to integrate knowledge between work relationships and the health and disease process¹. Associated with this area, biosafety is understood as a set of measures to prevent or eliminate the risks that may compromise human, environmental or animal health.² It was disseminated internationally in the 1970s with publications by the *Center for Disease Control and Prevention* (CDC) on the precaution categories³.

In Brazil, biosafety was regulated in the 90s, with Regulatory Norm (*Norma Regulamentadora*, NR) 32 standing out for this study, which provides for the use of Personal Protective Equipment (PPE) for health professionals⁴.

Concern about biological risks arose from the verification of health problems in health professionals while handling microorganisms and in direct patient care, such as in outbreaks, epidemics and pandemics. The Acquired Immunodeficiency Syndrome (AIDS) epidemic in the 1980s stands out in the literature⁵, as well as tuberculosis⁶, MERS-CoV, Ebola, SARS-CoV and bird flu⁷, COVID-19⁸ and exposure to chemical risks⁹, such as administration of antineoplastics.

When contaminated during their work practice, health professionals suffer negative impacts on their physical and psychological health, safety and morals, as well as on patients' trust. Thus, it is understood that there is a need to adequately protect these professionals from contagious-infectious diseases¹⁰ and in handling cytotoxic agents that are harmful to their health¹¹. As a biosafety strategy, PPE use allows mitigating occupational risks and possible accidents¹²⁻¹³.

Nursing stands out among the teams working in health services, consisting of nurses, technicians and assistants who provide direct care to all patients. Therefore, in their work practice, these professionals are routinely more exposed and vulnerable to diseases while handling patients' secretions/excretions and contaminated surfaces¹⁴, in addition to preparation and handling of potentially toxic medications.

In the literature there are studies that address biosafety prevention measures¹⁵, as well as PPE use during the care provided by health professionals¹⁶⁻¹⁸. Currently, a large part of the literature addresses the COVID-19 context and much has been seen in the media about shortage of materials for the professionals during this pandemic, including Brazil.

In addition to the socioeconomic context, it is understood from the professional practice that other factors can influence PPE use or non-use, such as perception of risk and vulnerability to exposure at work. In this sense, it becomes necessary to seek diverse evidence to corroborate (or not) this knowledge of the practice about which factors can influence PPE use.

Thus, the following guiding question is formulated for the study: which is the scientific knowledge available in the literature on PPE use by the Nursing team during direct care in the hospital environment? To answer this question, the objective was to analyze the scientific production on PPE use by the Nursing team during the care provided in the hospital environment.

METHOD

This is a scoping review, which allows mapping the key concepts that support a given research area, main sources and types of evidence available¹⁹. In this case, regarding PPE use during the care provided by the Nursing team in the hospital environment.

For this purpose, the methodological recommendations set forth in the *Joanna Briggs Institute (JBI) Reviewer's Manual* on scoping reviews²⁰ and the items from the *Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews-PRISMA-ScR* flowchart²¹ were used. A protocol was developed for this research and published in the *Open Science Framework* system available at the following address: <https://osf.io/7d8q9/files/>.

To establish the search strategy, the PCC acronym was used, where P (target population) - Nursing professionals, C (concept) - Use of Personal Protective Equipment, and C (context) - Direct care provided in hospitals.

Definition of the descriptors and databases was carried out together with a librarian who also validated the research protocol. To define the descriptors, the Health Sciences Descriptors (*Descritores em Ciências da Saúde*, DeCS) page of the Virtual Health Library (*Biblioteca Virtual em Saúde*, BVS) were consulted in Portuguese and Spanish, as well as the Medical Subject Headings (MeSH) in English, with the following choices: “*Equipamento de Proteção Individual*”, “*Equipo de Protección Personal*”, “*Personal Protective Equipment*”[Mesh], “*Prática Profissional*”, “*Práctica Profesional*” “*Professional Practice*”[Mesh], “*Pessoal de Saúde*” “*Health Personnel*”[Mesh].

When the *Enfermagem*, *Enfermería* and Nursing descriptors were used, the number of studies was considerably reduced. Thus, it was preferred to define the search strategy with “Health Personnel”. The databases used for the search were the following: National Library of Medicine (PUBMED), EMBASE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), SCOPUS, Web of Science (WoS), Latin American and Caribbean Literature in Health Sciences (*Literatura Latino-Americana e do Caribe em Ciências da Saúde*, LILACS), as well as the National Nursing Database (*Base de Dados Nacionais da Enfermagem*, BDEF) and the Scientific Electronic Library Online (SciELO). The search strategy used for each database is available in supplement 1.

In all the databases, filters for language, type of material and period of time were used, considering the inclusion criteria. These were as follows: studies that addressed Nursing team professionals (nurses, and nursing technicians and assistants) working in direct patient care in hospitals, outpatient clinics, wards, surgical centers, intensive and emergency care units, and that used PPE items during the assistance provided. As for the outcome, PPE items and barrier/restraint devices (coat/apron and foot protector) were considered²⁻⁴ regarding standard precautions and against contact, droplets and aerosols, in outbreaks, epidemics and pandemics; in the face of contagious-infectious and work-related diseases, exposure to radiation in operating rooms; as well as in administration of medications (antineoplastics, antibiotics, antivirals) and in the prevention of Healthcare-Associated Infections.

As for the research period, the intention was to map the knowledge in the literature of the last 20 years, justified by the political aspects about the occupational safety culture in Brazil and in the world. Thus, the period defined was from September 30th, 2001, to September 30th, 2021, in Portuguese, English and Spanish.

The exclusion criteria considered were as follows: studies that were presented in the form of books, literature reviews, abstracts, congress materials, editorials and duplicates, as well as those that were not available in full or online. In addition, there was exclusion of studies that addressed basic health units, home context, pre-care, private practice or other health institutions such as vaccination clinics and laboratories; aimed at students, residents and visitors, in addition to those that addressed other types of PPE items such as helmets and hearing protective devices.

As for the study sources, primary studies were considered in general, in order to understand PPE use in the global and national spectrum; a search was also carried out in the gray literature through the frameworks established by regulatory bodies such as the World Health Organization (WHO), the Center for Disease Control and Prevention (CDC) and the Ministry of Health (*Ministério da Saúde*, MS) used in the articles selected for this review. The search was carried out in September 2021. Data collection took place from September to October 2021.

Three reviewers were in charge of selecting the studies, with two (RKS and TLS) independently performing the selection and evaluation processes and the third reviewer (NG) being consulted for any and all discrepancies identified in the process. A pre-test was carried out with all three reviewers

with the evaluation of ten studies, in full, selected from two databases (five from each one) to ensure consensus of the entire team regarding the eligibility criteria.

Subsequently, we proceeded to select the studies first by titles and abstracts, considering the eligibility criteria already described. The studies selected in this first stage were imported into the *EndNote web*® software. At a second moment, full reading of the studies was carried out for selection of the final sample. The materials chosen for full reading were organized in an *Excel*® spreadsheet. To refine the data collection instrument, a pre-analysis was performed with five studies for each reviewer.

The variables chosen for analysis were the following: database, name of the journal, authors, year, title in the original language, country, objective in the original language, type of study described by the original authors; whether it was a single-center or multicenter study, number of participants, profession of the participants, inclusion and exclusion criteria, training time of the participants, whether any type of measuring instrument was used, whether any theoretical-methodological framework was used, type of analysis, types of PPE, context of PPE use indicated by the authors, biological or pharmacological agent, and interventions (if any). Diverse information was also extracted on the conditions that facilitate or hinder PPE use, individual, work and organizational factors and the main results. This process of extracting the results and mapping was carried out in a descriptive way.

To categorize the results, the research results presented by Cunha *et al*²² were used as a basis, which are related to the conditions that facilitate and/or hinder adherence to PPE use, in terms of the individual, work and organizational aspects.

RESULTS

A total of 5,801 publications were identified in the databases and 11 through the frameworks set forth by the regulatory bodies of the studies selected, as shown in Figure 1.

Of the 19 articles included in the final sample, ten were identified in PUBMED²⁴⁻³³, three in LILACS/BDENF³⁴⁻³⁶, and two in SCOPUS³⁷⁻³⁸, EMBASE³⁹⁻⁴⁰ and CINAHL⁴¹⁻⁴² each. Six publications were chosen in the gray literature: three from the CDC⁴³⁻⁴⁵, two from the WHO⁴⁶⁻⁴⁷ and one from the *American Society of Health-system Pharmacists (ASHP)*⁴⁸.

The United States of America stands out among the most predominant countries with 10 studies published in the scientific literature^{41-42,25-27,33} and from the gray literature^{43-46,48} (Chart 1). As for the years of publication of the studies, they are presented in a diversified way with greater predominance of 2019 (n=4) and 2016 (n=3).

Most of the studies had a quantitative and cross-sectional approach^{24,26-30,33-35,38-42}, followed by qualitative research studies^{25,31-32,36,37}, and only one mixed-methods study²⁴. Although most of the authors include the definitions of the approaches and/or method, some did not do so^{28,38}.

Of the studies conducted, 55% (n=11) were multicenter, 35% (n=7) single-center and 10% (n=2) were anonymous online surveys.

In relation to the Nursing team professionals, most of the studies (n=16) addressed only nurses^{24,26-28-33,37-40} and the number of participants varied from 20³¹ to 1,500²⁸. Two studies^{25,35} included the Nursing team (technicians and assistants) as well as other professionals, such as physical therapists, physicians and dentists. The training time of the professionals cited in the studies varied from 1 to 20 years.

Two papers were based on behavioral theories such as the Social Cognitive Theory²⁸ and the Health Beliefs Model²⁵. Others resorted to qualitative approach frameworks (ethnography³⁷, phenomenology³¹ and oral history³⁶) for data collection and analyses.

In the evaluation of the questionnaires and/or instruments, in addition to those for the collection of sociodemographic data, the studies used the Standard Precautions Adherence Scale translated and validated in Brazil³⁵, the Practice Environment Scale and Nursing Work Index²⁴, and the Hazardous Drug

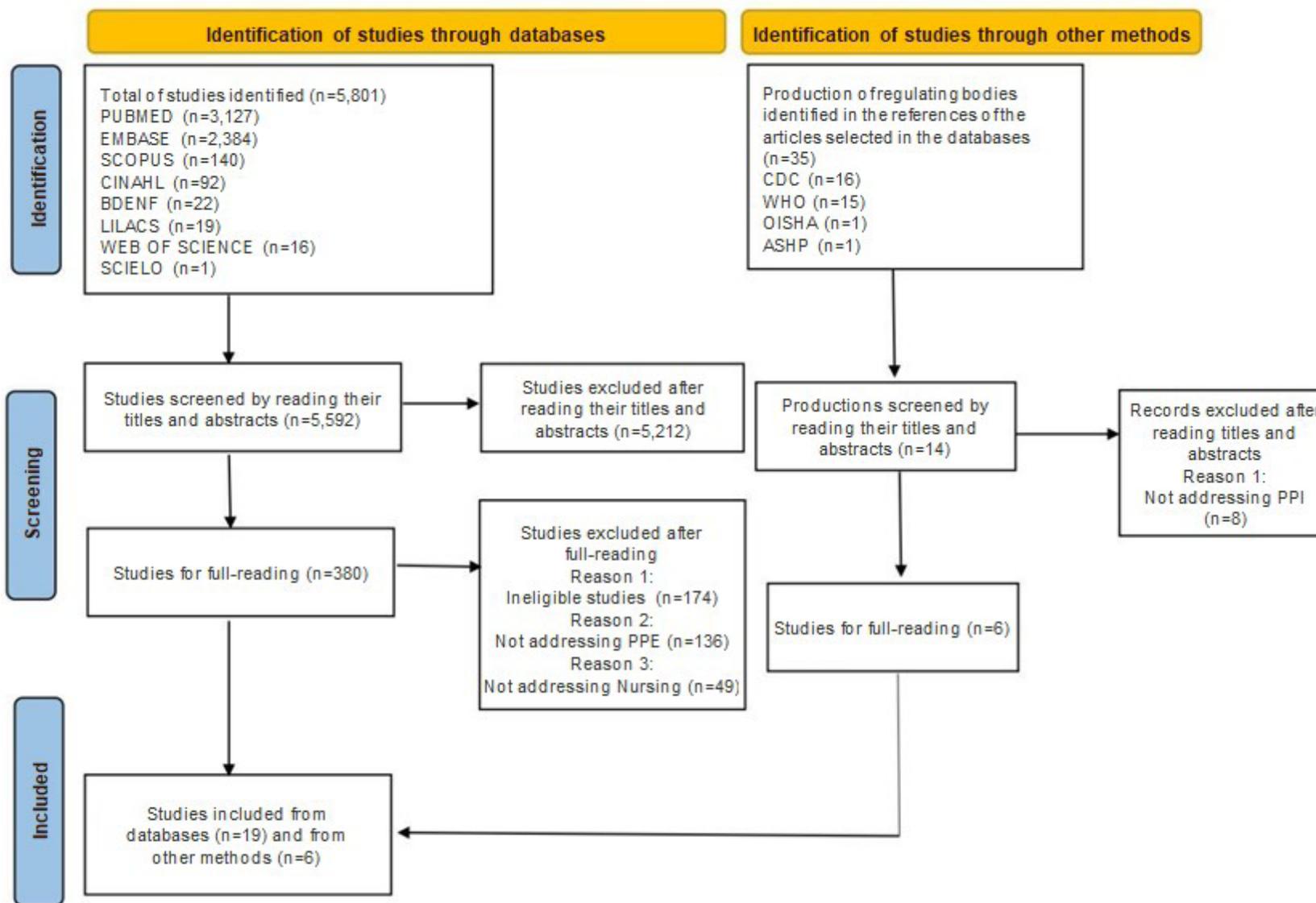


Figure 1 - Flowchart of the search and selection processes corresponding to the studies of the current scoping review, adapted from PRISMA-ScR²³. Florianópolis, SC, Brazil, 2021.

Chart 1 - Presentation of the reference number, country and type of Personal Protective Equipment addressed. Florianópolis, SC, Brazil, 2021.

Study	Country	Types of Personal Protective Equipment								
		Respiratory protection mask	Surgical mask	Face shield	Goggles	Cap	Apron/Coat	Gloves	Double gloves	Foot protector
25	USA	X								
26	USA							X		
27	USA	X								
28	China		X		X		X	X		X
29	Canada	X	X		X					
30	Canada	X								
33	USA		X		X		X		X	
34	Brazil		X	X			X	X		
35	Brazil		X		X		X	X		
37	China	X			X	X	X	X	X	
38	Poland		X		X		X	X		
39	Egypt	X								
40	Ethiopia	X			X	X	X	X		X
41	USA	X		X	X		X	X		
42	USA		X	X	X	X	X	X	X	X
44	USA	X	X	X	X	X	X	X	X	X
45	USA	X			X	X	X	X	X	X
48	USA	X			X	X	X	X	X	X

Handling Questionnaire³³. Two studies^{40–41} used different modules of the *Health and Safety Practices Survey of Healthcare Workers* research study to identify knowledge and practices for safe handling of cytotoxic drugs⁴⁰ and knowledge of the dangerous effects of aerosol medications⁴¹. In addition, other studies resorted to instruments based on previous publications about standard precautions²⁸, factors associated with self-protective behavior at work³⁰, the 2007 CDC isolation precautions guidelines³² and indicators from hospital infection quality assessment manuals³⁴.

As for the types of PPE and barrier devices addressed in the results, they are described in Chart 1. Six studies^{24,31–32,36,43,46} did not specifically address any PPE item, although they contextualize their use in the practice.

In relation to the context, the studies included health and safety in the face of biological and pharmacological agents. As for diseases and/or biological agents, the following were identified: Tuberculosis^{27,31,39}, HIV/AIDS^{36,38}, Hepatitis B and Hepatitis C³⁸, *Clostridium Difficile*, MRSA, Chickenpox, Flu and Meningococcal Meningitis²⁷ and COVID-19²⁴. As for the medications, antineoplastics^{33,37,40,42,44–45,48}, air sprayers⁴¹ and cytotoxics⁴³ were studied.

Some studies addressed standard precautions^{26,28,32,34–35}, mask use in a general context²⁵ and face protection for communicable respiratory diseases^{29–30}.

In relation to frequency, the most used PPE items were gloves with 83.4% (n=501) and the least used were goggles, with 8.8% (n=53). Of the nurses who wore goggles, nearly 50% had already had contact with splashes³⁸. In another study, it was observed that the use of goggles, masks and protective clothing presented less compliance, unlike gloves, due to their availability and accessibility in the sectors²⁸.

In the intensive care unit, the highest PPE adherence rate by the multiprofessional team in relation to the number of procedures observed corresponded to the use of gloves, followed by aprons, surgical masks and goggles. The authors attributed these results to the fact that a large percentage of the patients hospitalized during the collection period were under contact precautions. They also described that the rate of correct answers regarding PPE use in the procedures was below 50%, justified by the unnecessary use of masks in some procedures and by non-use of goggles in others (such as tracheal aspiration), which would be mandatory³⁴.

In another Brazilian study, conducted with a sample of 54 Nursing team professionals, the authors found that the items on the scale with the highest score (lower adherence to standard precautions) were disposal of sharps in proper containers, use of disposable gloves when there is risk of blood or other secretions, handling of other sharps (scalpel, for example), and that the item with the highest adherence to the precautions was the one that addresses needle recapping to puncture patients' veins. However, it is noted that 25 of the 54 participants stated never recapping needles³⁵.

Regarding protection against exposure to antineoplastics, the most consistent PPE use corresponded to gloves and masks as personal protective measures. The authors indicated that no professional in the study used all the PPE items required for the preparation, administration and disposal stages. Almost 70% of the sample of nurses reported lack of training to handle this type of medication⁴⁰, although the guideline set forth by the *American Society of Health-System Pharmacists* recommends the use of double gloves or chemotherapy gloves when administering antineoplastics to ensure workers' safety⁴⁸ and, preferably, for all drug handling processes.

In another study⁴² regarding handling of antineoplastics, it was identified that 98% (n=2,069) of the participants always exchanged damaged gloves immediately after contamination, and that 85% (n=1,972) wore gloves during chemotherapy and a non-absorbent apron with a closed front and tight cuffs. In addition, 59% (n=1,762) of the participants reported never wearing double gloves, 78% (n=1,886) not wearing protective goggles, 95% (n=1,953) respirators, 93% (n=1,997) foot protectors and 94% (n=1,995), caps. Figure 2 presents the results obtained from the sample on the conditions that facilitate and hinder PPE use.

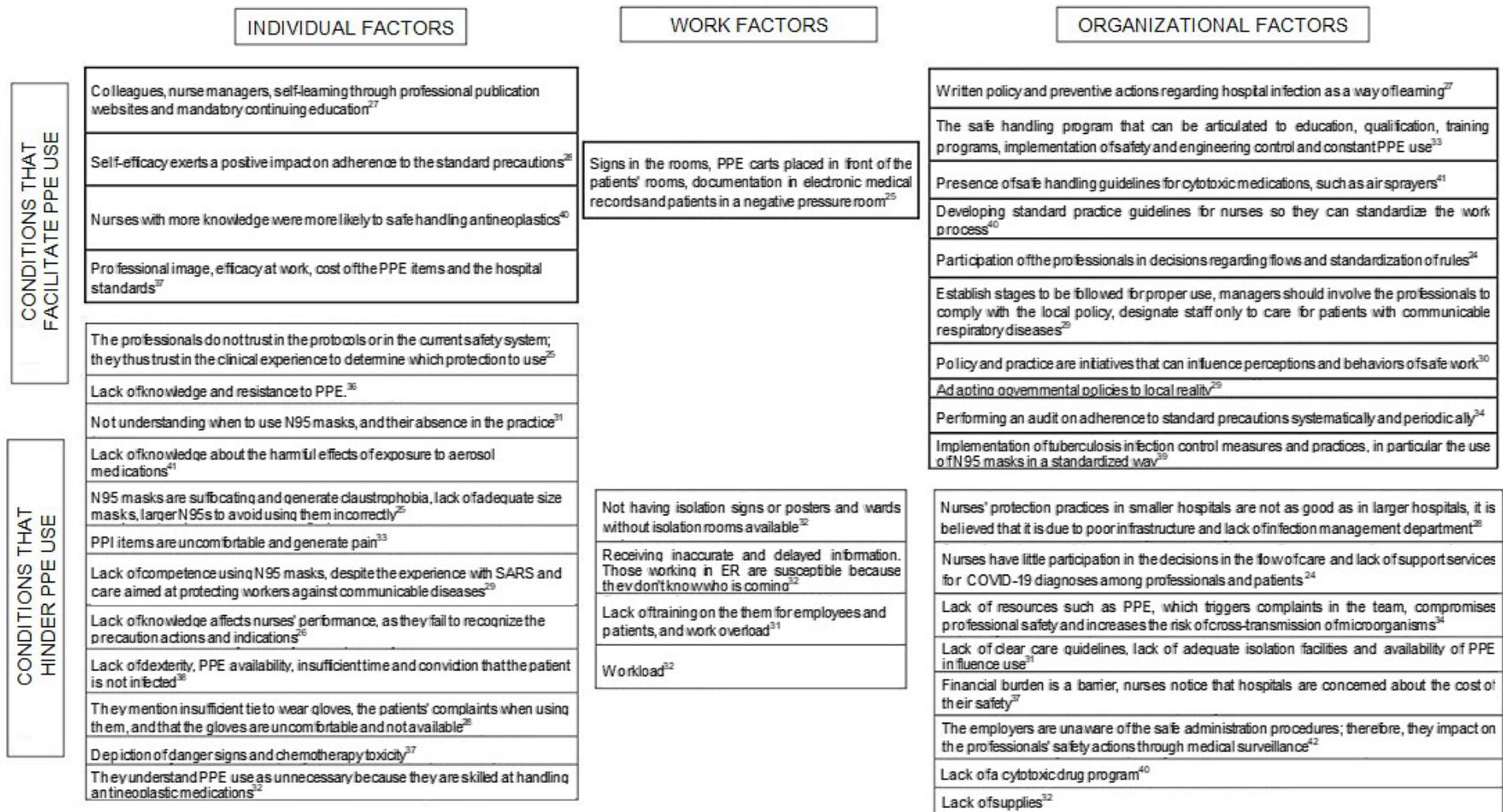


Figure 2 - Presentation of the results of the conditions that facilitate and hinder PPE use by the Nursing team in the hospital environment. Florianópolis, SC, Brazil, 2021.

In addition, the nurses who perceived the organization's support in relation to health and safety were twice as likely to report adherence to the use of respiratory protection masks²⁹.

Regarding the organizational factors, as reasons for not using chemotherapy gloves, the nurses mentioned low skin exposure, that PPE items were not offered by their employers, and that they were not part of the institution's protocol. In turn, in relation to the use of non-absorbent aprons, it was identified that no professional uses them. Regarding goggles and respirators, the respondents increasingly asserted the following: that they were not part of the protocol, little skin exposure, and that an engineering control was being used⁴².

When it comes to the professionals' experience, no statistically significant difference was identified between Nursing professionals with less and more than six years of experience. However, it was noticed that the professionals with more than 10 years of experience were more adherent to washing their hands after removing the disposable gloves than those with less than six years of experience. Overall, adherence to the standard precautions in this study was considered to be intermediate³⁵.

In the results of the current review, excessive PPE use was identified in situations in which there is no indication; the most used were surgical masks²⁷, aprons²⁸, respiratory protection masks^{25,27} and sterile gloves²⁷.

It was observed that few nurses, 20.2% (n=17), were following the standard infection control precautions and that a reduced number was following the transmission-based isolation precautions: 11.9% (n=10)³².

The type of unit was a significant predictor of adherence to respiratory protection masks by the emergency room nurses, as 60% reported that they are less likely to use such masks when compared to intensive care nurses. This is explained due to the fast-paced and hectic work environment, more focused on making diagnoses, managing crises and dealing with unforeseen events²⁹. Therefore, the Emergency Room was shown to be the locus with the lowest adherence to N95 masks²⁵.

In addition, the literature shows that the Nursing team is responsible for implementing infection control practices in patient care, with nurses being responsible for the Hospital Infection Control Commission, in its various functions, identifying Nursing adherence to the established policies⁴⁷.

DISCUSSION

In the current review it was sought to know what has been produced in the literature about PPE use by Nursing professionals in the hospital environment, considering the initial milestones of the public policies on safety at work.

The sample was heterogeneous in terms of the objectives, number of professionals included, time of experience and instruments used; however, there was predominance of cross-sectional studies, evidencing that there is a gap in intervention studies for PPE use or for the adoption of guidelines by Nursing professionals. As expected, there is a greater number of international publications on the theme. Considering that Brazil is a continental country with different realities and cultures, it is suggested to advance in the conduction of research studies related to PPE use by the Nursing team.

The hospital scenario is complex, consisting of a multiprofessional team with different specialties and organizational cultures. Thus, various factors can contribute to adherence or non-adherence to the instituted policies.

From the individual factors, the influence of colleagues and supervisors for PPE use is recognized. Choice to use it or not is individual, although there are shared values and beliefs that can be decisive in the personal choices. As also already mentioned, the perception of contamination risk along with work relationships must be observed and can be a strategy for the development of prevention measures, as well as of measures for improving adherence and promote behavioral changes⁴⁹. The literature

shows that future training programs should consider increasing the perception of self-efficacy and knowledge about the protection strategies used⁵⁰.

Regarding the conditions that hinder PPE use at the individual level, lack of knowledge is recognized as a reality present among nurses in the face of the standard precautions, despite recognizing the need to use such items⁵¹. As for the adherence findings of this review, high adherence to gloves and low adherence to goggles prevailed; however, no studies were found that substantiate low adherence to the use of goggles during the care provided, although it is suggested that this is related to the fact that the professionals do not perceive them as necessary despite being established in the regulatory and biosafety standards.

From the work factors, visual communication, such as signposts, available materials, adequate communication of patient information/conditions and training, is recognized as important in adherence to PPE use.

Nurses play a managerial role in organizing the work of their team and the unit⁵². As pointed out in the review sample guideline⁴⁸, nurses participate in hospital infection control commissions that should assist in adequacy of the hospital units, as well as facilitate the training processes of other professionals working in the institution. In addition to educational interventions and improvement of the work environment, diverse research results suggest that the workload should also be evaluated for the professionals to use PPE items⁵³.

From the organizational aspects, there is also the challenge faced by hospitals regarding the financial burden. The literature mentions that the daily costs to maintain PPE items in Intensive Care Units increased by nearly 500% at the beginning of the COVID-19 pandemic⁵⁴. As there was no forecast of an epidemic and, therefore, no financial planning for such an expense, many units were left without PPE items, as seen in the world's media. Associated with this, the impact on the production of PPE items in China due to the pandemic was evident.

Although few studies addressed accessibility to PPE items by the professionals, the results showed that the most expensive PPE items, such as N95 masks, are stored further away to avoid misuse²⁵. Therefore, the need to intervene in educating the Nursing team professionals is recognized, so that they can elucidate use of this PPE.

As for the managerial actions, the PPE adherence audit is recognized, so that it can monitor use by the Nursing team. However, this surveillance action has the *Hawthorne* effect as a negative aspect, which could be reduced by using camcorders⁵⁵.

Interesting results on adherence to PPE in the face of handling dangerous drugs shows detectable levels of antineoplastic medications in the urine of the professionals who handle them, an assessment made through biological monitoring, which characterizes permanence of occupational exposure⁵⁶. However, as seen in the results, there are guidelines that recommend and guide proper PPE use when it comes to toxic medications.

This biological monitoring process is carried out through the safe handling program, a monitoring practice that is also applied to biological agents, as in the case of COVID-19⁵⁷. However, no studies were found that addressed this practice in management. This care measure can also be applied to the professionals who take care of patients with tuberculosis, through admission and annual screening, performing chest X-rays and serological tests³⁹.

Therefore, the importance of professional care regarding handling of these drugs is emphasized through training and standardization grounded on occupational safety and on protection of the patients, the workers and the environment⁵⁸.

In addition to these aspects, the importance of PPE availability and permanent education is highlighted⁵⁹, reinforcing the results of the current review, which point out that there is a need

for nurses to participate in the clinical practice in the decisions/elaboration of managerial aspects, thus helping to survey the real needs of the team⁶⁰. Actions and interventions must be articulated by the management of the units and service managers in a way that can favor the safety climate and, consequently, the safety culture of professionals and patients alike⁵⁷.

The results of the current review indicate potential studies in order to verify adherence or non-adherence to PPE use by Nursing professionals, mainly bringing the individual, work and organizational aspects to light. Intervention studies help with evidence and, consequently, with practices. As for the Nursing practice, the results indicate that interpersonal relationships, leadership and organization are fundamental for adherence. With regard to teaching, it can be reinforced that nurses are educators and producers of knowledge.

CONCLUSION

The conditions that favor PPE use are geared towards education related to behavioral knowledge; in the face of adherence to PPE, gloves were identified as with greater adherence and goggles as less adhered to; a gap found was in relation to the investigation of low adherence to protection goggles in the assistance provided.

As for work, visual communication was identified as favorable; and sectors that demand dynamics, such as emergency rooms, and workload, as factors that exert negative influences on PPE use. As for the organization, it is worth incorporating managerial practices in relation to the working conditions and standardization of diverse information, as well as including healthcare professionals in the decision-making process. There is concern for workers handling dangerous drugs; however, a gap was found in relation to studies that address the monitoring program for the surveillance of occupational exposure.

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NOTES

ORIGIN OF THE ARTICLE

Extracted from the dissertation - Assessment of nurses' beliefs related to the use of respiratory protection masks to prevent COVID-19 in the Intensive Care Units from the South of the country, presented at the Graduate Program in Nursing, *Universidade Federal de Santa Catarina*, in 2021.

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CONFLICT OF INTERESTS

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