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SYSTEMATIC REVIEW ARTICLE

Determinants of nurses' adherence to personal protective equipment in the emergency department: Scoping review

Determinantes da adesão dos enfermeiros aos equipamentos de proteção individual no serviço de urgência: Scoping review

Determinantes de la adherencia de los enfermeros a los equipos de protección individual en el servicio de urgencias: Revisión exploratoria

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Abstract

Background: Personal protective equipment (PPE) ensures the safety of both health professionals and patients. However, the factors influencing adherence to PPE are scattered in the literature.
Objective: To map the factors influencing nurses' adherence to PPE use in the emergency department.
Review method: Scoping review based on the Joanna Briggs Institute (JBI) methodology. Two independent reviewers analyzed the relevance of the studies, and extracted and synthesized data.
Presentation and interpretation of results: The studies included in this review revealed that responsibility, knowledge of the consequences, educational interventions, and real-time feedback promote adherence to PPE use. In turn, factors such as age, diseases, lack of training and assessment, lack of knowledge, and insecurity hinder adherence to PPE use.
Conclusion: Identifying these factors is crucial in developing interventions to increase adherence to PPE use. Further studies should be carried out to determine the factors influencing PPE use.

Keywords: nurses; personal protective equipment; review; emergency departments

Resumo

Contexto: O uso de equipamentos de proteção individual (EPIs) garante a segurança dos profissionais de saúde e utentes. No entanto, os fatores que afetam a adesão aos mesmos encontram-se dispersos na literatura.
Objetivo: Mapear os fatores que determinam a adesão ao uso de EPIs pelos enfermeiros do serviço de urgência.
Método de revisão: *Scoping review* com base nos princípios preconizados pelo *Joanna Briggs Institute* (JBI). Dois revisores independentes realizaram a análise de relevância dos artigos, a extração e síntese dos dados.
Apresentação e interpretação dos resultados: Os artigos incluídos na revisão revelam que a responsabilidade, o conhecimento das consequências, as intervenções educacionais e o *feedback* em tempo real promovem a utilização de EPIs. Por sua vez, fatores como idade, patologias, falta de treino e avaliação, falta de conhecimento e insegurança inibem a adesão aos EPIs.
Conclusão: A identificação destes fatores é crucial para o desenvolvimento de intervenções que visem o aumento da adesão aos EPIs. Mais estudos devem ser realizados para determinar que fatores influenciam o seu uso.

Palavras-chave: enfermeiras e enfermeiros; equipamentos de proteção individual; revisão; serviço hospitalar de emergência

Resumen

Contexto: El uso de equipos de protección individual (EPI) garantiza la seguridad de los profesionales sanitarios y de los usuarios. Sin embargo, los factores que afectan su adherencia a los mismos se encuentran dispersos en la literatura.
Objetivo: Mapear los factores que determinan la adherencia al uso de EPI por parte de los enfermeros en el servicio de urgencias.
Método de revisión: Revisión exploratoria (*scoping review*) con base en los principios del Joanna Briggs Institute (JBI). Dos revisores independientes realizaron el análisis de relevancia de los artículos, la extracción y la síntesis de los datos.
Presentación e interpretación de los resultados: Los artículos incluidos en la revisión muestran que la responsabilidad, el conocimiento de las consecuencias, las intervenciones educativas y la retroalimentación en tiempo real promueven el uso de los EPI. A su vez, factores como la edad, las patologías, la falta de formación y evaluación, el desconocimiento y la inseguridad inhiben la adherencia a los EPI.
Conclusión: La identificación de estos factores es crucial para el desarrollo de intervenciones destinadas a aumentar la adherencia a los EPI. Deberían realizarse más estudios para determinar qué factores influyen en su uso.

Palabras clave: enfermeras y enfermeros; equipo de protección personal; revisión; servicio de urgencia en hospital

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Introduction

The hospital environment is one of the most dangerous working environments, putting health professionals at risk and influencing the quality and efficiency of health care (Mutifasari et al., 2018). As the largest group of health professionals, nurses are more exposed to risk because they are responsible for direct patient care (Loro et al., 2016; Mutifasari et al., 2018).
The emergency department (ED) is a dynamic environment of immediate and temporary care delivery that exposes nurses to an increased risk, making both the institution and the nurses responsible for minimizing the risk, whenever possible (Loro et al., 2016).
The risk of infection emerges as one of the most prevalent risks among nurses (Loro et al., 2016). However, these health professionals can also be a source of transmission, so there is a need to protect both nurses and patients (Brown et al., 2019).
Healthcare-associated infections (HAIs) affect one in 10 patients worldwide (World Health Organization [WHO], 2016). In 2016, in Portugal, 7.8% of patients acquired a HAI in the hospital (Direção-Geral da Saúde [DGS], 2017). Most of them are related to the lack of use or inappropriate use of prevention measures (WHO, 2019). These infections are a leading cause of morbidity and mortality, resulting in increased consumption of hospital and community resources. They are also associated with antibiotic resistance. It is estimated that about a third of these infections are preventable (DGS, 2015, 2017).
Infections are one of the most common reasons for an ED visit. Furthermore, due to its specific characteristics, the ED has its own challenges in controlling and preventing infections, namely due to its intense patient flow and overcrowding. Nonspecific signs and symptoms may delay the diagnosis of an infection and, consequently, delay isolation and the use of appropriate personal protective equipment (PPE), increasing the potential for transmission (Liang et al., 2018).
PPE is equipment designed to act as a barrier, preventing individuals from becoming contaminated with bodily fluids. These include all bodily secretions and excretions, including airborne particles, that may come from direct contact with the patient or the surrounding environment. PPE serves a dual purpose, preventing both health professionals and patients from becoming infected (Brown et al., 2019).
Despite the concerns mentioned above, particularly about the importance of PPE use and the specificities of the ED, several studies have shown that nurses' adherence to PPE use is lower than what is considered appropriate (Brown et al., 2019; Porto & Marziale, 2016).
A preliminary search of MEDLINE (PubMed), Cochrane Database of Systematic Reviews, Joanna Briggs Institute (JBI) Evidence Synthesis, PROSPERO, and Open Science Framework (OSF) revealed no reviews (published or ongoing) on this topic and time period.
The methodology proposed by the Joanna Briggs Institute (JBI) for scoping reviews (Peters et al., 2020) was used to answer the following review question: What are the factors influencing nurses' adherence to PPE use in the ED? Thus, this study aimed to map the factors promoting or hindering nurses' adherence to PPE use in the ED.

Systematic review method

A scoping review was conducted because the authors aimed to map the available evidence, identify gaps in the available evidence, and perform a preliminary exercise to justify and inform the development of a systematic literature review. The best approach to achieving these objectives is developing a scoping review (Peters et al., 2020).
The inclusion and exclusion criteria were selected based on the PCC (Population, Context, and Concept) framework. Based on these elements, this scoping review included studies that: a) regarding the type of participants, addressed nurses; b) regarding the concept, addressed PPE; c) regarding the context, addressed the ED.
Concerning the type of studies, published qualitative and quantitative studies and literature reviews were included.

Strategy for searching and identifying studies

The search strategy included published and unpublished studies and consisted of three steps: 1) Limited initial search of MEDLINE (via PubMed) and CINAHL (via EBSCO) databases, followed by an analysis of text words in titles and abstracts and index terms used to describe the article; 2) Second search using all keywords and index terms identified in all included databases (Table 1); 3) The reference lists of the included articles were analyzed to identify additional studies. This review considered studies written in English, Spanish, and Portuguese, published over a 5-year time period (2015-2020). This time limit was established to obtain the latest scientific evidence, given that the search found a review published in 2016 on this topic (Porto & Marziale, 2016).

Table 1

Results of the search strategy and limiters applied by database

Database: *CINAHL Complete (via EBSCOhost)*	
Records: 18	
Limiters: Publication date: (2015 – 2020); Exclude MEDLINE records; Language (English, Portuguese, Spanish)	
Search strategy (March 31, 2020):	
S7	*S1 AND S4 AND S5*
S6	*S1 AND S4 AND S5*

S5	*S2 OR S3*
S4	TI "emergency room" OR AB "emergency room" OR TI "emergency department" OR AB "emergency department" OR MH Emergency Service
S3	*TI respirator OR AB respirator OR TI gown OR AB gown OR TI "face shield" OR AB "face shield" OR MH Protective Devices*
S2	*TI "individual protection equipment" OR AB "individual protection equipment" OR TI glove OR AB glove OR TI gloves OR AB gloves OR TI mask OR AB mask OR TI masks OR AB masks OR TI goggles OR AB goggles*
S1	*TI nurs* OR AB nurs* OR MH nurses*

Database: *Cochrane Central Register of Controlled Trials (via EBSCOhost)*
Records: 6
Limiters: Publication date: (2015 - 2020)
Search strategy (March 31, 2020):

S6	*S1 AND S4 AND S5*
S5	*S2 OR S3*
S4	*TI "emergency room" OR AB "emergency room" OR TI "emergency department" OR AB "emergency department"*
S3	*TI respirator OR AB respirator OR TI gown OR AB gown OR TI "face shield" OR AB "face shield"*
S2	*TI "individual protection equipment" OR AB "individual protection equipment" OR TI glove OR AB glove OR TI gloves OR AB gloves OR TI mask OR AB mask OR TI masks OR AB masks OR TI goggles OR AB goggles*
S1	*TI nurs* OR AB nurs**

Database: *MEDLINE (via PubMed)*
Records: 18
Search strategy (March 31, 2020):

Search: (((nurses[MeSH Terms]) OR (nurs[Title/Abstract])) AND (((emergency room[Title/Abstract]) OR (emergency department[Title/Abstract])) OR (Emergency Departments[MeSH Terms]))) AND (((((((individual protection equipment[Title/Abstract]) OR ((glove[Title/Abstract]) OR (gloves[Title/Abstract]))) OR ((masks[Title/Abstract]) OR (mask[Title/Abstract]))) OR (gown[Title/Abstract])) OR (respirator)) OR (face shield[Title/Abstract])) OR (Personal Protective Equipment[MeSH Terms])) Filters: in the last 5 years, English, Portuguese, Spanish, MEDLINE*

Database: *SciELO*
Records: 18
Search strategy (March 31, 2020):

((ti:(nurs)) OR (ab:(nurs*))) AND ((((ti:("emergency department")) OR (ab:("emergency department"))) OR ((ti:("emergency room")) OR (ab:("emergency room")))) OR (ti:("emergency services")) OR (ab:("emergency services"))) AND ((((ti:("individual protection equipment")) OR (ab:("individual protection equipment")) OR (ti:(glove)) OR (ab:(glove)) OR (ti:(gloves)) OR (ab:(gloves)) OR (ti:(mask)) OR (ab:(mask)) OR (ti:(masks)) OR (ab:(masks)) OR (ti:(gown)) OR (ab:(gown)) OR (ti:(respirator)) OR (ab:(respirator)) OR (ti:("protection measures")) OR (ab:("protection measures"))) OR (ti:("face shield")) OR (ab:("face shield"))))*

Database: *DART-Europe*
Records: 0
Limiters: Publication date (2015-2020)
Search strategy (March 31, 2020):

S2	*nurses AND personal protective equipment = 0*
S1	*nurse AND personal protective equipment = 0*

Database: *OpenGrey*
Records: 0
Search strategy (March 31, 2020):

S2	*nurses AND personal protective equipment = 0*
S1	*nurse AND personal protective equipment = 0*

Database: Open Access Scientific Repositories of Portugal (RCAAP*)*
Records: 1
Limiters: Publication date (2015-2020)
Search strategy (March 31, 2020):

S4	*AB: nurses AND personal protective equipment = 0*
S3	*AB: nurse AND personal protective equipment = 0*
S2	*TI: nurses AND personal protective equipment = 0*
S1	*TI: nurse AND personal protective equipment = 1*

Two independent reviewers analyzed the relevance of the articles based on the information provided in the title and abstract. The full-text article was retrieved for all studies that met the inclusion criteria. If the reviewers had doubts about the relevance of a study based on the abstract, the full-text article was retrieved. Two independent reviewers analyzed the full-text articles to determine whether they met the inclusion criteria. Any disagreements between the reviewers were resolved with a third reviewer.
The relevance of the studies identified from reference lists was assessed based on their title and abstract.

Data extraction
Two independent reviewers extracted the data using an instrument developed by the researchers and aligned with the review objective and questions. Any disagreements between the reviewers were resolved through discussion or with a third reviewer. Authors of articles were contacted to request additional information, where required.

Presentation of results

The search found 44 potentially relevant studies. As shown in Figure 1, of these 44 articles, four were excluded because they were duplicates. Of the remaining articles, 30 were excluded after title and abstract reading. Finally, two articles were selected which, after full-text reading, met the inclusion criteria.
The qualitative study was conducted in Australia, with individual interviews with 13 ED nurses. More specifically, the interviewed nurses identified factors promoting and hindering PPE use (Baduge et al., 2017).
The quantitative study was conducted in an ED in Boston, United States of America, with the participation of 88 nurses, using the observation and development of an educational intervention (Peponis et al., 2016).
Table 2 shows the answers to the review question.

Figure 1

Flow diagram of the study selection process

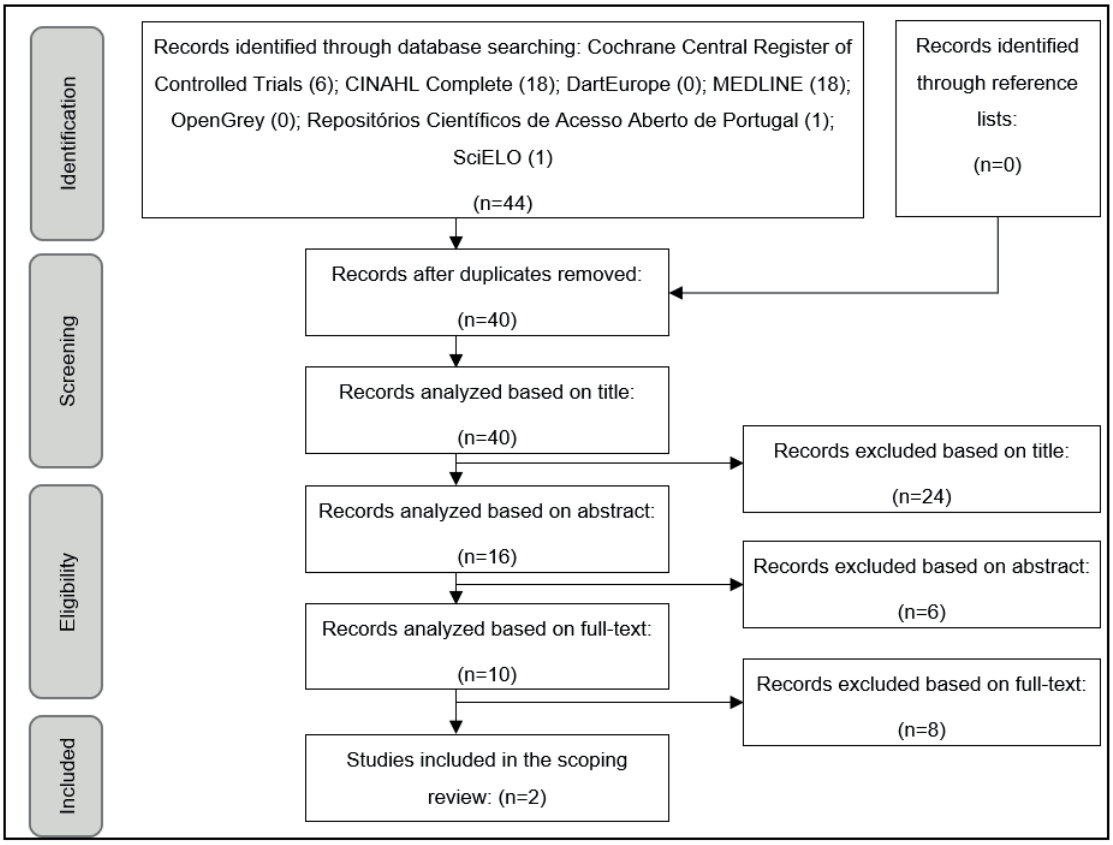

Table 2

Data extraction table

Study	Factors promoting the use of Personal Protective Equipment	Factors hindering the use of Personal Protective Equipment
Baduge et al., 2017	- Family responsibilities; - Professional responsibility; - Responsibility to the community; - Knowledge of the consequences of non-adherence.	- Age; - Diseases; - Lack of training and assessment; - Lack of knowledge about the correct use of PPE; - Insecurity.
Peponis et al., 2016	- Educational intervention; - Real-time feedback by colleagues.	- Lack of time; - Lack of assessment of the potential risk of exposure; - Forgetfulness.

Interpretation of the results

This scoping review aimed to map studies that identified factors promoting and hindering adherence to PPE use in the ED. To this end, two primary studies were included in this review.

Factors promoting adherence to the use of personal protective equipment

Baduge et al. (2017) focused on nurses' professional responsibility as a factor promoting adherence to PPE use to protect patients, nurses, the environment, and the community. Therefore, it is recommended that the delivery of nursing care should be based on scientific knowledge and a systematic assessment of the best clinical practices. More specifically, nurses are expected to make a critical and sustained reflection on nursing practices that may compromise patient safety (Ordem dos Enfermeiros [OE], 2015). Thus, based on the importance of using PPE to prevent the spread of contamination and protect patient safety, adherence to PPE use is closely related to nurses' professional responsibility. Moreover, in the study by Baduge et al. (2017), the responsibilities to the community and the family also promote adherence to PPE use. Fernandes et al. (2017), although in another context, corroborate the idea that professional responsibilities, namely patient safety, and responsibilities to the community and, consequently, the family are key factors for delivering safe patient care using PPE.

Nurses should use PPE while aware of the vulnerability to which patients are exposed to reduce potential harm and promote their well-being. Thus, the acquisition of knowledge about PPE can contribute to implementing clinical practices based on the principles that regulate the profession and the perception and internalization of the importance of using PPE.

Nurses' knowledge about the consequences of non-adherence to PPE use is a factor promoting their adherence (Baduge et al., 2017). Fernandes et al. (2017) also found an association between nurses' knowledge and the factors mentioned above, indicating that nurses' knowledge promotes responsible behaviors about adherence to PPE use. Moreover, Peponis et al. (2016) highlighted the importance of investing in health professionals' education to promote PPE use, given that adherence to PPE use increased after an educational intervention. However, the data obtained, particularly regarding the decrease in nurses' adherence to some PPE, suggest that greater adherence to PPE use can be achieved by developing specific educational interventions for each professional subgroup.

Porto and Marziale (2015) corroborate the aforementioned aspects by reporting that educational interventions are often considered, in different contexts, including the ED, as measures promoting adherence to PPE use. They also found that the inclusion of topics other than PPE, such as the perception of the potential risk of exposure and the standards that regulate health work, in educational interventions increases adherence to PPE use, namely in the ED (Porto & Marziale, 2015). However, the study conducted by Morioka et al. (2019), although carried out in a different context from that explored in this study, revealed that education alone is not enough, given that there is evidence to suggest that some educational interventions have failed to increase adherence to PPE use. Thus, other primary studies are needed to identify *a priori* the most effective methodologies or educational interventions for increasing adherence to PPE use.

Associated with the educational intervention, the real-time feedback provided by colleagues is also a strategy for promoting adherence to PPE use (Peponis et al., 2016). In an environment where co-workers are constantly encouraging and reminding each other to use PPE, any reluctance tends to disappear, and issues such as forgetfulness, which was reported as one of the reasons for nurses' poor adherence to PPE use, are tackled (Peponis et al. 2016).

In summary, the identified factors are interconnected. In nursing, there is a constant need to update existing knowledge, which is a responsibility of nurses. Furthermore, the feedback implies knowledge on the part of nurses, calling for the nurses' responsibility to maintain a safe environment and promote their own health and the health of their colleagues.

Factors hindering adherence to the use of personal protective equipment

Baduge et al. (2017) reported that the nurses' age and diseases, which were sometimes related to age, hinder adherence to PPE use due to the increased difficulty in donning and doffing this equipment. Professional experience was also identified as a

factor hindering adherence to PPE use. In several contexts, including the ED, Silva et al. (2019) found that the number of years of clinical practice hinders adherence to PPE use due to the nurses' sense of overconfidence resulting from their professional experience. This sense of overconfidence results from their increasing ability to provide care, which makes them feel that they are capable of performing procedures quickly and safely without using proper PPE.

Another factor identified was nurses' diseases. There are reports that disabling diseases make nurses less motivated to adhere to PPE use due to the difficulties in wearing them (Baduge et al., 2017). This factor is closely related to age because the identified disabling conditions tend to increase as age increases.

Education and knowledge increase adherence to PPE use. Proportionally, the lack of knowledge about PPE is hinders PPE use (Baduge et al., 2017). Yuliana (2018) also concluded that if the level of knowledge is low, the adherence to PPE use is also low. It should also be noted that lack of knowledge might lead to false beliefs, putting safety at risk (Peponis et al., 2016).

Porto and Marziale (2015) identified a deficit of knowledge about standard infection control precautions and PPE, namely about PPE use and the importance of PPE use by nurses in several clinical contexts. In some of those studies, the lack of knowledge was recognized as the reason for nurses' low adherence to PPE use. Morioka et al. (2019) also identified the lack of knowledge as a factor hindering adherence to PPE use, noting that nurses consider standard infection control precautions as fundamental when patients have signs or diagnosis of infection, but that these measures can be terminated if no infection is found.

Thus, although the evidence presented above is not restricted to the ED, there is a clear need for investment in nurses' training to fight against the lack of knowledge. Providing information in this area is seen as a challenge, but alternative methods such as digital learning packs can bring many benefits. It is also necessary to establish internal protocols and disseminate them so that nurses can have access to them and knowledge about how to act. Flowcharts and guidelines from internationally recognized sources are also a way of acquiring or deepening knowledge about PPE (Brown et al., 2019; Port & Marziale, 2015).

Another relevant finding is the lack of training on PPE use and the lack of assessment of adherence to and correct PPE use (Baduge et al., 2017). Therefore, protocols for increasing adherence to PPE use should include not only training and assessment but also education and demonstration (Reddy et al., 2019).

Insecurity about PPE use can also prevent nurses from using PPE. There are reports that nurses do not feel safe in complying with infection prevention protocols and using PPE (Baduge et al., 2017), which may result from a lack of knowledge and training. However, more studies are needed to test this hypothesis.

Peponis et al. (2016) found that lack of time, forgetfulness, and lack of assessment of the potential risk of exposure are factors hindering adherence to PPE use. The review conducted by Porto and Marziale (2015) corroborated forgetfulness as a factor inhibiting adherence to PPE use and identified factors such as nurse understaffing and work overload. Although the latter factors do not directly corroborate the factors identified by Peponis et al. (2019), they can trigger a cascade of lack of time and forgetfulness among nurses. Several studies (Henderson et al., 2020; Morioka et al., 2020), although in other contexts, corroborate lack of time as a factor hindering adherence to PPE use, which Henderson et al. (2020) classified as a lack of human resources.

Concerning the lack of assessment of the potential risk of exposure, several studies corroborate it as a factor hindering adherence to PPE use (Brown et al., 2019; Harrod et al., 2019; Port & Marziale, 2015). Harrod et al. (2019) found that nurses feel that they are constantly at risk of exposure, regardless of the precautions, and that permanent exposure makes them feel immune, without the need to adopt preventive strategies. Ultimately, this last factor may be associated with nurses' lack of time and knowledge, as well as with their overconfidence, which is a factor promoting adherence to non-preventive behaviors.

Concerning the limitations of the included studies, although their methodological quality was not assessed for not being a recommended step in scoping reviews, some aspects should be mentioned to inform future studies.

In the study by Peponis et al. (2016), there was a possibility of a Hawthorne effect. Uncertainties remain regarding the durability of the adherence to PPE use beyond the study period and the influence of the shift on the data, as most observations were made during daylight hours.

In the study by Baduge et al. (2017), the limitations were related to the use of a small (13 nurses) and homogenous (women) sample.

In both studies, the geographical limitation compromised the extrapolation of results, even to other contexts, given that both of them were conducted in limited contexts.

About the limitations of this scoping review, given that the assessment of the methodological quality of the included studies is not recommended for scoping reviews, no implications for clinical practice will be presented. Moreover, only studies published in Portuguese, English, and Spanish were included, and this review may have potentially left out relevant articles published in other languages. Finally, another limitation is the number of searched databases. The inclusion of other databases could have led to the inclusion of other relevant articles.

As implications for research, this mapping can be used as a basis for planning and developing interventions to increase ED nurses' adherence to PPE use, emphasizing the factors promoting their adherence and trying to overcome the hindering factors.

Nevertheless, given the extensively described importance of PPE use in EDs, more quantitative and qualitative studies should be conducted about the factors promoting and hindering adherence to PPE use in the ED. Future studies should use larger samples.

Conclusion

There is extensive evidence on the importance of PPE use by health professionals, particularly nurses. Nevertheless,

there is also evidence that nurses' adherence to PPE use is not as high as expected, so it is important to map the factors promoting and hindering ED nurses' adherence to PPE use. The following factors were identified as promoting ED nurses' adherence to PPE use: professional responsibility, family responsibilities, and responsibility to the community, knowledge of the consequences of non-adherence, educational interventions, and real-time feedback by co-workers for correction of behaviors. Conversely, the following hindering factors were identified: age, diseases, lack of training and assessment, lack of knowledge about the correct use of PPE, insecurity, lack of time, lack of assessment of potential risk of exposure, and forgetfulness.

This mapping identified gaps that should be addressed in future primary studies and the need to conduct a systematic literature review to identify the studies with the best scientific evidence available. This review can be a starting point for the development of interventions to increase ED nurses' adherence to PPE use.

Author contributions

Formal analysis: Soares, A. D., Torres, A. R.
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Writing – original draft: Soares, A. D., Torres, A. R.
Writing – review & editing: Soares, A. D., Torres, A. R., Coelho, A. R.

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