

Knowledge of nursing students about infection prevention and control: a scoping review

Conhecimento dos estudantes de enfermagem sobre medidas preventivas e controlo de infeção: scoping review

Mafalda Sofia Gomes Oliveira da Silva^{1,2}

ORCID: 0000-0002-2509-5566

Maria Margarida Silva Vieira Ferreira¹

ORCID: 0000-0003-2232-7314

¹Instituto Piaget de Vila Nova de Gaia, Gulpilhares, Vila Nova de Gaia, Portugal

²Universidade Católica Portuguesa, Porto, Portugal

Editors:

Ana Carla Dantas Cavalcanti
ORCID: 0000-0003-3531-4694

Paula Vanessa Peclat Flores
ORCID: 0000-0002-9726-5229

Érica Brandão de Moraes
ORCID: 0000-0003-3052-158X

Corresponding author:

Mafalda Sofia Gomes Oliveira Silva
E-mail: mafaldasilva@hotmail.com

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ABSTRACT

Objective: To assess the knowledge of nursing students regarding the prevention and control of healthcare-associated infections. **Method:** A scoping review was conducted using the methods set forth by Joanna Briggs Institute (JBI). The following databases were searched: PubMed, CINAHL Plus with Full Text, Nursing & Allied Health Collection, Cochrane Plus Collection, and MedicLatina (via EBSCOhost). Inclusion criteria were studies written in Portuguese, English, or Spanish and published in the last 5 years. The studies were extracted to the Qatar Computing Research Institute platform (Rayyan QCRI). **Results:** We identified 11 studies that demonstrated the need to involve facilitators in the teaching/learning process to raise awareness of training strategies for the prevention and control of healthcare-associated infections. **Conclusion:** Structured programs that include training and skill development for students need to be implemented. **Descriptors:** Students, Nursing; Universal Precautions; Infection Control.

RESUMO

Objetivo: Mapear o conhecimento dos estudantes de enfermagem relativo às medidas de prevenção e controlo de infeção associada aos cuidados de saúde. **Método:** Esta é uma *scoping* review baseada na metodologia de *Joanna Briggs Institute* (JBI). A busca foi realizada nas seguintes bases de dados: *PubMed*, *CINAHL Plus with Full Text*, *Nursing & Allied Health Collection*, *Cochrane Plus Collection* e *MedicLatina* (via EBSCOhost). Foram considerados como critérios de inclusão os estudos escritos em português, inglês e espanhol, publicados nos últimos 5 anos e extraídos para a plataforma *Qatar Computing Research Institute* (Rayyan QCRI). **Resultados:** Foram identificados 11 estudos que revelaram a necessidade do envolvimento dos intervenientes no processo de ensino/aprendizagem para a consciencialização de estratégias de formação na prevenção e controlo de infeção associada aos cuidados de saúde. **Conclusão:** É necessário implementar programas estruturados que incluam o treino e desenvolvimento de competências dos estudantes. **Descritores:** Estudantes de Enfermagem; Precauções Universais; Controle de Infecções.

INTRODUCTION

Over the past few decades, patient safety concerns have grown exponentially due to the high number of adverse events that occur in healthcare facilities.

According to the World Health Organization (WHO)⁽¹⁾, 134 million adverse events occur annually as a result of unsafe care, contributing to 2.6 million deaths.

Patient safety has become a critical issue nationally, in Europe, and globally in recent decades because of inadequate working conditions, patient complexity, staff turnover and retention, technological advances, and increased patient and family literacy (PNSD).

Patient safety is an essential component and an indispensable variable of quality in health care delivery and is becoming the focus of health

policies. Health policies include a set of appropriate patient-centered strategies and interventions to prevent and/or reduce inherent risks to a reasonable minimum. Thus, understanding the severity of harm caused to patients becomes essential and relies on a transparent system of incident reporting that allows healthcare workers to learn from the errors committed⁽²⁾. According to the Joint Commission International⁽³⁾, the six international patient safety goals are: to correctly identify patients; to improve the effectiveness of communication; to improve the safety of high-risk medications; to ensure the right surgery and the right patient; to reduce the risk of healthcare-associated infections (HCAIs); and to reduce the risk of patient harm from falls. Similarly, in the 2021–2026 Brazilian National Patient Safety Plan (PNSD), some of its pillars emphasize the importance of a safety culture, effective communication, and the prevention and management of safety incidents to promote safe and quality health care. Globally, Universal Precautions (UP) have been defined and implemented to reduce the risk of transmission of infectious microorganisms during the delivery of care by adopting preventive and infection control measures in health care services⁽⁴⁾ to limit the spread of HCAIs⁽²⁾. These guidelines have been adopted by Portugal and are known as Transmission-Based Precautions (TBPs)⁽⁵⁾. TBPs are a set of procedures to be implemented in healthcare settings to prevent cross-transmission of multidrug-resistant microorganisms from known or unknown sources. They include the implementation of intervention bundles, standard operating procedures, the adoption of a culture of safety, training, and awareness of workers, and the monitoring of safe practices (PNSD). TBPs contribute to the safety of the patient, the healthcare workers, and all those who come into contact with the patient as well as to the reduction of hospital stays and the minimization of morbidity and mortality⁽⁶⁾. Increasing the level of health literacy and the involvement of various healthcare facilitators is essential to prevent HCAIs and protect patients, healthcare workers, and families from exposure to infectious agents⁽⁴⁾. Investment in the education of first-cycle nursing students as future healthcare workers is necessary⁽⁴⁾. A study conducted to identify the psychoemotional impact and strategies used by nursing students during the COVID-19 pandemic demonstrates the need to expand knowledge of health promotion and

infection prevention⁽⁷⁾.

The present study aims to determine the knowledge of nursing students regarding the prevention and control of HCAIs. Based on the Participants/Population, Context, and Concept (PCC) framework (Figure 1), the following guiding review question was formulated: "What knowledge do nursing students have regarding universal precautions in the control of healthcare-associated infections?"

Figure 1 – PCC framework. Porto, PT, Portugal, 2024.

Participants/ Population (P)	Nursing students
Context (C)	Clinical practice
Concept (C)	Knowledge about universal precautions

METHOD

Type of study

The present scoping review has been conducted following the nine steps proposed by the Joanna Briggs Institute (JBI)⁽⁸⁾: 1) title, 2) development of title and guiding question, 3) introduction, 4) inclusion criteria, 5) search strategy, 6) selection of evidence sources, 7) data extraction, 8) analysis of evidence, and 9) presentation of results. This type of study allows the implicit evidence for the topic under review to be mapped and gaps to be identified⁽⁹⁾.

Protocol and registry

To ensure methodological rigor in the development of the study, we used the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR)⁽¹⁰⁾. The protocol for this scoping review has been registered on the Open Science Framework (OSF) under DOI 10.17605/OSF.IO/59GAV and can be accessed via the link: <https://osf.io/59gav/>.

Eligibility criteria

The scoping review strategy is based on an exploratory review to understand the state of the art in a given context and to identify gaps in existing studies⁽⁴⁾.

The inclusion criteria were studies published in the last five years (2017–2022), without design limitations, that addressed nursing students from any country and higher education institu-

tion. We decided that searching for studies published in the last five years was the most appropriate approach, due to the significant amount of existing primary information. It was also important to include the most recent studies as they reflect the current state of the art. Scoping reviews play an important role in bridging the gap between research findings and evidence-based health decision-making. To be reliable, these reviews must use reliable methods and include all the results of relevant research⁽¹¹⁾. Reference lists of the literature were reviewed to identify additional studies. The search was

conducted by two independent researchers in Portuguese, English, and Spanish, which were available in free full text.

Sources of information

The search was conducted in March 2022 in the following databases: PubMed, CINAHL Plus with Full Text, Nursing & Allied Health Collection, Cochrane Plus Collection, and MedicLatina (via EBSCOhost). No scoping review evidence was found on this topic. Keywords in English, Spanish, and Portuguese were used to search for information, as shown in Figure 2.

Figure 2 – Keywords used in the searches. Porto, PT, Portugal, 2024

Keywords		
English	Spanish	Portuguese
<i>Nursing Students</i>	Estudiantes de Enfermería	Estudantes de Enfermagem
<i>Universal Precautions</i>	Precauciones Universales	Precauções Universais
<i>Knowledge</i>	Conocimiento	Conhecimento

Search strategy

Keywords extracted from the Descriptors in Health Sciences (DeCS) and the Medical Subject Headings (MeSH) were used. The Boolean

operators 'AND' and 'OR' were used for combinations between descriptors, with "AND" used to find studies across topics and 'OR' used for synonyms⁽⁹⁾ (Figure 3).

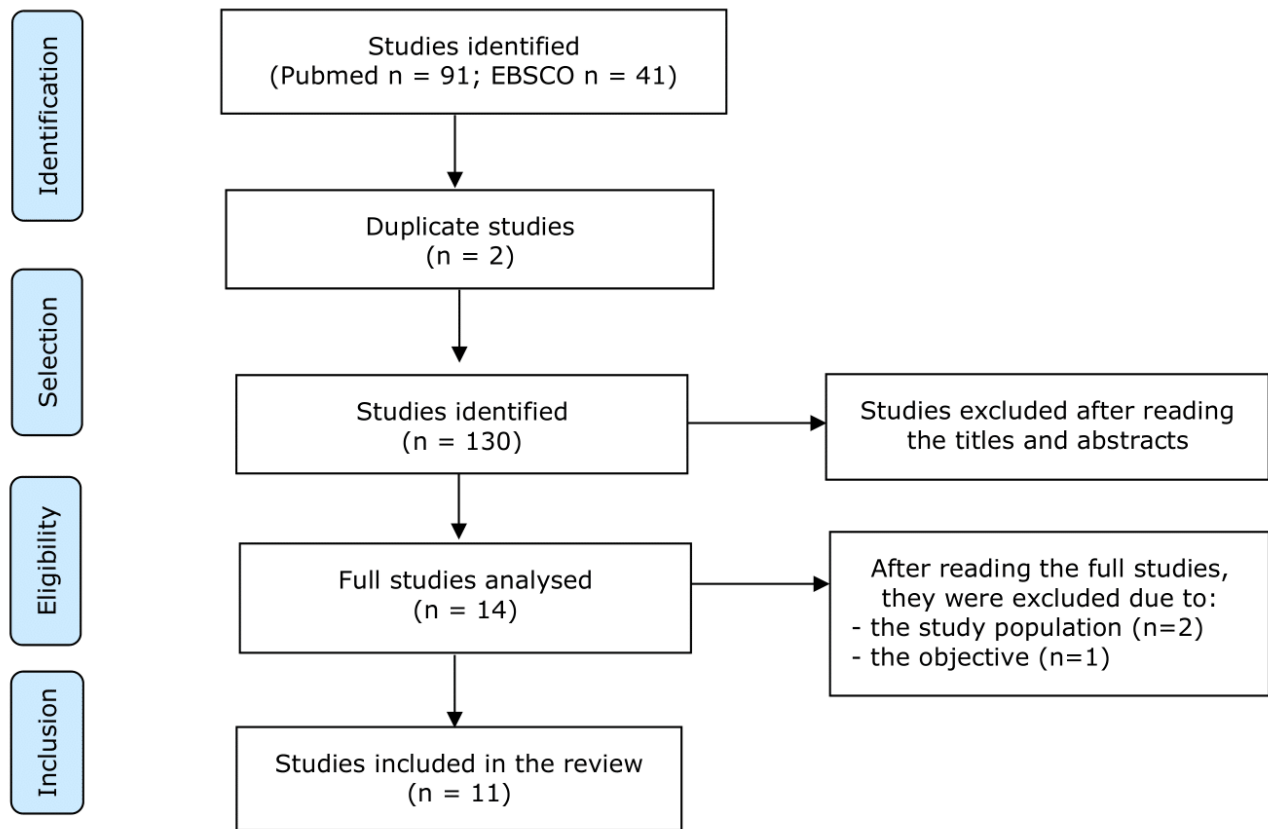
Figura 3 – Keywords used in database searches. Porto, PT, Portugal, 2024

Databases	Keywords	Termo não controlado
PubMed	(((((((((Knowledge[MeSH Terms]) OR (Knowledge[Title/Abstract])) AND (nursing students[MeSH Terms])) OR (nursing students[Title/Abstract])) AND (Universal Precautions[MeSH Terms])) OR (Universal Precautions[Title/Abstract]))))	Precauções Padrão/ Precauções <i>standard</i>
CINAHL	TX Knowledge AND TX nursing students AND TX Universal Precautions	Precauções Padrão/ Precauções <i>standard</i>
Nursing & Allied Health Collection, Cochrane Database of Systematic Reviews e MedicLatina	TX Knowledge AND TX nursing students AND TX Universal Precautions	Precauções Padrão/ Precauções <i>standard</i>

Study selection

The articles identified according to the eligibility criteria were organized on the platform of the Qatar Computing Research Institute (Rayyan QCRI®). The titles and abstracts were then

read, followed by a full-text reading of the identified studies. The search results were written according to the PRISMA-ScR⁽¹⁰⁾ flowchart (Figure 4) and the predefined inclusion and exclusion criteria.

Figure 4 - Flowchart of the study selection process. Porto, PT, Portugal, 2024

Source: PRISMA Flow Diagram adapted of Page et al., 2020.

Data extraction

To facilitate data extraction, the researchers created an evidence table consisting of the following items: title, study type, and design, author(s)/year, objectives, population studied, context, and main results (Figure 5). Data were extracted and analyzed independently by two review authors, with a third review author in case of disagreement to decide on the inclusion or exclusion of the article.

RESULTS

A total of 91 articles were found in the PubMed database and 41 articles in EBSCO, of which 11 articles were included according to the defined criteria. Most of these studies were quantitative, cross-sectional, and descriptive (54.5%), quasi-experimental (36.4%), and qualitative (9.1%) (Figure 5). The study population ranged from 7 to 829, for a total of 1,772 nursing students. The studies demonstrate the need for students/teachers and tutors' involvement in raising awareness of teaching/training strategies in the prevention and control of HCAs (Figure 6).

Figure 5 - Data extraction table for the scoping review. Porto, PT, Portugal, 2024

Title	Type and design of the study	Author(s)/ Year	Objectives	Population	Context
Compliance with standard precautions during clinical training of nursing students in Saudi Arabia: A multi-university study ⁽¹²⁾	Descriptive, cross-sectional	Alshammari et al., 2018	To examine adherence to standard precautions and its predictors among Saudi nursing students from six universities	n=829	Six government universities in Saudi Arabia
The Effect of Infection Control Course on Nursing Students' Knowledge of and Compliance With Universal Precautions: A Quasi-experimental Study ⁽¹³⁾	Quasi-experimental	Tawalbeh et al., 2019	Evaluate levels of knowledge and adherence, assess relationships between knowledge and adherence, and examine the effect of infection control educational courses on knowledge and adherence to universal precautions among university nursing students.	n= 130 (3º ano GE (n = 60) inscreveram-se no curso por 3 meses. GC (n = 70) não se inscreveram	Clinical course in infection control
A Study to Assess the Effectiveness of Structured Teaching Programme on Knowledge Regarding Universal Precaution among Basic B.sc Nursing First Year Student of State College of Nursing, Dehradun, Uttarakhand ⁽¹⁴⁾	Quantitative with pre-experimental design	Maheswari et al., 2019	To evaluate the effectiveness of the Structured Teaching Program on knowledge of universal precautions	n= 50	Structured teaching program (STP) applied
Knowledge and Attitude of Registered and Student Nurses on Mentor-Mentee Relationship in Specialist Hospital, Yola ⁽¹⁵⁾	Cross-sectional, descriptive	Kolawole et al., 2019	Evaluate the effectiveness of the STP on knowledge of universal precautions	n= 54	Six pediatric surgical and medical wards
Knowledge about HCAs in medical, bioanalysis and nursing students from a Venezuelan university ⁽¹⁶⁾	Descriptive	Guevara et al., 2020	To assess the level of knowledge about HCAs among final-year students enrolled in the School of Health Sciences, Universidad de Oriente, Venezuela.	n=98	School of Health Sciences, Universidad de Oriente, Venezuela
Conhecimento e adesão como fatores associados a acidentes com agulhas contaminadas com material biológico: Brasil e Colômbia ⁽¹⁷⁾	Transversal	La-Rotta et al., 2020	To evaluate the prevalence of accidents involving biological materials (AT-MB), adherence to standard precautions (SP), and knowledge of bloodborne pathogens and associated factors among healthcare workers and students as part of the implementation of NR-32.	n=214 in Brazil; n=134 in Colombia	Knowledge, adherence, and risk perception scales

Effects of Infection Control Education for Nursing Students Using Standardized Patients vs. Peer Role-Play ⁽¹⁸⁾	Quasi-experimental	Kim et al., 2021	To identify and compare the effects of two infection control education programs: a standardized patient simulation and a peer dramatization on knowledge of standard precautions, awareness of standard precautions, infection-related anxiety, and infection control performance	n= 65 (3rd year) EG (n= 29): lectures, skills training, simulation and debriefing CG (n=33): usual infection control education, consisting of lectures, skills training, and peer tutoring practices	Program based on the analysis, design, development, implementation, and evaluation model
Standard precautions for preventing Tuberculosis and HIV: Compliance of Eswatini University student nurses ⁽¹⁹⁾	Quantitativo não experimental	Gina et al., 2021	Avaliar a adesão dos enfermeiros universitários de Eswatini às precauções padrão para a prevenção da tuberculose e do vírus da imunodeficiência humana.	n= 105 (3º, 4º e 5º anos)	Eswatini University in Southern Africa
Hepatitis B vaccination status and associated factors among students of medicine and health sciences in Wolkite University, Southwest Ethiopia: A cross-sectional study ⁽²⁰⁾	Cross-sectional	Haile et al., 2021	To determine hepatitis B virus vaccination coverage and associated factors, level of knowledge, attitudes, and practices (KAP) regarding hepatitis B virus among medical and health sciences students at Wolkite University.	n=75 Self-completion questionnaire	Wolkite University
COVID-19 knowledge, attitudes, and practices of United Arab Emirates medical and health sciences students: A cross-sectional study ⁽²¹⁾	Cross-sectional	Baniyas et al., 2021	To assess the knowledge of COVID-19, awareness of preventive behaviors, practice, and risk perception among students of medicine and related health sciences in higher education institutions in the United Arab Emirates.	n = 117 Online questionnaire	Universities in the United Arab Emirates
Education of nursing profession amid COVID-19 Pandemic: A qualitative study ⁽²²⁾	Qualitative	Tolyat et al., 2022	To explain the experiences of nursing education in the midst of the COVID-19 pandemic.	N=7 In-depth unstructured face-to-face and recorded interviews	Birjand University of Medical Sciences

Figure 6 - Knowledge of nursing students regarding universal precautions in infection control. Porto, PT, Portugal, 2024

Thematic categories	Main results
Knowledge of universal precautions	Good adherence to mask use ⁽¹²⁾ What are HCAs ⁽¹⁶⁾ The importance of full HBV vaccination ⁽²⁰⁾ Good practices about the COVID-19 pandemic ⁽²¹⁾
The knowledge that needs further training	Poor adherence to the correct use of sharps containers ⁽¹²⁾ Poor knowledge of the origin of microorganisms ⁽¹⁶⁾ Poor knowledge of the correct use of gloves ⁽¹⁶⁾ Poor adherence to wearing glasses and not recapping needles ⁽¹⁷⁾
Knowledge of universal precautions influenced by various factors	University, academic year, participation in training, infection prevention, and control seminar ⁽¹²⁾ Attendance at a structured course contributes to improved knowledge and adherence to standard precautions ^(13,14,22) Ongoing mentoring programs, workshops, and seminars should be mandatory and included in nursing curricula and the outcome should be evaluated to ensure their effectiveness ⁽¹⁵⁾ Clinical monitoring of students by the mentor contributes to greater adherence to standard precautions ⁽¹⁹⁾ Marital status, no accidents, and perception of risk contribute to higher levels of adherence ⁽¹⁷⁾ Improvement in knowledge, awareness of standard precautions and infection control performance after implementation of lectures, skills training, simulation, and debriefing ⁽¹⁸⁾

DISCUSSION

The knowledge of nursing students regarding infection prevention and control is an area that has been minimally studied. Nursing students in clinical training provide care to a wide variety of patients and interact with healthcare workers and educators, playing a critical role in the spread of pathogenic microorganisms⁽²³⁻²⁴⁾.

With technological changes and scientific advancements, the responsibilities of healthcare workers and students in complex healthcare settings are increasing, as they are a vulnerable group in terms of exposure to microorganisms⁽¹⁹⁾.

Throughout clinical training, students are expected to demonstrate knowledge and skills in several areas, particularly infection control. However, studies⁽²⁵⁻²⁶⁾ have shown low levels of knowledge and inconsistency or even failure to adopt behaviors by national and international guidelines.

Integrating the teaching of best practices in infection prevention and control into the educational process of students is of great importance. In this regard, there is a need to invest in HCAs prevention and control in a structured, coordinated manner, aligning the content taught, innovative resources, pedagogical approaches, and coordination between faculty and tutors^(25,27).

It is the responsibility of the instructor to guide and correct the student in the proper use of preventive measures, integrating clinical infection control practice with classroom knowledge. The tutor should be a facilitator in the student's learning process, demonstrating up-to-date knowledge, interest, and availability to supervise and guide.

The integration of continuous peer mentoring programs in nursing education focused on students, with workshops and seminars, should be included in study plans to promote critical-reflective thinking and the promotion of autonomy and responsibility of future workers⁽¹²⁾. Mentoring programs are a strategy that allows students to improve their learning and academic performance by improving the development of skills, namely teamwork, interpersonal relationships, motivation, and personal and professional development⁽²⁸⁾.

The studies that have been conducted suggest that student nurses' adherence to TBPs is low, with limited knowledge of more specific aspects such as the origin of the microorganisms that cause these infections or the proper use of gloves. However, they do demonstrate a general knowledge of HCAs^(12,16).

Another study alludes to the importance of examining adherence to TBPs and identifying their

predictors among students, reporting that they have higher adherence to using personal protective equipment, memorizing the proper use of sharps containers, protective eyewear, and recapping needles⁽¹⁷⁾.

In this context, there is a need to implement continuous education programs to improve students' knowledge to adopt best practices in health care⁽¹²⁻¹³⁾. It is necessary to evaluate the effectiveness of structured training programs to improve adherence to infection control practices, as shown in the study conducted⁽¹⁴⁾. To ensure patient safety and the safety of future healthcare workers, students must be active agents of change in healthcare delivery. To this end, the World Health Organization has advocated the inclusion of formal infection prevention and control content in higher education curricula⁽³⁰⁾.

Improvement in student behavior and personal motivation tends to increase when learning combines different methods, including theoretical-practical classes, laboratory sessions, and simulation scenarios, which are essential pedagogical strategies for increasing student self-efficacy and awareness in infection prevention and control⁽²⁸⁾. Students have the opportunity to develop technical procedures in a collaborative learning environment, which helps them gradually gain confidence and facilitates the development of practical and communication skills⁽²⁸⁾. During the COVID-19 pandemic, the need for courses aimed at the knowledge and attitudes of nursing students in infection prevention and control became more pronounced. At this stage, the learning environment influenced by the pandemic changed, with the integration of new nursing teaching methodologies emphasizing a virtual model, creating new challenges and opportunities for students' skill development^(24-25,30).

The study conducted⁽¹²⁾ points to the need to improve educational programs for healthcare workers, particularly in educational institutions and workplaces.

The contributions of this study relate to nursing students' knowledge of preventive and infection control measures. Further studies are needed to assess nursing students' attitudes, implementation, and compliance with preventive infection control measures. In this sense, the implementation of structured, systematic educational programs that include skills training is essential for the safety of the patient, the student, and all those involved in the delivery of care. To do so,

close coordination between health care and higher education institutions, as well as between schools, students, and preceptors, is required.

Limitations of the study

The main limitation of the present study relates to the small number of studies available on the topic under review.

CONCLUSION

This study allowed for the analysis and systematization of the knowledge of nursing students regarding prevention and infection control measures in health care and reinforced the role of peer tutoring in clinical settings. To provide safer health care, it is necessary to adopt innovative, student-centered teaching and learning methods that emphasize the acquisition of theoretical knowledge through continuous education and the practice of practical skills in the context of TBPs.

Throughout the learning process, coordination between schools and healthcare institutions, as well as between faculty and tutors, is essential to promote the acquisition of knowledge, motivation, and self-efficacy for infection prevention and control among nursing students. Further studies in this area are inevitable and will contribute to the provision of quality health care in supportive working environments.

CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

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AUTHORSHIP CONTRIBUTIONS

Project design: Silva MSGO da, Ferreira MMSV

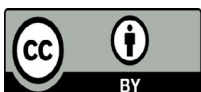
Data collection: Silva MSGO da, Ferreira MMSV

Data analysis and interpretation: Silva MSGO da, Ferreira MMSV

Writing and/or critical review of the intellectual content: Silva MSGO da, Ferreira MMSV

Final approval of the version to be published: Silva MSGO da, Ferreira MMSV

Responsibility for the text in ensuring the accuracy and completeness of any part of the paper: Silva MSGO da, Ferreira MMSV



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