

# EDUCATION AT THE MATERIALS AND STERILIZATION CENTER: AN INTEGRATIVE REVIEW

*Educação no centro de materiais e esterilização: revisão integrativa*

*Educación en el centro de materiales y esterilización: revisión integrativa*

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**ABSTRACT: Objective:** To analyze the publications of the last five years about education at the Materials and Sterilization Center. **Method:** Integrative review with search in databases: Latin American and Caribbean Health Sciences Literature, Online Medical Literature Analysis and Retrieval System, Scopus Info Site, Web of Science, Cumulative Index to Nursing and Allied Health Literature via EBSCOhost, Cochrane, and Virtual Health Library. **Results:** Ten articles were selected, all of them considering it essential to constantly update and make available minimum resources to carry out professional activities with improvements in clinical practice. Four publications identified perceptions of education, knowledge gaps and development opportunities. The educational strategies used were: continuing education with teaching materials, application of theoretical and practical training, restructuring of processes with technical training, on-site educational mentoring programs and professional self-reflection on best practices. **Conclusion:** The publications reinforce the importance of educational interventions for professional training, with view to them mastering new technologies, providing quality services and having a favorable impact on the effectiveness of health products' processing.

**Keywords:** Sterilization. Education. Patient safety.

**RESUMO: Objetivo:** Analisar as publicações dos últimos cinco anos com temas sobre educação em Centro de Materiais e Esterilização. **Método:** Revisão integrativa com busca nas bases de dados: Literatura Latino-Americana e do Caribe em Ciências da Saúde, Medical Literature Analysis and Retrieval System Online, Scopus Info Site, Web of Science, Cumulative Index to Nursing and Allied Health Literature via EBSCOhost, Cochrane e Biblioteca Virtual em Saúde. **Resultados:** Seleccionados dez artigos, todos consideraram indispensáveis a atualização constante e a disponibilização de recursos mínimos para realização das atividades profissionais com melhorias na prática clínica. Quatro publicações identificaram as percepções quanto à educação, lacunas de conhecimento e oportunidades de desenvolvimento. Estratégias educacionais utilizadas: educação permanente com materiais didáticos, aplicação de treinamento teórico e prático, reestruturação dos processos com treinamento técnico, programas de mentoria educativa *in loco* e autorreflexão profissional sobre melhores práticas aplicadas nos processos de trabalho. **Conclusão:** As publicações reforçam a importância de intervenções educativas para capacitação profissional, domínio de novas tecnologias, prestação de serviço de qualidade e impacto favorável na eficácia do processamento de produtos para a saúde. **Palavras-chave:** Esterilização. Educação. Segurança do paciente.

**RESUMEN: Objetivo:** Analizar las publicaciones de los últimos cinco años con temas de educación en el Centro de Materiales y Esterilización. **Método:** Revisión integradora con búsqueda en bases de datos: Literatura de Ciencias de la Salud de América Latina y el Caribe, *Medical Literature Analysis and Retrieval System Online*, *Scopus Info Site*, *Web of Science*, *Cumulative Index to Nursing and Allied Health Literature via EBSCOhost*, COCHRANE y Biblioteca Virtual en Salud. **Resultados:** Se seleccionaron 10 artículos, todos considerados imprescindibles a la constante actualización y disponibilidad de recursos mínimos para realizar actividades profesionales con mejoras en la práctica clínica. Cuatro publicaciones identificaron percepciones de educación, brechas

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de conocimiento y oportunidades de desarrollo. Estrategias educativas utilizadas: formación continua con material didáctico, aplicación de formación teórica y práctica, reestructuración de procesos con formación técnica, programas de tutoría educativa presencial y autorreflexión profesional sobre las mejores prácticas aplicadas en los procesos de trabajo. **Conclusión:** Las publicaciones refuerzan la importancia de las intervenciones educativas para la formación profesional, el dominio de las nuevas tecnologías, la prestación de servicios de calidad y el impacto favorable en la efectividad del procesamiento de los productos sanitarios.

**Palabras clave:** Esterilización. Educación. Seguridad del paciente.

## INTRODUCTION

The Materials and Sterilization Center (MSC) is a very specific and important area within a health service, being fundamental for its structure and functioning. In this sector, diversified practices that require specialized knowledge are carried out in order to properly process and provide health care products (HCP), ensuring safety in the care of patients<sup>1,2</sup>.

The activities developed at the MSC include receiving dirty/contaminated materials, cleaning, inspection, preparation, disinfection and sterilization, storage and distribution<sup>3</sup>. All processes in this sector are intended to prevent health-care-related infections (HAIs), following scientific evidence for practice of quality in the preparation of HCP<sup>4</sup>.

Professionals who work at the MSC do not only perform routine and repetitive activities, but also provide indispensable technical support by guaranteeing safe and contamination-free materials for patient care<sup>5,6</sup>. So they must understand the relevance and importance of these processes. Keeping up with technological advances and changes in other health sectors is essential, including the development of new instruments and surgical techniques<sup>2,7,8</sup>.

From the understanding of work processes and recognition of the increasingly complex and sophisticated activities carried out at the MSC, the importance of qualified and motivated human resources is increased<sup>1</sup>. Therefore, education strategies that reinforce the improvement of MSC professionals are important to ensure the quality and safety of service, considering the lack of specificity during professional training<sup>9,10</sup>.

Therefore, the implementation of continuing education (CE) and continuing education in health (CEH) activities is essential to promote changes in work processes and relationships between subjects and the environment, expanding learning spaces and contributing to the development of both the professionals and the service itself<sup>11</sup>.

Given this scenario, the interest in researching the topic of education at the MSC emerged. The intention is to provide an updated overview on the production of knowledge in the area of education aimed at professionals who works on the front-line HCP processing.

## OBJECTIVE

To analyze the publications of the last five years addressing education in MSC.

## METHOD

This is an integrative review, which allows to synthesize and analyze the scientific knowledge available in the search for data that answer a research question<sup>11,12</sup>.

To meet the methodological rigor, the article followed six steps:

- identification of the theme and selection of the research question;
- establishment of inclusion and exclusion criteria;
- identification of pre-selected and selected studies;
- categorization of selected studies;
- analysis and interpretation of results;
- presentation of review or knowledge synthesis<sup>11,12</sup>.

The following research question was formulated: what has been published about the education of professionals working in the MSC?

To delimit the search, the inclusion criteria was scientific articles published in full, from January 2015 to October 2020, with free online access, that addressed the research question, regardless of their typology. Exclusion criteria were: publications classified as editorial, letter to editors, dissertations, theses, manuals, and protocols.

Data were collected from online scientific databases: Latin American and Caribbean Health Sciences Literature (Lilacs), Online Medical Literature Analysis and Retrieval System (Medline / PubMed), Scopus Info Site (Scopus), Web of Science, Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCOhost, Cochrane and the Virtual Health Library (VHL).

The search for articles in the databases was performed from August 20th to October 7, 2020. The controlled descriptors obtained in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) were: sterilization, education, continuing, professional and medical devices. Uncontrolled descriptors were also used: central sterile supply department, sterile processing department and sterilizing practices. The descriptors defined for the search were combined by the Boolean operators “AND” and/or “OR” and tested in different associations, resulting in the sequences of combinations presented in Chart 1.

To restrict the results that met the research question, the fourth combination was chosen and, after applying the filters, 13,346 articles were identified. After screening by title, 264 articles remained. Of these, 213 were eliminated after reading the abstracts for presenting one or more exclusion criteria and 30 for being repeated in different databases. After reading the articles in full, 11 were excluded for not meeting the research topic, and the ten articles that met the criteria previously defined and answered the guiding question were kept, thus constituting the final sample.

**Chart 1.** Descriptors combined with Boolean operators used in the article search steps.

| Search steps    | Combinations of descriptors with Boolean operators   |
|-----------------|--|
| 1 <sup>st</sup> | <i>Sterilization AND Education OR Continuing Education</i>   |
| 2 <sup>nd</sup> | <i>Sterilization OR Medical devices OR Central sterile supply department AND Education OR Continuing Education OR Professional Education</i>   |
| 3 <sup>rd</sup> | <i>Sterilization OR Medical devices OR Central sterile supply department OR Sterile processing department AND Education OR Continuing Education OR Professional Education</i>                          |
| 4 <sup>th</sup> | <i>Sterilization OR Medical devices OR Central sterile supply department OR Sterile processing department OR Sterilizing practices AND Education OR Continuing Education OR Professional Education</i> |

The study followed the steps recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Prism)<sup>13</sup>, as shown in Figure 1.

For data collection, a detailed instrument containing the following variables was used: title, journal, authors, year of publication, objectives, methods and results. In the following step, we carried out an analysis and synthesis of the articles obtained descriptively.

The articles were evaluated and classified according to their scientific rigor, according to the characteristics of each study, enabling a classification by level of evidence. At this stage, an instrument based on the Rating System for the Hierarchy of Evidence for Intervention/Treatment Question<sup>14</sup> was used to classify the level of evidence (LE) of the studies, shown in Chart 2.

## RESULTS

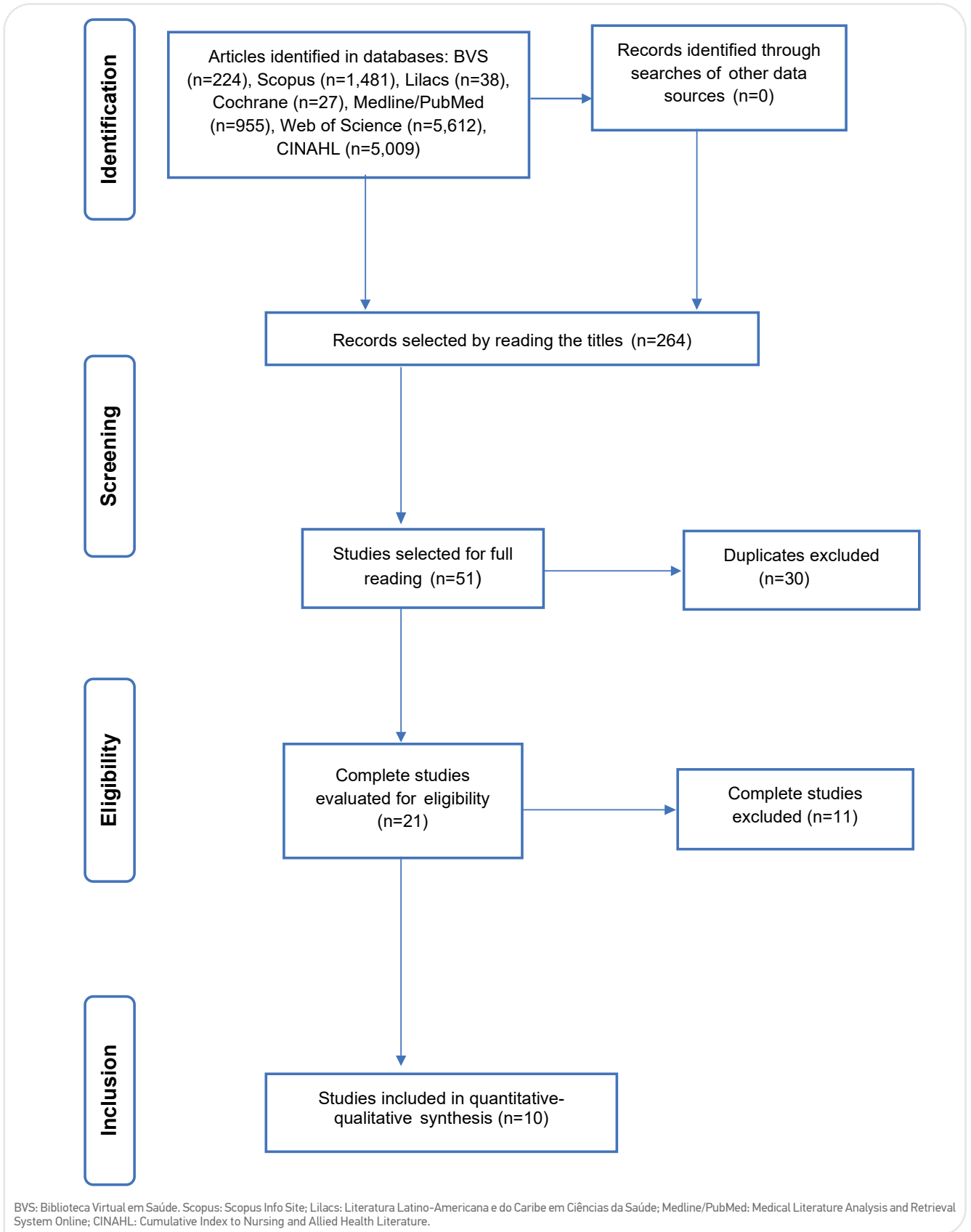
Among ten publications selected, 50% had been published in foreign journals. Of these, five were from Brazil, two from Africa, one from Australia, one from the United States and one from China. The periodicals in which the articles were published were: two in Revista SOBECC and two in Revista de Enfermagem of the Federal University of Pernambuco (UFPE) OnLine, and the others in the periodicals below: Revista Mineira de Enfermagem (Reme); Elsevier Journals — Infection, Disease & Health; Surgical Infections; BMC Health Services Research; Antimicrobial Resistance and Infection Control; PlosOne.

As for the study design, we had: six exploratory descriptive studies, one literature review, two experience reports and a cohort study. According to the Rating System for the Hierarchy of Evidence for Intervention/Treatment Question<sup>14</sup>, they were classified as follows: one article with evidence level 4, one with evidence level 5, six with evidence level 6 and two with evidence level 7. Chart 3 presents the characteristics of the articles.

Chart 4 presents a summary of the objectives and results of the studies included in this integrative review.

## DISCUSSION

The use of educational strategies to qualify professionals who work in the MSC has been of national and international interest. Interventions have intensified in the last decade, in



**Figure 1.** Flowchart of studies' selection based on methodologies used for education in the Material and Sterilization Center.

**Chart 2.** Classification of level of evidence.

| Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions |   |
|--|---|
| NE1  | Evidence from systematic reviews or meta-analysis of randomized clinical trials |
| NE2  | Evidence from randomized clinical trials  |
| NE3  | Evidence from clinical trials without randomization                             |
| NE4  | Evidence from case-control and cohort studies                                   |
| NE5  | Evidence from systematic reviews of descriptive and qualitative studies         |
| NE6  | Evidence from descriptive or qualitative studies                                |
| NE7  | Evidence from opinions from authorities/expert reports                          |

Source: Rating System for the Hierarchy of Evidence for Intervention/Treatment Question<sup>14</sup>.

line with the World Health Organization (WHO), which insistently recommends the implementation of continuing education programs as an essential initiative to develop professional skills and raise the standards of care procedures<sup>2</sup>, ensuring reliability and safety in the prevention of HAIs.

The teaching and learning actions used to train professionals, in addition to demonstrating effective results in the qualification of teams working with HCP in several countries<sup>16,18,22-24</sup>, are tools for professional motivation and enhancement<sup>19,20,22,23</sup>. However, the lack of robust guidelines and adequate infrastructure is a substantial obstacle that impacts the incidence of process gaps and directly affects patient safety<sup>21,22</sup>.

Additionally, among the proper conditions for adequate performance of MSC professionals, constant updating and

**Chart 3.** Characterization of articles addressing education in a Material and Sterilization Center published in journals between 2015 and 2020.

| Authors, year and country                            | Heading  | Journal  | Study design  | Level of evidence |
|--|--|--|---|-------------------|
| Athanázio e Cordeiro, 2015 <sup>15</sup><br>Brazil   | Continuing education for workers of a material and sterilization center  | <i>Revista de Enfermagem UFPE On Line</i>                  | descriptive, exploratory, qualitative                   | NE6               |
| Tolson e Friedewald, 2016 <sup>16</sup><br>Australia | Beyond the patient zone: improving hand hygiene performance in a Sterilising Services Department                                 | <i>Journals Elsevier – Infection, Disease &amp; Health</i> | Case report   | NE7               |
| Farias et al., 2016 <sup>17</sup><br>Brazil          | Continuing education in a material and sterilization center: perception of the nursing team                                      | <i>Revista de Enfermagem UFPE On Line</i>                  | Qualitative, quantitative, descriptive, cross-sectional | NE6               |
| Paula et al., 2017 <sup>18</sup><br>Brazil           | Elaboration of didactic material for processing health products in primary health care units                                     | <i>Revista SOBECC</i>                                      | Case report   | NE7               |
| Bugs et al., 2017 <sup>19</sup><br>Brazil            | Profile of the nursing staff and perceptions of the work performed in a materials center   | <i>REME</i>  | Descriptive, qualitative                                | NE6               |
| Lucon et al., 2017 <sup>20</sup><br>Brazil           | Training of nurses to work in the central sterile supply department nurse  | <i>Revista SOBECC</i>                                      | Qualitative, descriptive                                | NE6               |
| Forrester et al., 2018 <sup>21</sup><br>USA          | Surgical instrument reprocessing in resource-constrained countries: a scoping review of existing methods, policies, and barriers | <i>Surgical Infections</i>                                 | Scoping review  | NE5               |

Continue...

**Chart 3.** Continuation.

| Authors, year and country                   | Heading   | Journal   | Study design               | Level of evidence |
|---|---|---|----------------------------|-------------------|
| Wang et al., 2018 <sup>22</sup><br>China    | Application of a sub-specialties management model improves quality control in a central sterile supply department   | <i>BMC Health Services Research</i>                   | Descriptive mixed          | NE6               |
| Fast et al., 2018 <sup>23</sup><br>Benin    | Mixed methods evaluation of the impact of a short term training program on sterile processing knowledge, practice, and attitude in three hospitals in Benin | <i>Antimicrobial Resistance and Infection Control</i> | Comparative, retrospective | NE4               |
| Fast et al., 2019 <sup>24</sup><br>Ethiopia | The impact of a short-term training program on workers' sterile processing knowledge and practices in 12 Ethiopian hospitals: a mixed methods study         | <i>PLoS One</i>                                       | Descriptive mixed          | NE6               |

**Chart 4.** Synthesis of articles on MSC education published in journals from 2015 to 2020.

| Authors, year and country                           | Objective  | Methodological aspects  | Results   |
|---|--|---|---|
| Athanázio e Cordeiro, 2015 <sup>15</sup><br>Brazil  | To assess how continuing education functions on the qualification of nursing professionals at the MSC.                           | Application of semi-structured interviews with content analysis using the Bardin method.  | Previous Note article presents results expected to contribute to a better understanding of the National CEH Policy by professionals working at the MSC; implementation and development of CEH in the unit; and future reflections, discussions and research on CEH. |
| Tolson e Friedewald 2016 <sup>16</sup><br>Australia | To report the construction and application of the "5 steps" of hand hygiene at the MSC.  | Description of the implementation of an audit program associated with training educational activities for effective hand hygiene technique.   | The intervention promoted increased awareness of the need to improve personal hand hygiene practices. Global adherence to hand hygiene practice increased from 43% to 88%.  |
| Farias et al., 2016 <sup>17</sup><br>Brazil         | To identify the perception of nursing professionals about continuing education at the MSC.                                       | Application of a questionnaire with closed and objective questions, and semi-structured interview with collective subject discourse (CSD) analysis.   | CSD showed that the concept of CE is understood as education aimed at improving the professional's performance. We identified absence of CE activities and the team's insecurity regarding new technologies.  |
| Paula et al., 2017 <sup>18</sup><br>Brazil          | To report the experience of preparing a booklet on the processing of HCP in Primary Health Care Units.                           | Construction of educational material in booklet format involving three steps: preparation of content based on scientific literature; selection of illustrations on online search engines; elaboration and assembly. | The booklet was structured in four chapters: 1. MSC: infrastructure concepts and requirements; 2. Classification of articles and biosafety in MSC; 3. MSC areas and HCP processing steps; 4. Monitoring the sterilization process.                                  |
| Bugs et al., 2017 <sup>19</sup><br>Brazil           | To draw the profile of the nursing team, identify the CE processes and the perceptions of the MSC team about their work process. | Application of a semi-structured questionnaire to collect personal data, professional profile information and valuing of the work by the nursing team.  | Training on technical activities of the work process identified, but only 56.25% of respondents were trained over two years of work at the MSC.   |

Continue...

**Chart 4.** Continuation.

| Authors, year and country                   | Objective   | Methodological aspects   | Results   |
|---|---|--|---|
| Lucon et al., 2017 <sup>20</sup><br>Brazil  | To understand the training of nurses to work in the MSC.  | Application of interviews with Bardin content analysis.  | Content analysis showed difficulties in learning MSC practices, identifying knowledge gaps and deepening theoretical foundations. The construction of learning requires articulation between theory and practice through a comprehensive approach.  |
| Forrester et al., 2018 <sup>21</sup><br>USA | To explore the up-to-date status of HCP reprocessing in low- and middle-income countries and categorize barriers to implementing guidelines and safe practices. | Scoping review with description of current methods, guidelines and barriers for HCP reprocessing in low- and middle-income countries.  | Deficits in the structure and workforce of the MSC due to insufficient training and education, in addition to outdated technology and lack of resources.  |
| Wang et al., 2018 <sup>22</sup><br>China    | To investigate the effect of a routine management model by subspecialties in HCP processing on quality control and satisfaction of MSC professionals.           | Use of a routine subspecialty model associated with ongoing staff training compared to the traditional model. Application of a questionnaire to assess professional skills.      | The adaptation of routines for HCP processing by subspecialty showed better results in improving theoretical knowledge and practical skills, reflecting in the reduction of failures in processes and increasing the satisfaction of the areas served.  |
| Fast et al., 2018 <sup>23</sup><br>Benin    | To evaluate the impact of training on knowledge, skills and professional practices, identifying institutional changes in HCP processing.                        | Application of a theoretical course followed by on-site practical mentoring. Intervention analysis through hospital assessments, knowledge tests and semi-structured interviews. | The thematic analysis of the interviews identified five key themes related to the change in the professionals' practices and attitudes after the intervention: 1. Changing things already done; 2. Changing the way things are seen; 3. Paying more attention; 4. Reducing surgical site infections; 5. Concerns about resources. |
| Fast et al., 2019 <sup>24</sup><br>Ethiopia | To identify the impact of an education program focused on HCP reprocessing in 12 Ethiopian health facilities.   | Application of a program of theoretical classes associated with training and on-site mentoring.  | The knowledge test results showed significant improvements in knowledge acquisition. The practical improvement was statistically significant in several areas of the MSC after the program was implemented.   |

MSC: Material and Sterilization Center; CEH: Continuing Education in Health; PE: Permanent Education; CE: Continuing Education; CSD: Collective Subject Discourse; HCP: Healthcare Products.

the availability of minimum resources for the practices evaluated as essential for implementing improvements in clinical practice were mentioned in the ten studies<sup>15-24</sup>. In this sense, the development of technical skills to manage HCP can be monitored and improved through a variety of interventions such as permanent education with the implementation of teaching materials<sup>15,18</sup>, application of theoretical and practical training programs<sup>16,19,22-24</sup>, restructuring of work processes based on technical training<sup>16,22,24</sup>, in loco educational mentoring programs<sup>24</sup> and self-reflection on best practices applied to work processes<sup>15,17,20,21</sup>.

Continuing and permanent education, based on booklets and other teaching materials, are simple and viable proposals that facilitate management methods and benefit

care practice<sup>18</sup>, being in line with the National Policy on Continuing Education in Health<sup>15</sup>, which can be starting point to stimulate actions to improve MSC professionals. However, data measuring the relationship with improvements in care indicators are not documented in the scenarios of these interventions.

Regarding the theoretical and practical training programs, the impacts on professional practice were monitored, including implementation of new attitudes during service, functional changes, implementation of best practices according to technical recommendations, and changes in the perception of the importance and result of the work for the quality of care provided, impacting the reduction of surgical infections<sup>23,24</sup>.



Adhering to new practices is closely related to an understanding of tangible benefits and impacts. Measuring results and sharing data can contribute to improving organizational culture.

A study conducted in New South Wales<sup>16</sup>, with an intervention to improve the quality of hand hygiene by the MSC team, achieved compliance with this practice as to the local benchmark through an audit program with team peers, with the association of theoretical-practical activities in the format of distance education. The result of hand hygiene rates over 18 months went from 43 to 88% compliance since the beginning of the program's implementation. In addition to this achievement, other benefits were reported by the team: optimism, self-responsibility, awareness, and cultural change.

An intervention carried out in a hospital in the city of Suzhou<sup>22</sup> added a routine subspecialty model for HCP processing coupled with ongoing staff training. The results showed that improving theoretical knowledge and practical skills, in addition to contributing to gains in efficiency and service quality, also impacts other dimensions of the practice and how other areas of the health service see the MSC.

Four<sup>17,19-21</sup> out of the ten publications included in the analysis were aimed at identifying the profile of professionals in this context when it comes to perceptions of education at the MSC, knowledge gaps and development opportunities. The results of the studies reinforced the importance of educational interventions as a professional training tool for mastering new technologies, providing quality services and having a favorable impact on the efficiency of HCP processing<sup>17,19-21</sup>.

Considering the results of this study, there were few publications addressing education strategies in MSC. One limitation may be the standardization of descriptors for search in different databases. Considering the specifics of each platform, it can be assumed that using different descriptors for each database would be more effective.

However, in the search process, the relevance of the topic was evident, often mentioned as fundamental to promote improvements in the organizational culture and in the practices of health services at all levels of care, both in developed and developing countries<sup>16,18,23</sup>.

## FINAL REMARKS

This article aimed to analyze recent publications that addressed education in the MSC. The articles selected had a low level of evidence and 40% of the studies did not apply educational strategies, but were intended to identify the perceptions of professionals about training in the MSC.

The results show the importance of fostering new research to identify the training needs of professionals working at the MSC and to publicize existing education initiatives, in order to encourage the continuous improvement of this vital area of health services. The implementation of educational interventions enables the technical development and the mastering of new technologies, reducing flaws in HCP processing, improving the quality of the service provided, and stimulating the engagement, awareness and satisfaction of professionals.

More research on this theme is suggested, with the aim of promoting the qualification and appreciation of the teams that work on the front lines of HCP processing.

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