REVIEW ARTICLE

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Training of health professionals through clinical simulation for the management of postpartum hemorrhage: an integrative review

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ABSTRACT

Objective: to identify the impact of training health professionals through clinical simulation in managing postpartum hemorrhage. **Methods:** an integrative review carried out in September 2023, in the LILACS, SciELO, BEDENF, and MEDLINE/PubMed databases, which sought to answer the question "What is the impact of training health professionals through clinical simulation for the management of postpartum hemorrhage?". The descriptors used were: Postpartum hemorrhage, Simulation Training, and Health Personnel. The Transparent Reporting of Systematic Reviews and Meta-Analyses was used for the screening and selection process, and the Critical Appraisal Skills Program was used to assess methodological rigor, as well as the level of evidence of the selected studies. **Results:** 13 articles published in international journals in English were included, with a prevalence of level of evidence 3 (n = 9). Simulation training improves professionals' confidence, skills, and knowledge. It also helps to reduce maternal morbidity, increase the use of specific medications, and surgical procedures related to the management of postpartum hemorrhage. **Conclusion:** clinical simulation training promotes improvements in managing postpartum hemorrhage, favoring a reduction in maternal mortality.

Descriptors: Simulation Training; Postpartum Hemorrhage; Postpartum Period.

INTRODUCTION

Maternal mortality, defined as death during pregnancy or up to 42 days after childbirth, is still a worrying reality in the world, especially in emerging countries[1,2]. One of the goals of the United Nations (UN) 2030 Agenda is to reduce maternal death rates worldwide[3]. The importance of achieving this goal is to ensure better health indicators, as well as reducing the barriers to these women's access to services at different levels of care[1]. Despite efforts to reduce maternal mortality in Brazil, postpartum hemorrhage (PPH) is the second leading cause of maternal death[4].

In 2023, a United Nations (UN) document entitled "Trends in Maternal Mortality 2000 to 2020" was released, showing that maternal deaths have increased or stagnated across almost all regions of the world. Among these deaths, PPH remains the first direct cause of death[5]. Looking at the global context, PPH ranks first among the causes of maternal death, with 140,000 deaths annually, which is equivalent to one death every four minutes[6].

Most cases of PPH are preventable by identifying risk factors and classifying them correctly before and during labor. As preventive measures, health organizations recommend active management of the third stage of labor and the use of prophylactic uterotonic drugs shortly after birth, with oxytocin being the best choice; they also emphasize the importance of using protocols and training teams through simulations[7,8].

Due to the high maternal mortality related to PPH, which can be attributed in part to inadequate training of professionals, the use of realistic simulation programs has been growing and is becoming increasingly popular. This training strategy pre-

pares health professionals to identify and initiate the appropriate management of hemorrhagic conditions in a controlled environment[2], consequently improving the quality of obstetric care and producing health benefits for patients.

Clinical simulation training allows for developing and improving communication skills, leadership, decision-making, identifying scenarios that need improvement, and reducing avoidable adverse events, as these are activities that reproduce real or possible events in professional practice[9].

Constructing scenarios validated by experts results in the successful learning of knowledge through simulation training[10]. In view of the above and the importance of the subject for the qualification of professionals in terms of good practices for the management of patients with postpartum haemorrhage, this study aimed to identify the impact of training health professionals through clinical simulation for managing postpartum haemorrhage (PPH).

METHODS

Integrative Review (IR) study that followed five stages: 1) Choice of topic and selection of the review question; 2) Search for articles in the selected databases; 3) Data collection in the selected articles; 4) Analysis of the data collected; 5) Data interpretation; 5) Presentation and discussion of the results[11].

This review will answer the question: "What is the impact of training health professionals through clinical simulation in the management of postpartum hemorrhage?"

The search was carried out in September 2023, in the databases of Latin American and Caribbean Literature in Health Sciences (LILACS), Banco de Dados em Enfermagem – Bibliografia Brasileira (BDENF), the PubMed portal (National Library of Medicine, The United States of American - USA) and the Scientific Electronic Library Online (SciELO) search engine.

The search descriptors were extracted from the Health Sciences Descriptors (Portuguese acronym: DeCS), in English, Portuguese, and Spanish, and Medical Subject Headings (MeSH), in English, namely: Postpartum hemorrhage (Hemorragia pós-parto/ Hemorragia Posparto); Simulation Training (Treinamento por simulação/ Entrenamiento Simulado); Health Personnel (Pessoal de saúde/ Personal de Salud). The Boolean operators AND and OR were used for cross-referencing, adapted to the search mechanisms of each database.

Original articles published between 2018 and 2023 (time frame of the five years previous to the study, to ensure that the data was up-to-date) was included, in any language, carried out with human subjects, and whose results addressed the impact of training health professionals through realistic simulation on the management of PPH. Editorials, literature reviews of any kind, case reports, and papers published in congresses or any media other than journals were excluded.

The screening and selection of articles was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA): 1) Inserting the descriptors and applying the screening filters; 2) Reading the titles and excluding those that were repeated and those that did not fit the research; 3) Reading the abstracts and excluding those that did not meet the inclusion criteria or the review question; 4) Reading the full article and excluding those that did not meet the inclusion criteria[12].

Data was extracted using an instrument[13] containing information on the articles' metadata, main results, and conclusions. To assess the methodological quality of the manuscripts, an instrument appropriate to the type of study was used, according to the Critical Appraisal Skills Program (CASP), which classifies the articles into two categories: "A", works with high methodological rigor, by meeting at least 9 of the 10 items; and category "B", those with moderate methodological rigor, when at least 5 of the 10 items were met[14].

The level of evidence was measured according to the following criteria[15]: Level 1) systematic review or meta-analysis of all relevant randomized controlled clinical trials or derived from clinical guidelines based on systematic reviews of randomized controlled clinical trials; Level 2) evidence derived from at least one well-designed randomized controlled clinical trial; Level 3) well-designed clinical trials without randomization; Level 4) well-designed cohort and case-control studies; Level 5) evidence originating from systematic review of descriptive and qualitative studies; Level 6) evidence from a single descriptive or qualitative study; Level 7) opinion of authorities based on clinical competency or opinion of expert committees.

RESULTS

A total of 245 articles were identified, 232 of which were excluded after reading the titles and abstracts. The 13 articles selected were read in full and included in the review (Figure 1).

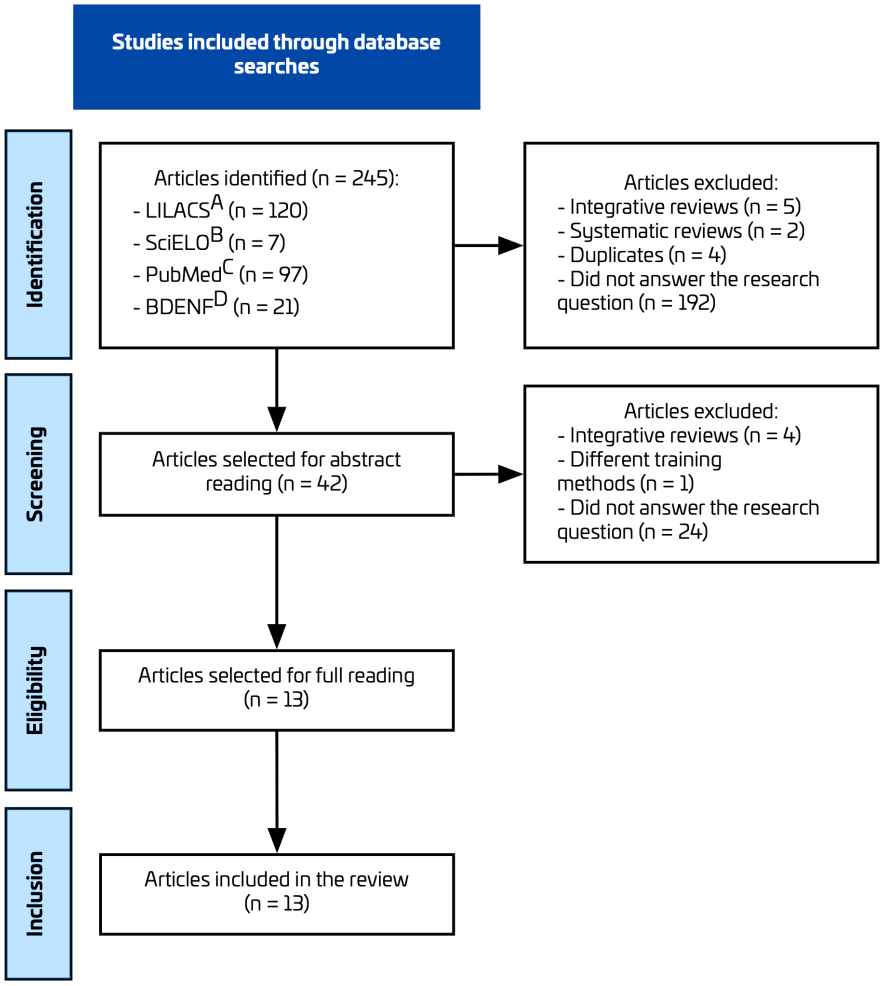
The year with the highest number of publications was 2021 (n = 5). All the articles (n = 13) were published in international journals in English and were classified as CASP category A. The most prevalent level of evidence was Level 3 (n = 8), followed by Level 6 (n = 3), (Table 1).

The management of postpartum hemorrhage (PPH) refers to a reduction in apprehension on the part of professionals regarding perceived benefits for the service and the women it assists.

The impact of training health professionals through clinical simulation for managing postpartum hemorrhage (PPH) refers to the reduction of apprehension on the part of the professionals concerning the perceived benefits for the service and the women assisted. After the simulation, health professionals obtained positive results regarding satisfaction with the method used for the training[16], safety in carrying out the procedures[2], and the acquisition of knowledge, competencies, and skills[16-21].

There were also significant gains in task management, teamwork, situational awareness, and decision-making[22], better rates of PPH management after the simulation on the part of the professionals who participated in it, identified by improved clinical response, administration of blood products, lower estimated blood

Figure 1 - Flowchart for screening and selecting articles for the review, based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses - PRISMA[12], 2023



Note: LILACS[A] - Latin American and Caribbean Health Sciences Literature; SciELO[B] - Scientific Electronic Library Online; PubMed[C] - portal of the National Library of Medicine, the United States of America; BDENF[D] - Banco de Dados em Enfermagem - Bibliografia Brasileira (Nursing Database - Brazilian Bibliography).

Table 1 - Summary of information on the authors/year of publication, objectives, participants, main results of the articles included in the review, level of evidence, and Critical Appraisal Skills Program - CASP, 2023

Continue...

Author / year	Objective / Research participants	Country of development / Main results	Type of study / Level of evidence / CASP[A]
Parameshwar PS, Bianco K, Sherwin EB, Meza PK, Tolani A, Bates P, et al. 2022[2]	To assess if simulation-based training (SBT) of B-Lynch suture and uterine balloon tamponade (UBT) for the management of postpartum hemorrhage (PPH) impacted provider attitudes, practice patterns, and patient management in Guatemala, using a mixed-methods approach. Research participants: 39 physicians	Country: Guatemala Professionals with previous simulation training reported greater comfort in performing B-Lynch suturing and uterine balloon tamponade for the management of PPH[C] compared to those without previous training.	Mixed methods evaluation, experimental Level: 3 CASP[A]: A
Siaulys MM, Cunha LB, Torloni MR, Kondo MM. 2019[16]	To present the experience and short-term learning outcomes of a private-public partnership in Sao Paulo, Brazil, to train public health sector personnel on the management of obstetric emergencies using a high-fidelity, simulation-based, multiprofessional course. Research participants: 340 professionals (117 physicians, 179 nurses, and 44 Licensed Practical Nurses)	Country: Brazil The training had high satisfaction scores and significantly increased heath professionals' knowledge. On average, knowledge about PPH[C] increased from 65 to 69%. The learning of nurses and licensed practical nurses was similar across the modules and significantly higher than that of physicians.	Before and after study Level: 3 CASP[A]: A

Table 1 - Summary of information on the authors/year of publication, objectives, participants, main results of the articles included in the review, level of evidence, and Critical Appraisal Skills Program - CASP, 2023

Continue...

Author / year	Objective / Research participants	Country of development / Main results	Type of study / Level of evidence / CASP[A]
Ramseyer AM, Lutgendorf MA. 2019[17]	To evaluate perceived competency in management of obstetric and pelvic hemorrhage following training with low fidelity task trainers using inexpensive and common medical supplies. Research participants: 23 gynecology and obstetrics residentes.	Country: The United States of America There was a statistically significant improvement in perceived competency for all participants after the training.	Observational Level: 6 CASP[A]: A
Hernández E, Camacho M, Leal-Costa C, Ruzafa-Martínez M, Ramos-Morcillo AJ, Cazorla E, et al. 2021[18]	To analyze the impact and evaluate the effects of training with high-fidelity simulation of obstetric emergencies on a multidisciplinary group. Research participants: 30 gynecologists, midwives, and nursing assistants.	Country: Spain Simulation training improved health professionals' competencies in relation to PPH[C] in all the areas evaluated: diagnosis, management of the situation, drug administration, recall, and communication. All the items described were statistically significant.	Quasi-experimental Level: 3 CASP[A]: A
Meza PK, Bianco K, Herrarte E, Daniels K. 2021[19]	To evaluate SBT[B] in low- and middle-income countries (LMICs) and the long-term retention of knowledge and self-efficacy. Research participants: 46 gynecology and obstetrics residents	Country: Guatemala Simulation-based training has been found to be an effective and viable method for increasing short- and long-term clinical knowledge and self-efficacy in obstetric emergencies in low- and middle-income countries.	Quasi-experimental Level: 3 CASP[A]: A
Changuiti O, Moustarhfir N, Marfak A, Saad E, Hilali A, Youlyouz-Marfak I. 2021[20]	To demonstrate the impact of the SBT[B] experience on the learning of midwifery students. Research participants: 28 professional midwifery students	Country: Morocco The experimental group (with simulation) had a higher average post-test score than the control group. The simulation significantly increased knowledge. The findings confirm that SBT[B] offers an opportunity for students to immerse themselves in an environment closer to reality, thus improving learning in a safe environment.	Experimental Level: 3 CASP[A]: A
Sumner E, Craig C, Coleman J, Kumi H, Scott H. 2022[21]	To evaluate low-fidelity simulation as a feasible and effective method of improving resident knowledge and confidence in a low-resource setting. Research participants: 35 obstetrics residents	Country: Ghana Statistically significant results were observed in relation to knowledge and confidence in the management of PPH[C] after the SBT[B]. All participants agreed that the simulation was educational, relevant, and realistic.	Quasi-experimental Level: 3 CASP[A]: A
Michelet D, Barré J, Job A, Truchot J, Cabon P, Delgoulet C, et al. 2019[22]	To assess whether a screen-based simulation designed specifically to train midwives in NTS[D] during PPH[C] led to better performance in relation to NTS[D] than the basic screen-based simulation (without NTS[D] training). Research participants: 24 midwives	Country: France The midwives in the NTS[D] group scored higher in: task management, teamwork, situational awareness, and decision-making.	Randomized Clinical Trial Level: 2 CASP[A]: A
Dillon SJ et al. 2023[23]	To examine the clinical performance and outcomes associated with postpartum hemorrhage because of uterine atony following the implementation of a multidisciplinary simulation program. Research participants: 300 obstetric nurses and anesthesiologists	Country: The United States of America After the training, the women started receiving blood products significantly earlier, within the first 12 hours after giving birth. In addition, there was a significant reduction in the time from administering uterotonic drugs to blood transfusion. The women had significantly less estimated blood loss.	Observational Level: 3 CASP[A]: A

Table 1 - Summary of information on the authors/year of publication, objectives, participants, main results of the articles included in the review, level of evidence, and Critical Appraisal Skills Program - CASP, 2023

Conclusion.

Author / year	Objective / Research participants	Country of development / Main results	Type of study / Level of evidence / CASP[A]
Lutgendorf MA, Ennen CS, McGlynn A, Spalding CN, Deering S, Delorey DR, et al. 2023[24]	To determine the impact of the Obstetric Simulation Training and Teamwork (OB-STaT) curriculum on postpartum haemorrhage (PPH) rates and outcomes. Research participants: 721 professionals, including Obstetrics and gynaecology physicians, obstetrics and gynaecology residents, certified nurse midwives, nurses, anaesthesiologists, anaesthesia residents, certified and student nurse anaesthetists, paediatricians, paediatrics residents, family medicine physicians, family medicine residents, hospital corpsmen (medical assistants), blood bank staff, radiology technicians, and operating room technicians. Number of deliveries observed: 9,980 deliveries.	Country: The United States of American Although PPH[C] rates have not decreased, there has been a significant improvement in maternal morbidity, a decrease in massive transfusions, an increase in the use of uterotonics by 36%, the use of tranexamic acid has almost doubled, and the rate of hysterectomy has increased significantly..	Before and after study Level: 3 CASP[A]: A
Baldvinsdóttir T, Blomberg M, Lilliecreutz C. 2018[25]	To evaluate whether the patient outcome and clinical management among women with PPH[C] had improved after practical obstetric team training (PROBE) compared with patient outcome and clinical management before PROBE. Research participants: 902 deliveries (419 pre-PROBE and 483 post-PROBE)	Country: Sweden PROBE improved the clinical management but not the outcome of patients with PPH[C]. Women seen post-PROBE[E] had more frequent venous access ensured, vital signs monitored, and received more volume replacement compared to those seen pre-PROBE. The use of uterine massage was also more common among women seen post-PROBE compared to those seen pre-PROBE.	Observational Level: 6 CASP[A]: A
Melo BCP, Van der Vleuten CPM, Muijtjens AMM, Falbo AR, Katz L, Van Merriënboer JJG, et al. 2021[26]	To compare postpartum hemorrhage (PPH) patient outcomes before and after an in situ instructional design based PPH simulation attended by obstetrics and gynecology (OBGYN) residents. Research participants: 36 obstetrics residents and 2,745 deliveries.	Country: Brazil PPH simulation based on in situ identification led to an increase in the average oxytocin dosage after training. This may indicate better situational awareness in the treatment of women with PPH.	Before and after study Level: 3 CASP[A]: A
Gerard JL, Turrentine MA, Leong-Kee S. 2022[27]	To estimate the effect of a simulation-based educational intervention related to PPH[C] on maternal morbidity outcomes. To estimate the effect of a simulation-based educational intervention on PPH-related maternal morbidity outcomes. Research participants: 19,927 deliveries and 888 PPH[C] cases.	Country: The United States of America Although the rate of PPH[C] increased after simulation, the composite morbidity* related to PPH[C] was lower after simulation training..	Cohort Level: 4 CASP[A]: A

Note: CASP[A] - Critical Appraisal Skills Program; SBT[B] - Simulation-based training; PPH[C] - Postpartum Hemorrhage; NTS[D] - Non-technical skills. *Composite morbidity: maternal death, hysterectomy, intensive care unit stay, blood transfusion, or unforeseen procedures to treat postpartum bleeding.

loss, increased use of uterotonics and tranexamic acid[23-26], and reduced maternal morbidity[24-27].

DISCUSSION

For proper and successful management of PPH, multiple tasks need to be carried out quickly and simultaneously, including, above all, early identification of the etiology of the bleeding and definition of the therapeutic measure of choice for the case. For this to happen, knowledge based on reliable sources is essential, and institutional training has proven to be efficient and important for professionals involved in caring for pregnant women[9].

The use of realistic simulation has proven to be an excellent strategy for training health professionals in the management of PPH, as observed in a study carried out at an obstetrics school in Paris with midwives and obstetrics students. This strategy had a positive impact on the professionals' performance in the face of a critical situation and promoted a significant improvement in task management and teamwork, allowing for situational awareness and timely decision-making[22].

Clinical simulation is an effective strategy, as it creates a scenario close to reality, with situations from everyday practice[18]. The positive contributions of this strategy to the training and qualification of health professionals extend to the different areas of health care, for example, in intensive care unit scenarios. One study used a realistic simulation in this scenario with good results, confirming that this practice is effective and innovative for the continuing education of health professionals[28].

When it comes to constantly improving the quality of patient care, the prior preparation of professionals through up-to-date

knowledge, combined with appropriate techniques, can be key to successful patient care and a good prognosis. It is recommended that the professionals involved in hemorrhagic care know their roles, perform them simultaneously, and that one member leads the team to ensure that actions are taken at the right time[29,30].

Simulation training in the scenario of obstetric hemorrhage has shown potential for acquiring knowledge, allowing professionals to gain more specific theoretical and practical input. This is confirmed by the use of this strategy in a course on the management of PPH and other obstetric emergencies carried out in three Guatemalan hospitals, which found that simulation is effective and viable for increasing short- and long-term clinical knowledge in low- and middle-income countries[19].

Other studies in different economic and cultural contexts have also found similar results. Studies carried out in Brazil, Ghana, and Morocco[16,20,21] have also shown that clinical simulation significantly increases knowledge about PPH, and boosts participants' confidence and satisfaction. Although professionals have an assertive basic knowledge of puerperal haemorrhage, there are shortcomings when it comes to identifying the causes and risk factors[31], which can be minimized by promoting this type of training, improving care not only with a focus on treatment but also on preventive measures[2].

National and international health organizations recommend the continuous identification of risks for PPH throughout obstetric care, given that a woman's clinical condition can be abruptly complicated. This practice aims to identify clinical evidence that could trigger possible complications and promote the timely adoption of preventive measures for PPH[29,30,32].

Other measures are pointed out as a way of preventing PPH, such as the administration of uterotonics (preferably oxytocin) during the third stage of labor and constant monitoring of uterine tone through abdominal palpation, which makes early identification of uterine atony possible[29].

In women who progress to PPH, oxytocin should be the uterotonic of first choice for initial treatment associated with tranexamic acid and an antifibrinolytic[29,30,32,33]. It is worth noting that the WHO recognizes that the most effective measure for preventing hypovolemic shock is early control of the bleeding site[28].

In addition, non-surgical measures such as bimanual uterine massage, intrauterine balloon tamponade, and the non-pneumatic anti-shock garment (NASG) can also be implemented as procedures to achieve better outcomes[25]. Due to the technicality of these procedures and the importance of properly prescribing the suggested medications, health professionals need to develop specific skills, and realistic simulation provides greater safety in carrying out these procedures while reducing the time it takes to indicate the administration of medications[2,23,24].

Other studies have shown the acquisition of perceived competency after simulation[17,18,24]. Perceived competency refers to what participants construct about their personal abilities and skills, which influences motivation and professional performance[34]. For example, training for medical residents on PPH carried out in the United States using realistic simulation, achieving excellent results. Participants in the study had better scores for Bakri placement, uterine tamponade, and temporary abdominal closure[17,24].

A study conducted with 39 physicians that allowed participants to experience simulation training on invasive procedures in PPH found that professionals who underwent the training reported being more comfortable performing B-Lynch suturing and uterine balloon tamponade compared to those without prior training[2].

Simulation training also improved health professionals' competencies in relation to PPH in all the areas evaluated: diagnosis, situation management, drug administration, recall, and communication[18].

These results reinforce the importance of training in order to improve care by developing competencies, skills, and knowledge. Care maneuvers during PPH, such as controlled umbilical cord traction and insertion of an intrauterine tamponade balloon, require specific skills so as not to generate new traumas and complications[29] and expertise and training on the part of the professional who performs them.

Other complications are also a cause for concern in the case of PPH, and training the obstetric team in a simulation environment can contribute to early identification and intervention, improving the patient's prognosis, as observed in a study carried out in Sweden, whose team began to offer venous access promptly, and increased adherence to the use of uterotonics and uterine massage, thus reducing complications from hemorrhage[25].

Taking a broader view, teaching through the realistic simulation method is not only limited to the benefits for professionals, but also contributes to reducing maternal morbidity associated with PPH[27,24], reduces the number of massive transfusions, increases the use of uterotonics and tranexamic acid[24], and improves the clinical response with the administration of blood products significantly earlier, even in the first 12 hours after delivery[23].

In care practice, obstetric nurses are usually the first professionals to identify PPH and start treatment[35]. Another professional responsible for providing first aid to patients with PPH is the emergency room nurse. This nurse also needs to be trained to recognize the signs and symptoms of PPH promptly in order to implement appropriate interventions and improve the clinical prognosis[36]. Investing in continuing education about this condition for nurses working in urgent and emergency care is of the utmost importance. The combination of factors, such as prediction and prevention, early recognition, and rapid coordinated action, is essential for avoiding PPH and reducing maternal mortality rates due to this specific condition[37].

While most professionals agree that competency acquisition and continuing education are important, not all training programs for obstetric emergencies are equal or effective. Therefore, multidisciplinary training based on high-fidelity clinical simulation can produce better results than other types of training[38].,

Generally speaking, clinical simulation has proven to be an

effective and important teaching tool for the health professionals continuing and permanent education, and can be used in both academic and hospital environments[7,25]. However, the apprehension of the knowledge offered can differ depending on the professional category, as shown in a study carried out with different professionals[16]. Although all professionals showed an improvement in their knowledge of PPH with this teaching and learning method, physicians showed a significant improvement in their knowledge when compared to nurses and Licensed Practical Nurses[16].

The 13 studies that made up this review were carried out in eight different countries on different continents, indicating that PPH is a global problem and that efforts need to be made to minimize its impact on the population of women of childbearing age, especially in low-income countries[5]. PPH is the leading cause of maternal mortality worldwide[5] and in Europe and the Americas (North and Latin America, and the Caribbean), for example, maternal mortality rates increased between 2016 and 2020[5]. This situation is exacerbated in low-income countries such as Guatemala and Ghana, which in 2020 had a maternal mortality rate of 96 per 100,000 live births and 250 per 100,000, respectively[5].

The limitations of this study are related to the time frame adopted between the years 2018 and 2023, which could lead to the loss of relevant articles published outside this cut-off period. It is worth mentioning that only one study addressed the use of realistic simulation to train health professionals in the management of PPH developed in Brazil, which may not portray reality. There is a growing increase in the use of this strategy in health professional training schools and the training of professionals working in Brazilian health services. However, publications on PPH are still scarce, indicating the need to carry out studies to develop and validate realistic simulation scenarios that address the PPH management in different regions of the country.

CONCLUSION

Clinical simulation for training healthcare professionals in the management of PPH promotes an increase in professionals' knowledge, skills, competencies, and confidence. This type of strategy contributes to the early adoption of treatment and/or prevention for PPH complications, the use of techniques that help prevent PPH, improves professionals' knowledge to identify signs and symptoms, and implement preventive and therapeutic measures early, such as the use of specific drugs (uterotonics and tranexamic acid) and the performance of surgical procedures. Additionally, it indirectly favors the reduction of maternal morbidity and the development of safe obstetric practice.

Health services are recommended to include clinical simulation in their training as a method of teaching and improving skills since it is a strategy that has proved to be effective, improving the quality of care provided to pregnant women, and has been satisfactorily evaluated by the participants.

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Conflict of Interests

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