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Review Article

Clinical simulation in training families for the hospital discharge of children with medical devices: an integrative review

Simulação clínica na capacitação de famílias para alta hospitalar de crianças com dispositivos: revisão integrativa

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ABSTRACT

Objective: to identify the impact of clinical simulation in training families for the hospital discharge of children who use medical devices. **Methods:** this integrative review was guided by the following research question: "How has clinical simulation supported family preparation for the hospital discharge of children who use medical devices?" We formulated this question based on the study's population, variable, and objective. Searches were conducted in the Embase, Scopus, Web of Science, PubMed, and Virtual Health Library databases. Full-text articles addressing the topic were included, while unavailable studies and those not aligned with this type of review were excluded. The selection and analysis process was performed in pairs using the Rayyan platform. **Results:** eight studies on simulation training programs for families of pediatric patients were included. Four focused on tracheostomy care, neonatal hospital discharge, and long-term mechanical ventilation in children. The remaining studies evaluated the impact of simulation on caregivers' self-efficacy, confidence, competence, and skills. **Conclusion:** simulation-based training for families enhanced safety and self-confidence; however, its use among family members remains limited. **Contributions to practice:** this study highlights the need to improve teaching practices by enabling professionals to implement simulation with families across diverse methodological and clinical settings.

Descriptors: Simulation Training; Family; Patient Discharge; Disabled Children; Pediatric Nursing.

RESUMO

Objetivo: identificar o impacto da simulação clínica na capacitação de famílias para alta hospitalar de crianças com dispositivos. **Métodos:** revisão integrativa guiada pela pergunta norteadora "Como a simulação clínica tem auxiliado o preparo das famílias para alta hospitalar de crianças que usam dispositivos?", construída mediante a observação da população, variável e objetivo do estudo. As buscas foram realizadas nas bases de dados Embase, Scopus, Web of Science, Pubmed e Biblioteca Virtual de Saúde. Foram incluídos os artigos completos que abordaram a temática e excluídos estudos indisponíveis e que não seguiam essa tipologia textual. A análise por pares utilizou a plataforma Rayyan. **Resultados:** foram incluídos oito estudos sobre programas de treinamento por simulação para famílias de pacientes. Quatro abordaram cuidados com traqueostomia, alta hospitalar de recém-nascidos e ventilação mecânica prolongada em crianças, enquanto os demais avaliaram o impacto da simulação na autoeficácia, confiança, competência e habilidades dos cuidadores. **Conclusão:** o treinamento com as famílias por meio da simulação aumentou a segurança e autoconfiança, no entanto ainda é pouco utilizado com os familiares. **Contribuições para a prática:** aprimoramento das práticas de ensino mediante o acesso dos profissionais à implementação da simulação com famílias em diferentes contextos metodológicos e clínicos.

Descritores: Treinamento por Simulação; Família; Alta do Paciente; Crianças com Deficiência; Enfermagem Pediátrica.

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Introduction

With advances in technology and healthcare, the survival of children with chronic conditions — particularly those with special healthcare needs — has increased. However, these children still require complex care that demands greater time and quality from healthcare services[1-2]. They can be categorized according to the complexity of their care needs, one of which is technological care, designated for those who depend on invasive medical devices. Among these devices, the most common are oxygen therapy, gastrostomy, tracheostomy, and ventriculoperitoneal shunts[3].

Children with special healthcare needs tend to use healthcare services more frequently because they are more vulnerable to developing secondary conditions, which often lead to illness and recurring hospitalizations[3-4]. In this context, any care provided for invasive devices is essential for maintaining their health and preventing complications or clinical deterioration, especially in the home environment[2]. During the transition of care from hospital to home, nurses play a fundamental role in guiding the child's family or caregiver, as it is in the home that continuous health care is provided[4-5].

For the family — especially the primary caregiver — managing technological devices becomes challenging, which often generates feelings of insecurity, distress, and inadequacy. The need to acquire complex knowledge and information to perform care, often practiced directly on the child, reinforces the negative emotions described above. Nevertheless, families are understood to play a crucial role in maintaining these children's health, making it essential to involve them in hospital discharge planning to ensure continuity of care[3-5].

Active methodologies in educating family caregivers have become increasingly evident in the literature. These methodologies stand out as educational strategies that place the family member at the center of the learning process, promoting more profound and meaningful engagement. This approach can be applied across a wide range of fields, from computer science to health education, to improve information retention and developing higher-order cognitive skills[6].

In the context of health and family, meaningful learning enhances families' ability to anticipate problems that may occur at home and supports the development of observational and behavioral skills needed to handle both routine and emergencies. It also facilitates more effective information absorption[7]. Focusing on the patient's clinical condition, encouraging family involvement, and addressing questions raised by healthcare professionals provide participants with opportunities for deliberation, experience sharing, and a closer theoretical-practical connection to the patient's clinical status. This approach creates a safe environment for embracing and addressing expectations, fears, and uncertainties[4-5].

In most cases, the preparation of families still follows a traditional model in which healthcare professionals deliver information in a lecture-based format and simply demonstrate the techniques and procedures. These traditional methods are predominantly educator-centered, with family members assuming a passive role, mainly as listeners. Education for families remains heavily focused on hospital-based care, often neglecting the child's individual context and the family's living conditions, which may result in a gap in the teaching-learning process[2-3].

This context highlights clinical simulation for caregiver training as a promising method for preparing families to provide care in the home setting. Training aimed at enabling caregivers to provide individualized care for the child has been associated with outcomes such as relief, self-confidence, and satisfaction, as well as greater safety in performing procedures on the child and facing challenges related to home care[8].

The results have proven favorable to using simulation as a teaching strategy, making learning dynamic and effective for the participants involved. Therefore, to ensure the safety of children with special healthcare needs, training for home care must begin at hospital admission and continue through discharge. This approach is believed to be rarely used with families to support knowledge acquisition and assimilation of new caregiving skills for children through simulation. From this perspective, this study aimed to identify the impact of clinical simulation in training families for the hospital discharge of children who use medical devices.

Methods

This is an integrative review conducted by pairs. Its development followed six stages: (1) formulation of the guiding question; (2) literature search; (3) data collection; (4) critical analysis of the included studies; (5) discussion of results; and (6) presentation[9]. To ensure reporting rigor, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension (PRISMA) checklist[10]. The protocol was registered on the Open Science Framework (OSF) platform under DOI: 10.17605/OSF.IO/WU9FT.

The object of study was the preparation of families of children with invasive medical devices during the hospital-to-home care transition. Based on that, the following guiding question was developed: "How has clinical simulation supported the preparation of families for the hospital discharge of children who use medical devices?" The article search strategy used the PVO acronym[11], in which P (Population): families; V (Variable): clinical simulation; and O (Outcome): hospital discharge.

Based on the research question, controlled descriptors and entry terms were selected from Medical Subject Headings (MeSH), Health Sciences Descriptors (DeCS), and EMBASE Subject Headings (EMTREE). The Boolean operators OR and AND were used to combine the terms.

Two independent researchers conducted the searches in January 2025, working in pairs and using remote access to the following databases: EMBASE, SCOPUS, National Library of Medicine (PubMed), Web of Science, and the Virtual Health Library (VHL). The databases were accessed through the Coordination for the Improvement of Higher Education Personnel (CAPES) journal portal via the Federated Academic Community (CAFe).

Full-text articles addressing clinical simulation and family were included, regardless of language or publication date. Publications in the form of letters to the editor, reviews, editorials, expert opinions, and book reviews were excluded. The selected articles were uploaded to the Rayyan QCRI platform for duplicate removal and initial screening based on title and abstract. Full-text reading was then conducted to select the final sample of studies that answered the research question.

A summary table was created to extract relevant information, including article identification, reference, objective, methodological approach, type of simulation and simulators used, the impact factor of the journal in which the study was published, levels of evidence, and main results. Studies were numbered and coded for analysis purposes, and the results were presented in a descriptive report.

To classify the level of evidence of the studies, we used the framework for clinical questions related to treatment or intervention in the health field, according to Critical Appraisal of Evidence: Part I – I: systematic review or meta-analysis of randomized controlled trials; II: randomized controlled trials; III: non-randomized clinical trials; IV: cohort or case-control studies; V: systematic review of descriptive and qualitative studies; VI: descriptive or qualitative study[12]. Figure 1 shows the databases used and the combinations applied during the search.

Database	Search strategy combinations
EMBASE	A# (family OR caregiver) AND 'simulation training' AND 'hospital discharge' B# ('family'/exp OR 'caregiver'/exp OR 'family caregiver') AND ('simulation training'/exp OR 'interactive training') AND ('hospital discharge'/exp OR 'discharge planning' OR 'patient discharge')
SCOPUS	A# ALL ("family" OR "caregivers" AND "simulation training" AND "patient discharge") B# ALL ("family" OR "caregivers" AND "simulation training" OR "interactive learning" AND "patient discharge")
PubMed	A# (("Family"[Mesh]) OR "Caregivers"[Mesh]) AND "Simulation Training"[Mesh]) AND "Patient Discharge"[Mesh] B# ((((family) AND (caregivers)) AND (simulation training)) OR (interactive learning)) AND (patient discharge)
Web of Science	A# (((ALL=(family)) OR ALL=(caregivers)) AND ALL=(simulation training)) AND ALL=(patient discharge) B# ((((ALL=(family)) OR ALL=(caregivers)) AND ALL=(simulation training)) OR ALL=(interactive learning)) AND ALL=(patient discharge)
BVS	A# (família) OR (cuidadores) AND (treinamento por simulação) AND (alta do paciente) B# (family) OR (caregivers) AND (simulation training) AND (patient discharge) C# (familia) OR (cuidadores) AND (entrenamiento simulado) AND (alta del paciente)

Figure 1 – Search strategy combinations by database using Boolean operators. Campo Grande, MS, Brazil, 2025

Results

The search yielded 401 articles, of which 164 were excluded as duplicates, leaving 237 articles for title and abstract screening according to the inclusion and exclusion criteria. Next, 20 full-text articles were retrieved for detailed review. In the end, eight articles were included in this review, as five did not address simulation with family members but rather with healthcare professionals, and two were not available in full (Figure 2).

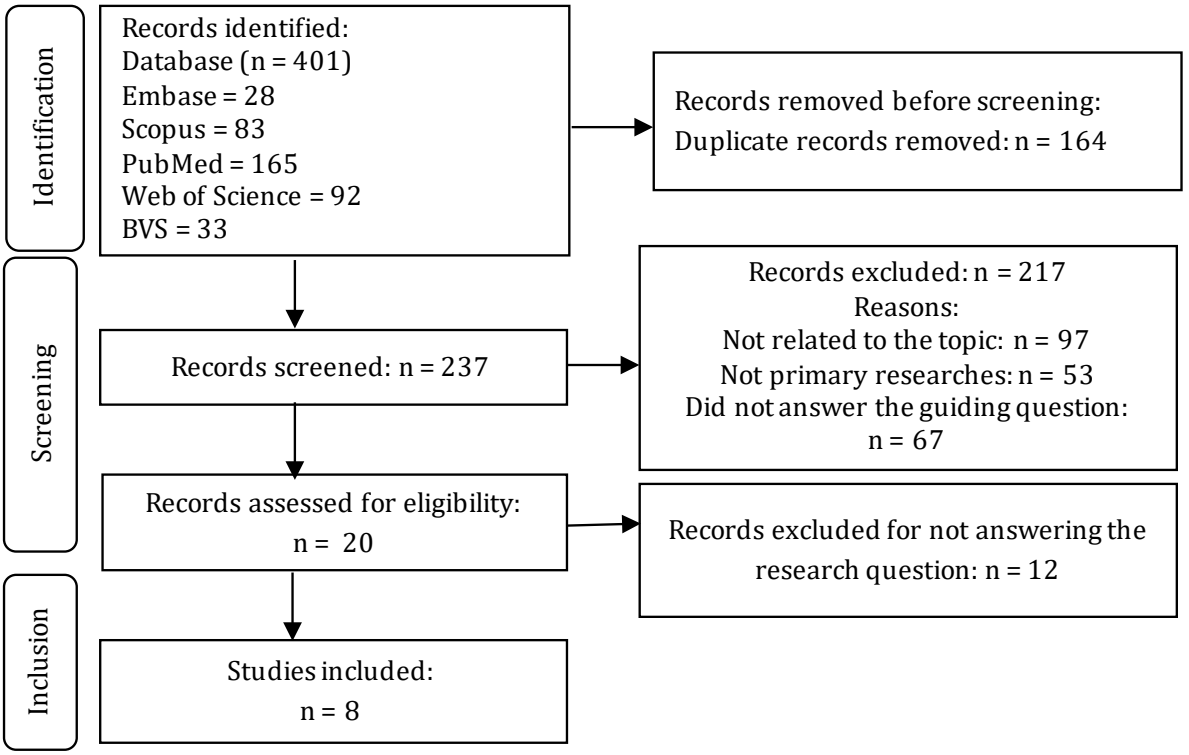

Figure 2 – Flowchart of study identification, selection, and inclusion, developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension. Campo Grande, MS, Brazil, 2025

Regarding the characterization of the studies, there was no significant variation in publication years, which ranged from 2017 to 2022. All the studies were published in English. Four were conducted in the United States, one in Turkey, and three did not have their location identified. The methodologies employed included experimental[13], methodological[14-15], quantitative[16], prospective cohort[17-18], qualitative[19], and quasi-experimental[20] designs. As for the level of evidence (LE), four studies were classified as level IV and the remaining four as level VI. The impact factor (IF) ranged from 1.5 to 3.8, with three journals having an IF of 2.4.

Concerning the objectives of the eight studies, four focused on the development, implementation, and/or evaluation of simulation-based training programs for families. In terms of subject matter, five studies addressed home care for children with tracheostomy[15,17-20], one focused on the hospital discharge of newborns from the intensive care unit[13], another on home parenteral nutrition[16], and one on children requiring long-term mechanical ventilation[14]. Four studies aimed to assess and examine the impact of clinical simulation, as well as to improve family caregivers' self-efficacy, confidence, competence, and skills.

In relation to the use of devices, hospital discharge, and simulation, six studies featured simulationbased training related to the care of children with tracheostomy[14-15,17-20], one focused on the use of a central venous catheter for parenteral nutrition[16], and only one addressed the hospital discharge of a newborn without the use of technological devices[13]. The findings indicate that simulation as a teaching method has positive impacts, particularly in improving caregiver performance in simulated scenarios, enhancing technical skills, and fostering the development of competencies required for patient care (Figure 3).

Authors/Year/ Journal	Simulator	Sample	Main findings	Limitations
Raines[13] 2017 Am J Matern Child Nurs	High-fidelity Premie HAL® infant simulator and lowfidelity premature baby mannequin	30 family members	Significant improvement in parents' confidence levels for performing home care. The debriefing revealed two categories: "Doing this alone differed from what I expected" and "Feeling more confident."	Lack of equipment and neonatal intermediate care unit staff to increase the number of interventions.
Thrasher et al[14] 2017 J Pediatr Nurs	High-fidelity pediatric mannequin with tracheostomy and ventilatorrelated emergencies	87 family members	Family members reported that the debriefing was the most beneficial part of the training. The most frequently mentioned words regarding the simulation were: learning (70.7%), self-confidence (17.3%), and preparation (13.6%). There was a reduction in readmissions within seven days after the simulation.	Simulator did not match children's real age. No long-term evaluation of skill retention.
Prickett et al[16] 2019 Int J Pediat Otorrinolaring	Gaumard HAL S3004 high-fidelity pediatric simulator, one year old (Gaumard Scientific, Miami, Florida)	39 family members	Average self-assessment scores before and after simulation increased significantly across the three scenarios, with averages of: 9 for desaturation; 16 for mucus obstruction; and 10 for decannulation. Family members reported increased confidence and effectiveness in discharge preparation, although they found the scenario stressful.	Lack of validation and reliability of assessment tools; no evidence of reduced readmission rates and/or complications.
Raphael et al[17] 2021 Nutr Clin Pract	High-fidelity SimBaby or SimJunior (Laerdal Medical, Inc., Stavanger, NY, USA)	14 families	Activities performed: 74% of participants requested training on handling parenteral nutrition equipment; 64% opted for central venous catheter dressing changes; and 21% for needleless aseptic changes. Results: 16% of families correctly set up the parenteral nutrition equipment, and 37% completed the dressing change, with 32% performed independently.	Small number of participants, limiting statistical power.

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Authors/Year/ Journal	Simulator	Sample	Main findings	Limitations
Yuen et al[15] 2021 Hosp Pediatr	High-fidelity pediatric simulator (Gaumard HAL S3004)	25 family members	Post-test scores were significantly higher in the "self-report" and "effective competence" items. The self-report items showed considerable improvement in confidence and comfort in performing care after simulation. Overall, only 17% of participants completed all 27 items competently.	Single simulation session, small sample size, and need for long-term follow-up.
Wooldridge et al[19] 2021 J Pediatr Nurs	Low-fidelity mannequin in the simulation lab	Of the 20 family members, only 15 completed the simulation	After the simulation, 90% of participants reported that the program was effective in helping them achieve their goals. Three main qualitative themes emerged: 1) Reduced trauma for the patient; 2) Effective educational method for lifethreatening events; and 3) Increased confidence and feelings of relief.	Small number of participants.
Yegit et al[20] 2021 Pediatr Pulmonol	Low-fidelity pediatric mannequin	65 family members	After training, 50.8% of participants performed all steps correctly, and scores increased in both theoretical knowledge and caregiving skills. Additionally, 98% of participants rated the course as excellent at the end of the program.	Limited access to the simulation lab, selection bias, and absence of a control group; no long-term effect evaluation.
McCoy et al[18] 2022 Respir Care	High-fidelity SimBaby (Laerdal Medical, Wappingers Falls, New York) modified for tracheostomy	18 family members	Significant increase in scores for "knowledge," "confidence," and "comfort." All participants gave positive feedback; 61% indicated improvement, and 36.4% requested additional scenarios. No significant difference was found in readmission rates within 90 days.	Small sample size, scenario order bias, and post-discharge testing without follow-up.

Figure 3 – Characterization of the studies by author(s), year of publication, journal, type of simulator, main findings, and limitations. Campo Grande, MS, Brazil, 2025

Discussion

The reviewed studies concentrate on family training through simulation as a means to develop skills and competencies for providing care at home and/or responding to clinical emergencies. However, only three studies explicitly identified hospital discharge as an objective[13,1617]. The remaining studies did not clearly state whether the training took place during the hospital-to-home transition[14-15,18-19].

Hospital discharge is part of the care process, particularly within the nurse's scope of practice, both in hospital settings and primary care. Ongoing support for the child and their family contributes to comprehensive, health-promoting care. Discharge should not be viewed as an isolated event in which the child and family are simply sent home; rather, it should be understood as a continuous process that begins at admission and undergoes regular evaluation based on the family's needs and the child's clinical condition[3,21].

In this context, developing initiatives aimed at families — such as guidance and training in techniques, skills, and caregiving practices — is essential to prevent complications and frequent readmissions. Discharge should be considered a stage within the Nursing Care Systematization process, guiding planning and implementing actions from admission through to the actual discharge to ensure continuity of care at home[22]. This planning can take place through a collaborative agreement involving the child (depending on their age), the family, and the nurse during the hospitalization period, with communication being a key element for cooperation throughout

the process. Furthermore, it allows for adaptability and flexibility; in other words, discharge planning can be adjusted according to the clinical condition to meet the child's and their family's actual needs[23-24].

Of the reviewed studies, three were conducted by nursing professionals, while most were developed by physicians and other healthcare professionals not directly involved in the hospital discharge process[13,18,20]. The evidence suggests that healthcare professionals often perceive discharge as the sole responsibility of the attending physician. In addition to gaps in the healthcare system related to resources supporting continuity of care at home, a lack of consensus in developing a discharge care plan creates anxiety and uncertainty among professionals regarding the discharge of children[25]. Nurses frequently take on the responsibility of providing discharge instructions. However, the information given to families may be insufficient, as nurses face high demands in healthcare settings and often cannot adequately plan for discharge, which hinders continuity of care[26].

One study sought to explore the perspective of the interprofessional team in a pediatric inpatient unit regarding the discharge of technology-dependent children. The findings revealed a fragile process that requires greater structure to carry out hospital discharge effectively, as it currently occurs in a fragmented and rushed manner. In addition, a biomedical model was predominant, characterized by brief instructions, professional overload, and communication challenges. These issues limit proactive discharge planning and the development of a family support network[3,24,26].

This highlights a breakdown in the continuity of care, which is related both to poor discharge management and to the underestimation of the family's role in promoting and sustaining care. As the central pillar of care, the family is responsible for managing resources, organizing support networks, and structuring the household and other emotional ties essential for continuing care. Although the importance of family participation is emphasized in pediatric contexts — due to the need for care embedded in children's daily lives — it is imperative to involve family members from hospital admission through to discharge. Doing so contributes to care continuity, quality, and safety, recognizing families' capacity to identify possibilities and scenarios to be addressed by the care team[26-27].

Improving care requires a patient, and family centered approach, actively involving them while considering their strengths, particularities, and challenges. Empowering families leads to more confident and appropriate decisions regarding home care[28]. In addition, the lack of effective communication between professionals and families — stemming from the undervaluation of the family's role in the care process — violates one of the six international patient safety goals and prevents the potential benefits of involving families in care planning from being realized in pediatric settings[29].

Aligned with this perspective, family-centered care advocates for and promotes patient safety while building safe, evidence-based caregiving knowledge and skills. In this model, families shift from serving as error correctors to becoming key players in preventing harm and protecting the patient from iatrogenic events[29]. In this context, most of the studies in our review focused on training and care involving devices such as the tracheostomy. Maintaining technical proficiency, developing new skills, and making safe decisions related to device use are fundamental principles of high-quality home care and can be effectively addressed through clinical simulation[30].

However, there is a clear gap in the literature regarding the preparation of caregivers of children who use other types of life-support devices. The lack of targeted studies undermines patient safety, particularly when family members perform care. Without proper training, families may provide inadequate care, which increases the risk of preventable readmissions and endangers both patient outcomes and quality of care[31].

Preparing families to care for children with

chronic illnesses or medical devices is a challenge that demands strategies focused on promoting health literacy. This literacy strengthens patient- and family-centered care by equipping caregivers with the competencies needed to understand and apply care instructions while maintaining autonomy, respect, and individualization[32]. Although hospital discharge is a complex process, sharing information between professionals and families helps create a safer environment by facilitating communication and addressing common doubts related to caregiving. In this setting, the nurse plays a central role as an educator, being responsible for equipping families throughout the discharge process[29].

As professionals take on this educational role, a variety of methods, tools, and activities become necessary. The primary goal of health education — whether aimed at students or patients — is to ensure that individuals are able to understand and correctly apply the techniques and care practices taught. Among the educational methods, traditional approaches are still widely used, in which knowledge is transmitted passively by the instructor, usually accompanied by printed materials such as manuals, booklets, and brochures, or by digital resources such as blogs, apps, and websites. Many professionals opt for this type of intervention because it provides accessible sources of safe and reliable information regarding caregiving practices to be followed by families and caregivers in their daily routines[33-35].

In contrast, active teaching methodologies — such as clinical simulation — are increasingly implemented in the health field. The fundamental principle of this approach is that knowledge should be built collaboratively between the facilitator and the participant, who assumes a central role in the learning process. In this context, the results of this review indicate that families evaluated clinical simulation rounds positively, as these sessions helped them better understand home care for children who use medical devices[13-20]. Simulation provides a safe and controlled environment that supports the learning process. Moreover, it allows family members to handle medical devices, practice complex procedures, make decisions in emergencies, build confidence, and reduce anxiety. As a result, the quality of care provided to children improves, contributing to better prognosis and overall well-being[36-37].

We found that clinical simulation-based interventions positively influence the development of knowledge, attitudes, and skills among family caregivers while also underscoring the importance of conducting additional studies on this topic[37-39]. Simulation-based education for caregivers of children with chronic conditions enhances their comfort, confidence, knowledge, skills, and ability to manage their child's care at home. Furthermore, open collaboration and information sharing among family members, healthcare teams, and simulation specialists support the development of increasingly effective simulation scenarios[39-40].

Overall, research on clinical simulation involving family participation is still recent; however, this review already reveals significant barriers to advancing this practice with caregivers and families. Among the structural limitations that hinder the implementation of this strategy are the absence or unavailability of designated spaces for simulated practice within healthcare institutions, as well as the lack of quality materials and simulators. Additionally, the high cost of setting up an appropriate environment discourages administrators from investing in such spaces and delays the adoption of this teaching method among frontline healthcare professionals[41-43].

Despite the barriers to expanding simulation as a teaching method for families and caregivers, it is currently the primary tool used in training healthcare professionals, as it aligns with new educational paradigms and experiential learning theories. Simulation offers a safe and controlled environment for developing practical skills and decision-making without placing real patients at risk. It also promotes confidence

and competence among students and professionals. As a result, it contributes to improved quality of care delivery through a dynamic and targeted training process[44-45].

In this regard, simulation stands out as an excellent learning opportunity for caregivers, who often play a crucial role in supporting patients. Integrating caregivers into clinical simulation programs not only enhances their skills but also strengthens collaboration and communication among all care team members, resulting in more effective and holistic care. Within this context, families can take on an autonomous role and act as health promoters, equipped to make decisions in emergencies. Simulation builds their confidence and reduces anxiety when facing real-life scenarios, ultimately improving the quality and continuity of care provided to these children.

Study limitations

A limitation of this review lies in the small number of studies included (only eight), despite the use of a robust methodology and the inclusion of studies with significant participant samples. Additionally, there is a scarcity of research focused on other types of technological devices used by children, as well as a lack of Brazilian studies since most of the included articles were conducted in other countries.

Contributions to practice

This study identified and synthesized evidence on using simulation as a health education strategy for families of children who use medical devices. It promotes changes in the pedagogical strategies used by nursing teams when training these families, fostering greater confidence, technical skills, and autonomy among caregivers. Furthermore, these findings may contribute to improving the quality of care provided to children, reducing complications related to improper device handling, and strengthening the bond between healthcare teams and family members.

Conclusion

The use of simulation proved effective in training parents and caregivers to care for children with special healthcare needs. Most simulation interventions focused on the care of medical devices such as tracheostomy and parenteral nutrition, aiming to guide families and caregivers in developing complex skills for assisting their children.

In addition to encouraging the active participation of caregivers in the care process, simulation also supports inclusive practices that promote patient protection and safety.

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Authors' contributions

Conceptualization and design, or data analysis and interpretation: Marti GF, Arruda DA, Almeida RGS. Manuscript writing or critical review of relevant intellectual content: Marti GF, Arruda DA, Fogaça KS. Final approval of the version to be published: Fogaça KS, Marques FRB, Queiroz-Cardoso AI, Costa RRO, Almeida RGS. Accountability for all aspects of the manuscript to ensure accuracy and integrity: Marti GF, Arruda DA, Almeida RGS.

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