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REVIEW

Technologies for teaching the removal of foreign body airway obstruction in children: a scoping review

Tecnologías para enseñar la limpieza de las vías respiratorias de cuerpos extraños en niños: revisión del alcance

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ABSTRACT

Introduction: educational technologies serve as essential teaching tools for laypeople, as they not only provide knowledge but also foster the development of safer practices. However, limited information is available regarding their use in teaching the removal of foreign body airway obstruction in children aged 2–12 years.
Objective: to identify the educational technologies used for teaching the removal of foreign body airway obstruction in children.
Method: this scoping review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines and the Joanna Briggs Institute (JBI) methodology. Were consulted eleven data sources between June and December 2024. The results were synthesized into tables and figures and analyzed using descriptive statistics.
Results: were included 19 studies. Most publications came from Brazil, followed by Spain and the United States. Regarding the study setting, the school environment was the most common (26,3 %), with family members (26,3 %) and school professionals (15,8 %) as the primary target audiences. Concerning the main types of educational technologies, 8 studies (42,1 %) focused on non-digital technologies (e.g., practical exercises, simulation, in-person courses, educational books, and calendars), while 11 studies (57,9 %) involved digital technologies (e.g., mobile applications, videos, video calls, telesimulation, games, and artificial intelligence).
Conclusions: digital technologies were the most frequently used tools for teaching foreign body airway obstruction removal in children, primarily in school settings and targeting family members.

Keywords: Educational Technology; Choking; Heimlich Maneuver; Child; Review.

RESUMEN

Introducción: las tecnologías educativas específicas son importantes herramientas de enseñanza para los

legos, ya que además de conocimientos, permiten el desarrollo de prácticas más seguras. Sin embargo, se sabe poco sobre su uso en la enseñanza de la limpieza de las vías respiratorias de cuerpos extraños en niños de 2 a 12 años.
Objetivo: identificar las tecnologías educativas utilizadas para enseñar la limpieza de las vías respiratorias por cuerpos extraños en niños.
Método: esta es una revisión de alcance, guiada por los elementos de informe preferidos para revisiones sistemáticas y la extensión de metanálisis para revisiones de alcance (PRISMA-ScR) y la metodología del Instituto Joanna Briggs. En el período de junio a diciembre de 2024 se consultaron 11 fuentes de datos. Los resultados se resumieron en tablas y figuras y se detallaron mediante estadística descriptiva.
Resultados: se incluyeron 19 estudios. Brasil, seguido de España y Estados Unidos tuvo el mayor número de publicaciones. En relación al escenario de estudio, prevaleció el ambiente escolar (26,3 %), siendo el público objetivo los familiares (26,3 %) y los profesionales de la escuela (15,8 %). En cuanto a las principales tecnologías utilizadas, se encontraron 08 (42,1 %) estudios con tecnologías no digitales (ejercicios prácticos, simulación, curso presencial, libro educativo y calendario) y 11 (57,9 %) estudios con tecnologías digitales (aplicación móvil, video, videollamadas, telesimulación, juego e inteligencia artificial).
Conclusiones: las tecnologías digitales fueron las más utilizadas para la enseñanza de la limpieza de las vías respiratorias a los niños, realizada en el ámbito escolar y para los familiares.

Palabras clave: Tecnología Educacional; Atragantamiento; Maniobra de Heimlich; Niño; Revisión.

INTRODUCTION

Foreign body airway obstruction (FBAO) or choking can result in partial or complete blockage of the airways caused by food or objects that prevent oxygen from reaching the lungs, potentially leading to acute or chronic complications or even death.[1] Preschool-aged children are the most affected,[2,3] and the most common obstructing objects include region-specific seasonal foods, coins, toys, and balloons.[1]

In the United States, it is estimated that in 2022, over 175 000 preventable deaths were related to home and community accidents, with choking being one of the leading causes among children and adolescents.[4] In 2023, Brazil recorded nearly 230 000 hospitalizations due to external causes among children and adolescents, and in 2022, more than 14 000 deaths from external causes in this population.[5] This review includes studies focusing on children aged 2-12 years.

The knowledge of family members and school professionals regarding airway clearance maneuvers in children remains insufficient,[6,7] and educational initiatives can contribute to adopting safer responses to choking incidents.[8,9]

In this context, educational technologies, which have an innovative impact on teaching practices,[10] effectively enhance knowledge, making the learning process engaging and interactive[11] while placing the target audience at the center of the teaching-learning process.[12] These technologies have evolved over time, with a growing trend toward digital resources due to technological advancements. Studies indicate improvements in people's health behaviors across different contexts using digital interventions.[13,14]

Despite this progress, little is known about the types of educational technologies used for teaching the removal of foreign body airway obstruction in children, as well as the specific contexts and target populations. Thus, this study aims to identify the educational technologies employed in teaching the removal of foreign body airway obstruction in children.

METHOD

We conducted this scoping review between June and December 2024 to identify studies mapping scientific contributions to teaching how to remove foreign body airway obstruction (FBAO) in children. The methodology followed the review framework proposed by the Joanna Briggs Institute (JBI)[15] and the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).[16] The study protocol was registered in the Open Science Framework (https://osf.io/xn72w/) under DOI 10.17605/OSF.IO/XN72.

Thus, we consulted the following data sources: Biblioteca Virtual em Saúde (BVS), SCOPUS, EMBASE, MEDLINE/PubMed, Web of Science, CAPES (Theses and Dissertations), The National Library of Australia Trobe (TROVE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Science Direct, SciELO, and the Directory of Open Access Journals (DOAJ).

Table 1. Data source and search strategy

Data source	Search strategy according to the resource used
MEDLINE/ Pubmed SCIELO	(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging) AND (“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR Technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials” OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR Simulation) AND (“Child Health” OR Child OR Children OR “Child Health Services” OR “Child, Preschool” OR “Infant, Newborn” OR “Preschool child” OR Infant*)
SCOPUS	(TITLE-ABS-KEY (“Heimlich Maneuver” OR “Airway Obstruction” OR gagging) AND TITLE-ABS-KEY (“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials” OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR simulation) AND TITLE-ABS-KEY (“Child Health” OR child OR children OR “Child Health Services” OR “Child, Preschool” OR “Infant, Newborn” OR “Preschool child” OR infant*)) AND PUBYEAR > 2018 AND PUBYEAR < 2025 AND (LIMIT-TO (LANGUAGE , “English”) OR LIMIT-TO (LANGUAGE , “Portuguese”) OR LIMIT-TO (LANGUAGE , “Spanish”)
EMBASE	(‘heimlich maneuver’ OR ‘airway obstruction’ OR gagging) AND (‘educational technology’/exp OR ‘technology, educational’ OR ‘instructional technology’ OR ‘technology’/exp OR ‘biomedical technology’ OR ‘digital technology’ OR ‘information technology’/exp OR ‘teaching materials/exp’ OR ‘instructional film and video’ OR ‘video games’/exp OR ‘education, distance’ OR ‘mobile applications’ OR ‘artificial intelligence/exp’ OR ‘augmented reality’ OR simulation) AND (‘child health’ OR ‘child’/exp OR children OR ‘child health services’ OR ‘child, preschool’ OR ‘preschool child’ OR ‘infant, newborn’ OR infant) AND (2019:py OR 2020:py OR 2021:py OR 2022:py OR 2023:py OR 2024:py) AND (‘article’/it OR ‘article in press’/it OR ‘review’/it)
Biblioteca Virtual em Saúde (BVS)	(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging) AND (“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR Technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials” OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR Simulation) AND (“Child Health” OR Child OR Children OR “Child Health Services” OR “Child, Preschool” OR “Preschool child” OR “Infant, Newborn” OR Infant*)
Directory of Open Access Journals (DOAJ)	(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging) AND (“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR Technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials” OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR Simulation) AND (“Child Health” OR Child OR Children OR “Child Health Services” OR “Child, Preschool” OR “Infant, Newborn” OR Infant*)
Web of Science	((ALL=(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging)) AND ALL=(“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR Technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials” OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR Simulation)) AND ALL=(“Child Health” OR Child OR Children OR “Child Health Services” OR “Child, Preschool” OR “Preschool child” OR “Infant, Newborn” OR Infant*)
The National Library of Australia Trobe (TROVE)	(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging) AND (“Educational Technology” OR “Technology, Educational” OR “Instructional Technology” OR Technology OR “Biomedical Technology” OR “Digital Technology” OR “Information Technology” OR “Teaching Materials”
Cumulative Index to Nursing and Allied Health Literature (CINALH)	OR “Instructional Film and Video” OR “Video Games” OR “Education, Distance” OR “Mobile Applications” OR “Artificial Intelligence” OR “Augmented Reality” OR Simulation) AND (“Child Health” OR Child OR Children OR “Child Health Services” OR “Child, Preschool” OR “Infant, Newborn” OR Infant*)
CAPES (Catálogo de Teses e Dissertações)	(Gagging)
Science Direct	(“Heimlich Maneuver” OR “Airway Obstruction” OR Gagging) AND (“Educational Technology” OR “Technology, Educational”) AND (“Child Health” OR Child OR Children OR “Child Health Services”)

The study applied the PCC strategy, which consists of three core elements: P - Problem (Removal of foreign body airway obstruction), C - Concept (Educational technologies), and C - Context (Child health and pediatric healthcare services).

We included primary and secondary studies that addressed the contributions of educational technologies for teaching the removal of foreign body airway obstruction in children. Studies published between 2019 and 2024 in English, Portuguese, or Spanish were eligible, covering all article categories, including original research,

literature reviews, systematic reviews, reflections, updates, and experience reports, as well as theses and dissertations.

In the initial search, we applied the following query: ("Heimlich Maneuver" OR "Airway Obstruction") AND ("Educational Technology" OR "Technology, Educational") AND ("Child Health"). This step helped us identify the most frequently used keywords in studies indexed in the National Library of Medicine (PubMed) and Cumulative Index to Nursing and Allied Health Literature (CINAHL). We then refined the search strategy using descriptors from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH), applying the Boolean operators "AND" and "OR" to construct a more comprehensive search query. The final strategy included the terms: ("Heimlich Maneuver" OR "Airway Obstruction" OR Gagging) AND ("Educational Technology" OR "Technology, Educational" OR "Instructional Technology" OR Technology OR "Biomedical Technology" OR "Digital Technology" OR "Information Technology" OR "Teaching Materials" OR "Instructional Film and Video" OR "Video Games" OR "Education, Distance" OR "Mobile Applications" OR "Artificial Intelligence" OR "Augmented Reality" OR Simulation) AND ("Child Health" OR Child OR Children OR "Child Health Services" OR "Child, Preschool" OR "Infant, Newborn" OR "Preschool child" OR Infant*). We adapted the search strategy for each data source using the selected descriptors.

We initially selected studies by screening titles and abstracts of references retrieved through the search strategy, using the Rayyan QCR tool. The articles were then exported to this platform for organizational purposes. After the preliminary selection, we assessed the full text of the pre-selected studies to confirm their eligibility, retaining only those that met the inclusion criteria. Once the final selection was complete, we organized and summarized the data in a structured table.

We extracted data from the articles using an instrument that included the first author's name, year of publication, country of publication, study type, level of evidence, study objectives, study setting, target audience, and results. The classification of study evidence levels followed established recommendations.[17]

The results were presented in figures and tables, categorizing technologies as either digital or non-digital based on the primary tool used. Digital technologies were defined as learning tools that rely on technological instruments for instruction.[18,19] We analyzed the results using descriptive statistics.

RESULTS

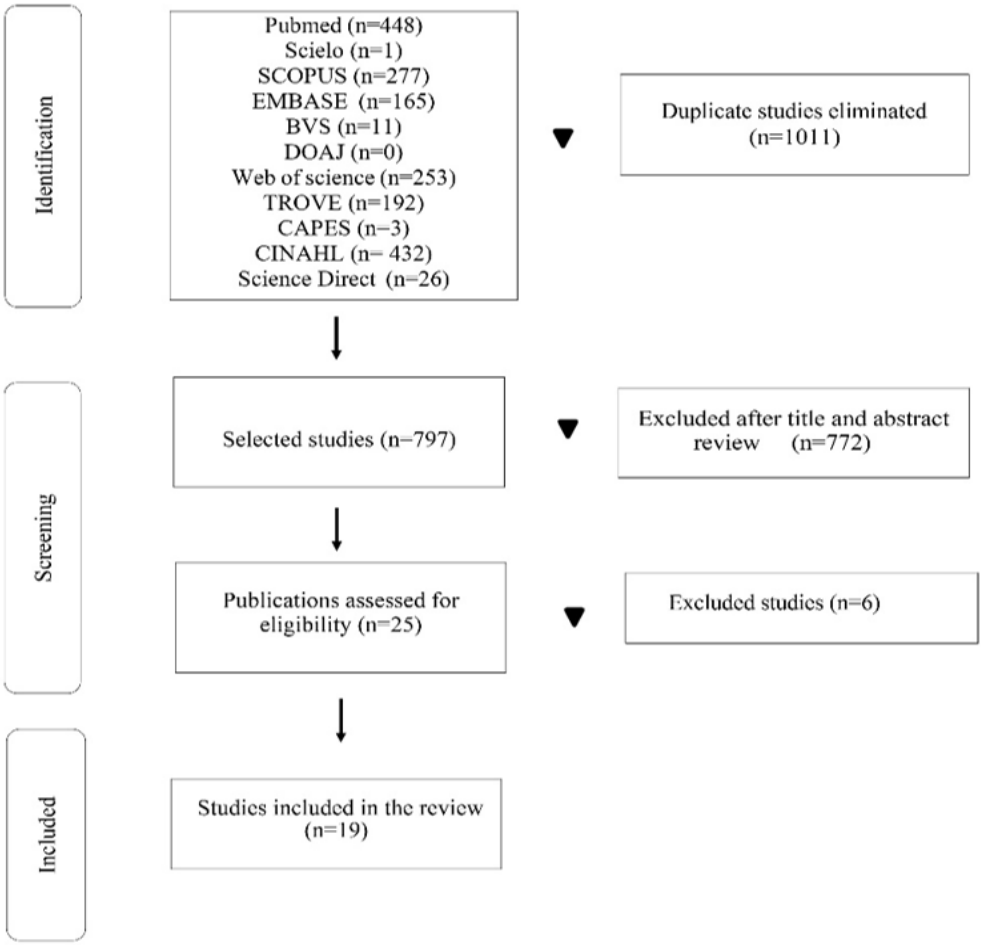

Figure 1. Flow diagram of literature search and article inclusion

Table 2. Summary of non-digital and digital technologies used for teaching the removal of foreign body airway obstruction in children. Salvador, Bahia, Brazil, 2025

Authors, year of publication, and countries	Type of technology	Study type and level of evidence	Objectives	Study setting / Target audience	Results
Johnson et al. (2012) United States [20]	Non-digital	Retrospective and observational study Level VI	Describe the implementation of a care system for children with critical airway obstruction using simulations.	Emergency department / Healthcare professionals	Simulation was an effective method for designing and implementing a new treatment system for critical pediatric airway obstruction.
Amaral. et al. (2018) Brazil [21]	Non-digital	Quasi-experimental study Level III	Evaluate the effectiveness of an educational intervention on preventing and managing airway obstruction and cardiopulmonary arrest in children aged zero to one year, focusing on maternal knowledge.	Maternity and Gynecology-Obstetrics Unit / Postpartum women	The educational intervention effectively increased postpartum women's cognitive knowledge and skills regarding the prevention, identification, and management of airway obstruction, choking, and asphyxia in infants.
Hasselager et al. (2018) Denmark [22]	Non-digital	Methodological study Level VI	Examine the validity of performance assessments developed and establish reliable pass/fail standards for pediatric basic life support and for training laypersons in removing foreign body airway obstruction.	Daycare centers / Daycare staff	Laypersons' pediatric basic life support skills and foreign body airway obstruction management skills can be reliably and validly assessed in a standardized simulated environment.
Silva (2020) Brazil [23]	Non-digital	Qualitative quasi-experimental study Level VI	Implement health education training on first aid for foreign body airway obstruction and cardiopulmonary arrest in a public school.	Schools / School professionals	The results demonstrated that the professionals involved felt more prepared and empowered regarding the acquired knowledge.
Carballo-Fazanes et al. (2022) Spain [24]	Non-digital	Letter to the editor Level VII	Report the results of a pilot simulation study assessing parents' and teachers' ability to use anti-choking suction devices (LifeVac® and DeCHOKER®).	Parents and kindergarten teachers	The findings showed a higher success rate in removing foreign body airway obstruction in a shorter time using LifeVac, followed by simulations with abdominal compressions and DeCHOKER.
Martínez-Isasi et al. (2023) Spain [25]	Non-digital	Quasi-experimental study Level III	Assess knowledge of maneuvers to remove foreign body airway obstruction in children following training.	Schools / Children aged 10 to 13 years	Knowledge improved after the training.
Carballo-Fazanes et al (2024) Spain [26]	Non-digital	Controlled clinical trial Level II	Evaluate the knowledge and skills of pediatric residents in managing a simulated pediatric choking scenario, adhering to recommended protocols, and using airway clearance devices (ACDs) LifeVac® and DeCHOKER®.	Hospital / Pediatric medical residents	Only a minority of pediatric residents could adhere to the recommended protocol to treat foreign body airway obstruction, while 70 % were able to use airway clearance devices appropriately.

Sunde et al. (1998) Norway[27]	Non-digital	Controlled clinical trial Level II	Assess whether sending a 12-month wall calendar focused on child and infant safety and first aid treatment had any educational impact on laypersons.	Insurance company / Company employees	The calendar had no educational effect when distributed by mail. However, a safety campaign that included calendar distribution and the opportunity for hands-on training with a mannequin positively influenced laypersons' first-aid skills and knowledge.
Barry (2015) Ireland[28]	Digital	Randomized trial Level II	Develop a mobile application and evaluate its effectiveness by measuring nursing students' knowledge, skills, and confidence in performing airway obstruction relief in infants.	University / Nursing students	Smartphone-based education may be an effective method for nursing education related to teaching foreign body airway obstruction in children.
Kim et al. (2017) South Korea[29]	Digital	Methodological study (quantitative) Level VI	Develop a first aid education app for children.	Not identified / Children	The First Aid Guideline (FAG) is an innovative application for first aid education for children aged 11 to 14 years. This app can serve as a tool for learning about first aid.
Ekaprasetia. et al (2018) Indonesia[30]	Digital	Randomized clinical trial Level II	Compare training using instructional videos with practical exercises conducted without an instructor and with a certified instructor in foreign body airway obstruction removal, and examine the cost-effectiveness of the training methods.	Daycare centers / Daycare professionals	Instructor-led training was the most effective training method but also the most expensive, making it less cost-effective than self-guided training. When the goal is to train a large number of individuals rather than focus on quality, self-guided training would be the preferred choice.
Hasselage et al. (2019) Denmark[31]	Digital	Quasi-experimental study Level III	Evaluate the effectiveness and feasibility of a first aid course and compare students' performance in simulation-based assessments using an interactive cloud-based format versus a traditional paper-based approach.	School / Elementary school students	The course was associated with noticeable and valuable improvements in knowledge and self-confidence in performing first aid. Higher team scores were observed using the cloud-based gaming format compared to the traditional format.
Cheng et al. (2021) United States[32]	Digital	Quasi-experimental trial Level III	Determine the effect of mobile devices compared to an educational book and videos on knowledge and decision-making regarding choking prevention and removing foreign body airway obstruction.	Schools / Mothers	Only the intervention group (mobile application) showed improvement in knowledge and decision-making regarding prevention and the maneuver for removing foreign body airway obstruction.
Behboudi et al. (2022) Iran[33]	Digital	Randomized controlled clinical trial Level II	Determine whether video calls with guidance from certified responders improve the quality of first aid for infants with foreign body airway obstruction.	University / University students enrolled in a health department	In first aid simulations for choking infants, the proportion of university students unable to correctly perform back blows was significantly lower when assisted by a certified rescuer via video call compared to voice-only assistance.

Igarashi et al. (2022) Japan[34]	Digital	Methodological study (quantitative) Level VI	Develop and validate an educational video on airway obstruction relief for deaf individuals.	Online / Deaf individuals	The video was validated in terms of face and content validity for teaching foreign body airway obstruction relief in children.
Silva (2022) Brazil[35]	Digital	Methodological research Level VI	Design and validate an educational video on first aid for children experiencing choking incidents in the school environment.	Schools / School professionals	The educational video was deemed valid by expert judges and the target audience, being characterized as engaging, attractive, and objective.
Miranda et al. (2023) Brazil[36]	Digital	Quasi-experimental study Level III	Analyze the contributions of telesimulation to mothers' knowledge in responding to foreign body airway obstruction in children.	Online / Mothers	There was a significant improvement in knowledge after telesimulation, particularly among those who had never experienced a choking incident and those with higher levels of education.
Camilo, Freitas, Okido (2023) Brazil[37]	Digital	Cross-sectional study Level VI	Test pediatric cases, including foreign body airway obstruction, to evaluate the performance and safety of ChatGPT and GPT-4 in children.	Online / Lay responders	ChatGPT/GPT-4 is a questionable emergency support tool, as in some cases, it provided incorrect guidance on how to contact emergency services, perform first aid, and apply advanced life support techniques.
Bushuven et al. (2023) Germany[38]	Digital	Randomized trial Level II	Develop a mobile application and evaluate its effectiveness by measuring nursing students' knowledge, skills, and confidence in performing airway obstruction removal in infants.	University / Nursing students	Smartphone-based education may be an effective method for nursing education related to teaching foreign body airway obstruction in children.

We identified 1808 studies, of which 19 addressed the topic. The study selection flow is presented in figure 1.

Most studies were published in 2022 and 2023, with Brazil as the most represented country, followed by Spain and the United States. Quasi-experimental studies with Level III scientific evidence predominated (36,8 %).

The technologies were classified into two categories: non-digital technologies, accounting for 42,1 % (including practical exercises, simulation, in-person courses, educational books, and calendars), and digital technologies, representing 57,9 % (including mobile applications, videos, video calls, telesimulation, games, and artificial intelligence).

Regarding the study setting, schools were the most common environment (26,3 %). The primary target audiences were family members (26,3 %), school professionals (15,7 %), and children (15,7 %). The study objectives and final considerations for each type of technology (nondigital and digital) are presented in table 2.

DISCUSSION

This scoping review mapped the educational technologies employed to teach the removal of foreign body airway obstruction in children, revealing a broad diversity of studies on the topic.

Quasi-experimental studies, classified as Level III evidence, were the most common study type. In these studies, educational technologies are implemented and evaluated before and after the intervention, with participants assigned to groups in a non-randomized manner.[39] These studies offer advantages, as they are more costeffective and time-efficient while generating valid causal evidence and mitigating internal validity issues commonly found in non-blinded experiments. Moreover, they are not methodologically inferior to randomized studies, as they assess interventions that cannot be randomized due to ethical or logistical constraints.[40]

Most technologies were applied in the school setting,[23,25,32,33,36] with a primary focus on parents and school professionals,[23,24,33,36,37] as these locations are where children spend a significant portion of their time.[41,42] Educational interventions targeting professionals and family members are essential, as they equip individuals with the necessary skills to perform initial airway obstruction removal in children, thereby reducing morbidity and mortality risks until a healthcare professional arrives.[9,43,44]

Only one technology was specifically designed for the deaf population, despite their right to educational training and the proven effectiveness of tailored technologies that accommodate their communication and comprehension needs.[45] However, sign language-based technologies remain limited to a few countries. According to the Global Strategy on Digital Health 2020-2025, countries must strengthen health equity approaches for people with disabilities, promoting a more inclusive digital society.[46]

Regarding the types of technologies, recent studies indicate a trend toward digital technologies, reflecting the growing adoption of innovative teaching methods. Studies that incorporated videos found them engaging, appealing, and effective,[36] particularly when combined with other instructional approaches such as simulation and instructor-guided training on airway obstruction removal.[33] Additionally, providing verbal instructions via video calls was identified as a potential strategy to improve performance in managing choking incidents when physical distance is a factor.[31]

Simulation was also one of the most frequently cited educational technologies. It serves as a teaching methodology that recreates real-life scenarios, enabling learners to develop practical skills through experiential learning. Studies have demonstrated its effectiveness in achieving positive learning outcomes,[25] testing airway clearance devices,[24] and enhancing video call-based training.[34] Furthermore, research suggests immediate feedback and structured debriefing following simulation sessions can reinforce learning and knowledge retention.[47] A recent evidence-based guideline from the Society for Simulation in Healthcare recommends combining simulation-based training with other learning modalities, such as instructional activities, to provide additional educational benefits.[48]

Among non-digital technologies, printed materials were the least commonly used despite their accessibility and potential to reduce both physical and digital exclusion.[49] This decline may be attributed to the evolution of technology over the years, transitioning from text-based and computer-based tools to digital platforms.[50] According to Brazil's Digital Health Strategy 2020–2028, positioning users as key participants in digital health initiatives is essential,[51] thereby ensuring equitable access to health information, particularly for individuals working with children.

For digital technologies, using serious games for teaching foreign body airway obstruction removal has demonstrated that cloud-based games have a greater impact on knowledge acquisition and self-confidence in performing first aid than traditional formats.[32] Serious games are designed to provide both entertainment and education while enhancing healthcare training.[52] In health education, gamification can contribute to knowledge improvement, health promotion, treatment adherence, rehabilitation, and chronic disease management.[53]

In addition to serious games, many studies have tested the use of mobile applications. These apps may include emergency call menus alongside educational content on choking incidents.[30] Findings from studies that utilized mobile applications indicate that this technology not only increases users' interest in the subject but also improves their skills and confidence in responding to emergencies, highlighting its effectiveness.[29,30] Artificial intelligence has also been explored, with studies testing its ability to assess cases of foreign

body airway obstruction in children using ChatGPT and GPT-4. However, this tool was deemed unreliable for emergency support, as it occasionally provided incorrect guidance on activating emergency services, performing first aid, and administering advanced life support techniques.[38] This type of misinformation is referred to in the literature as artificial intelligence hallucination, a phenomenon that has been identified in other studies as well.[54]

Despite these limitations, evidence suggests that artificial intelligence can surpass human accuracy, efficiency, and execution in healthcare processes. Its benefits range from diagnosis, treatment, and consultation to monitoring and self-management of chronic conditions.[55] However, broader research, including multicenter trials, is still needed to validate its effectiveness.[56]

Certain educational technologies, such as social media, podcasts, virtual reality, robotics, hybrid learning, online learning platforms, Massive Open Online Courses (MOOCs), music, comic books, teleconferencing, websites, hybrid teaching, and educational workshops, were not identified in the studies reviewed.[57,58,59] Future research should explore these unexamined technologies, highlighting their potential role in educational innovation.

Most studies concluded that the technologies analyzed were valid, effective, and yielded positive learning outcomes, contributing to developing essential skills for removing foreign body airway obstruction in children. However, there is no consensus in the literature on which technology is the most effective for this purpose, and few studies compare different technologies or assess long-term learning outcomes.

Integrating digital and non-digital technologies can enhance the teaching of foreign body airway obstruction removal in children. Despite the advancements and expansion of digital technologies over time, educators must critically reflect on their use in this educational context. This reflection should consider equity across different countries and regions, addressing barriers such as unequal access to technology and internet connectivity, policies targeting digital health, the development of necessary skills for proper usage, as well as ethical, security, and motivation-related concerns in the learning process.[60] Additionally, educational technologies must prioritize active learning, encouraging learners to take an active role in their own learning process.

Study limitations include the selection of databases—while comprehensive, this may have excluded other relevant sources—and the heterogeneity of methods and assessment instruments used to evaluate these technologies.

CONCLUSIONS

This review showed that the educational technologies most commonly used to teach children about airway clearance due to foreign bodies are predominantly digital. However, integration with non-digital methods can enhance learning, making it more accessible and effective. The combination of these technologies favors the consolidation of knowledge and the development of practical skills, contributing to the reduction of morbidity and mortality in children.

This study brought practical implications to the identification of educational strategies described in the literature for teaching children about airway clearance, in addition to presenting innovative technologies that have been little explored to date. Therefore, we suggest future research investigating artificial intelligence, serious games, and virtual reality. Despite the growth of these technologies in recent years, there is still a shortage of studies focused on teaching this topic.

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