



KNOWLEDGE, ATTITUDE, AND PRACTICE IN CHOKING MANAGEMENT AMONG TODDLERS: A SCOPING REVIEW

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ABSTRACT

Choking remains a leading cause of morbidity and mortality among children under five, commonly triggered by food and small objects, yet community knowledge and practices are often inadequate. This scoping review aimed to map existing evidence on educational interventions for paediatric choking management among toddlers. Literature searches were conducted in PubMed, Science Direct, and other databases for studies published in 2019-2024, applying the PICO framework targeting parents, teachers, caregivers, and healthcare providers. The initial search identified 674 records, with 14 studies meeting inclusion criteria after systematic screening. Studies employed pre-experimental, quasi-experimental, cross-sectional, or randomised designs with sample sizes ranging from 30-447 participants. Educational interventions using audiovisual media, demonstrations, counselling, and simulations consistently enhanced knowledge and skills, with audiovisual approaches showing the most notable effects. Despite improvements in knowledge acquisition, gaps remained between theoretical understanding and practical application in real-life choking incidents. This review contributes to the scientific literature by providing comprehensive mapping of effective educational strategies and identifying the persistent theory-practice gap, informing evidence-based intervention design for enhanced community preparedness.

Keywords: attitude; choking; education; knowledge; paediatric; practice

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INTRODUCTION

Choking represents a critical medical emergency that occurs when foreign objects, including food items or toys, obstruct the upper respiratory tract, thereby impeding airflow to the trachea (Maalim Issack et al., 2021; Thirunavukkarasu et al., 2024). This life-threatening situation demands immediate intervention from bystanders to prevent fatal outcomes. Choking is a major cause of illness and death in the pediatric population under the age of 5 years, with children at this age being at high risk during feeding and playing activities (Maalim Issack et al., 2021). The condition is recognized as a significant global public health concern requiring urgent attention from healthcare systems, educational institutions, and communities worldwide (Thirunavukkarasu et al., 2024).

Epidemiological data demonstrate that choking continues to pose a substantial threat to paediatric populations across different geographical regions. In the United States, approximately 305,814 non-fatal injury cases and 2,347 deaths due to choking were documented among individuals aged 0–19 years during 2001–2016, with toddlers representing the most vulnerable demographic experiencing both the highest incidence rates and mortality figures (Chang et al., 2021). Childhood choking is a global health concern that mainly affects children under the age of five years, with the parent's and caretaker's response being crucial for outcomes (Thirunavukkarasu et al., 2024). Indonesian research further confirms that limited mastication abilities and relatively narrow respiratory passages place young children at heightened risk for choking incidents, emphasising the need for targeted preventive strategies in developing countries (Kunbaran et al., 2024).

The vulnerability of toddlers to choking incidents is reinforced by multiple anatomical and physiological characteristics that differentiate them from older children and adults. Certain characteristics, including shape, size, and consistency, of certain toys and foods increase their potential to cause choking among children (American Academy of Pediatrics, 2010). These include diminished airway dimensions, immature swallowing reflexes, and natural exploratory behaviours involving oral insertion of objects. Choking injuries are one of the major causes of death among children ages 0-3, and most of these injuries are related to food (Lorenzoni et al., 2022). Food-related choking accounts for approximately 60–80% of paediatric cases, with peak incidence occurring between ages 1–3 years, although this risk persists through adolescence (Mayorathan et al., 2022).

The theoretical framework underlying choking prevention and management is grounded in health behaviour change models, particularly the Knowledge-Attitude-Practice (KAP) model, which suggests that knowledge acquisition leads to attitude formation, subsequently influencing practice behaviours. However, current guidelines worldwide are based on outdated data, with unclear evidence regarding the effectiveness and safety of these rescue manoeuvres (Bielński et al., 2024). This highlights the need for evidence-based approaches to choking education and management protocols. Regarding emergency response, parents—particularly mothers—serve as crucial first responders in most choking incidents. Rapid and appropriate actions by parents or caregivers can determine the success of life-saving interventions for choking children (Thirunavukkarasu et al., 2024). Unfortunately, multiple studies indicate that community knowledge, attitudes, and competencies in choking management remain inadequate across different cultural and socioeconomic contexts. Research conducted in the United Arab Emirates revealed that only 23.7% of participants correctly identified the most appropriate sign of choking, despite 43.3% having experienced choking incidents personally (Ala'Alajjuri et al., 2023). Research conducted in Saudi Arabia revealed that fewer than half of participants possessed sufficient knowledge, positive attitudes, or appropriate practices regarding choking first aid (Thirunavukkarasu et al., 2024).

Educational interventions targeting choking prevention and management have emerged as promising strategies to address these knowledge and skill gaps. A quasi experimental study was performed to evaluate the effect of an educational intervention on parental knowledge of choking hazards and prevention, showing significant improvements in knowledge scores (Bentivegna et al., 2018). Brief educational videos have been shown to improve parental knowledge of choking hazards and prevention immediately after viewing and for extended periods up to 30 days later. From a public health perspective, comprehensive prevention activities should address epidemiology, risk factors, and hazardous product characteristics, with coordinated regulatory and educational initiatives showing promise for reducing injury burden (Lorenzoni et al., 2022). Previous investigations across diverse population groups—including parents, educators, and healthcare personnel—have consistently identified gaps in choking first aid knowledge and practice. Understanding first aid is crucial for immediate intervention during health emergencies, with choking representing a significant danger, particularly for young children (Alenezi et al., 2024). In Indonesia, Wahyuni et al. (2022) determined that knowledge, attitudes, and family support factors were significantly associated with choking prevention behaviours among mothers of toddlers. Similarly, Kunbaran et al. (2024) demonstrated that demonstration-based educational approaches effectively enhanced maternal understanding of initial choking management procedures.

The application of various educational modalities has shown differential effectiveness in improving choking management competencies. Educational programmes are effective when utilising various methods such as video-based e-learning programmes, direct learning, and installation of hazard warning systems. Recent studies have demonstrated that structured educational interventions can

effectively improve knowledge, attitudes, and practices regarding choking management across different target populations (Alenezi et al., 2024; Thirunavukkarasu et al., 2024). Contemporary challenges in choking education include the need for evidence-based guidelines, standardised training protocols, and sustainable implementation strategies. Community intervention trials aim to teach families how to prevent food choking injuries while increasing knowledge relating to nutrition, representing comprehensive approaches that address both prevention and emergency management aspects (Lorenzoni et al., 2022). These multifaceted interventions show promise for addressing the complex nature of choking prevention and management. Health education interventions have proven to be highly effective strategies for improving community preparedness. Brief educational sessions, whether through demonstrations or video materials, can substantially improve parental knowledge not only immediately following instruction but also for extended periods thereafter (Bentivegna et al., 2018). Such interventions have the potential to reduce paediatric choking risk and improve emergency response outcomes.

From a public health perspective, choking prevention requires coordinated efforts involving healthcare systems, educational institutions, and community organisations. Comprehensive prevention activities should address epidemiology of the phenomenon, characteristics that make children more prone to choke, obstruction mechanisms, and detailed description of hazardous products. The integration of choking education into existing health promotion programmes represents an efficient approach to reaching diverse population groups while maximising resource utilisation. Therefore, this scoping review was conducted to explore and map the current evidence regarding knowledge, attitudes, and practices related to paediatric choking management among caregivers and healthcare providers of toddlers. The primary objective is to identify the existing level and characteristics of knowledge, attitudes, and practices, as well as the factors influencing them. By synthesizing the available evidence, this review aims to provide a comprehensive understanding of how these three components interact in shaping effective choking management and prevention among toddler populations.

METHOD

This study employed a scoping review approach through literature analysis to provide a comprehensive overview of choking management education, synthesize existing evidence, and formulate recommendations for future research.

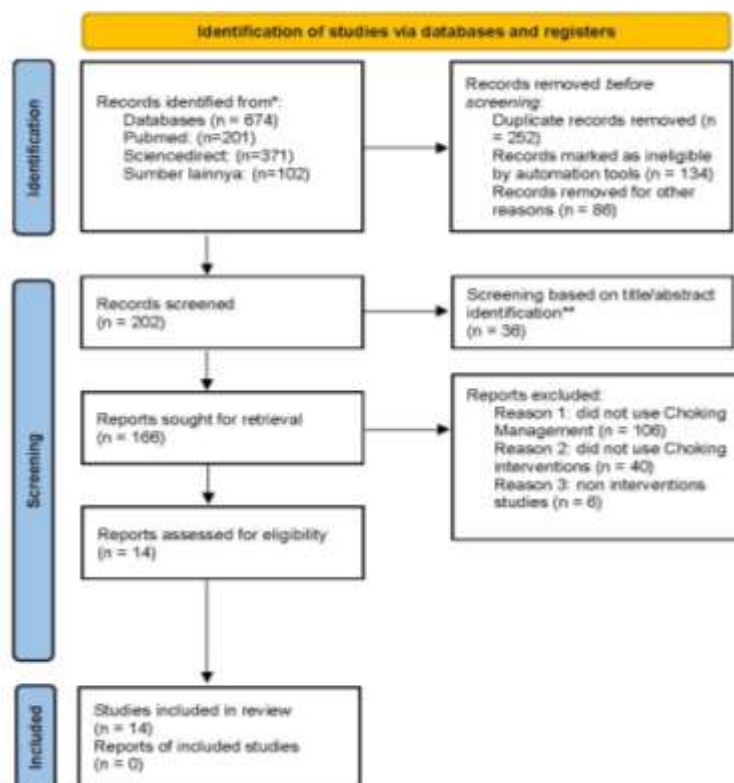
Table 1.
PICO Framework

Population	Patients, families, healthcare providers, or general population
Intervention	Knowledge, attitude, and practice assessment regarding choking management; educational interventions (videos, demonstrations, counseling, audiovisual materials)
Comparator	Pre-intervention levels, standard care, control groups without intervention, or different educational methods
Outcomes	Knowledge levels, attitude scores, practice implementation, and skill demonstration in choking management

The review was structured using the PICO framework, defined as follows: Population (P): patients, families, parents of toddlers, teachers, healthcare providers, caregivers, or members of the general population; Intervention (I): choking management education and assessment, including knowledge, attitude, and practice evaluation as well as educational interventions delivered through videos, demonstrations, counseling, audiovisual materials, booklets, leaflets, simulations, telephone, or social media; Comparator (C): pre-intervention levels, standard care, no intervention, control groups, or alternative educational methods; and Outcomes (O): knowledge levels, attitude scores, practice implementation, and skill demonstration in choking management. The literature search was conducted in PubMed, Science Direct, and additional sources using the keywords: *Assessment AND (Knowledge OR Attitude OR Practice) AND Choking*. The inclusion criteria were primary research articles with experimental, quasi-experimental, cross-sectional, randomized controlled trial, or methodological designs; studies specifically addressing choking management education;

publications from the last five years; articles in English or Indonesian; and those available in full text. The exclusion criteria comprised narrative reviews, integrative reviews, scoping reviews, systematic reviews, meta-analyses, and studies without an interventional or empirical component.

The article search was conducted across multiple databases, yielding 201 articles from PubMed, 371 from Science Direct, and 102 from other sources, totaling 674 articles. Following the PRISMA 2020 flow diagram, we systematically excluded 252 duplicate articles, 134 records marked as ineligible by automation tools, and 86 records removed for other reasons, leaving 202 articles for screening. Articles were carefully reviewed based on predetermined inclusion and exclusion criteria. After screening titles and abstracts, 36 articles were identified for full-text retrieval. From 187 reports sought for retrieval, 14 reports were assessed for eligibility. We excluded 106 studies for not using choking management interventions, 40 for not applying choking interventions, and 6 for being non-interventional studies. Each article underwent systematic examination, with extracted information summarized into a comprehensive review table covering author, year, location, objectives, methods, results, and conclusions. The review process involved initial title and abstract screening, followed by full-text analysis to confirm eligibility. Publication years were limited to the last five years to ensure current relevance.



RESULT

A total of 14 articles met the inclusion and exclusion criteria. The studies exhibited diverse designs: pre-experimental studies (n=5), cross-sectional studies (n=3), quasi-experimental studies (n=4), one randomized clinical trial (n=1), and one methodological validation study (n=1). Most publications originated from 2022-2024, with research locations spanning multiple countries, predominantly Indonesia. Sample sizes ranged from 30 to 447 participants across varied target populations including parents of toddlers, kindergarten and primary school teachers, healthcare providers, and childcare workers. Data collection methods encompassed questionnaires, observation checklists, simulations, and audiovisual media.

Most studies (n=12) provided interventions to participants. The most common method was video or audiovisual-based education (n=6), followed by direct training/counseling (n=4) and practical

simulations (n=2). Two studies were non-interventional (cross-sectional and instrument validation studies). Several studies compared the effectiveness of different educational methods, though none directly compared three types of educational methods simultaneously. Educational interventions consistently proved effective in improving participants' knowledge and skills in choking management. Audiovisual-based education showed superior effectiveness compared to other methods in enhancing first aid knowledge and practice. Cross-sectional studies revealed diverse levels of knowledge, attitude, and practice regarding choking management across different populations. Most studies focused primarily on improving knowledge and skills through interventions, with limited analysis of determinant factors influencing existing choking management practices in communities. Additionally, previous research utilized relatively small sample sizes, indicating a need for larger-scale studies to strengthen evidence base.

Table 2.
Review Results

No	Authors (Year)	Objective	Methods	Results
1	Ratiyun et al. (2023)	To determine the effect of choking education on parents of toddlers aged 1-5 years.	Design: Pre-experimental design with one-group pretest-posttest. Sample: 30 parents using Paul Leedy formula. Variables: choking management education for toddlers. Instrument: Questionnaire to measure choking management education for toddlers aged 1-5 years. Analysis: Wilcoxon Matched Pairs test.	Parental knowledge significantly improved after education (mean score 35.63, p-value = 0.000).
2	Thirunavukkarasu et al. (2024)	To assess knowledge, attitudes, practices, and associated factors related to choking first aid management among Saudi adults.	Design: Analytical quantitative study. Sample: 390 Saudi adults from Eastern Province healthcare centers. Variables: age, gender, occupation, first aid training (independent); KAP (Knowledge, Attitude, and Practice) levels (dependent). Instrument: Standardized and validated research tools were used to assess participants' knowledge, attitudes, and practices. Analysis: Spearman correlation, binomial logistic regression.	KAP levels were 43.3%, 38.9%, and 36.4% respectively. Positive correlations found between all KAP components (p = 0.001).
3	Maalim Issack et al. (2021)	To assess kindergarten teachers' knowledge, attitudes, and practices regarding pediatric choking first aid and identify associated factors.	Design: Cross-sectional study using structured questionnaires. Sample: 224 kindergarten teachers (95% response rate). Variables: first aid training, experience, age, education (independent); KAP levels (dependent). Instrument: Structured and pretested questionnaire completed independently by respondents. Analysis: SPSS version 25, multiple logistic regression.	Only 37% had good knowledge. First aid training increased good knowledge likelihood 2.9 times (AOR: 2.902, 95% CI: 1.612-5.227).
4	Arfan et al. (2024)	To determine the effect of choking education on mothers' knowledge regarding toddler choking management.	Design: Pre-experimental design with cross-sectional approach. Sample: 38 mothers using total sampling. Variables: choking management education (independent), mothers' knowledge (dependent). Instrument: Knowledge questionnaire about choking prevention and management in toddlers. Analysis: Wilcoxon Matched Pairs Test	Good knowledge increased from 5 mothers (13.2%) to 38 mothers (100%) post-education (p-value = 0.00).
5	Aidah & Novianty (2022)	To determine the effect of choking education on mothers' knowledge regarding toddler choking management.	Design: Pre-experimental research with one-group pre-test/post-test design. Sample: 38 mothers using total sampling. Variables: choking management education on parental knowledge. Instrument: Validity-tested questionnaire distributed through "Google Form". Analysis: Wilcoxon Signed Rank Test.	Poor knowledge decreased from 31 (91.2%) to 0 respondents; adequate knowledge increased to 21 (61.8%) post-education (p-value = 0.000).
6	Alenezi et al.	To evaluate understanding,	Design: Cross-sectional study conducted July-October 2023. Sample: 447 elementary school	High knowledge of choking signs (86.3%),

No	Authors (Year)	Objective	Methods	Results
	(2024)	attitudes, and implementation of choking first aid measures among elementary school teachers in Saudi Arabia.	teachers in Riyadh. Variables: knowledge of signs/symptoms, attitudes, practices (independent); first aid implementation (dependent). Instrument: Questionnaire including demographic information, knowledge of choking signs and symptoms, attitudes toward choking management importance, first aid practices, and relationships between knowledge levels and first aid practices. Analysis: SPSS Statistics version 29, correlation tests, chi-square.	but only 33.8% provided actual first aid. Higher knowledge significantly associated with implementation ($p < 0.001$).
7	Fitriana et al. (2024)	To improve participants' knowledge and skills in performing first aid for choking incidents through education and simulation.	Design: Education and simulation with pre-test/post-test approach. Sample: mothers of PAUD Bunda Lestari students. Variables: knowledge and skills improvement in choking management. Instrument: Leaflets, pediatric phantoms, pre-test and post-test questions, and skill observation sheets. Analysis: written tests and skill observation evaluation.	Participants demonstrated improved knowledge and correctly performed Heimlich maneuver after educational activities and simulation training.
8	Paiva et al. (2023)	To compare choking and gagging incidents in infants receiving complementary foods through three different feeding methods.	Design: Randomized clinical trial. Sample: 130 mother-infant pairs. Variables: complementary feeding methods - PLW, BLISS, mixed (independent); choking/gagging incidents (dependent). Instrument: Questionnaire used to collect data on choking and gagging incidents in infants at 9 and 12 months. Analysis: ANOVA for between-group comparisons ($p < 0.05$)	No significant differences in choking rates between groups: PLW (30.2%), BLISS (22.2%), mixed (26.2%) ($p > 0.05$).
9	Wiryansyah (2024)	To identify parental knowledge regarding first aid for choking children through health education intervention.	Design: Pre-experimental design with initial assessment then post-treatment reassessment. Sample: 49 mothers from TK Kenten Permai kindergarten. Variables: health education (independent), mothers' knowledge (dependent). Instrument: Knowledge questionnaire about first aid for choking children consisting of 15 questions. Analysis: Wilcoxon test with 0.05 significance level.	Good knowledge increased from few respondents to 36 (73.5%) post-education. All respondents (100%) showed improvement with 40.8% average increase.
10	Miranda et al. (2023)	To develop and validate an educational video about pediatric choking first aid in school environments.	Design: Methodological study (2021-2022) with six stages: theme exploration, theoretical study, video development, expert validation, adaptation, target validation. Sample: 13 teachers for interviews, 17 experts, 17 teachers for validation. Variables: educational video (independent), validity/effectiveness (dependent). Instrument: Interviews for theme exploration, 4-minute 10-second animated educational video, and validation measurement tools such as concordance index to measure validity levels. Analysis: Iramuteq software, concordance calculations.	Animated video achieved 97% concordance among experts and 96% with target audience, indicating high validity for educational use.
11	Margaretta & Isnaeni (2022)	To determine the effect of training on parental knowledge and skills in managing infant choking.	Design: Pre-experimental with one-group pretest-posttest design. Sample: 45 mothers using total sampling at Posyandu Ngasem. Variables: infant choking management training (independent), parental knowledge/skills (dependent). Instrument: Questionnaire to measure knowledge levels before and after training. Observation to measure parental skills in infant choking management. Analysis: Wilcoxon test for pre/post differences.	Significant improvement in both knowledge (p -value = 0.000) and skills (p -value = 0.001) after training intervention.

No	Authors (Year)	Objective	Methods	Results
12	Saelan et al. (2023)	To determine mothers' knowledge levels in pediatric choking management.	Design: Quasi-experiment with pre/post-test without control group. Sample: 33 mothers with children aged 2-5 years. Variables: Heimlich maneuver education (independent), mothers' knowledge (dependent). Instrument: Questionnaire to measure mothers' knowledge levels before and after education. Analysis: paired t-test for significance measurement.	Results showed that Knowledge significantly improved: 30 mothers with poor knowledge pre-education decreased to 8, with 25 achieving good knowledge (p-value = 0.000).
13	Suleman (2023)	To determine whether choking management demonstration method affects kindergarten teachers' knowledge levels.	Design: Quasi-experimental research with pre-test/post-test control group design. Sample: 40 kindergarten teachers in Telaga District using purposive sampling. Variables: demonstration method effect on teacher knowledge. Instrument: Questionnaire with 19 questions based on Guttman scale (true/false), modified from Panji (2019) and Tarigan, A.B (2019). Analysis: univariate/bivariate analysis after normality testing.	Demonstration method significantly affected kindergarten teachers' knowledge throughout Telaga District (Wilcoxon test p-value = 0.000).
14	Novianti & Khadijah (2023)	To improve mothers' knowledge and skills about choking management using audiovisual video education.	Design: Quasi-experimental design with one-group pretest-posttest without control. Sample: 99 mothers with toddlers at Posyandu Kenanga Harum using purposive sampling. Variables: audiovisual video education on knowledge/skills. Instrument: Choking management questionnaire adapted from Panji (2019), consisting of 20 questions with Guttman scale (true/false), validity and reliability tested. Analysis: Wilcoxon test for pre/post comparison.	Audiovisual video education significantly improved mothers' knowledge and skills in choking management (p-value = 0.000).

Knowledge

Across studies, participants' knowledge of choking management significantly improved following educational interventions. Pre-experimental and quasi-experimental designs consistently demonstrated positive effects (Aidah & Novianty, 2022; Arfan et al., 2024; Novianti & Khadijah, 2023; Ratiyun et al., 2023; Saelan et al., 2023). For example, in several studies, the proportion of participants with good knowledge increased from less than 20% to over 90% post-intervention. Cross-sectional findings also showed that baseline knowledge remained suboptimal in many community groups, with only 37% of kindergarten teachers and 43.3% of adults in Saudi Arabia demonstrating adequate understanding (Maalim Issack et al., 2021; Thirunavukkarasu et al., 2024).

Attitudes

Although fewer studies directly measured attitudes, those that did (Alenezi et al., 2024; Thirunavukkarasu et al., 2024) reported generally positive perceptions toward the importance of choking management. Positive correlations were observed between knowledge and attitude ($p=0.001$), indicating that increased knowledge contributes to more favorable attitudes. However, attitude improvement did not always translate into behavioral change, suggesting the need for reinforcement and practical experience to sustain motivation and confidence.

Practices

Evidence regarding actual practice or behavioral implementation was comparatively limited. While many participants demonstrated adequate theoretical knowledge, the translation into real-life actions remained low. For instance, Alenezi et al. (2024) found that 86.3% of teachers recognized choking symptoms, but only 33.8% had ever provided first aid in real situations. Similarly, Thirunavukkarasu et al. (2024) reported that practice levels were the lowest among KAP domains (36.4%). Studies incorporating simulation-based or demonstration training (Fitriana et al., 2024;

Margaretta & Isnaeni, 2022) showed significant improvements in skill performance, suggesting that hands-on methods are essential for bridging the knowledge–practice gap. Overall, the review highlights that while educational interventions effectively enhance knowledge and attitudes toward paediatric choking management, actual practices remain inconsistent and dependent on prior training exposure, experience, and contextual factors such as institutional support and policy.

DISCUSSION

Global Burden and Scope of Pediatric Choking

The findings from this scoping review confirm that pediatric choking incidents continue to represent a significant global child safety concern, carrying substantial morbidity and mortality burdens, particularly among children under five years of age. Data from the United States between 2001 and 2016 documented more than 300,000 non-fatal injuries and over 2,300 deaths related to choking among individuals aged 0–19 years, with toddlers accounting for the largest proportion of cases, underscoring the urgent need for preventive interventions and rapid community response capabilities (Chang et al., 2021). Choking is one of the leading causes of death among unintentional injuries in young children, representing a considerable public health burden, with the fourth leading cause of unintentional injury deaths being choking-related incidents (Lorenzoni et al., 2021).

The anatomical and developmental characteristics of young children inherently predispose them to choking risks. Children at preschool age spend more time in their school environment and are at high risk during feeding and playing activities, making immediate provision of first aid in response to choking by educators crucial to decrease the risk of developing life-threatening complications (Maalim Issack et al., 2021). Although the overall number of choking-related deaths has decreased in high-income countries due to improved awareness and safety regulations, the burden remains disproportionately high in low- and middle-income countries (LMICs), where public knowledge, regulatory frameworks, and healthcare infrastructure are less developed (Bieliński et al., 2024). This disparity necessitates a dual approach: strengthening community-level capacity and ensuring systemic policy support.

Knowledge, Attitudes, and Practices in Community Settings

At the community level, knowledge, attitudes, and practices (KAP) regarding choking first aid remain inconsistent and often inadequate among those closest to children—including parents, caregivers, and early childhood/primary school educators. This creates preparedness gaps precisely at the point of occurrence where immediate intervention is most critical (Maalim Issack et al., 2021; Thirunavukkarasu et al., 2024). The KAP levels among different populations have been documented to be suboptimal, with studies showing knowledge, attitude, and practice levels of 43.3%, 38.9%, and 36.4% respectively among adults, indicating significant room for improvement (Thirunavukkarasu et al., 2024). Cross-sectional studies consistently reveal concerning knowledge deficits across different populations and geographic regions. Among kindergarten teachers, only 37% demonstrated good knowledge regarding pediatric choking first aid, highlighting significant educational gaps in this critical population (Maalim Issack et al., 2021). The problem is not confined to LMICs; gaps are also evident in high-income countries, where cultural differences, lack of standardized training, and variations in guideline dissemination contribute to inconsistent preparedness (Cave et al., 2011). Research examining pediatric exposure to choking hazards has demonstrated that parental knowledge of choking hazards is directly associated with children's exposure risks (Bentivegna et al., 2018).

The attitude component of the KAP model reveals important insights about community preparedness. While many caregivers and educators express concern about choking incidents, this concern does not always translate into proactive learning behaviors or skill acquisition. Studies have documented positive correlations between knowledge, attitude, and practice components, suggesting that improvements in one domain can potentially enhance others (Thirunavukkarasu et

al., 2024). However, the gap between expressed concern and actual preparedness remains substantial across different populations and settings. Practice gaps are particularly evident when examining the translation from knowledge to action. Among elementary school teachers in Saudi Arabia, while 86.3% demonstrated high knowledge of choking signs and symptoms, only 33.8% had actually provided first aid in real situations (Alenezi et al., 2024). This substantial gap indicates significant translational barriers from "knowing" to "doing" that require addressing through comprehensive training approaches that include both knowledge transfer and practical skill development. The resulting "knowledge–practice gap" illustrates how awareness does not automatically translate into competent action during emergencies.

The Role of Training and Education

Training exposure or previous first aid course participation consistently emerges as a positive predictor of knowledge levels and the likelihood of appropriate action implementation across multiple studies. First aid training has been shown to increase the likelihood of good knowledge by 2.9 times among kindergarten teachers (AOR: 2.902, 95% CI: 1.612-5.227), demonstrating the critical importance of formal training programs (Maalim Issack et al., 2021). Multiple studies observed significant improvements in participants' knowledge and skills following structured educational interventions, with training shown to multiply the odds of correct choking management practice several fold. Unlike demographic variables such as age or occupation, training can be systematically delivered and scaled through policy and institutional programs, making "training exposure" a key modifiable determinant in intervention strategies.

Educational interventions—particularly those utilizing audiovisual or video-based formats combined with simulation components—demonstrate remarkable effectiveness in rapidly improving target population knowledge and skills across diverse settings and populations. School-based intervention strategies have proven particularly effective in fostering choking prevention knowledge and skills among both children and adults (Lorenzoni et al., 2021). Research has shown that choking training programs can significantly improve young children's ability to grasp and remember choking-management techniques, with randomized controlled trials demonstrating the effectiveness of age-appropriate educational approaches (Alharbi et al., 2020).

Video-based educational interventions have shown superior outcomes compared to traditional approaches across multiple demographics and settings. Studies have documented statistically significant improvements in knowledge scores following video-based educational interventions, with participants showing substantial gains in both theoretical understanding and practical preparedness (Bentivegna et al., 2018). Audiovisual media are especially valuable for reaching large audiences efficiently, given their scalability, low cost, and adaptability to diverse cultural contexts (Novianti & Khadijah, 2023). The development of animated videos has demonstrated very high levels of expert and user validation, with reported concordance exceeding 95%, suggesting that such materials can reliably convey accurate and engaging content (Miranda et al., 2023). Simulation-based training components add crucial hands-on experience that bridges the gap between theoretical knowledge and practical application. Educational programs incorporating practical simulations and hands-on training have demonstrated superior outcomes in both knowledge retention and skill acquisition compared to knowledge-only interventions. Studies confirmed that participants exposed to both audiovisual education and simulation were significantly more likely to perform the Heimlich maneuver correctly compared to those who only received information passively (Fitriana et al., 2024). The combination of audiovisual education with practical exercises appears to be the most effective approach for comprehensive skill development in choking management, aligning with educational theory that suggests procedural competencies are best acquired through experiential learning.

Current Guidelines and Evidence Limitations

Current literature highlights that pediatric choking first aid guideline recommendations still exhibit variation and are based on limited-quality evidence. A narrative review examining the effectiveness and safety of first aid rescue manoeuvres found that despite widespread implementation, the quality of evidence supporting many recommended interventions remains suboptimal (Bieliński et al., 2024). Different organizations and countries sometimes promote varying approaches to choking management, particularly regarding the sequence of interventions and age-specific modifications. For example, different organizations have issued slightly divergent instructions on the sequence and techniques for infants versus older children, which may cause confusion among lay rescuers (Topjian et al., 2021).

Medical students' knowledge and adherence to paediatric choking rescue manoeuvre guidelines show inconsistencies worldwide, indicating the need for more standardized and evidence-based approaches (Bieliński et al., 2024). These inconsistencies can create confusion in training programs and may reduce public confidence in first aid techniques. The challenge of evidence quality is compounded by the ethical constraints inherent in conducting randomized controlled trials with choking incidents as outcomes. Most research necessarily relies on knowledge scores, skill assessments, and self-reported measures rather than actual emergency response effectiveness. This limitation necessitates the development of robust surrogate outcomes and the careful interpretation of intervention effectiveness based on available evidence.

Implementation Challenges and Solutions

Despite demonstrated effectiveness of educational interventions, several implementation challenges persist in real-world settings. Regulatory and educational initiatives to prevent food choking injuries in children require comprehensive approaches that address multiple stakeholders and settings (Lorenzoni et al., 2022). Time constraints, particularly in busy educational environments, often limit opportunities for comprehensive training programs. However, evidence suggests that even brief educational interventions can produce meaningful improvements in knowledge and preparedness. Cultural and linguistic barriers may affect the accessibility and effectiveness of educational materials, particularly in diverse communities. The development of culturally adapted and multilingual educational resources represents an important area for future investment, as does the consideration of local contexts and practices in program design and implementation. Institutional support and policy development play crucial roles in successful implementation of choking prevention and response programs. Schools and childcare facilities with clear policies regarding staff training requirements and emergency response protocols demonstrate better preparedness levels than those without formal structures.

Technology and Innovation Opportunities

Emerging technologies offer exciting possibilities for enhancing choking management education and response capabilities. Digital platforms and mobile applications can provide readily accessible resources for caregivers and professionals, offering interactive training modules, video demonstrations, and quick-reference guides. The scalability and accessibility of technology-based interventions make them particularly attractive for widespread implementation. Digital health tools, such as mobile applications and virtual reality (VR) simulations, could provide interactive, immersive training experiences accessible to wider audiences. VR-based training has shown promise in medical education by offering realistic, repeatable scenarios for practice without patient risk (Kyaw et al., 2019). Such innovations could be particularly useful in addressing the intention–behavior gap by enhancing learner engagement and procedural confidence. Mobile applications can further extend accessibility by providing on-demand, scenario-based guidance during emergencies, as well as refresher modules to support long-term knowledge retention.

Interprofessional Collaboration and Systems Approach

Beyond community- and school-based strategies, interprofessional collaboration represents a critical yet underexplored dimension of pediatric choking management education. Effective prevention and response require not only parental and teacher preparedness but also coordination among healthcare professionals, emergency medical services, and policymakers. Nurses are uniquely positioned to deliver community training because of their expertise in both clinical care and health education. Integrating choking first aid modules into routine pediatric visits, vaccination campaigns, and maternal-child health programs could leverage existing healthcare touchpoints to reach a broader audience (Cave et al., 2011). Collaborations with emergency services could ensure that first aid education reflects real-world practice, including the importance of rapid activation of emergency response systems. At the policy level, embedding choking prevention within child safety legislation—such as mandating basic first aid training for childcare workers and school staff—could institutionalize preparedness as a standard of care rather than an optional skill (Bieliński et al., 2024). Such a systems-level strategy not only enhances the reach of interventions but also promotes sustainability by ensuring that choking management education is reinforced across multiple layers of society.

Policy Implications and Recommendations

The evidence mapping from this review suggests several important policy implications requiring systematic attention. First, structured and recurring educational programs for parents, caregivers, and early childhood educators should be established as standard components of child safety initiatives (Lorenzoni et al., 2021). These programs should be integrated into existing healthcare, educational, and community service delivery systems to maximize reach and sustainability. Second, the utilization of validated audiovisual media combined with simulation and practical exercises should be prioritized to bridge existing skill gaps effectively. Investment in high-quality educational resource development and dissemination represents a cost-effective approach to improving community preparedness, particularly given the demonstrated effectiveness of video-based interventions (Miranda et al., 2023). Third, the adoption and dissemination of uniform, current first aid guidelines across educational facilities and communities is essential for reducing confusion and improving response consistency. This requires coordination among various stakeholders including medical associations, educational authorities, and community organizations to ensure consistent messaging and standardized approaches.

Public health programs aimed at reducing choking injuries should be evidence-based and systematically implemented across multiple settings. The CHOP (CHOKing Prevention) trial and similar initiatives demonstrate the feasibility and effectiveness of comprehensive school-based intervention strategies (Lorenzoni et al., 2021). Such programs should incorporate both prevention education and emergency response training to address the full spectrum of choking-related risks. Schools and childcare facilities should be mandated to integrate first aid preparedness into institutional policy, including regular refresher sessions and visible dissemination of emergency protocols.

Future Research Priorities

Future research priorities should include comparative testing of educational methods with larger sample sizes to establish optimal training approaches. Randomized controlled trials comparing different intervention strategies are needed to identify the most effective combinations of educational components and delivery methods. The evaluation of technology-enhanced training approaches compared to traditional methods represents a particularly important area for investigation, though these emerging tools require robust evaluation in the specific context of choking management before widespread adoption. Measurement of actual behavioral outcomes and real-world incident responses, beyond knowledge scores and intentions, represents a crucial area for investigation. Longitudinal studies that track trained individuals over extended periods could

provide valuable insights into knowledge and skill retention patterns, helping to determine optimal refresher training intervals and program sustainability strategies.

Cost-effectiveness analyses of different training approaches and implementation strategies would inform policy decisions and resource allocation priorities. Such analyses should consider not only immediate training costs but also long-term benefits including reduced healthcare utilization, improved emergency response outcomes, and enhanced community preparedness. The development and validation of standardized assessment tools for measuring choking management competencies could improve research quality and facilitate program evaluation across different settings and populations. Such tools would enable more rigorous comparison of educational interventions and identification of optimal training components while supporting evidence-based program development and refinement. Research examining the broader impact of community-wide training programs on actual choking incident outcomes represents the ultimate goal for this field. While challenging to conduct, such studies would provide the most compelling evidence for program expansion and policy support, potentially transforming choking prevention and response capabilities at the population level.

CONCLUSION

The findings of this review underscore the need for holistic, evidence-informed, and policy-supported approaches to pediatric choking management education. Interventions should go beyond short-term knowledge gains to focus on skill retention, translation of learning into real-world action, and long-term sustainability. The combination of audiovisual media, simulation-based learning, technological innovations, and interprofessional collaboration offers a powerful framework for equipping communities with the competencies needed to act effectively in choking emergencies. By shifting from isolated educational efforts to coordinated, multi-stakeholder initiatives, the potential for reducing pediatric choking morbidity and mortality can be significantly amplified. Further research is required to strengthen the evidence base, particularly through randomized controlled trials with large, diverse samples and long-term follow-up. Only through this comprehensive approach can the global burden of pediatric choking be meaningfully reduced.

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