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Research Article

Effectiveness of Educational Interventions Integration with Health Services in Improving Oral Health Behaviors and Preventing Oral Diseases; Systematic Review

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Abstract

Background: Oral diseases is a major global health concern, mainly in children and adolescents. Integrating educational interventions within health services can improve oral health behaviors and clinical outcomes. In this systematic review we aimed to evaluate the effectiveness of educational interventions integrated with health services to improve oral health behaviors and prevent oral diseases.

Methods: A literature search was conducted in PubMed, Scopus, Web of Science, and Google Scholar. We include studies with individual's ≤19 years, include educational strategies linked to health systems, and report clinical oral health outcomes. Thirteen studies were included following PRISMA guidelines. Data were synthesized qualitatively. Methodological quality was assessed using the Joanna Briggs Institute (JBI) appraisal tools.

Results: Included interventions differ in type (digital tools, school-based sessions, visual aids) and delivery settings (schools, primary care, community clinics). Most interventions show improvements in knowledge, brushing behavior, plaque index, gingival health, or ECC reduction. Integration within health services and reinforcement by health professionals or teachers improve effectiveness.

Conclusion: Educational interventions integrated into health systems promote oral health behaviors and prevent disease. Implementation in school and primary care is recommended for long-term public health improvement.

Keywords: Oral Health Education; Health Services Integration; Preventive Dentistry; Behavioral Intervention

Abbreviations

OH: Oral Health; ECC: Early Childhood Caries; PI: Plaque Index; GI: Gingival Index; PHC: Primary Health Care; RCT: Randomized Controlled Trial; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; JBI: Joanna Briggs Institute; mHealth: Mobile Health

Introduction

Oral diseases is a widespread global problem, contributing to pain, discomfort, and affect quality of life for millions of individuals [1]. Conventional oral health education show benefits, and integrating educational interventions within health service systems also show greater potential in to promote oral hygiene practices and prevent oral conditions [2]. This integration provide a systematic, accessible, and contextually relevant approach to oral health promotion, mainly in vulnerable populations [3].

Combination of oral health education with primary care centers, community clinics, and school health services, facilitates routine exposure to prevent messages and reinforces behavior through interaction with healthcare professionals [2]. This aligns with the strategy of addressing common risk factors for chronic diseases, creating synergy between oral and general health initiatives [4]. The agreement between oral health promotion and general health services fosters a more holistic and cost-effective model of care, mainly in settings where dental services alone are not available [4].

School-based interventions, mainly offer opportunities to educate children in their formative years while involving teachers and parents [5]. These programs shape lifelong habits that prevent dental caries and periodontal conditions [5]. Community-based programs embedded in health service contexts enhance oral health literacy and empower individuals to take control of their preventive care practices [3].

Strategic scaling of integrated educational interventions is important to address equity gaps and oral health outcomes on a broader scale [2]. This review aims to evaluate the effectiveness of educational interventions integrated with health services to improve oral health behaviors and prevent oral diseases.

Method

Search strategy

A systematic literature search was conducted to identify interventional studies which evaluate educational strategies and aimed to improve oral health in children and adolescents. Databases searched include PubMed, Scopus, Web of Science, and Google Scholar. Keywords include, oral health education, school-based intervention, children, adolescents, plaque index, and preventive dentistry. We also do manual searches of references in relevant articles to identify additional eligible studies. Only full-text, peer-reviewed articles published in English were considered.

Inclusion criteria

We include studies when, the intervention involved an educational strategy targeting oral health behavior or awareness, participants were children or adolescents aged ≤19 years, measured oral health-related outcomes, design was experimental or quasi-experimental, full-text was accessible. We exclude reviews, opinion pieces, or editorials, studies included adult participants exclusively, and studies did not assess behavioral or clinical oral health outcomes.

Study selection

Two independent reviewers screened titles and abstracts, followed by full-text assessments to assess eligibility. Disagreements were resolved through discussion with a third reviewer. Thirteen studies were selected for final analysis (Figure 1).

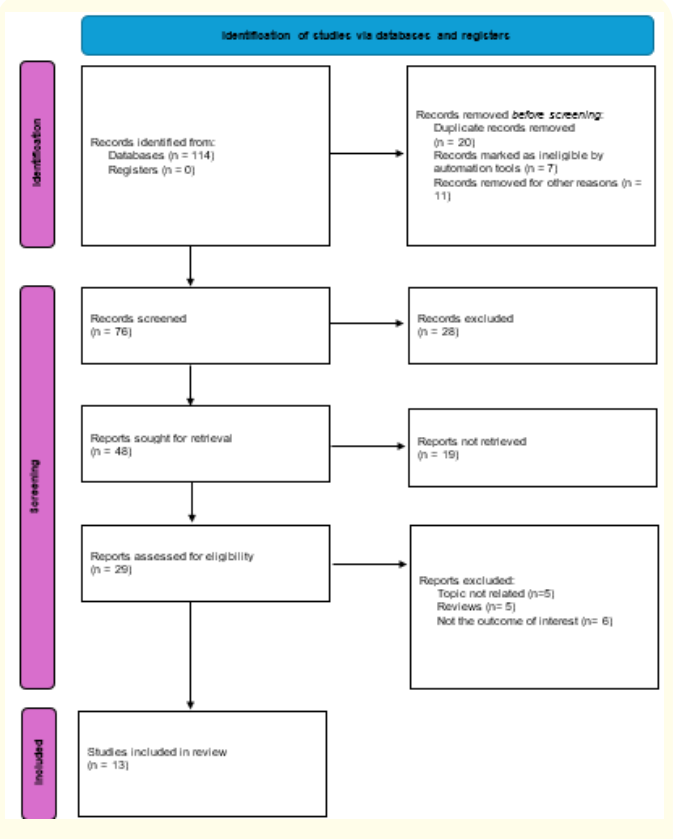

Figure 1: PRISMA consort chart of the included studies.

Data extraction

A standardized data extraction form was used to collect (citation, country, study design, sample size, participant demographics, type and duration of the intervention, outcome measures, and main findings). Extracted data were categorized into comparative tables for synthesis.

Quality assessment

We used the Joanna Briggs Institute (JBI) Critical Appraisal Tools to assess the methodological quality of included studies. Each study was appraised using the checklist appropriate to its design. We evaluate clarity of cause-effect relationship, group similarity, presence of control group, equal treatment across groups, reliable outcome measurement, follow-up completeness, and appropriate statistical analysis (Table 1).

Citation	Clear cause-effect aim?	Participants similar?	Control group present?	Groups treated equally?	Reliable outcome measures?	Follow-up complete?	Appropriate statistics?	Quality Rating
Khurana., *et al*. 2019	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
Khudanov., *et al*. 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Lotto., *et al*. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Mohebbi., *et al*. 2009	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Movaseghi Ardekani., *et al*. 2022	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
Mohamadkhah., *et al*. 2013	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Shirahmadi., *et al*. 2024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Blake., *et al*. 2015	Yes	Yes	No	Yes	Yes	Partial	Yes	Moderate
Frohlich., *et al*. 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Moosavi., *et al*. 2021	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
Edvardsson., *et al*. 2022	Yes	Yes	No	Yes	Yes	Partial	Yes	Moderate
Jafari., *et al*. 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Strong
Gholami., *et al*. 2017	Yes	Yes	No	Yes	Yes	Partial	Yes	Moderate

Table 1: JBI Quality Appraisal Summary of included studies.

Data analysis

We performed qualitative synthesis and findings were grouped based on intervention methods and their effectiveness to improve knowledge, behavior, and clinical oral health indices.

Results

Thirteen studies were included in this systematic review, with a range of interventions aimed at promoting oral health in children and adolescents. These interventions varied in content,

delivery methods, and participant demographics but all aimed to enhance oral hygiene knowledge, attitudes, and practices through structured educational programs (Table 2).

Interventions based on visual or digital media were effective in multiple settings. One study show that an educational film improved students' knowledge and attitudes in brushing and flossing, with maintained effects at three months follow-up [6]. Another trial used comic-based materials and found significant gains in both oral health knowledge and self-reported practices in schoolchildren [7]. A quasi-experimental study of children with intellectual disabilities showed improvement in both plaque index and oral hygiene behavior scores after exposure to tailored educational materials [8] (Table 3).

Digital platforms were a successful tools. An intervention using WhatsApp messages target parents resulted in reductions in visible plaque and improved parental engagement in oral health practices for their children [9]. Gamification strategies in Telegram groups, posters, and animations led to increases in tooth brushing and flossing frequency, with improved plaque and hygiene indices [10].

School-based and professional-led approaches show a good benefits. A single classroom session conducted by dental professionals enhance oral hygiene knowledge and behavioral intention at six-week follow-up [11]. Teacher-led programs in rural areas also boosted brushing frequency and student knowledge [12]. Peer-led and culturally adapted programs were effective to improve attitudes and self-efficacy, mainly in students from marginalized or migrant backgrounds [13,14].

Technological enhancements, QLF-based visualization devices, increased adolescents' awareness of plaque and enhanced commitment to oral hygiene behaviors [15]. In children with hearing impairments, visually supported sessions were successful to reduce plaque and gingival index scores [16].

Braille-based oral health education was effective in visually impaired children, with repeated exposure over five months and produce a decrease in plaque and gingival inflammation [17]. Interventions delivered by vaccination staff, were effective to lower early childhood caries rates and improve overall dental health [18].

Citation	Study Design	Intervention Type and Duration	Study Aim	Population Characteristics	Study Duration	Methodology
Khurana., *et al*. 2019	Before-after comparison trial	Braille-based oral health education	To assess impact of Braille text on oral hygiene in visually impaired children	165 children (7–19 years), blind school in Delhi	5 months	Questionnaire + PI and GI indices at 1, 3, and 5 months; repeated instructions in Braille
Khudanov., *et al*. 2018	Randomized controlled trial	QLF technology-based education using Qscan device	To assess impact on oral hygiene and literacy using QLF tech	100 adolescents aged 14–16 in Tashkent, Uzbekistan	8 weeks	Control vs QLF tech; plaque index, knowledge, attitude, behavior assessed pre/post
Lotto., *et al*. 2020	Randomized controlled trial	Educational WhatsApp messages for parents	To evaluate mHealth intervention on ECC in low-income children	104 parent-child pairs (36–60 months), Bauru, Brazil	6 months	WhatsApp messages biweekly; VPI and ICDAS measured at baseline, 3, and 6 months
Mohebbi., *et al*. 2009	Cluster randomized trial	Oral health education via vaccination staff	To assess ECC prevention in 12–15 month-olds via PHC staff	242 children in Tehran, Iran, attending 18 public health centers	6 months	Three arms: Control, Education, Education+Reminders; dt/de indices tracked over 6 months

Movaseghi Ardekani., *et al*. 2022	Quasi-experimental	Educational intervention in students with intellectual disability	To assess the impact of oral health education in special needs children	60 students with intellectual disability (10–16 years), Tehran	3 months	Pre/post questionnaires; plaque index and health behavior scores compared
Mohamadkhah., *et al*. 2013	Quasi-experimental	Educational film for oral health promotion	To examine the effect of film on self-care behaviors in students	300 girls aged 10–12 in Chabahar, Iran	3 months	Pre/post testing of knowledge, attitude, practice; film group vs control vs lecture group
Shirahmadi., *et al*. 2024	Randomized controlled trial	Multi-method SCT-based oral health education program	To evaluate gamified SCT-based education for oral health behavior	190 girls (11–12 years), fifth-grade, Hamadan, Iran	3 months	10 sessions + Telegram group + family engagement; Plaque Index, OHI-S, and CPI used
Blake., *et al*. 2015	Cohort study (pre/post design)	Single classroom oral health education session	To evaluate school-based education by dental professionals on child oral health	150 children (9–12 years), 3 UK primary schools	6 weeks	One 60-min session; questionnaires at baseline, post, and 6-week follow-up
Frohlich., *et al*. 2022	Cluster randomized trial	Comic-based oral health education	To assess the effectiveness of comics to improve dental health knowledge	361 students aged 9–12, Berlin schools	4 weeks	Pre/post questionnaires + interviews assessing knowledge, attitude, practices
Moosavi., *et al*. 2021	Experimental study	Education on oral hygiene for hearing-impaired students	To improve oral health behavior among hearing-impaired children	60 children (9–14 years), special schools in Tehran	2 months	PI and GI measured pre/post; verbal + visual aids used for instruction
Mohamadkhah., *et al*. 2013	Quasi-experimental	Educational film on oral health	To examine the effect of film on self-care behaviors in students	300 girls aged 10–12 in Chabahar, Iran	3 months	Pre/post testing of knowledge, attitude, practice; film group vs control vs lecture group

Shirahmadi., *et al*. 2024	Randomized controlled trial	Gamified SCT-based education (videos, booklets, Telegram group, ceremonies)	To evaluate gamified SCT-based education for oral health behavior	190 girls (11–12 years), fifth-grade, Hamadan, Iran	3 months	10 sessions + Telegram group + family engagement; PI, OHI-S, CPI used pre/post
Blake., *et al*. 2015	Cohort study (pre/post design)	Classroom session by dental professionals	To evaluate school-based education by dental professionals on child oral health	150 children (9–12 years), 3 UK primary schools	6 weeks	One 60-min session; questionnaires at baseline, post, and 6-week follow-up

Table 2: Educational Intervention Studies in Oral Health.

Citation	Demographic Characteristics	Main Findings	Outcomes
Khurana., *et al*. 2019	165 children (7–19 years), blind school in Delhi	Braille-based education improved oral hygiene scores	Significant improvement in PI and GI over 5 months
Khudanov., *et al*. 2018	100 adolescents aged 14–16 in Tashkent, Uzbekistan	QLF-based tech increased awareness and improved plaque scores	Improved oral hygiene and knowledge scores post-intervention
Lotto., *et al*. 2020	104 parent-child pairs (36–60 months), Brazil	WhatsApp education reduced visible plaque and caries incidence	Lower VPI and better parental knowledge at follow-up
Mohebbi., *et al*. 2009	242 children, 12–15 months, Tehran, Iran	PHC-based education reduced ECC rates	Education and reminders group showed lowest dt/de scores
Movaseghi Ardekani., *et al*. 2022	60 students with intellectual disability (10–16 years), Tehran	Oral health education improved plaque index and behavior	Significant gain in health behavior scores post-training
Mohamadkhah., *et al*. 2013	300 girls aged 10–12 in Chabahar, Iran	Film-based education increased knowledge and attitude	Knowledge, attitude, and some behaviors improved at 3 months
Shirahmadi., *et al*. 2024	190 girls (11–12 years), Hamadan, Iran	Gamified SCT-based intervention improved brushing, flossing	Higher frequency of brushing/flossing, lower plaque, improved OHI-S
Blake., *et al*. 2015	150 children (9–12 years), UK	Single session increased knowledge and behavior intent	Sustained improvement in self-reported hygiene after 6 weeks
Frohlich., *et al*. 2022	361 students aged 9–12, Berlin	Comic-based education increased engagement and knowledge	Statistically significant increase in knowledge and practices
Moosavi., *et al*. 2021	60 hearing-impaired children (9–14 years), Tehran	Tailored education improved hygiene scores	Reduced PI and GI scores post intervention

Edvardsson., *et al*. 2022	84 children with migration background, Sweden	Cultural adaptation of content improved retention	Greater oral health awareness and hygiene practice improvement
Jafari., *et al*. 2020	200 schoolchildren (10–11 years), rural Iran	Teacher-led intervention increased daily brushing	Statistically significant rise in brushing frequency and knowledge
Gholami., *et al*. 2017	93 adolescents (12–14), Isfahan, Iran	Peer-led education effective in attitude change	Improved self-efficacy and reduction in harmful oral habits

Table 3: Main findings of the included studies.

Discussion

The findings of this systematic review show that educational interventions integrated with health services improve oral health behaviors and prevent oral diseases in children and adolescents. Across the 13 included studies, interventions differ in format and delivery but showed positive impacts on knowledge acquisition, behavior change, and clinical outcomes, plaque reduction, gingival health, and caries prevention.

These findings closely related to those of Menegaz., *et al*. (2018), who reported that educational interventions delivered by healthcare professionals in health service settings result in positive behavioral changes and improvements in oral health outcomes. Their review show the contextual strength of education within existing healthcare structures, mainly in underserved populations. Our included studies confirmed that interventions delivered through schools, primary care, or family-centered approaches were more effective when combined with regular health service contact and reinforcement [19].

Akera., *et al*. (2022) conducted a systematic review and meta-analysis focused on school-based oral health programs in low- and middle-income countries. They reported improvements in DMFT scores, plaque reduction, and behavioral indicators, mainly when interventions included skills training, access to care, and family engagement, these support our results, which show that multifaceted school-based programs involving gamification and community participation, had strong behavioral outcomes and measurable clinical benefits [20].

Our review included studies that used WhatsApp and Telegram for parent-targeted interventions, which showed high engagement and behavioral change. Chau., *et al*. (2023) found that mHealth interventions in older adults result in improvements of oral hygiene behaviors and knowledge. Though their population differs, the parallel in using mobile platforms to deliver accessible educational content strengthens the case for digital interventions in age groups and settings [21].

Nakre and Harikiran (2013) found that oral health education programs are effective when they are labor-intensive, involve teachers or caregivers, and supported by resources. This is in line with our findings, where studies that involved trained teachers, peer leaders, or health professionals with structured curricula show higher impact on knowledge retention and long-term behavioral change [22]. The variation in quality and long-term follow-up in reviewed studies, as shown by Menegaz., *et al*. (2018), is a concern in this field. Interventions that were grounded in behavioral theory, offered multiple exposures, and integrated family components show the highest success, which support previous findings [20,22].

Conclusion

Integrating educational interventions into health service systems and leveraging school infrastructure enhance their reach and sustainability. Continued investment in structured, theory-based, and context-sensitive programs is essential to achieve oral health improvement in diverse populations.

Conflict of Interest

None.

Ethical Approval

Not applicable.

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