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ORIGINAL ARTICLE

Oral health promotion through health-promoting schools in developing countries: A scoping review

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Abstract

Objectives: To explore and assess what is known about oral health promotion through health-promoting primary schools in developing countries.

Methods: A scoping review was conducted using the Arksey & O'Malley framework. Web of Science, PubMed, Scopus and Cochrane Library were searched, followed by the reference lists of the resulting studies. The UN classification of developing countries was used to define the countries included and the search was between 1986 and 2021. Quality assessment was carried out using Joanna Briggs Institute's quality appraisal tools.

Results: The search resulted in 33 studies of which almost half were randomized controlled trials. The oral health promotion strategies were oral health education ($n = 16$) delivered by teachers, parents or peers, or multicomponent involving both toothbrushing ($n = 15$) and dietary components ($n = 2$). Most of the included studies were conducted in Asia ($n = 25/33$).

Conclusions: Findings suggested that comprehensive, multicomponent theory-based oral health promotion showed improvements in oral health outcomes of schoolchildren, particularly if delivered using a whole-school approach. However, further research on feasibility and implementation of oral health promotion through health-promoting primary schools in developing countries should be considered.

KEYWORDS
dental, developing country, health promotion, health-promoting schools, oral health education

1 | INTRODUCTION

The prevalence of oral disease has reduced since the 1970s; yet, dental caries levels remain high among both adults and children in developing countries.[1] There are marked differences in oral health within developing countries, with the socio-economically deprived bearing the greatest burden of oral disease.[2] Poor child oral health has a deleterious influence on quality of life through pain and discomfort affecting eating, speaking and socializing. Evidence suggests that over 50 million school hours are lost every year due to poor oral health, negatively affecting academic achievement and future life outcomes.[2]

Schools are considered highly convenient settings for health promotion. Children in formative years are highly manageable and interventions at this critical stage of physical and cognitive development influence both immediate and future health outcomes, providing an opportunity to shape healthy lifetime habits and behaviours.[3]

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The concept of health-promoting schools (HPS) provides a platform for oral health promotion (OHP).[4] Extending from the structure of the WHO School Health Initiative, Kwan et al.[5] illustrated a way of integrating OHP into the constitutional components of HPS incorporating healthy school environment, health services, health education, healthy nutrition, physical exercise, mental health and well-being, and intersectoral collaboration as key components of HPS.

The evidence of effectiveness of HPS initiative has been documented in several systematic reviews.[4,6] Findings from these reviews demonstrated that increased effectiveness was found to be associated with long-term interventions, active participation of the whole school and holistic multifaceted programmes involving many domains of school life.[4]

There is a current lack of evidence on successful HPS initiatives in developing countries.[5] However, findings of a recent scoping study[6] assessing the impact of HPS in developing countries supported evidence that whole-school multicomponent approaches are likely to be more effective. This previous scoping review did not, however, include oral health programmes specifically, and included research only up to 2015.

There are many challenges to incorporating health promotion into schools in both developing and developed countries. These include lack of sustainability, evaluation and resources.[1] The obstacles to implementation of school health initiatives in developing countries appear even more complicated due to poverty, inequality and political unrest.[5] Additionally, many schools in the developing world are based in unhealthy environments that lack basic elements of health like access to clean air, water or even safe commute to school.[1]

Although health-promoting initiatives related to general health are well documented and researched, OHP in schools has gained little attention within the literature to date, particularly in developing countries. Given this, the aim of the scoping review was to explore and assess what is known about OHP through HPS (primary schools) in developing countries.

2 | METHODS

This scoping review was conducted using the updated Arksey and O'Malley[7] methodology by Levac et al.[8]

2.1 | Search strategy

The electronic databases: Web of Science, SCOPUS, PubMed and Cochrane Library, were searched for the key nomenclature. Hand searching of reference lists was also carried out. Additionally, WHO, FDI, IUHPE and UNESCO websites were searched for relevant literature. The search terms used were as follows:

Primary Schoolchild* OR elementary schoolchild* AND

Caries OR decay OR fluorid* OR gingivitis OR gum health OR sealant OR toothbrushing OR oral health promotion OR oral health education AND

Oral health OR oral/dental hygiene OR OHRQoL OR COHIP AND

Health-promoting school OR School-based OR School initiative AND

Developing countr*

The search for 125 developing countries was done as a separate phase by dividing the countries into 11 regions (see Appendix S1) plus searching 'developing countr*', combining results using 'OR' and placing filters on the time span of the search (01/01/1986–31/03/2021). The identified records were then combined with results of searching the above-mentioned terms.

2.2 | Study selection

Oral health promotion was defined as any strategy that targeted oral hygiene (toothbrushing), dental health (caries, gingivitis), included fluoride, sealants or explicitly mentioned oral health promotion or education. Studies were included if they: (1) discussed oral health promotion in primary school settings, (2) were conducted in developing countries (according to UN classification 2019), (3) written in English and (4) studies published since 1986 onwards; the start date was chosen based on publication of the Ottawa Charter outlining Health Promotion.[9] The selection process was checked by a second reviewer (SB).

2.3 | Data charting

As recommended by Levac et al.,[8] a pilot study was conducted with five articles in which both reviewers independently scored each article. Following agreement on these five studies, full data extraction commenced. The data extraction sheet (Tables 1–3) included authors, year, study design, participants information, sample size, aim of study, name of country, type of strategy, duration, outcomes and key findings.

It has been noted that the lack of critical appraisal in scoping review methodology has limited the uptake of their findings and, in turn, weakened their chance to inform policy and practice.[8] As a result, in this review, each study was assessed using the Joanna Briggs Institute (JBI) quality assessment tool.[10]

3 | RESULTS

The search of four databases retrieved 167 records (Figure 1). Five additional records were added: four relevant articles from a Cochrane systematic review[11] (that could not be included 'as a whole' because it included studies from developed and developing countries) and one study retrieved from the references of an

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TABLE 1 Randomized controlled trials (RCT) included in the scoping review.

Author/s (year)	Participant demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Al Bardaweel & Dashash (2018)	200 10–11 year olds	Syria	OHE	3 months	Primary: OH knowledge Secondary: GI and PI scores	*Baseline vs. post-intervention comparison* showed statistically significant increase in OH knowledge and decrease in PI and GI. *Intercluster comparison* revealed statistically significant difference with better knowledge and lower PI and GI in the leaflet cluster
Aljundi et al. (2006)	808 6–12 year olds	Jordan	Supervised toothbrushing	30 min, 5 days/week, 2/year for 4 years	DMFT/deft, caries-free percentage	DMFT/deft for control group were significantly higher than intervention group. Caries-free percentage decreased more in the control group over 4-year period
Al-Kheraif & AlBejadi (2008)	400 9–11 year olds (females)	Saudi Arabia	OHE	1 year	Oral hygiene and diet, PI scores	Statistical significant difference in oral health status and frequency of toothbrushing with higher scores in intervention group. No significant difference between groups regarding use of dental floss, mouthwash, sugary snacks, and dental services (main reason: severe toothache)
Chounchaisithi et al. (2014)	122 8–10-year olds	Thailand	Supervised toothbrushing (disclosed plaque visualization)	3 months	Patient hygiene performance (PHP)	Disclosed plaque visualization resulted in statistical significant reduction in overall PHP scores, especially for anterior and mandibular teeth and buccal and gingival surfaces. Not significant for posterior teeth. No significant effect of sex, parental supervision or twice-a-day brushing on PHP scores for both techniques
De Farias et al. (2009)	195 7–15 year olds	Brazil	OHE	4 months	DMFS/dmfs, VPI, GBI, OH awareness	Statistical significant reduction in GPI and VPI and higher number of correct answers in the intervention group. No association between GPI and VPI and the awareness levels of students but association between GBI and DMFS in bivariate analysis & lost in multivariate
Frencken et al. (2007)	1117 grade 2 pupils	Syria	School health services: ART vs. TA	3 months, evaluated at 2.3, 3.3, 4.3, and 6.3 years	DMFT/DMFS, OHI, cumulative survival rate	No statistical significant difference between groups in caries and plaque scores. A statistically significant difference in survival percentage between single surface non-occlusal ART and comparable TA observed after 4.3, 5.3 and 6.3 years. No statistical significant difference in survival of large and small restorations, and occlusal and non-occlusal

(Continues)

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TABLE 1 (Continued)

Author/s (year)	Participant demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Haleem et al. (2012)	1517 10–11-year olds	Pakistan	OHE (dentist-led, teacher-led and peer-led)	2 years	Primary: Oral hygiene status, BOP Secondary: OH knowledge and behaviour	All three educator-led groups had significantly higher mean OHK, OHB, OHS and combined knowledge, behaviour and OHS (KBS) than the self-learning and control groups, these outcomes did not differ significantly between the three educator-led groups except the peer-led group showed significantly better OHB than the teacher-led. Same findings for self-learning and control groups
Hartono et al. (2002)	140 8–12-year olds	Indonesia	Supervised toothbrushing (weekly) + OHE (monthly)	20 months	DMFT/dmft, plaque scores, oral hygiene skills, OH knowledge and self-reported habits	Statistical significant reduction in plaque scores and improvement in toothbrushing effectiveness in experimental group, dmft/dmfs were comparable but DMFT/DMFS were lower (not statistically significant) in the experimental group. Differences in OH knowledge were apparent but comparable in OH habits between the groups
Naidu & Nandlal (2017)	926 6–12-year olds	India	PPSDHEP for pupils and teachers' training	6 months	KAP, GI and PI and DMFT/DMFS	Significant improvement in KAP for intervention group (>older age). PI and GI significantly lower for both age groups in intervention, DMFT/DMFS and dfs/dft significantly higher in young age control group but difference not significant for old age group
Nammontri et al. (2013)	257 10–12-year olds	Thailand	OHE + whole school approach (last three sessions)	3 months	Primary: OHRQoL; Intermediate: SOC and OH beliefs; Clinical: DMFT, CPI and IOTN	2 weeks and 3 months: the intervention group had lower CPQ scores, thus better OHRQoL, significantly better SOC points, OH beliefs, no significant difference in clinical parameters except that more intervention children had normal gingivae
Petersen et al. (2004)	666 yr1 pupils, their mothers and 347 teachers	China	OHE based on WHO HPS approach (involvement of mothers and teachers)	3 years	OH status, DMFT/dmft, gingival bleeding, OH habits of students, knowledge and attitude of mothers and teachers	No significant difference in DMFT/DMFS between groups but f/F components were higher in experimental group and the bleeding scores were significantly lower. Test group children adopted regular OH behaviour and dietary habits compared to controls. Mothers and teachers showed improved OH knowledge and attitudes
Said-Moallemi (2009)	447 9-year olds	Iran	Classroom/home OHE	3 months	PI and BI, self-administered questionnaire for mothers at baseline	Statistical significant improvement in gingival health in parental-aid and combined group but no significant difference in the classwork group compared to control. Girls better than boys in all intervention groups and parental education had no impact on outcome

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TABLE 1 (Continued)

Author/s (year)	Participant demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Tai et al. (2009)	1358 6–7 year olds	China	OHE based on WHO HPS approach (involvement of mothers and teachers)	3 years	Primary: DMFT/dmft, PI and BI, Secondary: oral care habits, 'restoration, sealant & decay'	No difference between groups for DMFT, but slight reduction in DMFS in intervention group. Intervention students had a greater mean decrease in PI and BI. Statistically significant proportion of intervention group received restorations and sealants and had less untreated decay than controls. Intervention group were more likely to report FI toothbrushing and dental visit within the past year
Tomazoni et al. (2019)	356 8–14-year olds	Brazil	OHE + whole school approach (last three sessions)	7 weeks	Primary: OHRQoL, Secondary: SOC, Clinical: DMFT, CPI	No statistical significant difference between groups at baseline; the intervention group showed better OHRQoL (lower CPQ scores) in 2 weeks (not significant) and 3 months (statistically. significant). SOC significantly improved post-intervention at 2 weeks and 3 months
Yekaninejad et al. (2012)	379 11–12-year olds	Iran	HBM-based OHE (booklet for parents and school staff)	3 months	Primary: dental brushing and flossing, Secondary: HBM constructs, OHI and CPI	Flossing and brushing behaviours and oral hygiene index improved significantly for both intervention groups but slightly better for comprehensive group. Gingival health of comprehensive group improved significantly compared to student group. results indicated HBM constructs: self-efficacy and perceived barriers were associated with changes in OH behaviours

Abbreviations: CPI, Community Periodontal Index; CPQ, Child Perception Questionnaire; GI, Gingival Index; HBM, Health Belief Model; KAP, Knowledge Attitude Practice; OHE, Oral Health Education; OHI, Oral Hygiene Index; PI, Plaque Index; PPSDHEP, Primary Preventive Dental Health Education Programme; SOC, Sense of Coherence.

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TABLE 2 Quasi-experimental studies (QE) included in the scoping review.

Author/s (year)	Participants' demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Duijster et al. (2017)	1499 6–8-year olds	Cambodia, Indonesia and Lao PDR	FIT Programme: daily FI tooth brushing (1450 ppmF) + (handwashing and deworming)	2 years	dmft/DMFT index for caries and pufa/PUFA	Statistically significant reduction in DMFT between baseline and follow-up compared to control in overall sample. No significant difference in PUFA and prevalence of odontogenic infections. The DMFT was higher in younger children, with more permanent teeth, and from urban areas
Frencken et al. (2001)	965 grade 2 and 4 students	Zimbabwe	OHE	3.5 years	OHI-S, caries increment	Students: No stat. Significant difference between groups in plaque scores and caries increment of both second and fourth grade students Teachers: ranked language and reading first in importance before health, body care first then teeth and eyes, 52% of teachers reported OHE was responsibility of parents
Nyandindi et al. (1996)	600 9-year olds	Tanzania	OHE delivered by trained teachers (Nyandindi et al, 1995)	30 min evaluated at 4 months	self-reported OH KAP and skills (Dietary and oral hygiene), plaque scores	Modified OHE group had better knowledge, reported less consumption of sugary foods, more toothbrushing frequency and made better 'mswakis' and slightly improved oral hygiene compared to referents. The conventional group had somewhat better OH knowledge
Peng et al. (2004)	1143 6–7-year olds	China	OHE (daily supervised toothbrushing) and sugar-free chewing gum	2 years	dmfs/dmft, DMFS/DMFT gingival bleeding scores	DMFT were 9.6%, 12.4% and 13.8% for gum, education and control groups respectively. DMFS in group G was 42% lower than groups E and C. F-S/F-T were higher in groups G and E than C. Compared to group C, bleeding scores in group G were 71% lower and in group E 42% lower
Van Palenstein Helderman et al. (2012)	431 9–14-year olds	Tanzania	One day training workshop for teachers followed by weekly supervised toothbrushing and monthly OHE	One school year evaluated at 3, 8, 15 and 36 months	DMFT, plaque, calculus and gingival bleeding scores of 'Ramjford teeth'	Statistically significant difference between intervention and control groups only for plaque after 8 months and G. bleeding after 36 months, overall plaque and calculus scores but not bleeding scores were consistently lower in both groups, DMFT after 36 months were similar for both groups
Karuveettil et al. (2020)	Lower primary (7.40+/−1), Upper primary (10.76+/−0.97), (private school)	India	CBSE curriculum, supervised toothbrushing	1 year	KAP, DMFT, deft (WHO Survey method)	KAP: Knowledge and attitude increase in LP, attitude and practice increase in UP. Both LP and UP: deft decrease (statistically significant), DMFT increased (statistically significant)

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TABLE 2 (Continued)

Author/s (year)	Participants' demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Al Saffan (2017)	1279 8–15-year-old (private school)	Saudi Arabia	OHE	3 months	OH knowledge, topic specific knowledge by gender/ nationality/education	(1) Stat. significant increase in OH Knowledge post-OHE. (2) Correct answers for topic-specific questions showed stat. significant increase post-test. (3) Females, non-Saudi nationals & primary school students showed significantly higher knowledge scores post-OHE than their counterparts
Jafar & Hasan (2018)	60 8-year-old boys	Iraq	OHE	2 weeks	GI and PI scores, OH knowledge and attitude	GI and PI were lower after motivation, but difference was not statistically significant, improvement in knowledge and attitude after motivation but not significant
Halawany et al. (2018)	1661 6–8-year-old females	Saudi Arabia	OHE	2 months	OH Knowledge & self-reported behaviour	All questions showed stat. significant improvement in knowledge & self-reported behaviour post-intervention
Jain et al. (2016)	279 8–10-year olds (nine teachers)	India	OHE (Teacher training programme)	6 months	Students' and teachers' OH knowledge and practice, OHI-S for children	Significant improvement in OH knowledge and practices of schoolteachers and children post-training compared to pre-training. Statistically significant improvement in oral hygiene status of schoolchildren after the programme
Lattanzi et al. (2020)	12-year-old schoolchildren (public schools)	Nova Friburgo, RJ, Brazil	School Health Programme	6 months	OHRQoL (CPQ), gingivitis-free, trauma-free, SHP access	CPQ11–14 > 0 was 99.69%, females 1.71 worse OHRQoL than males, non-SHP 1.56 poor OHRQoL than SHP participants

Abbreviations: GI, Gingival index; OH, oral health; OHI-S, Oral Hygiene Index-Simplified; PI, Plaque Index.

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TABLE 3 Longitudinal cohort studies included in the scoping review.

Author/s (year)	Participants' demographics	Country	Type of oral health strategy	Duration of strategy	Outcome measures	Key findings
Douda et al. (2016)	171 6-year olds (yr1) and 11-year olds (yr6)	Senegal	(IEC) based on toothbrushing messages, dietary advice, fluoride use and primary dental care	6 years (first to sixth grade)	prevalence of dental caries, DMF/T and df/t	First grade: prevalence of decay in primary = 75%, permanent = 31.6%. sixth grade: prevalence of decay in primary = 12%, permanent = 51%. The prevalence of decayed permanent teeth increased from 31.6% to 51%, statistical significant difference in mean df/t but not DMF/T between grades
Lai et al. (2016)	240 10–11-year olds	Taiwan	OHE and oral hygiene (flossing and toothbrushing)	20 weeks	Oral hygiene behaviours, CPI, DMFT/DMFS, plaque control record	RR of having plaque, calculus and pockets was better in the intervention group. Intervention group had fewer sextants per participants with CPI ≥ 2, more caries-free participants and lower mean DMFT and DMFS than control group; F component was statistically significant but M was not. Intervention group showed better dental knowledge and habits
Monse et al. (2013)	341 6–7-year olds	Philippines	The Fit for School Health: daily handwashing, Fl toothbrushing and biannual deworming, 2/year access to school oral care	1 year	mean DMFS in permanent molars, PUFA/pufa	Increase DMFS/dmft and PUFA/pufa were lower in the experimental group (not statistically significant)
Petersen & Razanamihaja (1999)	702 grade 1 and 4 children	Madagascar	Carbamide-polyol chewing gum (OHE + daily supervised toothbrushing)	3 years	dmft/dmfs, DMFT/DMFS	Grade1: the DMFS difference was not statistically significant except for occlusal caries. Grade4: non-significant reduction in DMFS in both test groups compared to control
Yusof & Jaafar (2013)	3455 11–12-year olds	Malaysia	Doctor Muda Programme (DMP): Peer-led health education	6 years	Malay Child-OIDP	DMP children reported significantly better OHRQoL and less plaque & bleeding gums
Moyses et al. (2003)	1823 12-year olds (deprived)	Brazil	Health-promoting school	–	Dental trauma and caries-free percentage	Children in supportive schools were more likely to have higher percentage of caries-free children and lower levels of dental trauma
Heinrich-Weltzein et al. (2009)	1748 11.7 ± 1.1 year olds	Philippines	Comprehensive preventive programme (daily toothbrushing, 3/year FL varnish and restorations)	5 years	Prevalence of black stains, prevalence and experience of caries (DMFT and DMFS)	No statistical significant difference in prevalence of black stains between all groups, but was higher in remote schools, children with black stain had significantly lower caries experience, no difference in DMFS pattern on surfaces children with and without stains

Abbreviations: CPI, Community Periodontal Index; DMFT/DMFS, Decayed Missing Filled Tooth/Surface; IEC, Information, Education and Communication; OHE, Oral Health Education; PUFA/pufa, open pulp (p/P), ulceration (u/U), fistula (f/F), abscesses (a/A) index for odontogenic infections.

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included article.[12] After removal of duplicates and application of inclusion and exclusion criteria, 33 articles were retained and included in the review.

The review included a variety of school initiatives with 25 432 children in 21 developing countries. While most of the studies ($n=25/33$) were conducted in Asia, four studies were from Africa and four studies from South America (all conducted in Brazil). Additionally, one of the included studies was carried out in three countries, namely Cambodia, Indonesia and Lao PDR.[14]

Despite all studies being located in primary/elementary schools, there was a wide age range of pupils in the studies included in the review (range: 6–15 years). Three studies were carried out in single-gender schools, one in a boys' school[15] and two in a girls' school.[16,17] Twenty-nine of the schools included in the review were public schools; with two private schools[18,19] and two in private and government-run schools.[20,21] The majority of the studies were carried out in urban schools typically based in capital and large cities; only three[22–24] were based in rural areas. Of the 33 studies, only two targeted socially deprived areas specifically.[25,26]

Of all studies included in the review, 15 were described as randomized controlled trials (RCT); other designs were cohort studies ($n=7$) and quasi-experimental ($n=11$) (see Tables 1–3 which details data from each of these designs respectively).

As can be seen from the tables, all the studies incorporated at least one component of HPS within their strategy. The majority involved OHE either in isolation (toothbrushing and dietary advice or topic-specific education on oral diseases) or as the main component combined with either toothbrushing and/or dietary interventions (e.g. daily sugar-free chewing gum).[27,28] Only three studies integrated oral health with general health using the common risk factor approach,[14,25,29] utilizing more of the key components of HPS (e.g. healthy school environment, health education, etc). Tai et al.[30] included a multicomponent intervention, which improved clinical outcomes (e.g. caries and plaque indices) in 3 years.

Nine articles were based on a theoretical framework. Five[12,25,27,30,31] stated their interventions were based on the HPS concept. In addition, psychological theories including the Health Belief Model,[32] social-cognitive theory[20] and sense of coherence (SOC)[26,33] were utilized in four studies.

In almost all the studies, the data collected to evaluate the strategy was based on self-reported questionnaires completed by the child and/or parent. These primarily focussed on measures of knowledge, attitude and behaviour. However, most of the studies ($n=30/33$) included clinical examinations carried out by dental health professionals and demonstrated significant improvements in clinical parameters, for example, dmft and gingival indices. Multicomponent programmes,[21,30] that involved teacher training, free toothbrushing-packs with OHE resulted in significantly improved clinical outcomes as well as students' knowledge, attitude and practice (KAP).

Information-giving interventions[22,34,35] showed no significant difference in oral health variables. Other interventions included

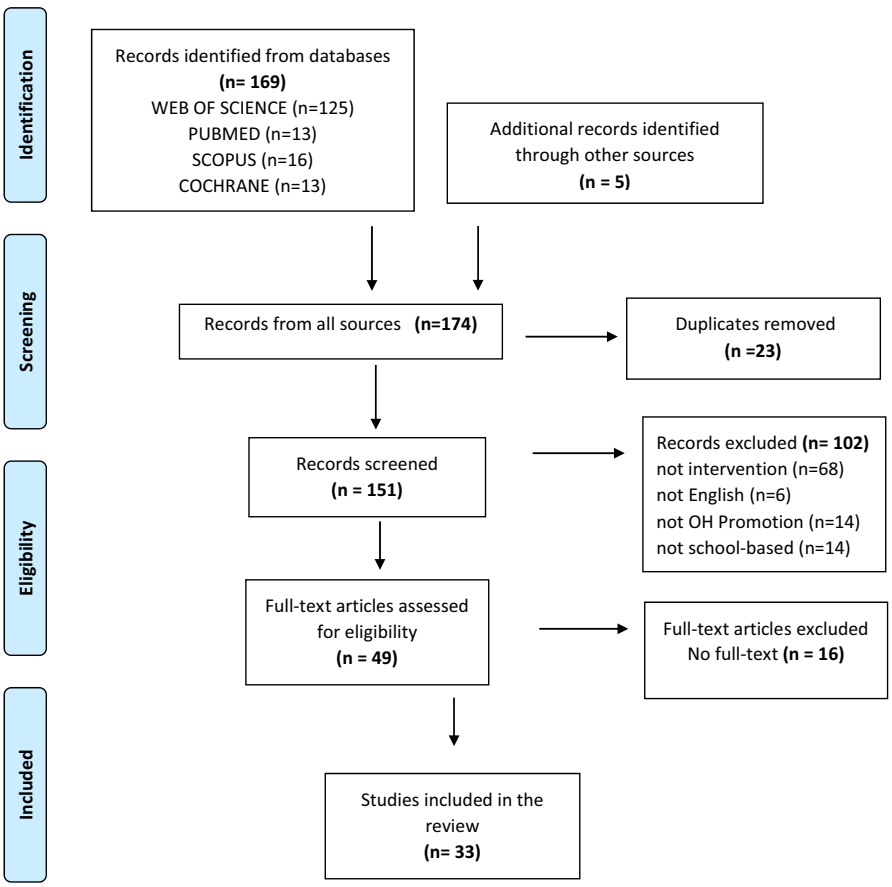

FIGURE 1 PRISMA flow diagram for the scoping review process.[13]

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OHE as a component within a combination of programmes,[23,27,36,37] such as supervised toothbrushing and sugar-free chewing gum, and found improvements in caries levels and gingival bleeding scores.[27] Additionally, improved oral hygiene performance was reported when supervised toothbrushing was evaluated,[38,39] particularly where disclosed plaque visualization was used.[39]

Those studies that incorporated more than one component of HPS such as daily fluoride toothbrushing with handwashing and biannual deworming (FIT programme),[14,29] fluoride varnish application and school-based health services[24] led to significant improvements in pupils' DMFT and oral health knowledge.

The providers of the oral health strategies differed from study to study. Some of the studies included more than one provider and also compared their effectiveness in delivery. Haleem et al[20] compared dentist-led, teacher-led and peer-led OHE and found improvements significantly better in the peer-led group. Similarly, findings of Doctor Muda[12] suggested peer-led OHP was more effective in improving oral health-related quality of life (OHRQoL) of schoolchildren. Saied-Moallemi[40] compared classroom and home OHE, and confirmed significance of parental-aid intervention. The effectiveness of training schoolteachers to impart OHE was examined in two studies,[21,34] showing improvement in knowledge of both teachers and children. The remaining studies were either conducted by dental professionals[17] or demonstrated collaboration between parents, health and education professionals and the students as part of a whole-school approach.[18,30,31,32]

Regarding formal evaluation of the interventions, for most studies ($n = 31/33$), there was no explicit description of an evaluation process. It is possible that the evaluation was performed but not explicitly reported.

The JBI assessment indicated that the overall quality of the 33 studies was fair to good (see Appendix S2). Interestingly, of the specific assessment criteria within the JCBI tool, randomization and blinding were unclear in 75% of the RCTs. Of the total JBI quality criteria (dependent on study design), 20 studies met 75% and above, 10 studies met over 50% and three studies were considered of poor-quality meeting less than 50% of JBI criteria.

4 | DISCUSSION

This was the first review to explore the evidence surrounding oral health promotion through HPS in developing countries. Although only five studies[12,25,27,30,31] were found to base their oral health strategies explicitly on the HPS framework, many others incorporated multiple components of HPS[14,25] or took a whole-school approach to OHE. Critically, whether HPS-based or incorporating HPS components, strategies had significant effect on plaque and caries reduction.

Strategies including OHE alone provided only short-term improvement in oral health knowledge, attitudes and behaviour, which corroborates evidence from previous literature.[41] However, OHE when based on a sound theoretical framework showed significant results, including behaviour change and improvements in schoolchildren's OHRQoL. The effectiveness of theory-based interventions has been emphasized in systematic reviews of school-based health promotion.[42] For example, interventions based on salutogenic theory specifically 'sense of coherence' were found to lead to improved OHRQoL of primary school children.[26,33] This supported evidence from previous SOC-based school interventions that found association of SOC with oral health behaviours.[43] In terms of e-application of OHE specifically, Al-Bardaweel and Dashash[44] found traditional OHE leaflets more effective than e-leaflets, findings that were in accordance with those from other parts of the developing world.[45]

Multicomponent health promotion programmes have demonstrated promising results.[3] Example interventions include supervised toothbrushing preceded by oral hygiene instruction sessions[39] resulted in statistically significant reduction in the percentage of caries-free children. Furthermore, studies involving supervised toothbrushing as part of a comprehensive programme[23,24,27,37] showed oral hygiene improvement. Henceforth, recommendations have been made to integrate supervised toothbrushing into general health promotion.[5,11]

Collaboration and engagement with the school community along with pupils' families is a main domain of the WHO HPS concept. Many studies utilized this domain; yet three[27,30,31] explicitly stated the WHO HPS approach as their basis. Nammontri et al.[33] and Tomazoni et al.[26] also embraced the whole-school approach. Some studies aimed health-educating material (e.g. booklets) at parents[35] and schoolteachers,[32,34] concluding that lack of parental motivation is a barrier to achieving better oral health in children.[16,35] Those studies which assessed the effectiveness of training schoolteachers in conducting OHE[21,22,34,46] highlighted the importance of teacher motivation[22] and children's social environment[43] in determining pupils' motivation to take part in health promotion activities. The present findings also show support for peer-led health promotion,[12,20] which is consistent with the previous literature.[4]

The duration of the oral health strategies and follow-ups varied in this review; information-giving interventions[17,22,36,37,47] either provided short-term results or were concluded as relatively ineffective. In contrast, longitudinal studies that were comprehensive, that is, involving different oral health activities, theory-based and adopting integrated approaches that address school ethos and policies showed significant changes in oral health.[12,32] However, this review recommends further longitudinal and better-quality research in this area, for example, more theory based RCTs with longer durations in developing countries.

The global evidence on school health initiatives is unambiguous.[1,4] While most of the evidence to date has come from developed countries, Langford et al.[4] highlighted the importance of HPS in poor developing countries. The findings of this review support this call and have emphasized the importance of capacity building, by empowering students and their families to actively partake in health promotion.[6] However, evidence to date has been primarily from studies conducted in Asia, which raises important questions about

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whether such initiatives are happening in other regions of the world but remain unreported in the published evidence-base. Inequalities in publications between developing and developed countries and among different developing countries may be due to the financial costs of the scientific publications as well English language as a barrier.

The overall improvements in child oral health in high income countries is multifactorial; the widespread use of fluoride, improvements in the social determinants of health and reorientation towards prevention are few of the positive factors leading to the downward trend of oral disease. On the other hand, the upward trend observed in developing countries is mostly due to financial and cultural limitations (e.g. oral health care not being a tradition). In many of these developing countries, large proportions of children lack access to public health programmes or are inadequately served.[48]

Budget constraints create major obstacles to sustainable implementation of national school oral health programmes. For example, supervised toothbrushing, although effective in reducing dental caries, appeared too expensive to generalize within local contexts.[38] Policy approaches were lacking in the included studies which implied, oral health not being a priority for local authorities in developing countries.[48] Additionally, the lack of trained dental personnel results in teachers dually carrying out educational and health-promotional activities,[34] and perhaps increasing teachers' reluctance to participate in time-consuming HPS intitatives.[5,48]

There were a number of limitations in this scoping review. Firstly, despite being of importance in reducing poor oral health, sugar reduction strategies were not specifically included in this scoping review. Secondly, the review was limited to publications in English. Given that the review was focussed on developing countries, this is an important limitation. It maybe that non-English language studies had been conducted and reported in regional journals, and/or country-specific discussion articles. Finally, there are limitations with the JBI quality appraisal tools utilized in this review. This tool assesses only the methodological quality of a study, and does not include criteria for assessing public health interventions, such as sustainability and ethics.[5]

5 | CONCLUSIONS

Evidence for oral health promotion through health-promoting schools was limited in methodological quality and number of studies conducted. Findings from those studies that were included suggested that multicomponent, comprehensive approaches to oral health promotion in schools with a theoretical underpinning improved clinical oral health outcomes and oral health-related quality of life of schoolchildren. This was particularly the case if strategies were delivered using a whole-school approach and with the active involvement of parents, teachers and the children themselves.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no data sets were generated or analysed during this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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