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Community-based population-level interventions for promoting child oral health (Review)

de Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, Morrice HR, Riggs E, Leong PM, Meyenn LK, Yousefi-Nooraie R

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Community-based population-level interventions for promoting child oral health (Review)

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[Intervention Review]

Community-based population-level interventions for promoting child oral health

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ABSTRACT

Background

Dental caries and gingival and periodontal disease are commonly occurring, preventable chronic conditions. Even though much is known about how to treat oral disease, currently we do not know which community-based population-level interventions are most effective and equitable in preventing poor oral health.

Objectives

Primary

- To determine the effectiveness of community-based population-level oral health promotion interventions in preventing dental caries and gingival and periodontal disease among children from birth to 18 years of age.

Secondary

- To determine the most effective types of interventions (environmental, social, community and multi-component) and guiding theoretical frameworks.
- To identify interventions that reduce inequality in oral health outcomes.
- To examine the influence of context in the design, delivery and outcomes of interventions.

Search methods

We searched the following databases from January 1996 to April 2014: MEDLINE, Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Education Resource Information Center (ERIC), BIOSIS Previews, Web of Science, the Database of Abstracts of Reviews of Effects (DARE), ScienceDirect, Sociological Abstracts, Social Science Citation Index, PsycINFO, SCOPUS, ProQuest Dissertations & Theses and Conference Proceedings Citation Index - Science.

Selection criteria

Included studies were individual- and cluster-randomised controlled trials (RCTs), controlled before-and-after studies and quasi-experimental and interrupted time series. To be included, interventions had to target the primary outcomes: dental caries (measured as decayed, missing and filled deciduous teeth/surfaces, dmft/s; Decayed, Missing and Filled permanent teeth/surfaces, DMFT/S) and gingival or periodontal disease among children from birth to 18 years of age. Studies had to report on one or more of the primary outcomes at baseline and post intervention, or had to provide change scores for both intervention and control groups. Interventions were excluded if they were solely of a chemical nature (e.g. chlorhexidine, fluoride varnish), were delivered primarily in a dental clinical setting or comprised solely fluoridation.

Data collection and analysis

Two review authors independently performed screening, data extraction and assessment of risk of bias of included studies (a team of six review authors - four review authors and two research assistants - assessed all studies). We calculated mean differences with 95% confidence intervals for continuous data. When data permitted, we undertook meta-analysis of primary outcome measures using a fixed-effect model to summarise results across studies. We used the I^2 statistic as a measure of statistical heterogeneity.

Main results

This review includes findings from 38 studies (total $n = 119,789$ children, including one national study of 99,071 children, which contributed 80% of total participants) on community-based oral health promotion interventions delivered in a variety of settings and incorporating a range of health promotion strategies (e.g. policy, educational activities, professional oral health care, supervised toothbrushing programmes, motivational interviewing). We categorised interventions as dietary interventions ($n = 3$), oral health education (OHE) alone ($n = 17$), OHE in combination with supervised toothbrushing with fluoridated toothpaste ($n = 8$) and OHE in combination with a variety of other interventions (including professional preventive oral health care, $n = 10$). Interventions generally were implemented for less than one year ($n = 26$), and only 11 studies were RCTs. We graded the evidence as having moderate to very low quality.

We conducted meta-analyses examining impact on dental caries of each intervention type, although not all studies provided sufficient data to allow pooling of effects across similar interventions. Meta-analyses of the effects of OHE alone on caries may show little or no effect on DMFT (two studies, mean difference (MD) 0.12, 95% confidence interval (CI) -0.11 to 0.36, low-quality evidence), dmft (three studies, MD -0.3, 95% CI -1.11 to 0.52, low-quality evidence) and DMFS (one study, MD -0.01, 95% CI -0.24 to 0.22, very low-quality evidence). Analysis of studies testing OHE in combination with supervised toothbrushing with fluoridated toothpaste may show a beneficial effect on dmfs (three studies, MD -1.59, 95% CI -2.67 to -0.52, low-quality evidence) and dmft (two studies, MD -0.97, 95% CI -1.06 to -0.89, low-quality evidence) but may show little effect on DMFS (two studies, MD -0.02, 95% CI -0.13 to 0.10, low-quality evidence) and DMFT (three studies, MD -0.02, 95% CI -0.11 to 0.07, moderate-quality evidence). Meta-analyses of two studies of OHE in an educational setting combined with professional preventive oral care in a dental clinic setting probably show a very small effect on DMFT (-0.09 weighted mean difference (WMD), 95% CI -0.1 to -0.08, moderate-quality evidence). Data were inadequate for meta-analyses on gingival health, although positive impact was reported.

Authors' conclusions

This review provides evidence of low certainty suggesting that community-based oral health promotion interventions that combine oral health education with supervised toothbrushing or professional preventive oral care can reduce dental caries in children. Other interventions, such as those that aim to promote access to fluoride, improve children's diets or provide oral health education alone, show only limited impact. We found no clear indication of when is the most effective time to intervene during childhood. Cost-effectiveness, long-term sustainability and equity of impacts and adverse outcomes were not widely reported by study authors, limiting our ability to make inferences on these aspects. More rigorous measurement and reporting of study results would improve the quality of the evidence.

PLAIN LANGUAGE SUMMARY

Community-based population-level interventions for promoting child oral health

Tooth decay (caries) and gum disease are commonly occurring, preventable chronic conditions that can develop early in childhood and have lifelong impact on health and quality of life. These diseases are often seen in disadvantaged communities, and preventing the development of disease from an early age is considered an important step in reducing health inequalities across the population. Although much is known about how to treat oral disease clinically, we do not know which community-based population-level interventions are most effective and equitable in preventing poor oral health.

This review examined the evidence base from January 1996 until April 2014 on effective community-based oral health promotion interventions for preventing caries and gum disease among children from birth to 18 years of age.

We found little evidence that oral health education alone can make a difference in the level of caries, although some studies have reported improvements in gum health, oral hygiene behaviours and oral cleanliness. Oral health promotion interventions that included supervised toothbrushing with fluoridated toothpaste were generally found to be effective in reducing caries in children's baby teeth. Interventions of oral health education provided in an educational setting combined with professional preventive oral care in a dental clinic were effective in reducing caries in children's permanent teeth. We found several studies that offered multi-component and multi-setting interventions. Although these interventions were varied in nature (oral health education coupled with interventions such as toothpaste provision, sugarless chewing gum, motivational interviewing, professional oral care, training of non-dental professionals, fluoride varnish application and fluoride supplements), researchers reported a positive impact in most of the studies in this group. Interventions that focus on diet and reduced sugar consumption also hold promise for reducing caries, but additional studies are needed.

Interventions included in this review were diverse and were delivered in a range of childhood settings, including education, community, healthcare and home environments. Most interventions were delivered in educational settings; however, studies did not report broadly on the extent and nature of engagement with students, educators, caregivers and oral health service providers. Improvements can be made in recognising the multiple influences of broader determinants linked to clinical oral health outcomes, for example, oral health knowledge, behaviours and practices and healthcare systems, including those involving a psychosocial environment. More rigorous measurement and reporting of study findings would improve the quality of available evidence.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Dietary interventions

Dietary interventions compared with control for promoting oral health in children

Patient or population: children
Setting: school- and community-based study (Brazil)
Intervention: dietary interventions
Comparison: no treatment control

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with control	Risk with dietary interventions				
DMFT	No study provided data for this outcome		-	(0 studies)	-	
DMFS	No study provided data for this outcome		-	(0 studies)	-	
dmft measured up to 1 year	Mean dmft was 4.15	Mean dmft in the intervention group was 0.9 lower (1.85 lower to 0.05 higher)	-	340 (1 RCT)	⊕⊕⊕⊖ Moderate ^{a,b}	
dmfs measured up to 1 year	Mean dmfs was 2.45	Mean dmfs in the intervention group was 1.48 lower (2.51 lower to 0.45 lower)	-	510 (1 RCT)	⊕⊕⊖⊖ Low ^c	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio; RR: risk ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

^aThe outcome of interest is not likely to be affected by knowledge of treatment group assignment, so we did not downgrade for risk of bias

^bDowngraded one level owing to serious imprecision. Confidence intervals include beneficial effect and no or little difference with intervention

^cDowngraded two levels owing to very serious risk of bias. Inadequate information was available to assess risk of bias for any domain

Summary of findings 2. Oral health education

Oral health education for promoting child oral health

Patient or population: children

Setting: primary/elementary schools in Africa, Asia and South America

Intervention: oral health education

Comparison: no intervention.

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with control	Risk with oral health education				
DMFT measured at between 1 and 2 years of follow-up	Mean DMFT was 0.48	Mean DMFT in the intervention group was 0.12 higher (0.11 lower to 0.36 higher)	-	856 (2 RCTs)	⊕⊕⊕⊕ Low ^{a,b}	
DMFS measured at between 1 and 2 years of follow-up	Mean DMFS was 0.1	Mean DMFS in the intervention group was 0.01 lower (0.24 lower to 0.22 higher)	-	285 (1 RCT)	⊕⊕⊕⊕ Very low ^{c,d}	
dmft measured at between 1 and 2 years of follow-up	Mean dmft was 0	Mean dmft in the intervention group was 0.3 lower (1.11 lower to 0.52 higher)	-	276 (3 RCTs)	⊕⊕⊕⊕ Low ^{a,d}	
dmfs	No study provided data for this outcome		-	(0 studies)	-	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio; RR: risk ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

^aDowngraded one level owing to serious risk of bias. Insufficient evidence available for risk of bias assessment

^bDowngraded one level owing to serious imprecision. Confidence intervals include little or no effect of intervention

^cDowngraded two levels owing to very serious risk of bias. Study described as quasi-experimental. High risks of selection and performance bias

^dDowngraded one level owing to serious imprecision. Confidence intervals include meaningfully better or worse effects with intervention

Summary of findings 3. Oral health education + supervised toothbrushing

Oral health education + supervised toothbrushing with fluoridated toothpaste for promoting child oral health

Patient or population: children

Setting: mix of school and care settings in Jordan, China, Africa, Asia and Europe

Intervention: oral health education + supervised toothbrushing with fluoridated toothpaste

Comparison: no intervention

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with placebo	Risk with oral health education + supervised toothbrushing with fluoridated toothpaste				
DMFT measured at between 1 and 2 years of follow-up	Mean DMFT ranged from 0.22 to 0.4	Mean DMFT in the intervention group was 0.02 lower (0.11 lower to 0.07 higher)	-	1004 (3 RCTs)	⊕⊕⊕⊖ Moderate ^a	
DMFS measured at between 1 and 2 years of follow-up	Mean DMFS was 0	Mean DMFS in the intervention group was 0.02 lower (0.13 lower to 0.1 higher)	-	443 (2 RCTs)	⊕⊕⊖⊖ Low ^{a,b}	
dmft measured at more than 1 year of follow-up	Mean dmft was 0	Mean dmft in the intervention group was 0.97 lower (1.06 lower to 0.89 lower)	-	99481 (1 small RCT and 2 large interrupted time series study)	⊕⊕⊖⊖ Low ^{c,d}	We applied GRADE for NRS for this outcome, as the analysis was dominated by a large ITS study
dmfs measured at two years follow-up.	The mean dmfs was 0	The mean dmfs in the intervention group was 1.59 lower (2.67 lower to 0.52 lower)	-	500 (3 RCTs)	⊕⊕⊖⊖ Low ^{e,f}	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio; RR: risk ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect
Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- ^aDowngraded one level owing to serious risk of bias. Insufficient information was available for assessment of risk of bias for most domains across studies
^bDowngraded one level owing to serious imprecision. Small sample size
^cDowngraded one level owing to serious inconsistency. Although the direction of effect in studies favoured intervention, the magnitude of effect differed between them
^dUpgraded one level owing to large effect from non-randomised evidence
^eDowngraded one level owing to serious risk of bias. Studies at high and unclear risk of bias across more than one domain
^fDowngraded one level owing to inconsistency. Results were sensitive to inclusion of one study at high risk of bias that showed a large effect. Removing this study reduced the size of the effect

Summary of findings 4. Oral health education + fluoride (varnish/supplement) + training/support

Oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic for promoting child oral health

Patient or population: children

Setting: community-based health services and homes in studies conducted in Australia and Thailand

Intervention: oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic

Comparison: no intervention

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with placebo	Risk with oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic				
DMFT	No study provided data for this outcome		-	(0 studies)	-	
DMFS	No study provided data for this outcome		-	(0 studies)	-	
dmft measured up to 1 year	Mean dmft was 1.27	Mean dmft in the intervention group was 0.57 lower (2.05 lower to 0.91 higher)	-	114 (1 RCT)	⊕⊕⊕⊕ Low ^{a,b}	
dmfs measured at between 1 year and 2 years of follow-up	Mean dmfs was 0	Mean dmfs in the intervention group was 3 lower (4.91 lower to 1.09 lower)	-	543 (1 RCT)	⊕⊕⊕⊕ Moderate ^c	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio ;RR: risk ratio

GRADE Working Group grades of evidence
High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

^aDowngraded one level owing to serious risk of bias. High or unclear risk of bias

^bDowngraded one level owing to serious imprecision. One small study contributed data to this outcome

^cDowngraded one level owing to serious risk of bias. Insufficient information to judge risk of bias for several domains

Summary of findings 5. School-based OHE and toothpaste provision + clinic-based professional preventive oral care
School-based OHE and toothpaste provision + clinic-based professional preventive oral care for promoting child oral health
Patient or population: children

Setting: primary/elementary schools in China and Russia

Intervention: OHE and toothpaste provision + clinic-based professional preventive oral care

Comparison: no intervention

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with placebo	Risk with school-based OHE and toothpaste provision + clinic-based professional preventive oral care				
DMFT measured at up to 1 year post intervention	Mean DMFT was 0.28	Mean DMFT in the intervention group was 0.09 lower (0.1 lower to 0.08 lower)	-	1458 (2 RCTs)	⊕⊕⊕⊖ Moderate ^{a,b}	
DMFS	No study provided data for this outcome		-	(0 study)	-	
dmfs	No study provided data for this outcome		-	(0 study)	-	
dmft	No study provided data for this outcome		-	(0 study)	-	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio; RR: risk ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

^aNot downgraded for risk of bias, as analysis was dominated by one large well-conducted study

^bDowngraded one level owing to serious inconsistency. Two studies provided very different results despite the same direction of effect

Summary of findings 6. Oral health education + chewing gum

Oral health education + chewing gum for promoting child oral health

Patient or population: children

Setting: China

Intervention: oral health education + chewing gum

Comparison: no intervention

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with placebo	Risk with oral health education + chewing gum				
DMFT	Mean DMFT was 0	Mean DMFT in the intervention group was 0.08 lower (0.18 lower to 0.02 higher)	-	548 (1 RCT)	⊕⊕⊕⊕ Low ^{a,b}	
DMFS	No study provided data for this outcome		-	(0 studies)	-	
dmfs	No study provided data for this outcome		-	(0 studies)	-	
dmft	No study provided data for this outcome		-	(0 studies)	-	

***Risk in the intervention group** (and its 95% confidence interval) is based on assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI)

CI: confidence interval; OR: odds ratio; RR: risk ratio

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of effect but may be substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

^aDowngraded one level owing to serious risk of bias. High risk of detection bias

^bDowngraded one level owing to serious imprecision. Confidence intervals include benefit as well as little or no effect

BACKGROUND

Oral health has been defined as 'a standard of health of the oral and related tissues that enables an individual to eat, speak and socialise without active disease, discomfort or embarrassment, and that contributes to general well-being' (UK Department of Health 1994). A strong link has been noted between oral and general health, with evidence showing that poor oral health can lead to poor general health (Watt 2012). Oral disease shares common risk factors with major chronic systemic diseases such as cardiovascular disease (Baheker 2007), diabetes (Kinane 2008), chronic respiratory disease (Azarpazhooh 2006), rheumatoid arthritis (de Smit 2011) and certain types of cancer (Söder 2011; Tezal 2009).

Description of the condition

A range of diseases and conditions, including dental caries (tooth decay), gingival and periodontal disease (gum disease), oral cancers, noma, dental erosion and dental fluorosis, can be classified as oral disease (Watt 2005). Of all the oral diseases, dental caries and gingival and periodontal disease are the most common preventable chronic oral diseases among children (Jürgensen 2013; Petersen 2004a). Although dental caries remain the most persistent and prevalent childhood disease in the world today, globally, most children and adults have initial signs of gingival and periodontal disease (Guido 2011; Jürgensen 2013; Satur 2010). Both dental caries and periodontal disease are progressive in nature, are initiated early in life and manifest in infancy, childhood and adolescence and at all ages of adulthood (Jürgensen 2013; Satur 2010). They are frequently associated with infection, tooth loss and decreased quality of life (Gussy 2006). In addition to causing pain, suffering and distress, oral disease can impair children's ability to eat, leading to reduced nutritional status and diet-related ill health at a very young age (Petersen 2005). Oral health problems in early childhood have been shown to be predictive of future dental problems, and they influence children's growth, development and cognitive functions (Jürgensen 2013; Petersen 2005).

Despite major improvements in oral health for the population as a whole, inequalities in oral health have been noted. Dental caries and gingival and periodontal disease have been shown to disproportionately affect underprivileged, disadvantaged and socially marginalised communities, giving rise to oral health inequalities (Jin 2011; Watt 2007). Widening social inequalities in oral health are mediated predominantly through determinants such as education, socio-economic circumstances, material possessions, living and working environments, genetics and lifestyle factors (Petersen 2010; Watt 2007). Lifestyle and behavioural factors such as poor diet and sugar intake (Moynihan 2014), smoking (Hugoson 2011), substance abuse, poor oral hygiene and stress are risk factors for poor oral and general health outcomes (Watt 2007). For example, in addition to the harmful effects of tobacco smoking on general health (such as cardiovascular and respiratory systems), tobacco use (whether in the form of cigarettes, cigars, pipes or water pipes) is associated with increased risk of oral diseases such as oral cancer, dental caries and gingival and periodontal disease (Carr 2006; Hugoson 2011; Leroy 2008). Studies have also linked behaviours such as tobacco chewing with increased risk of dental caries, smokeless tobacco with increased risk of gingival recession (Tomar 1999) and second-hand smoke with risk of dental caries (Hanioka 2011; Leroy 2008).

Description of the intervention

Globally, oral health issues continue to be among the most costly health problems to treat, resulting in high direct and indirect costs to individuals, families and governments (Bertrand 2011). Although oral disease remains a significant public health challenge in high-income countries, the burden of oral disease is growing and is considerably high in low- and middle-income countries (Petersen 2010). Oral diseases are the fourth most expensive diseases to treat in most high-income countries (Petersen 2003). In most low-income countries, the costs of providing curative services for dental caries alone in children would exceed the total healthcare budget for children (Yee 2002). Given the preventable and reversible nature of many oral diseases, it is important to consider community-based population-level interventions that target the greatest number of children at the lowest possible cost (Savage 2004). These interventions have the greatest potential to effectively and economically reduce oral health inequalities between specific population groups while reducing the burden of oral disease among children through early identification and disease management (Weintraub 2013).

How the intervention might work

Treating individuals solely in clinical settings and focusing entirely on individuals at high risk for oral disease is no longer effective (Watt 2005; Watt 2007). Prevention of oral disease along with promotion of oral health begins with implementation of effective public health measures, wherein efforts are directed towards examining and understanding the influence of contextual factors. Community-based population-level interventions consider contextual factors such as community demographics, resources, access to health care and political environment (global, regional, national and local level policies), including sociocultural, physical, economic and environmental conditions in which children live and grow (Petersen 2010; Waters 2011; Watt 2012).

To examine contextual influences, investigators in several studies have used conceptual frameworks adopting a socio-ecological approach, such as the Fisher-Owens model, to recognise the multi-dimensional and multi-level nature of influences on children's oral health (Fisher-Owens 2007; Watt 2007). These models guide our understanding of how population-level interventions might work to improve oral health (de Silva-Sanigorski 2010; Fisher-Owens 2007). For example, Fisher-Owens 2007 specifically describes five domains that can influence child oral health (genetic and biological factors, social and physical environment, health behaviours, dental care and medical care) (see Additional Table 1). Frameworks such as these provide a strong foundation for designing and implementing effective public health interventions (Fisher-Owens 2007; Watt 2007). When they were reported, this review has captured the theoretical underpinnings that informed interventions in the included studies.

Oral diseases, specifically dental caries and gingival and periodontal disease, can be best understood through the life-course perspective, which shows the impact of early life circumstances in shaping health across an entire lifetime and potentially across generations (Braveman 2009). This approach considers the influence of broader determinants and contextual factors that can potentially predict current and future oral health trends (Braveman 2009; Shearer 2012). The Dunedin Multi-disciplinary Health and Development longitudinal study ("Dunedin

Study"), for example, followed a birth cohort of 1037 children for over 40 years and demonstrated intergenerational continuity in oral health. This continuity was related to childhood circumstances, which included a range of childhood exposures such as maternal educational level, maternal oral health status, place of residence and access to health care, including socio-economic, socio-cultural and psychosocial factors (Shearer 2012).

Childhood, particularly early childhood, is an influential stage of life, as it is the period during which lifelong beliefs, attitudes and skills are developed (Kwan 2005). Community-based population-level interventions targeting childhood have the potential to improve health, development and well-being throughout childhood, and subsequently into adolescence and adult life. Targeting risk factors and promoting healthy practices at an early stage in life may also reduce oral health inequalities between social groups.

Why it is important to do this review

Over the past two decades, several reviews have examined this topic, and they have been used to inform this review. Truman 2002 focused on population-level interventions. However, this review was broader and focused on prevention and control of dental caries, oral and pharyngeal cancers and sports-related craniofacial injuries. Kay 1998 reviewed and assessed the effectiveness of oral health promotion interventions specifically for dental caries, oral hygiene, oral health-related knowledge, attitudes and behaviour. The Kay 1998 review identified a large number of studies ($n = 164$) that focused on individual behaviours and 'downstream' interventions. However, this review found limited evidence on the best interventions and strategies to promote oral health at community and population levels. Klinge 2005 examined the strength of associations between periodontal disease and socio-economic conditions, particularly among adults. Gussy 2006 completed a review of the evidence base while focusing on interventions intended to prevent early childhood caries. This review concluded that effective interventions should be provided during the first two years of a child's life. The Gussy 2006 review specifically focused on children five years of age and younger. We propose to explore similar issues across childhood, while specifically focusing on children from birth to 18 years of age. Despite the findings provided by these reviews, significant gaps remain in our understanding of effective community-based population-level oral health interventions. We conducted this review to evaluate and assess the effectiveness of oral health interventions targeting children in community settings.

OBJECTIVES

Primary

- To determine the effectiveness of community-based population-level oral health promotion interventions in preventing dental caries and gingival and periodontal disease in children from birth to 18 years of age.

Secondary

- To determine the most effective types of interventions (environmental, social, community and multi-component) and guiding theoretical frameworks.
- To identify interventions that reduce inequality in oral health outcomes.

- To examine the influence of context in the design, delivery and outcomes of interventions.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised or quasi-randomised controlled trials (RCTs), cluster-RCTs, controlled before-and-after studies (CBAs) and interrupted time series (ITSs) with a minimum of three points before and after the intervention for examination of intervention effects. We considered no minimum duration of intervention or follow-up period.

Types of participants

Eligible participants included children and adolescents up to and including 18 years of age at commencement of the study. The Convention of the Rights of the Child defines a 'child' as every human younger than 18 years of age (OHCHR 1989). Although this legislation can vary by country, and some countries recognise 21 years as the upper limit for childhood for some legal purposes, this review included children 18 years of age and younger. We excluded from this review studies that targeted only particular groups in the community, such as children with special needs or those with already high levels of dental caries.

Types of interventions

Setting

We included interventions delivered external to clinical settings and within settings in which children spend their time or with which they have contact. These settings included home, community, childcare facilities, educational settings, healthcare sites and sites providing care to children when out of school. This review included single-component and multi-component oral health promotion interventions based on a range of strategies such as oral health education, toothbrushing, chewing gum programmes, motivational interviewing and others.

Types of comparisons

This review included studies that compared interventions that aimed to have an impact on primary and secondary outcomes versus non-intervention comparisons or controls consisting of usual care or another active intervention, or pre-intervention measures provided through an ITS design.

Intervention personnel

This review applied no restrictions on who delivered the interventions. Interventions could be delivered by researchers, government agencies, oral health professionals, healthcare workers, primary care practitioners, nutrition and other allied health professionals, teachers, care providers, health promotion practitioners, specialist doctors and others.

Interventions excluded

Included studies were not required to have a minimum intervention or follow-up duration. We excluded interventions that were of a chemical nature alone (e.g. fluoride varnish only) and were delivered primarily in a clinical setting and fluoridation alone (in water, milk, salt, etc.). Water fluoridation is considered an

important and cost-effective public health measure that has been endorsed by the World Health Organization (WHO) for prevention of dental caries and reduction of oral health inequalities (Petersen 2004a). Although water fluoridation is considered a population-level intervention, ongoing Cochrane reviews (Iheozor-Ejiofor 2013) and other published reviews (McDonagh 2000) have examined this topic. To narrow the focus of our review, and to avoid duplication with existing and ongoing reviews, we excluded studies that focused solely on water fluoridation.

Types of outcome measures

To be included, studies had to report on one or more of the following primary outcomes, presenting baseline and post-intervention measurements or change scores. We excluded studies that solely measured the craniofacial complex outcomes however we included those that in addition reported gingival/periodontal and dental caries outcomes. Included studies had to report data for both intervention and control groups.

Primary outcomes

- Measurement of dental caries by an oral health clinician or trained examiner (including early childhood caries, white spot lesions, decayed, missing and filled teeth (dmft/DMFT) or decayed, missing and filled surfaces (dmfs/DMFS)).
- Measurement of periodontal disease by an oral health clinician or trained examiner (e.g. gingival/periodontal infection, gingival/periodontal index).

Secondary outcomes

- Plaque index.
- Self reported or parent-reported oral health status, including measures of quality of life and oral pain (from survey or interview data).
- Behaviours and practices (e.g. infant feeding practices, oral hygiene practices using direct reporting or parent proxy, tobacco use).

- Health literacy, knowledge, attitudes and skills (e.g. child, adult, health professional).
- Policies and practices of government, organisation or setting (e.g. nutrition-related policies in schools, tobacco cessation policies).
- Harms or unintended consequences associated with implementation or outcomes of the intervention.
- Cost-effectiveness or costs of the intervention.

We included the following outcomes in our 'Summary of findings' tables.

- DMFT.
- DMFS.
- dmft.
- dmfs.

Search methods for identification of studies

A search expert (a librarian at The University of Melbourne) used a combination of controlled vocabulary and free-text terms to develop comprehensive search strategies for each of the databases searched to identify relevant studies. The initial search strategy was developed for MEDLINE Ovid and was revised to consider differences in controlled vocabulary and syntax rules for each database. A previous systematic review by Kay 1998 covered the literature on oral health promotion interventions until 1996; therefore, we decided to search the literature from 1996 onwards. We excluded studies reported before 1996. Our review conducted a two-phase search and included all studies published between January 1996 and April 2014 (see Figure 1 for details). We applied no restrictions on the language of publication to the search. On occasions when library access to full-text articles was restricted, we sought assistance within The Cochrane Collaboration network in locating full-text articles.

Figure 1. Flow diagram showing two-phase search strategy and results.

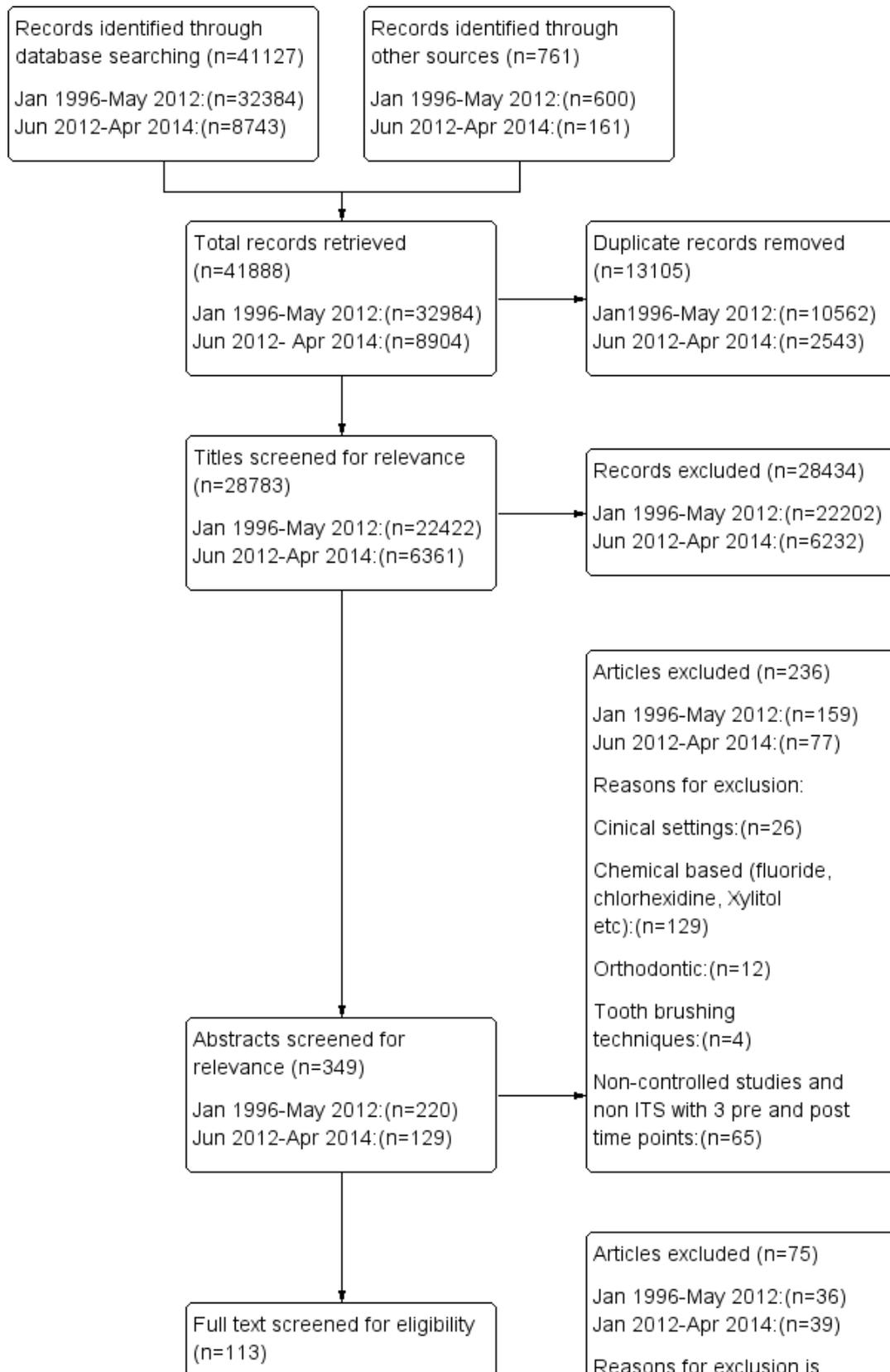
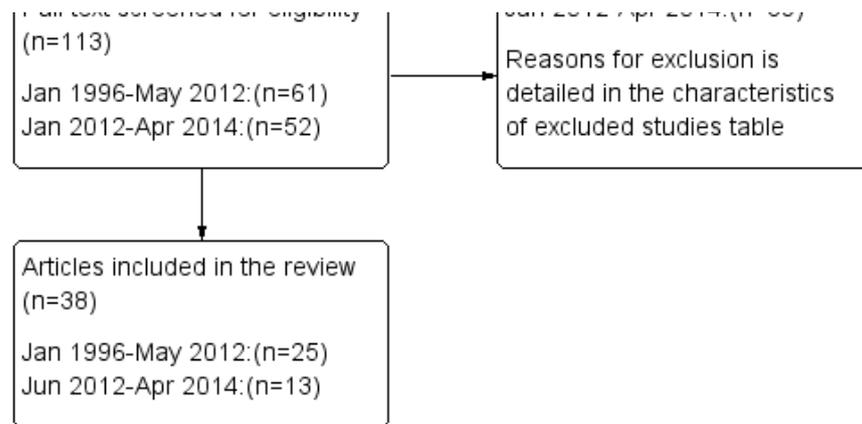


Figure 1. (Continued)



Electronic searches

We searched the following databases from 1996 to April 2014.

- Cochrane Central Register of Controlled Trials (CENTRAL) in *The Cochrane Library* 2012 and 2014 (1996 to 30 April 2014) ([Appendix 1](#)).
- MEDLINE (Ovid) (1996 to 30 April 2014) ([Appendix 2](#)).
- Embase (1996 to 30 April 2014) ([Appendix 3](#)).
- Cumulative Index to Nursing and Allied Health Literature (CINAHL) (EBSCO) (1996 to 30 April 2014) ([Appendix 4](#)).
- Education Resource Information Center (ERIC) (EBSCO) (1996 to 30 April 2014) ([Appendix 5](#)).
- BIOSIS Previews (Institute for Scientific Information (ISI)) (1996 to 30 April 2014) ([Appendix 6](#)).
- Web of Science (ISI) (1996 to 30 April 2014) ([Appendix 7](#)).
- Database of Abstracts of Reviews of Effects (DARE) (Ovid) (1996 to 30 April 2014) ([Appendix 8](#)).
- Social Science Citation Index (ISI) (1996 to 30 April 2014) ([Appendix 9](#)).
- PsycINFO (Cambridge Scientific Abstracts (CSA)) (1996 to 30 April 2014) ([Appendix 10](#)).
- ProQuest Dissertations & Theses (PQDT) (1996 to 30 April 2014) ([Appendix 11](#)).
- ScienceDirect (Elsevier) (1996 to 30 April 2014) ([Appendix 12](#)).
- Conference Proceedings Citation Index - Science (1996 to 30 April 2014) ([Appendix 13](#)).
- Web of Science (1996 to 30 April 2014) ([Appendix 14](#)).
- Sociological Abstracts (CSA) (1996 to 30 April 2014) ([Appendix 15](#)).
- SCOPUS – version 4 (Elsevier) (1996 to 30 April 2014) ([Appendix 16](#)).

Searching other resources

In addition to conducting systematic searches of electronic databases, we cross-checked the reference lists of key articles identified through our search. We also electronically searched the key journals listed below. Our search was informed by a combination of key words related to population (child*, infant*, “young children”, adolescent*, teenag*, “school* children” youth), intervention (“prevention of oral diseases”, “oral health promotion”, nutrition, diet) and outcomes (“dental caries”,

"periodontal disease*", "gingival index", dmft/DMFT, dmfs/DMFS, "tooth decay").

- *International Dental Journal* (1996 to 30 April 2014).
- *African Index Medicus Journals* (1996 to 30 April 2014).
- *Current Controlled Trials* (1996 to 30 April 2014).
- *Community Dental Health* (1996 to 30 April 2014).
- *Health Promotion International* (1996 to 30 April 2014).
- *Community Dentistry and Oral Epidemiology* (1996 to 30 April 2014).
- *BMC Public Health* (1996 to 30 April 2014).
- *Preventive Medicine* (1996 to 30 April 2014).
- *Bulletin of the World Health Organization* (1996 to 30 April 2014).

To identify conference proceedings, newsletters, government reports, policy documents and dissertations, we undertook a targeted electronic search (in April 2014) of the key health promotion and oral health organisation websites listed below. We used the combinations of key words given above to identify relevant studies.

- Australian Dental Association (<http://www.ada.org.au/>) (accessed 4 April 2014).
- American Dental Association (<http://www.ada.org/index.asp>) (accessed 4 April 2014).
- British Dental Association (<http://www.bda.org/>) (accessed 4 April 2014).
- British Dental Health Foundation (<http://www.dentalhealth.org>) (accessed 4 April 2014).
- British Fluoridation Society (<http://www.bfsweb.org/>) (accessed 24 April 2014).
- Californian Health Promotion Clearinghouse (<http://www.hpclearinghouse.ca/>) (accessed 24 April 2014).
- Oral Health Promotion Clearinghouse (<https://www.adelaide.edu.au/oral-health-promotion/>) (accessed 24 April 2014).
- International Union for Health Promotion and Education (<http://www.iuhpe.org/>) (accessed 25 April 2014).
- International Association for Dental Research (<http://www.iadr.org>) (accessed 4 April 2014).
- National Institute for Health and Care Excellence (NICE) guidelines (<http://www.nice.org.uk>) (accessed 28 April 2014).

- Health-Evidence (<http://health-evidence.ca>) (accessed 28 April 2014).
- World Health Organization (WHO) (<http://www.who.int/>) (accessed 28 April 2014).
- WHO International Clinical Trials Search Portal (<http://apps.who.int/trialsearch/>) (accessed 28 April 2014).
- Canadian Best Practices Portal for Health Promotion and Chronic Disease Prevention, Public Health Agency of Canada (<http://www.cbpp-pcpe.phac-aspc.gc.ca/>) (accessed 24 April 2014).
- Fédération Dentaire Internationale (FDI) World Dental (<http://www.fdiworldental.org/>) (accessed 24 April 2014).
- National Oral Health Promotion Group (<http://www.nohpg.org/>) (accessed 4 April 2014).
- New Zealand Dental Association (<http://www.nzda.org.nz/pub/>) (accessed 4 April 2014).
- Oral Health Cooperative Research Centre (CRC) (<http://www.crcoralhealthscience.org.au/>) (accessed 4 April 2014).
- Intute (www.intute.ac.uk/) (accessed 24 April 2014).
- Turning Research Into Practice (www.tripdatabase.com/) (accessed 28 April 2014).

Data collection and analysis

Meta-analysis

Calculating mean change from baseline and standard deviations

When data were reported as change from baseline, and standard deviation (SD) (or standard error of the mean (SEM)) was provided in the paper, we used these values. When baseline and follow-up data were provided, we entered these into RevMan and calculated the change and SD automatically. We calculated mean change from baseline and SD for 11 studies ([Al-Jundi 2006](#); [Ekstrand 2000](#); [Frencken 2001](#); [Hochstetter 2007](#); [Mbawalla 2013](#); [Petersen 2004](#); [Rodrigues 1999](#); [Shenoy 2010](#); [Song 2004](#); [Tubert-Jeannin 2008](#); [van Palenstein 1997](#)).

[Hochstetter 2007](#) presented results visually. Two review authors used the data presented for dmft and dmfs to estimate point estimates for mean scores at baseline and follow-up, as well as their 95% confidence intervals (CIs). We then estimated SDs using the upper limit of the 95% CIs.

Calculating or imputing standard deviations

As data were not provided for [Slade 2011](#), we calculated the SD for mean change from baseline from the 95% CI reported in the paper, and for [Schwarz 1998](#), we used the baseline SE value reported in the paper. [Petersen 2004](#) did not present the SD for means at baseline and at follow-up. To use [Peng 2004](#) in the meta-analysis for DMFS, the SD for the control group was imputed from the SD for the mean DMFS score at baseline reported for the treatment group (those who received oral health education and sugar-free chewing gum). [Rodrigues 1999](#) did not report the SD for mean dmfs score at follow-up, we imputed from the SD for mean dmfs score provided at baseline.

Applicability

We adapted the methods outlined in [Glasgow 2006](#) and [Lavis 2009](#) to assess review findings using the following six questions.

- Were the studies included in the systematic review conducted in the same geographical setting, or were study findings consistent across settings?
- Was it reported that relevant stakeholders were involved in planning and implementing the intervention?
- Were plans made by the stakeholders to institutionalise the programme into school activities, policies or curriculum?
- Were programme outcomes and activities maintained at follow-up?
- What resources were needed to implement the programme?
- Who delivered the intervention?

Selection of studies

We imported records obtained from the search (January 1996 to April 2014) to EndNote referencing software and removed all duplicates before screening. We pilot-tested study selection and screening processes on a sample of papers to check for reviewer consistency in applying and interpreting inclusion criteria appropriately. Six review authors (SH, AdS, BN, SB* and two research assistants) independently and in pairs screened the titles and abstracts of all citations retrieved by searches for potential relevance against predetermined inclusion criteria. We excluded studies that did not meet the inclusion criteria. For studies that appeared to meet the inclusion criteria and in cases where a clear decision could not be made on the basis of title and abstract alone, we obtained the full text of articles to conduct a detailed assessment for potential inclusion. Six review authors (SH, AdS, BN, HM, LM and one research assistant) independently and in pairs screened full-text articles to identify studies of potential relevance to the topic. We resolved disagreements related to inclusion of studies through discussion with the other review authors.

*Su-Yan Barrow's contribution to this review was limited to reviewing the initial protocol and screening (title/abstract only) and reviewing early drafts of the review. She ceased involvement with the review after gaining employment with Colgate-Palmolive in January 2014 (after initial submission of the review in 2014, but before the review was revised in 2015) and was removed from the authorship list.

Data extraction and management

Before use, we piloted the data extraction form on a sample of studies to allow for any necessary modifications, and to ensure that accurate and consistent information was extracted by review authors. Six review authors (SH, AdS, BN, HM, LM and one research assistant) worked independently and in pairs to extract data from all included studies. The team discussed discrepancies that arose and resolved them by mutual agreement. For each included study, we recorded the following information.

- Study characteristics: study design, unit of randomisation, unit of analysis, year the study commenced and finished, study location (country), study setting (where participants were recruited), length of follow-up/s and funding.
- Participant characteristics: study inclusion criteria, number of children in intervention and control groups at baseline and post intervention, attrition rate, age (range) and mean age at baseline, gender ratio and background exposure to fluoride sources (toothpaste, water, etc.).

- **Intervention characteristics:** theoretical underpinnings that informed intervention design, intervention description, programme facilitators, intervention comparisons (e.g. oral health education, toothbrushing vs only oral health education) and duration of the intervention.
- **Implementation-related factors:** theoretical basis for intervention, contextual factors, resources for implementation, personnel delivering the intervention, materials and resources used to deliver interventions, information related to calibration of examiners and progress categories related to equity measures (gender, residence, education, income, race). We assessed reporting of outcomes against the Prognosis Research Strategy (PROGRESS) framework (Ueffing 2009) to determine the effectiveness of the intervention in reducing inequality.
- **Outcome characteristics:** primary outcome measures at baseline and follow-up (dmft/DMFT, dmfs/DMFS, gingival and periodontal measures), secondary outcome measures at baseline and follow-up (plaque index, self reported oral health status, oral health behaviour, practices, knowledge, organisational policies and practices including unintended consequences associated with intervention or outcomes and cost-effectiveness or costs of the intervention).
- We also extracted analysis details, adverse effects and, when available, data on economic evaluation.

Assessment of risk of bias in included studies

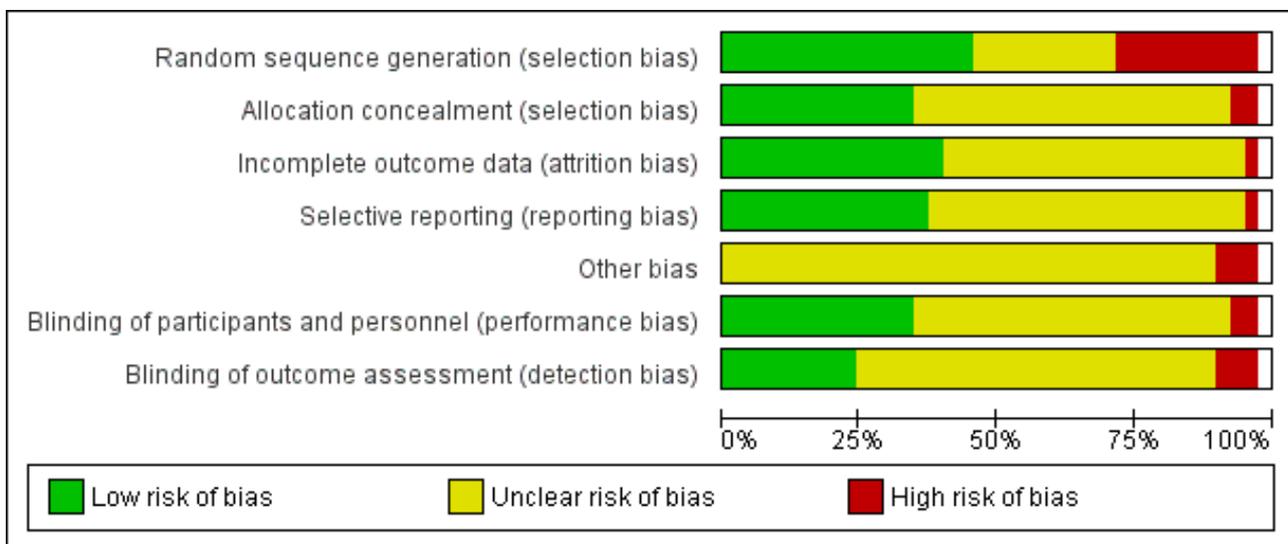
We applied the recommended method for assessing risk of bias of studies included in Cochrane reviews, as set out in Chapter 8

of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). Six review authors (SH, AdS, BN, HM, LM and one research assistant) independently and in pairs carried out risk of bias assessments using the two-part tool to address seven specific domains (sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and 'other bias'). Each domain in the tool includes one or more specific entries in the 'Risk of bias' table. Within each entry, the first part of the tool describes what was reported to have happened in the study. The second part assigns a judgement related to risk of bias for that entry. This is achieved by assigning a judgement of 'low risk', 'high risk' or 'unclear risk' of bias. After taking into account additional information provided by trial authors, we graded studies according to the following categories.

- **Low risk of bias:** low risk of bias for all domains (plausible bias unlikely to seriously alter the results).
- **Unclear risk of bias:** unclear risk of bias for one or more key domains (plausible bias that raises some doubt about the results).
- **High risk of bias:** high risk of bias for one or more key domains (plausible bias that seriously weakens confidence in the results).

We prepared a Risk of bias table for each included study (see [Characteristics of included studies](#)) and presented results graphically in [Figure 2](#).

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Measures of treatment effect

We expressed continuous outcomes as weighted mean differences (WMDs) when the same measure was used across studies.

Unit of analysis issues

We used inverse variance and fixed-effect modelling for meta-analysis to generate effect estimates and their standard errors from included studies. If cluster-randomised trials did not adjust results

for clustering of the data, we estimated the design effect using the intraclass correlation co-efficient (ICC) (Higgins 2011). The reported ICC for indicators of dental caries in children varied in different studies, ranging from 0.01 (Tai 2009) to 0.05 (Lawrence 2008). We calculated design effect by assuming an ICC of 0.05.

Dealing with missing data

We used data available from published papers. Owing to limited resources, we did not contact the authors of included studies to ask for missing data.

Assessment of heterogeneity

Assessments of consistency of effects across studies, together with qualitative consideration of whether studies should be combined, informed the decision on the best method for presenting study results (meta-analysis, narrative synthesis or both). We considered heterogeneity by examining study design, participants, setting, intervention duration and age groups. We included in the meta-analysis only studies that reported the same relevant outcome and were sufficiently similar. We examined forest plots visually for heterogeneity and conducted statistical testing for heterogeneity by using the I^2 statistic. We undertook interpretation of the I^2 statistic per Section 9.5.2 of the *Cochrane Handbook for Systematic Reviews of Interventions* ("Identifying and measuring heterogeneity").

Assessment of reporting biases

We conducted meta-analysis on fewer than 10 studies for any single measure; therefore we generated no funnel plots to examine reporting/publication bias. We conducted sensitivity analysis by removing studies with high risk of bias from the analysis and assessing the impact of this on the estimate of effect.

Data synthesis

We used a fixed-effect model to conduct a meta-analysis for relevant clinical outcomes reported across studies in a consistent manner by intervention type. We used this approach to adhere to recommendations provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We used clinical data as reported (DMFS/dmfs, DMFT/dmft and gingival health), and if both surface- and tooth-level data were provided for the same sample, we used only tooth-level data in the meta-analysis.

Subgroup analysis and investigation of heterogeneity

We used subgroup analysis based on the type of intervention to explore heterogeneity.

Sensitivity analysis

We carried out sensitivity analysis to examine the effect of excluding studies with high risk of bias from meta-analysis using a fixed-effect model. We also conducted sensitivity analysis to examine trials reporting that they were supported by commercial companies. Support could be provided in the form of direct funding or through provision of products. We undertook these analyses by repeating the meta-analyses and comparing the results.

Summary of findings tables

For each comparison, we rated the quality of the evidence for effects of interventions on outcomes as identified in [Types of outcome measures](#) by applying methods developed by the [GRADE working group](#). We determined ratings of high, moderate, low or very low by noting the number of downgrades. For randomised evidence, the quality of the evidence started at high, and we downgraded the evidence by assessing the impact of the following considerations on results of randomised studies.

- Risk of bias.
- Imprecision.
- Inconsistency.
- Indirectness.
- Publication bias

We included non-randomised studies in this review, and so we applied the extension of GRADE to evidence from non-randomised studies, starting at low. In addition to considerations for downgrading, we upgraded on the basis of the following considerations.

- Evidence of a dose-response relationship.
- Large effect based on assessment of mean differences.
- Direction of confounding opposite to what was observed.

RESULTS

Description of studies

We have provided detailed information for each study in the [Characteristics of included studies](#) tables.

Results of the search

The flow diagram in [Figure 1](#) shows the search results, which include results from both the first (January 1996 to May 2012) and the second search (June 2012 to April 2014). Electronic searching and handsearching yielded 41,888 records. After removing 13,105 duplicate records, six review authors (SH, AdS, BN, HM and two research assistants) independently and in pairs screened the titles of 28,783 records for relevance. At this stage, we found that 28,434 records were not relevant to this review, and we excluded them. We screened the abstracts of the remaining 349 articles and excluded an additional 236 articles, as they did not meet the review inclusion criteria. Reasons for excluding studies included types of interventions - chemical in nature (chlorhexidine, fluoride varnish, xylitol, sealants; $n = 129$); orthodontics ($n = 12$); testing of toothbrushing techniques ($n = 4$) - as well as study designs not included in this review - uncontrolled study design/non-interrupted time series ($n = 65$) - and setting - based primarily in clinical settings ($n = 26$).

We retrieved and screened full-text reports for the remaining 113 articles and excluded 75 additional articles. We documented the reasons for exclusion in the [Characteristics of excluded studies](#) table. We could not locate the full text of one report (Hashemian 2012), and we contacted the primary author to ask for the full report. We have classified this study under [Studies awaiting classification](#). Subsequently, we included a total of 38 studies in this review.

Included studies

The included studies were conducted across 21 countries (Argentina ($n = 1$), Australia ($n = 2$), Brazil ($n = 6$), Canada ($n = 1$), China ($n = 5$), France ($n = 1$), India ($n = 2$), Ireland ($n = 1$), Iran ($n = 3$), Japan ($n = 1$), Jordan ($n = 1$), Korea ($n = 1$), Pakistan ($n = 1$), Philippines ($n = 1$), Russia ($n = 1$), Sweden ($n = 1$), Tanzania ($n = 2$), Thailand ($n = 3$), UK ($n = 1$), USA ($n = 2$), Zimbabwe ($n = 1$)). We have provided detailed information for each study in the [Characteristics of included studies](#) tables.

It is clear that studies meeting the inclusion criteria were heterogeneous in nature. Therefore, we grouped the interventions on the basis of their primary intervention components, as described below. We have presented study results by intervention types, which may include one or more of these intervention components.

Main Intervention components include the following.

- **Dietary:** Intervention was focused on diet and was primarily related to reducing the sugar content of the diet through activities directed towards the educational setting and/or home environment. Strategies were directed towards policy implementation at the settings level or nutrition education related to healthy eating practices, frequency of between-meal snacks and reduction of sucrose intake.
- **Oral health education (OHE):** Intervention strategies comprised education related to improving oral health, provided through classroom lessons, videos, comics, brochures and demonstrations (related to toothbrushing techniques, sugar content, etc.) and measurements (plaque accumulation, presence of oral bacteria, etc.) of students and/or parents. The frequency and duration of educational activities varied
- **Supervised toothbrushing with fluoridated toothpaste:** Setting-based supervised toothbrushing programmes used fluoridated toothpaste. Toothbrushing generally was supervised daily, but weekly and twice-daily programmes were also provided. Toothbrushing occurred after meals - generally after lunch. A range of personnel provided supervision.
- **Professional preventive oral care** included some or all of the following: application of fluoride varnish, use of fluoride supplements, use of mouthwash fluoride solution, professional teeth cleaning, application of fissure sealants and restorative care.
- **Motivational Interviewing (MI):** The brief counselling approach was focused on the individual and used an empathic, collaborative style to elicit and build on individuals' own reasons for change.
- **Chewing gum:** Use of sugar-free gum was supervised up to four times daily.

Below, we describe key elements of the 38 included studies. We have provided a summary of these studies in Additional [Table 2](#).

Excluded studies

We have listed the studies excluded from this review along with reasons for exclusion in the [Characteristics of excluded studies](#) table.

Excluded studies included studies that did not report on the primary outcomes (dental caries or periodontal disease; n = 31), did not report baseline data for primary outcomes (n = 11), focused entirely on clinically administered interventions in clinical settings (n = 10) and focused solely on interventions that were chemical in nature (e.g. chlorhexidine, fluoride varnish, Xylitol; n = 3). Additionally, we excluded several studies on the basis of study design, toothpaste trials, protocols and editorials.

Risk of bias in included studies

We have summarised risk of bias across all domains for all studies included in this review in [Figure 2](#).

We rated 10 studies as having high risk of bias for sequence generation ([Ekstrand 2000](#); [Freeman and Oliver 2009](#); [Freitas-Fernandes 2002](#); [Frencken 2001](#); [Nylander 2001](#); [Schwarz 1998](#); [Shenoy 2010](#); [Tubert-Jeannin 2008](#); [Ueno 2012](#); [Vichayanrat 2012](#)) and two studies ([Schwarz 1998](#); [Shenoy 2010](#)) as having high risk of bias for allocation concealment. Of the two studies that were rated high risk in both domains of selection bias, [Schwarz 1998](#) was a controlled before-and-after study, and [Shenoy 2010](#) was a controlled before-and-after study with a cross-over design, without random allocation of participants.

One study - [Macpherson 2013](#) - was an interrupted time series (ITS). We rated this study as having low risk of bias in all relevant risk of bias domains for ITS, except one domain, for which it was unclear whether the shape of the intervention effect was prespecified. We have summarised the risk of bias for [Macpherson 2013](#) in Additional [Table 3](#).

We rated 10 studies as having unclear risk for sequence generation ([Al-Jundi 2006](#); [Arunakul 2012](#); [Hochstetter 2007](#); [Monse 2013](#); [Peng 2004](#); [Petersen 2004](#); [Rodrigues 1999](#); [Saied-Moallemi 2009](#); [Song 2004](#); [van Palenstein 1997](#)). The study designs of these studies differed. Three were randomised controlled trials ([Al-Jundi 2006](#); [Arunakul 2012](#); [Hochstetter 2007](#)), two cluster-randomised trials ([Petersen 2004](#); [Saied-Moallemi 2009](#)), four quasi-experimental controlled before-and-after studies ([Peng 2004](#); [Rodrigues 1999](#); [Song 2004](#); [van Palenstein 1997](#)) and one a controlled before-and-after trial ([Monse 2013](#)). We rated 12 studies as having low risk of bias for sequence generation ([D'Cruz 2013](#); [Feldens 2010](#); [Haleem 2012](#); [Mbawalla 2013](#); [Nammontri 2013](#); [Pakpour 2014](#); [Plutzer 2012](#); [Toassi 2002](#); [Turrioni 2012](#); [Weber-Gasparoni 2013](#); [Weinstein 2006](#); [Yazdani 2009](#)). We rated six studies ([Feldens 2010](#); [Frazão 2011](#); [Ismail 2011](#); [Rong 2003](#); [Slade 2011](#); [Tai 2009](#)) as having low risk in both domains of selection bias, as they provided a clear method of generating the random sequence of participants. We rated most studies (n = 30) as having unclear risk of bias for allocation concealment because information reported in the paper was insufficient to allow a decision.

Allocation

Of the 38 included studies, 11 studies were conducted as randomised trials ([Al-Jundi 2006](#); [Arunakul 2012](#); [D'Cruz 2013](#); [Feldens 2010](#); [Frazão 2011](#); [Hochstetter 2007](#); [Ismail 2011](#); [Plutzer 2012](#); [Turrioni 2012](#); [Weber-Gasparoni 2013](#); [Weinstein 2006](#)). Eleven studies were randomised at a cluster level (school/class/kindergarten/community) ([Haleem 2012](#); [Mbawalla 2013](#); [Nammontri 2013](#); [Pakpour 2014](#); [Petersen 2004](#); [Rong 2003](#); [Saied-Moallemi 2009](#); [Slade 2011](#); [Tai 2009](#); [Tubert-Jeannin 2008](#); [Yazdani 2009](#)). Two studies were conducted as quasi-experimental ([Ekstrand 2000](#); [Frencken 2001](#)), five as quasi-experimental/controlled before-and-after studies ([Peng 2004](#); [Rodrigues 1999](#); [Song 2004](#); [van Palenstein 1997](#); [Vichayanrat 2012](#)), five as controlled before-and-after studies ([Freitas-Fernandes 2002](#); [Monse 2013](#); [Nylander 2001](#); [Schwarz 1998](#); [Ueno 2012](#)), one as a cross-over controlled before-and-after study ([Shenoy 2010](#)), one as a before-and-after study with two active arms ([Toassi 2002](#)), one as a matched controlled trial ([Freeman and Oliver 2009](#)) and one as an interrupted time series ([Macpherson 2013](#)).

Blinding

We rated two studies ([Frencken 2001](#); [Schwarz 1998](#)) as having high risk of bias for blinding of participants and personnel (performance

bias), and three studies (Frencken 2001; Ismail 2011; Peng 2004) as having high risk of bias for blinding of outcome assessment (detection bias). These studies clearly identified that blinding could not be done because of the nature of the intervention, or because those collecting outcome data (researchers/dental examiners) could not be blinded.

We rated 13 studies as having low risk of performance bias (D'Cruz 2013; Feldens 2010; Frazão 2011; Haleem 2012; Ismail 2011; Monse 2013; Pakpour 2014; Peng 2004; Plutzer 2012; Rong 2003; Saied-Moallemi 2009; Weber-Gasparoni 2013; Yazdani 2009), and similarly nine studies (Feldens 2010; Frazão 2011; Freeman and Oliver 2009; Haleem 2012; Hochstetter 2007; Rong 2003; Saied-Moallemi 2009; Tai 2009; Yazdani 2009) as having low risk of detection bias. We rated 23 studies as having unclear risk of performance bias, and a total of 25 studies as having unclear risk of detection bias. We determined that Macpherson 2013 had low risk of bias, as it was not possible to blind participants to the intervention.

Incomplete outcome data

We rated one study as having high risk of bias (Freeman and Oliver 2009) for incomplete outcome data (attrition bias) because a high percentage of participants was missing from the final analysis. We rated 16 studies as having low risk of attrition bias (Arunakul 2012; D'Cruz 2013; Feldens 2010; Frazão 2011; Haleem 2012; Ismail 2011; Macpherson 2013; Nammontri 2013; Pakpour 2014; Peng 2004; Petersen 2004; Plutzer 2012; Saied-Moallemi 2009; Schwarz 1998; Tai 2009; van Palenstein 1997). We rated the remaining studies (n = 21) as having unclear risk, as information needed to ascertain attrition bias was insufficient.

Selective reporting

We judged this item by comparing outcomes that trialists measured and reported in the article and outcome data provided in the Results. We did not have access to the proposal of the studies to identify additional selective reporting bias. We rated one study (Ekstrand 2000) as having high risk of selective reporting (reporting bias) because data on baseline and follow-up findings were not reported for all intervention groups. We rated 15 studies as having low risk of bias (Macpherson 2013; Mbawalla 2013; Nylander 2001; Pakpour 2014; Peng 2004; Petersen 2004; Plutzer 2012; Rong 2003; Schwarz 1998; Shenoy 2010; Slade 2011; van Palenstein 1997; Weber-Gasparoni 2013; Weinstein 2006; Yazdani 2009), as all expected outcomes were reported satisfactorily. We rated the remaining studies as having unclear risk because information needed to make a judgement on reporting bias was insufficient.

Other potential sources of bias

We identified three studies (Plutzer 2012; Ueno 2012; Yazdani 2009) as having high risk of other bias. Yazdani 2009 allocated clusters by classrooms, which were close to one another, increasing the risk of contamination. The authors of this study acknowledged that contamination had occurred during post-intervention examination. Investigators in the Ueno 2012 study delivered the intervention in the same school as the control, increasing the likelihood of contamination. We rated all other studies (n = 35) as having unclear risk of other potential sources of bias, as review authors were unable to determine any other risk of bias in these studies. However, two studies (Rong 2003; Tai 2009) received funding from commercial companies, and this could have resulted in other potential sources of bias.

Researchers in five studies (Rong 2003; Schwarz 1998; Slade 2011; Tai 2009; Vichayanrat 2012) declared that they had received support (in terms of funding or study supplies, such as toothbrushes and toothpastes) from the manufacturers of oral care products. Schwarz 1998 received continuous material support from Colgate-Palmolive (Hong Kong) and Colgate (Guangzhou). For the Slade 2011 study, Colgate-Palmolive of Australia provided free supplies of Duraphat varnish and low-cost toothbrushes and toothpaste to community stores. In addition, one of the authors in Slade 2011 is the Director of the Dental Practice Education Research Unit at the University of Adelaide, which receives funding from Colgate-Palmolive Proprietary Limited. However, study authors have clearly declared that none of the study personnel, including study authors, received or receive consulting payments or any other form of personal benefit from Colgate-Palmolive. In Vichayanrat 2012, Colgate-Palmolive (Thailand), Lion (Thailand) and Diethelm & Company Limited contributed toothbrushes and toothpastes. Tai 2009 received support from Colgate-Palmolive (Guangzhou), and Rong 2003 from Procter & Gamble. Studies supported by commercial companies may be expected to have some degree of publication bias, and to report outcomes in favour of the company's products. We found some evidence of this when we performed sensitivity analyses to examine effect estimates (see Table 4). However, these results are largely inconclusive, as only a small number of interventions given to some of the groups were analysed, and for one intervention group, the only two studies in the group were commercially supported, so no comparison is available.

Effects of interventions

See: [Summary of findings for the main comparison](#) Dietary interventions; [Summary of findings 2](#) Oral health education; [Summary of findings 3](#) Oral health education + supervised toothbrushing; [Summary of findings 4](#) Oral health education + fluoride (varnish/supplement) + training/support; [Summary of findings 5](#) School-based OHE and toothpaste provision + clinic-based professional preventive oral care; [Summary of findings 6](#) Oral health education + chewing gum

Measures

- Effects: See Additional [Table 5](#): Outcomes of included studies for reporting of primary outcomes and secondary outcomes. Most studies reported measures of caries; however, across studies, measures varied on the basis of age group (primarily related to examining primary or secondary dentition) and level of measurement (tooth or surface level). As such, we grouped by outcome measure (i.e. DFMS and DMFT, as measured in permanent dentition; and dmfs and dmft as measured in primary (deciduous) dentition) the caries data presented in the meta-analysis. For cluster-randomised trials that did not correct for clustering (Nammontri 2013; Petersen 2004; Rong 2003; Tubert-Jeannin 2008), we reported the effective sample size for each study arm.
 - * Most studies reported measures of gingival health; however, we could not perform a meta-analysis because of inconsistencies in measurement and reporting.
 - * We have presented in the table of outcomes ([Table 5](#)) the findings of studies that could not be included in a meta-analysis.
- We assessed reach, adoption and outcomes against PROGRESS categories.

We present the results below.

Summary of findings tables

We presented the results by comparison in [Summary of findings for the main comparison](#); [Summary of findings 2](#); [Summary of findings 3](#); [Summary of findings 4](#); [Summary of findings 5](#) and [Summary of findings 6](#).

Effects by intervention type

Intervention type: dietary

Location: Of the three studies focusing on dietary interventions, two were conducted in Brazil ([Feldens 2010](#); [Rodrigues 1999](#)) and one in Northern Ireland ([Freeman and Oliver 2009](#)).

Target age group: The age of participants at baseline varied: Two studies involved children from birth to five years of age ([Feldens 2010](#); [Rodrigues 1999](#)), and one involved children nine years of age ([Freeman and Oliver 2009](#)).

Duration: Two studies were conducted for less than one year ([Feldens 2010](#); [Rodrigues 1999](#)), and one study was conducted for up to two years ([Freeman and Oliver 2009](#)).

Theoretical basis: All intervention development was based on government health policy. One study was also based on the socio-ecological model and the World Health Organization (WHO) health promoting schools approach ([Freeman and Oliver 2009](#)).

Implementation settings and delivery: All three studies delivered interventions in different settings that included homes ([Feldens 2010](#)), kindergartens/nurseries ([Rodrigues 1999](#)) and rural primary schools ([Freeman and Oliver 2009](#)). Two of the three studies implemented dietary interventions on the basis of national policies adopted in their respective countries - 'Ten Steps for Healthy Feeding' ([Feldens 2010](#)) and 'Boosting Better Breaks' ([Freeman and Oliver 2009](#)) - whereas [Rodrigues 1999](#) devised dietary guidelines that were based on expert recommendations. All dietary interventions focused on reducing sugar intake and/or access to and consumption of sugary foods. Additional intervention strategies included promoting exclusive breastfeeding up to six months ([Feldens 2010](#)), promoting consumption of milk and fruit and reduction of sugary snacks at break time ([Freeman and Oliver 2009](#)) and providing a recommended menu that was based on dietary guidelines as assessed by a nutritionist ([Rodrigues 1999](#)). Different professionals administered all interventions: One study utilised nutrition students ([Feldens 2010](#)), another teachers, school administrators and school policy makers ([Freeman and Oliver 2009](#)) and the third local and expert nutritionists and decision makers ([Rodrigues 1999](#)). Researchers did not comprehensively report resources and materials used within intervention programmes, including staff training and time, dental examination tools, questionnaires, resources for 'rubbish bag' collection and materials for dissemination of dietary guidelines.

Outcomes: All three studies measured primary outcomes of early childhood caries (ECC), decay experience and caries increment, as assessed by dental examination. Two studies reported positive impact on caries post intervention ([Feldens 2010](#); [Rodrigues 1999](#)), and [Freeman and Oliver 2009](#) reported no positive change in caries reduction. [Feldens 2010](#) measured the secondary outcome of severe early childhood caries (SECC) and reported a positive outcome post intervention. Investigators examined

other secondary behavioural measures, such as number of sugary snacks consumed and mother's attitudes towards children's sugar intake, with small or no positive impact reported post intervention ([Feldens 2010](#); [Freeman and Oliver 2009](#); [Rodrigues 1999](#)). Two studies provided data for the meta-analysis on caries outcomes ([Feldens 2010](#); [Rodrigues 1999](#)), although they reported different indices ([Analysis 1.1](#)). In [Feldens 2010](#), average dmft score for the intervention group was 0.90 (95% confidence interval (CI) -1.85 to 0.05) smaller than for the control group. [Rodrigues 1999](#) showed significant benefit of the intervention (dmfs -1.48, with 95% CI of -2.51 to -0.45).

Intervention type: oral health education (OHE)

Location: Seventeen studies focused on OHE ([Arunakul 2012](#); [D'Cruz 2013](#); [Frencken 2001](#); [Haleem 2012](#); [Hochstetter 2007](#); [Mbawalla 2013](#); [Nammontri 2013](#); [Pakpour 2014](#); [Plutzer 2012](#); [Saied-Moallemi 2009](#); [Shenoy 2010](#); [Song 2004](#); [Tubert-Jeannin 2008](#); [Turrioni 2012](#); [Ueno 2012](#); [Weber-Gasparoni 2013](#); [Yazdani 2009](#)). These studies were conducted across various countries (Argentina, Australia, Brazil, Japan, Korea, Tanzania, Thailand, India, Iran, Pakistan, USA and Zimbabwe).

Duration: All studies were conducted for one year or less, except [Mbawalla 2013](#), which lasted two years.

Target age group: Four studies provided interventions targeting children from birth to five years of age ([Hochstetter 2007](#); [Plutzer 2012](#); [Song 2004](#); [Weber-Gasparoni 2013](#)), six studies targeted six to 12-year-olds ([Arunakul 2012](#); [Frencken 2001](#); [Haleem 2012](#); [Nammontri 2013](#); [Saied-Moallemi 2009](#); [Tubert-Jeannin 2008](#)) and six targeted 13 to 18-year-olds ([D'Cruz 2013](#); [Mbawalla 2013](#); [Shenoy 2010](#); [Turrioni 2012](#); [Ueno 2012](#); [Yazdani 2009](#)). One study ([Pakpour 2014](#)) targeted only 15-year-olds.

Theoretical basis: We could not determine the theoretical basis for intervention development in seven studies. As reported, the intervention provided in [Frencken 2001](#) was informed by behaviour change theory, in [Haleem 2012](#) by social-cognitive theory and in [Hochstetter 2007](#) and [Tubert-Jeannin 2008](#) largely by health promotion theory, the socio-ecological model and social determinants of health. [Mbawalla 2013](#) was set within a health promoting schools approach, [Nammontri 2013](#) was informed by a sense of coherence framework, [Plutzer 2012](#) used an anticipatory guidance approach, [Turrioni 2012](#) used an educational framework, [Ueno 2012](#) used the encourage school programme framework and [Weber-Gasparoni 2013](#) was informed by self determination theory.

Implementation settings and delivery: Fifteen interventions were delivered only in educational settings ([Arunakul 2012](#); [D'Cruz 2013](#); [Frencken 2001](#); [Haleem 2012](#); [Hochstetter 2007](#); [Mbawalla 2013](#); [Nammontri 2013](#); [Pakpour 2014](#); [Saied-Moallemi 2009](#); [Shenoy 2010](#); [Song 2004](#); [Tubert-Jeannin 2008](#); [Turrioni 2012](#); [Ueno 2012](#); [Yazdani 2009](#)). Two studies ([Saied-Moallemi 2009](#); [Turrioni 2012](#)) delivered interventions at home and in an educational setting and [Weber-Gasparoni 2013](#) delivered the intervention exclusively at home. [Saied-Moallemi 2009](#) described varying degrees of parental involvement in delivering the intervention, including home-based oral health promotion activities, and [Hochstetter 2007](#) incorporated a parent education component. The intervention provided in [Plutzer 2012](#) included both home and health service settings.

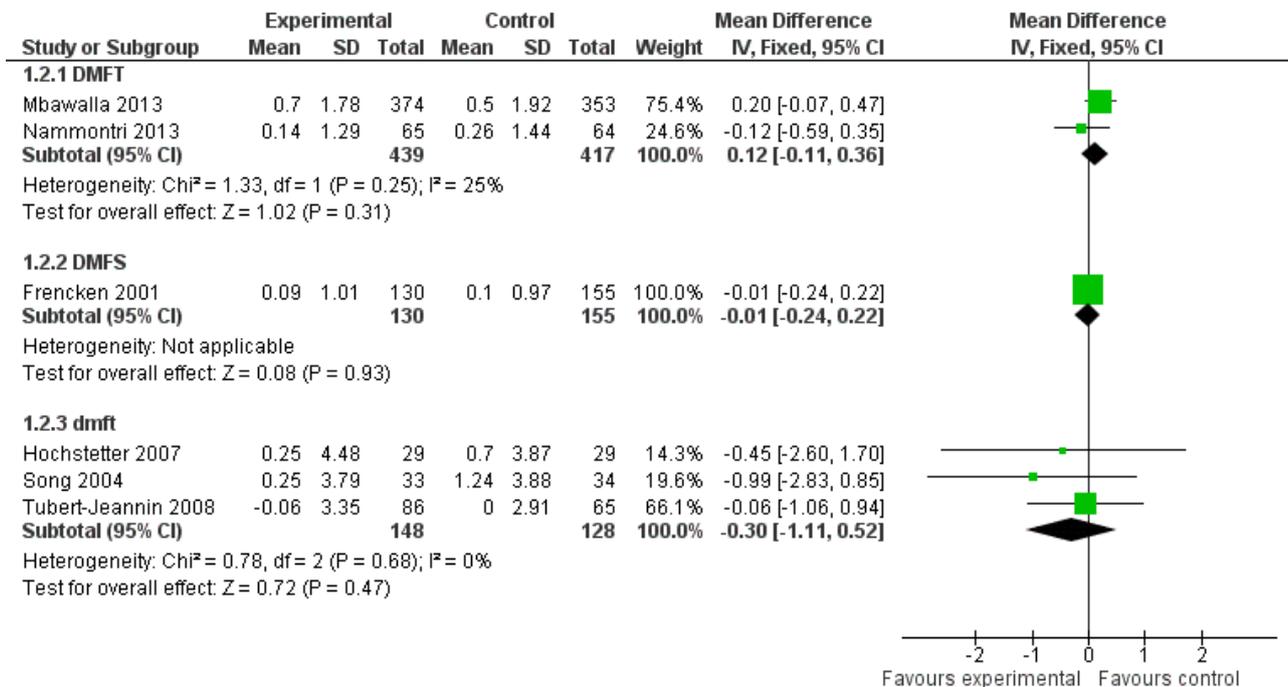
The nature of school-based OHE programmes differed. In some, teachers or dental professionals who had been trained through a train-the-trainer approach (Frencken 2001) or were directly trained (Haleem 2012; Hochstetter 2007; Nammontri 2013; Song 2004; Tubert-Jeannin 2008; Yazdani 2009) delivered programmes to students, and in others, OHE programmes were delivered directly to students (Yazdani 2009) or to their parents (Hochstetter 2007; Saied-Moallemi 2009). Three studies used research staff (Mbawalla 2013; Turrioni 2012; Ueno 2012). It was unclear who delivered the interventions in six studies. Education programmes focused on toothbrushing techniques, oral hygiene, behaviours and knowledge (oral health, plaque, tooth structure and function, causes and development of dental caries and gingivitis and caries-reducing effects of fluoride). Educational materials used included booklets, leaflets, videotapes, posters, audiovisual aids and demonstrations, including some with disclosing solution.

Outcomes: Nine of the OHE studies reported measurement of caries (Frencken 2001; Hochstetter 2007; Mbawalla 2013; Nammontri 2013; Plutzer 2012; Song 2004; Tubert-Jeannin 2008; Ueno 2012; Weber-Gasparoni 2013), and five studies reported positive impact after the intervention (Hochstetter 2007; Nammontri 2013; Plutzer 2012; Song 2004; Tubert-Jeannin 2008), with the positive impact in Song 2004 seen up to 28 weeks post intervention. Thirteen studies reported a measure of gingival health (Arunakul 2012; D’Cruz 2013; Haleem 2012; Hochstetter 2007; Mbawalla 2013; Nammontri 2013; Pakpour 2014; Saied-Moallemi 2009; Shenoy 2010; Tubert-Jeannin 2008; Turrioni 2012; Ueno 2012; Yazdani 2009), and all but one

described positive impact (Mbawalla 2013). One study (Saied-Moallemi 2009) found that girls had better gingival outcomes than boys. Three studies measured oral cleanliness (Frencken 2001; Shenoy 2010; Yazdani 2009), and all reported positive impact. One study (Mbawalla 2013), showed no impact on gingival measures among students investigated; nevertheless, compared with the control group, more favourable changes occurred in the intervention group with respect to gingival measures, in particular, bleeding on probing, suggesting a positive impact on oral hygiene status. Two studies reported measures of oral hygiene behaviours (Shenoy 2010; Song 2004), and one described a positive impact (Shenoy 2010). Results reported by Shenoy 2010 must be interpreted with extreme caution, given the cross-over design and the settings-based nature of the study (with no washout period and high risk of contamination).

Six studies provided data on caries outcomes for the meta-analysis (Frencken 2001; Hochstetter 2007; Mbawalla 2013; Nammontri 2013; Song 2004; Tubert-Jeannin 2008), although different indices were reported across studies (Analysis 1.2; Figure 3). Of these studies, two provided simple/brief oral health education (Frencken 2001; Song 2004), and the others were multi-component studies providing educational activities directed at students, parents and teachers. Analysis showed that the nature of oral health education was not related to effectiveness, and neither intervention type had a significant effect on measured outcomes (DMFT: WMD 0.12, 95% CI -0.11 to 0.36; dmft: WMD -0.30, 95% CI -1.11 to 0.52; DMFS: WMD -0.01, 95% CI -0.24 to 0.22).

Figure 3. Forest plot of comparison: oral health education interventions and control, outcome: dental caries (Analysis 1.2).



Intervention type: oral health education and supervised toothbrushing with fluoridated toothpaste

Location: Eight of the included studies (Al-Jundi 2006; Frazão 2011; Macpherson 2013; Monse 2013; Petersen 2004; Rong 2003; Schwarz

1998; van Palenstein 1997) assessed effectiveness of targeted school-based OHE combined with supervised toothbrushing programmes with fluoridated toothpaste for children’s oral health outcomes. These studies were conducted across various countries (Brazil, China, France, Jordan, Philippines, Scotland and Tanzania).

Target age group: The age range of children included in these studies varied. Four of the eight studies involved children from birth to five years of age (Frazão 2011; Macpherson 2013; Rong 2003; Schwarz 1998), and four involved six to 12-year-olds (Al-Jundi 2006; Monse 2013; Petersen 2004; van Palenstein 1997).

Duration: Two studies (Al-Jundi 2006; Monse 2013) were conducted for one year or less, three (Frazão 2011; Rong 2003; van Palenstein 1997) for one to two years and two (Petersen 2004; Schwarz 1998) for longer than two years. Macpherson 2013 is an interrupted time series study conducted over six years, with data collected via annual cross-sectional surveys (n = 99,071). This single large study contributed 80% of the total participants included in this review.

Theoretical basis: We could not determine the theoretical underpinning used to guide intervention activities in three studies, but the remaining five studies used a range of theoretical frameworks such as social determinants of health and the socio-ecological model (van Palenstein 1997), national oral health improvement policy (Macpherson 2013), the WHO health promoting schools framework (Petersen 2004), the cost-effectiveness framework (Frazão 2011) and the fit for school action framework (Monse 2013).

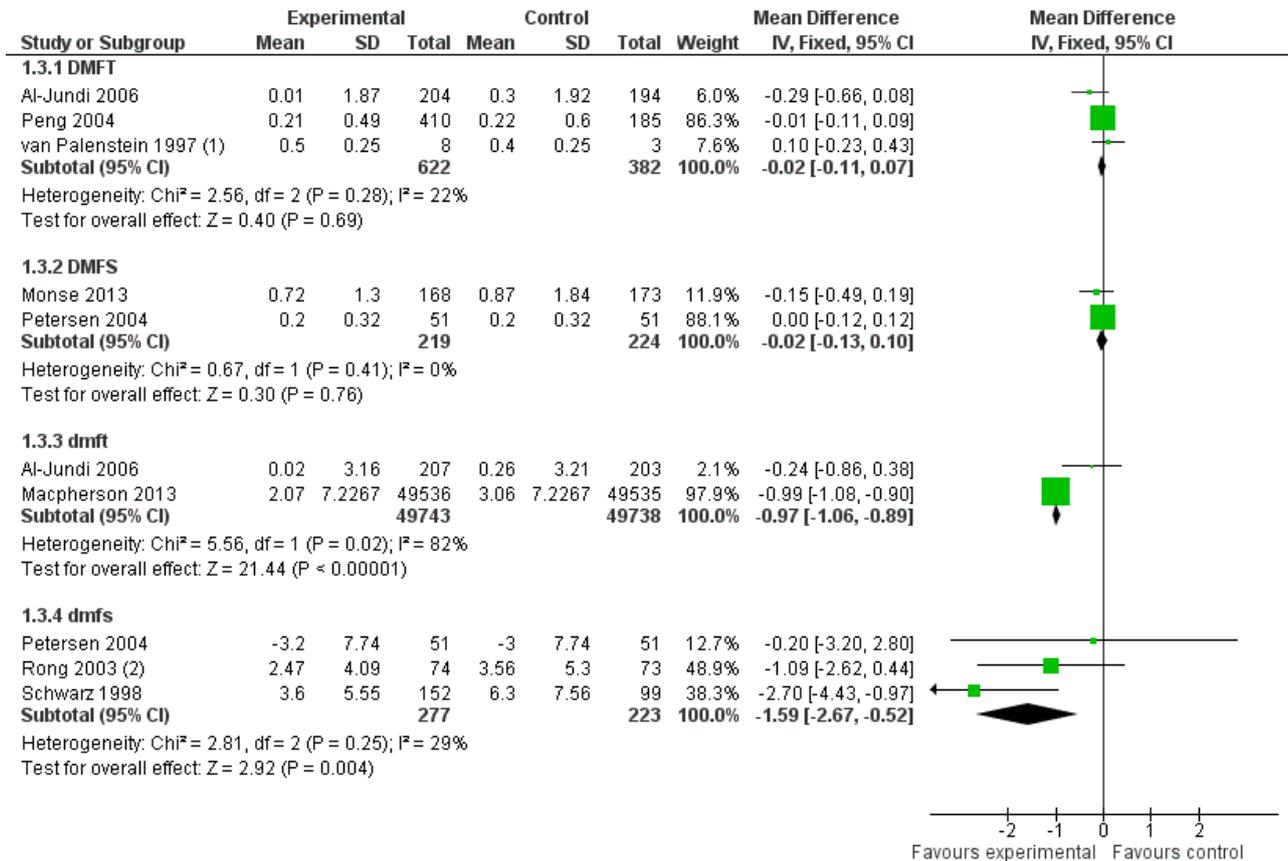
Implementation settings and delivery: All interventions were delivered in educational settings that included schools or kindergartens. Although all interventions included OHE and supervised toothbrushing components, a range of personnel delivered the interventions. In seven studies (Frazão 2011; Macpherson 2013; Monse 2013; Petersen 2004; Rong 2003; Schwarz 1998; van Palenstein 1997), teachers were trained to deliver interventions to children, and one study used dental clinicians and research assistants to deliver the intervention (Al-Jundi 2006). Intervention components included targeted educational activities largely focused on diet and nutrition, oral anatomy, the value of oral and general health, tooth development, causes and prevention of dental caries and periodontal diseases, as well as effective use of fluorides, self care and emergency

oral care, oral hygiene and toothbrushing. Educational materials included traditional PowerPoint lectures, slide shows, coloured posters, booklets and leaflets, as well as audiovisual aids and illustrative models. Teachers generally monitored the supervised toothbrushing programme. In Macpherson 2013, the intervention also included the distribution (via kindergartens) of fluoride toothpaste for home use.

Outcomes: All eight studies reported a measure of dental caries. Six of the eight studies (Al-Jundi 2006; Frazão 2011; Macpherson 2013; Monse 2013; Rong 2003; Schwarz 1998) reported that OHE in conjunction with supervised daily toothbrushing using fluoridated toothpaste had a positive impact on the caries experience among children in the intervention group, and Al-Jundi 2006 further reported that decline in caries was related to an increase in dental awareness and positive behaviour change. Two studies (Petersen 2004; van Palenstein 1997) reported no reduction in caries increment among children in the intervention schools. Macpherson 2013 evaluated the impact of the national nursery toothbrushing programme on dental caries among five-year-old Scottish children (n = 99,071) and showed a dramatic decline. A corresponding reduction in absolute inequality between dental caries rates in the most deprived areas and those in least deprived areas was observed. This is the first study to demonstrate the association between a supervised nursery toothbrushing programme and reduced dental caries at community and country-wide levels.

Eight studies provided data for the meta-analysis on caries outcomes (Al-Jundi 2006; Macpherson 2013; Monse 2013; Petersen 2004; Peng 2004; Rong 2003; Schwarz 1998; van Palenstein 1997), although different indices were reported across studies, and Macpherson 2013 used an ITS design. Peng 2004 provided data from one arm of a three-arm trial testing several interventions (Analysis 1.3; Figure 4), reporting the following effects of the intervention on caries outcomes: DMFT: WMD -0.02, 95% CI -0.11 to 0.07; DMFS: WMD -0.02, 95% CI -0.13 to 0.10; dmft: WMD -0.97, 95% CI -1.06 to -0.89; dmfs: WMD -1.59, 95% CI -2.67 to -0.52). The meta-analysis showed significant beneficial effects of the intervention on dmft and dmfs.

Figure 4. Forest plot of comparison: oral health education + supervised toothbrushing with fluoridated toothpaste interventions and control, outcome: dental caries (Analysis 1.3).



(1) Weekly supervised toothbrushing in the school
(2) Twice daily supervised toothbrushing in kindergarten

Two studies reported a measure of gingival health (Petersen 2004; van Palenstein 1997). Petersen 2004 showed that the intervention was effective in establishing good oral health habits among children, and in enhancing oral health knowledge, behaviour and attitudes among parents and teachers. van Palenstein 1997 showed only small improvement in relation to plaque and gingival bleeding and observed no improvement in oral hygiene along the gingival margin, possibly indicating that teachers may not have imparted the required skills needed for effective toothbrushing and/or children may not have practised/applied the oral health education taught at school or would have lacked parental support at home.

Intervention type: oral health education plus other interventions

Location: Ten studies (Ekstrand 2000; Freitas-Fernandes 2002; Ismail 2011; Nylander 2001; Peng 2004; Slade 2011; Tai 2009; Toassi 2002; Vichayanrat 2012; Weinstein 2006) assessed the effectiveness of OHE programmes provided in combination with other interventions. These studies were conducted across various countries (Australia, Brazil, Canada, China, Russia, Sweden, Thailand and USA).

Target age group: Four studies (Ismail 2011; Slade 2011; Vichayanrat 2012; Weinstein 2006) included children from birth to five years

of age, three included six to 12-year-olds (Freitas-Fernandes 2002; Peng 2004; Tai 2009) and two (Ekstrand 2000; Toassi 2002) included both age brackets (birth to five years, and six to 12 years of age). Nylander 2001 included 13 to 18-year-olds.

Duration: Six studies (Ekstrand 2000; Freitas-Fernandes 2002; Ismail 2011; Toassi 2002; Vichayanrat 2012; Weinstein 2006) lasted one year or less, two (Peng 2004; Slade 2011) lasted for one to two years and two (Nylander 2001; Tai 2009) lasted longer than two years.

Theoretical basis: Nine studies (Ekstrand 2000; Freitas-Fernandes 2002; Ismail 2011; Nylander 2001; Peng 2004; Slade 2011; Tai 2009; Toassi 2002; Weinstein 2006) used a range of frameworks, including social determinants and the socio-ecological model, health promoting schools, policy frameworks, pedagogical motivational approaches, social-cognitive theories and motivational interviewing and behaviour change, and one study (Vichayanrat 2012) used self efficacy theory, the health belief model, social support and organisational change theory.

Implementation settings and delivery: Five of the 10 studies (Ekstrand 2000; Nylander 2001; Peng 2004; Tai 2009; Toassi 2002) delivered interventions in educational settings, and one study (Ekstrand 2000) used both educational and health service settings. Three studies (Ismail 2011; Vichayanrat 2012; Weinstein 2006)

provided home-based interventions. Two of these interventions involved supplementary settings such as community (Ismail 2011) and health service (Vichayanrat 2012). One study (Slade 2011) included a multi-component community-wide intervention that comprised a range of settings such as home, health service and community, and another study (Freitas-Fernandes 2002) specifically delivered the intervention at an orphanage.

A range of personnel delivered these interventions. One study (Slade 2011), alongside the project team (dental clinicians), used health centre staff directly trained to deliver the intervention. One study (Vichayanrat 2012), in addition to health centre staff, employed lay health workers to deliver the interventions. Two studies (Peng 2004; Tai 2009) trained teachers to deliver the interventions alongside dental clinicians. Two studies included motivational interviewing (MI); one study (Ismail 2011) trained Master's level community therapists as motivational interviewers, and the second study (Weinstein 2006) specifically trained three local South Asian women as MI counsellors. In Freitas-Fernandes 2002, investigators trained nuns to deliver the intervention components, and in three studies (Ekstrand 2000; Nylander 2001; Toassi 2002), it was unclear who had delivered the interventions. None of the studies reported any adverse effects resulting from the interventions.

Ekstrand 2000 and Tai 2009 provided multi-component intervention programmes implemented over two to three years, including strategies developed for parents, teachers and children. In Tai 2009, teachers delivered the oral health programme alongside dental health professionals, who conducted the examinations and provided educational sessions at school. Intervention components included targeted counselling sessions; educational activities on diet and nutrition, oral hygiene and caries prevention; supervised toothbrushing including application of fluoride varnish; and community engagement. Educational materials included health education resources such as charts, books, pamphlets, brochures, DVD instructions, lecture slides and audiovisual aids.

Outcomes

OHE and professional preventive oral care in non-clinical settings

- **OHE + Fluoride varnish + Professional development:** Slade 2011 reported that twice-yearly fluoride varnish application combined with community health promotion activities considerably reduced caries increment (by 2.3 to 3.5 surfaces per child) among high-risk children (dmfs: mean difference (MD) -3.00, 95% CI -4.91 to -1.09) (Analysis 1.4).
- **OHE + Fluoride supplements + Social support:** Vichayanrat 2012 showed that the multi-level oral health promotion intervention, which sought to change behaviour through home visits, social support, education, fluoride supplements and access to health services, significantly increased toothbrushing and use of toothpaste and fluoride supplements among participating children. Investigators noted positive improvement in caregivers' oral health knowledge and attitudes, outcome expectations and self efficacy. However, the intervention had no effect on dental caries (P value > 0.05), and caries actually increased in both control and experimental groups (dmfs: MD -0.57, 95% CI -2.05 to 0.91) (Analysis 1.4). Findings from this study confirm that multi-level

factors influence reported oral health behaviour, but not clinical outcomes.

School-based OHE and toothpaste provision + Clinic-based professional preventive oral care

Two studies (Ekstrand 2000; Tai 2009) comprised multi-component intervention programmes that provided educational and dietary information for multiple stakeholders and provided toothpaste through the schools and professional tooth cleaning and application of fluoride varnish, sealants and curative treatments as needed. Ekstrand 2000 did not report a significant effect of the intervention on dental caries. Tai 2009 showed a significantly lower mean net DMFS increment score three years after the intervention was provided. Tai 2009 also reported plaque and sulcus bleeding increment scores that were significantly lower in the intervention group after three years. Investigators also described positive trends in restorations received, sealants placed, amount of untreated dental caries and oral health-related behavioural practices (i.e. toothbrushing, dental visits and use of fluoride toothpaste).

Meta-analysis of these two studies showed a significant beneficial effect of the intervention on caries: DMFT: WMD -0.09, 95% CI -0.1 to -0.08; two studies, 1458 participants; P value < 0.0001, I² = 97% (Analysis 1.5).

- **OHE + Motivational Interviewing (MI):** Ismail 2011 reported that MI of caregivers had some positive impact on certain oral health behaviours such as checking the child's teeth for pre-cavities and ensuring that the child brushed at bedtime; however the MI intervention did not reduce the number of new untreated carious lesions among children. Weinstein 2006 reported positive effects of MI on caries among children, with those in the MI group exhibiting noticeably less new caries than those in the control group. Toassi 2002 reported positive impact on plaque and the gingival bleeding index in both intervention (MI through four pedagogical sessions) and control (one explanatory session on oral hygiene) groups; however, the positive effect was greater in the intervention group.
- **OHE + Chewing gum:** Peng 2004 reported that caries increment was considerably lower (42%) in the group that received sugar-free chewing gum in addition to OHE compared with the group receiving OHE and supervised toothbrushing. The effect of intervention on DMFT was beneficial but non-significant (MD -0.08, 95% CI -0.18 to 0.02) (Analysis 1.6). Peng 2004 also reported a positive impact on bleeding scores for children in the intervention groups; the bleeding score was substantially lower in the group receiving OHE and chewing gum than in the group receiving OHE and toothbrushing.
- **OHE + Diet (focus on sugar):** Nylander 2001 reported virtually no difference in caries development in the intervention group compared with the reference group, although all increment figures in the intervention group were lower than those in the reference group. Differences were not statistically significant, with the exception of proximal enamel caries (P value < 0.05). It is important to note that this study was conducted among a low-caries risk population.

Assessment of reach, adoption and outcomes against PROGRESS categories

Reach (geographical setting)

Ten of the included studies were conducted in developed countries, and 28 were carried out in developing countries. However, three of the studies carried out in developed countries (Ismail 2011; Slade 2011; Ueno 2012) specifically targeted socially disadvantaged groups with high risk of dental caries. According to the World Bank income classification of countries based on economies, 12 studies (Ekstrand 2000; Freeman and Oliver 2009; Ismail 2011; Macpherson 2013; Nylander 2001; Plutzer 2012; Slade 2011; Song 2004; Tubert-Jeannin 2008; Ueno 2012; Weber-Gasparoni 2013; Weinstein 2006) were carried out in high-income countries; 19 (Al-Jundi 2006; Arunakul 2012; Feldens 2010; Frazão 2011; Freitas-Fernandes 2002; Hochstetter 2007; Nammontri 2013; Pakpour 2014; Peng 2004; Petersen 2004; Rodrigues 1999; Rong 2003; Saied-Moallemi 2009; Schwarz 1998; Tai 2009; Toassi 2002; Turrioni 2012; Vichayanrat 2012; Yazdani 2009) in upper-middle-income countries; five (D'Cruz 2013; Frencken 2001; Haleem 2012; Monse 2013; Shenoy 2010) in lower-middle-income countries and two (Mbawalla 2013; van Palenstein 1997) in low income countries.

Included studies were conducted in a range of regions, with most studies (n = 18) undertaken in Asia - across Eastern (n = 7), Southern (n = 7), South-Eastern (n = 3) and Western Asia (n = 1). Ten studies were carried out in the Americas - across both South (n = 7) and North America (n = 3), five were conducted in Europe (Eastern (n = 1), Northern (n = 3) and Western Europe (n = 1)), two in Oceania (Australia and New Zealand (n = 2)) and three in Africa (all in Eastern Africa).

Overall, 29 studies showed positive impact of the interventions on dental caries or gingival health. Studies demonstrating positive impact were predominantly based in Asia (n = 16), followed by the Americas (n = 8), Europe (n = 3) and Oceania (n = 2). Nine studies across a range of regions showed no effects of the interventions on dental caries or gingival health. These nine studies were conducted in Africa (n = 3), Asia (n = 2), the Americas (n = 2) and Europe (n = 2).

Eleven studies implemented interventions that included strategies to address diversity and disadvantage. Most of these studies (n = 6) took place in the Americas (Brazil (n = 4), Argentina (n = 1), USA (n = 1)), followed by Asia (n = 3) (Japan (n = 1), India (n = 1), Thailand (n = 1)), Oceania (n = 1) (Australia (n = 1)) and Europe (UK (n = 1)). Six of these 11 studies (Feldens 2010; Frazão 2011; Ismail 2011; Macpherson 2013; Rodrigues 1999; Shenoy 2010) specifically targeted children of low socio-economic status (SES). Five studies targeting low SES communities showed positive impact of intervention on dental caries or gingival health, but one study (Ismail 2011), which specifically targeted African American children of low SES, showed no reduction in caries increment following intervention. Three studies (Hochstetter 2007; Turrioni 2012; Ueno 2012) specifically targeted vulnerable children and those at high social risk, and all three studies showed positive effects of the intervention on dental caries or gingival health. One study (Arunakul 2012) targeted hearing impaired children and demonstrated positive impact on gingival health. Another study (Slade 2011) targeted children from remote indigenous communities and showed positive impact of the intervention on caries increment.

Adoption (stakeholder involvement and institutionalisation)

Only four studies (Freeman and Oliver 2009; Slade 2011; van Palenstein 1997; Vichayanrat 2012) outlined a clear process of negotiation or contact with stakeholders during planning stages of the intervention. Freeman and Oliver 2009 noted a process of negotiation with several stakeholders (principal teachers, class teachers, parents, wholesalers and providers of milk, fruit and vegetables) during the development phase of the intervention. Slade 2011 used community consultations to develop interventions alongside council members, community elders and other community leaders, and researchers set up an indigenous reference group, for which individuals could make recommendations. van Palenstein 1997 conducted interviews with head teachers and teachers before the intervention was developed, to understand knowledge gaps and develop an appropriate oral health education programme. No other studies explicitly refer to stakeholder involvement in planning and implementation of the intervention. Vichayanrat 2012 noted a programme preparation phase that included conducting a formative study with programme implementers (interviews with health staff, stakeholder meetings and group discussions with lay health workers). Results from the formative study and from meetings and group discussions were used to guide programme planning and intervention development.

As many studies were delivered in school settings, we can infer that most studies (Al-Jundi 2006; Arunakul 2012; D'Cruz 2013; Ekstrand 2000; Frazão 2011; Freeman and Oliver 2009; Frencken 2001; Haleem 2012; Hochstetter 2007; Macpherson 2013; Mbawalla 2013; Monse 2013; Nammontri 2013; Nylander 2001; Pakpour 2014; Peng 2004; Petersen 2004; Rong 2003; Saied-Moallemi 2009; Schwarz 1998; Tai 2009; Tubert-Jeannin 2008; Turrioni 2012; Ueno 2012; van Palenstein 1997; Yazdani 2009) negotiated with school administrators or teachers to implement the intervention. One study (Shenoy 2010) identified the limitation of not involving teachers and school administrators in delivery of the intervention.

Many interventions were aimed at improving oral health-related behaviours, and several studies (Feldens 2010; Freeman and Oliver 2009; Hochstetter 2007; Ismail 2011; Peng 2004; Rong 2003; Saied-Moallemi 2009; Slade 2011; Tai 2009; Weinstein 2006) delivered intervention components to parents or caregivers. Despite this fact, it does not appear that parents and caregivers were involved in the development of intervention strategies or were engaged as stakeholders. Studies on oral health promotion interventions using the World Health Organization "Health Promoting Schools" approach (Mbawalla 2013; Peng 2004; Petersen 2004; Tai 2009) involved the district Department of Health or National Ministry of Health in planning before the programme was implemented.

PROGRESS categories

Of the 38 included studies, 15 did not report on PROGRESS categories, and categories were unclear in two studies (Song 2004; Toassi 2002). PROGRESS categories commonly reported in the remaining 23 studies included socio-economic status (SES), education, gender, race and residence. At baseline, 12 studies (Feldens 2010; Freeman and Oliver 2009; Ismail 2011; Macpherson 2013; Mbawalla 2013; Nammontri 2013; Pakpour 2014; Plutzer 2012; Rodrigues 1999; Shenoy 2010; Tai 2009; Vichayanrat 2012) reported on SES, 12 studies (D'Cruz 2013; Feldens 2010; Frazão 2011; Ismail 2011; Mbawalla 2013; Monse 2013; Nylander 2001; Pakpour 2014; Peng 2004; Slade 2011; Tai 2009; Ueno 2012) reported on

gender, three (Ismail 2011; Mbawalla 2013; Slade 2011) reported on residence (rural, urban and remote), seven (Feldens 2010; Ismail 2011; Pakpour 2014; Plutzer 2012; Rodrigues 1999; Shenoy 2010; Tai 2009) reported on the level of education of parents, two (Ismail 2011; Slade 2011) reported on race and one (Arunakul 2012) reported on disability (specifically hearing impaired).

Of the 23 studies that reported PROGRESS categories at baseline, only seven studies (Feldens 2010; Frazão 2011; Mbawalla 2013; Plutzer 2012; Rodrigues 1999; Shenoy 2010; Slade 2011) analysed results by any of the PROGRESS items. Of these studies, Frazão 2011 showed that although differences in caries rates were observed in both genders, the programme was seen to be more effective among boys independent of the variation in their caries experience and in their age; among girls, investigators observed no significant differences. Plutzer 2012 noted no differences in clinical outcomes based on SES, but researchers reported that loss to follow-up was more frequent when mothers were younger, separated or single, had lower levels of education, had lower income and did not have dental insurance. Shenoy 2010 showed marked plaque and gingival score reductions in intervention schools, but these were not influenced by SES status (high income vs low income). Nevertheless, SES influenced oral hygiene aids (toothbrushes and toothpastes) used and the frequency of change in toothbrushing, indicating the need for basic oral hygiene aids free of cost or at concessional rates to disadvantaged communities. Mbawalla 2013 showed that their intervention was not effective in noticeably reducing oral health differences related to gender and residence status versus those recorded at baseline. Caries increment was most pronounced among rural students, whereas gender and urban rural differences in bleeding scores not present at baseline appeared at follow-up. Similarly, Slade 2011 showed that the community-level fluoride varnish intervention was effective in reducing caries among remote indigenous high-risk communities with inadequate access to dental services. It should be noted that 10 studies (Feldens 2010; Freeman and Oliver 2009; Freitas-Fernandes 2002; Ismail 2011; Mbawalla 2013; Rodrigues 1999; Shenoy 2010; van Palenstein 1997; Weinstein 2006; Yazdani 2009) targeted interventions solely towards low-income and/or disadvantaged groups.

Maintenance of impact

Twenty three studies clearly reported duration of post-intervention follow-up, with follow-up ranging from less than one year to four years. Four studies (D'Cruz 2013; Nammontri 2013; Pakpour 2014; Weber-Gasparoni 2013) included short-term follow-up of less than one year. D'Cruz 2013 had three-, six- and nine-month follow-up points post intervention, and the study showed improvement in oral hygiene knowledge and practices, including gingival and plaque scores, at follow-up. Nammontri 2013 had three-month follow-up, and the study showed improved gingival status and oral health beliefs at follow-up. It was also evident that worse oral health symptom status at baseline predicted worse functional status at three-month follow-up. Pakpour 2014 had two-week and 24-week follow-ups, and investigators reported higher rates of brushing and flossing at follow-up than were seen in the control group. Weber-Gasparoni 2013 had one-month and six-month follow-ups and observed more positive changes for dietary and oral hygiene behaviours among mothers in the intervention groups.

A few studies had a longer-term follow-up period ranging from one to seven years. Hochstetter 2007 had follow-up of only one year and did not report a significant effect at follow-up. Ekstrand 2000; Ismail 2011; and Rong 2003 evaluated interventions two to 2.5 years post intervention. Only Rong 2003 observed a sustained significant impact on dental caries. Four studies (Feldens 2010; Frencken 2001; Nylander 2001; van Palenstein 1997) followed up study participants for three years or longer post intervention. Among these studies, only Feldens 2010 observed sustained improvement in caries after programme implementation. Only Tai 2009 observed both active continuation of programme activities and positive improvement in clinical outcomes after three years. Freeman and Oliver 2009 and Rodrigues 1999 assessed dietary policy interventions (to reduce sugar consumption among preschool children), and these policy interventions showed no clear indication of the end of the intervention. Plutzer 2012 followed the impact of the intervention initiated before birth, for up to seven years after birth. The study showed that all measures of caries severity were lower in the intervention group than in the control group at follow-up, but these differences were not statistically significant. Three studies (Mbawalla 2013; Petersen 2004; Tai 2009) are known to be evaluating ongoing long-term programme impact.

DISCUSSION

Summary of main results

This review includes 38 studies of community-based population-level interventions for promoting child oral health, with a total of 119,789 children. Interventions were generally implemented for less than one year ($n = 26$), and about half ($n = 11$) of studies were randomised controlled trials. Investigators tested a variety of oral health promotion strategies: dietary interventions ($n = 3$), oral health education alone ($n = 17$), oral health education in combination with a supervised toothbrushing programme ($n = 8$) and oral health education in combination with a variety of other interventions ($n = 10$). The broad spectrum of oral health promotion interventions tested and the mixed approaches to intervention dose, delivery and reporting make it difficult to pool outcome data; however, meta-analyses of available data suggest that oral health education alone is the least effective intervention and on its own will not make a difference in caries.

Researchers generally found oral health promotion interventions that included supervised toothbrushing with fluoridated toothpaste to be effective in reducing caries in children, although some investigators found these interventions to be non-effective. Varied effects may be related to the level of supervision provided and the frequency of toothbrushing involved. Interventions that combined oral health education with professional preventive oral care were also effective in reducing dental caries in children. Many studies used a multi-component approach and multi-setting interventions; although interventions were varied in nature (oral health education coupled with interventions such as toothpaste provision, chewing gum, motivational interviewing, professional oral care, training of non-dental professionals, fluoride varnish application and fluoride supplements), most studies in this group reported positive impact. Interventions that focus on diet and reduced sugar consumption also hold promise for reducing caries; additional studies are needed.

Overall completeness and applicability of evidence

The small number of studies that have examined each intervention type limits our ability to draw firm conclusions about effectiveness, although interventions that integrate settings-based oral health education with toothbrushing programmes or professional preventive oral care appear to be most effective. When interventions of this nature are considered, issues of access, cost and appropriateness of care must be explored. However, investigators have rarely reported evidence related to approaches to intervention development and delivery or cost-effectiveness and equity of impact and adverse outcomes, leaving gaps in the evidence base. The stage of childhood when delivery of interventions is most effective for children remains unclear, although interventions that coupled oral health education with toothbrushing programmes including fluoridated toothpaste have been found effective in reducing caries in deciduous teeth, and interventions that comprise oral health education and professional dental care have been effective in reducing caries in children's permanent teeth. Investigators have not often examined the long-term sustainability of impact, but this is clearly an important consideration, as oral disease is a chronic condition.

Our ability to draw firm conclusions from the evidence reviewed is limited because of the nature of the included studies. In particular, we highlight the following limitations of these studies.

- Less than one in five of these studies (18%) were conducted in lower-middle-income or low-income countries.
- Included studies were conducted in various regions, but most were undertaken in Asia.
- Most studies lasted less than one year.
- Close to two-thirds of studies assessed post-intervention follow-up, and the period of follow-up ranged from less than one year to four years. Reported sustainability of impacts varied across studies, and only a few studies looked at long-term sustainability.
- Most studies did not include strategies to address diversity and disadvantage, although about one-quarter of studies were implemented solely in highly disadvantaged groups. Although included studies that provided access to education and oral health services addressed disadvantage in some way, evidence related to implementation and acceptability of the intervention, long-term impact and sustainability was generally lacking, as was evidence on whether characteristics of the study population (e.g. socio-economic status (SES), ethnicity, education level) were related to the effectiveness of interventions. These aspects limit our ability to draw conclusions on the applicability and transferability of intervention strategies to other populations and contexts.
- Researchers did not widely report stakeholder engagement and involvement in intervention development and implementation, and only a few studies appear to have taken such an approach.
- Most studies targeted early (38%) and middle (41%) childhood. Only a few targeted adolescence.
- Most studies reported on at least one of the PROGRESS categories at baseline, and the categories most frequently reported were SES, education, gender, race and residence.
- Only one-third of studies reported analysis of results by any of the PROGRESS items, and items reported against varied across studies.

- Many published reports did not provide a clear description of implementation factors.
- Investigators have only rarely collected or reported economic or cost-effectiveness data.
- Study findings generally show inconsistency in intervention components tested, in intensity and duration of tested interventions and in reporting of outcomes.

The 38 included studies show substantial variation in intervention strategies and components, age groups of participants, study settings, intervention doses provided, training for implementation and personnel who delivered the interventions, as well as considerable differences in impact and outcome measures and in personnel who collected data. Various moderators such as social environment, parent and teacher involvement and use of dental health services have been identified to influence oral health behaviour change and clinical outcomes. Our review identified that more than half of the interventions tested were developed on the basis of sound theory for health promotion, population health or behaviour change. Although intervention development was not always based on theory, this represents improvement in findings from those of earlier evidence reviews and is a promising development. Despite this fact, only a few studies have investigated how these moderators may have affected intervention outcomes. Further, only a few studies that reported behaviour change outcomes also examined associations of these with clinical outcomes. Researchers must undertake these important analyses to further our understanding of the pathways involved, ranging from oral health promotion to clinical impact. Although several studies have reported on the cost of implementing interventions, we found few economic evaluations of the interventions included in this review, resulting in lack of cost-effectiveness data upon which decision makers can rely.

There does not appear to be any particular bias associated with the studies that were commercially funded when compared with the others of the same intervention type, however the number of studies is small and definitive conclusions cannot be made (see [Table 4](#)).

Quality of the evidence

We graded the evidence as having moderate to very low quality. All studies had some form of limitation regarding risk of bias. Several studies lacked thorough reporting methods and provided insufficient information to permit informed judgement about risk of bias. This review included both randomised and non-randomised controlled trials. Selection bias could present concern in non-randomised studies. A few such studies included in this review attempted to minimise the impact of potential selection bias. Whilst selection bias can be controlled in randomised controlled trials, a few such trials lacked information on randomisation methods and the process of allocation concealment. When sufficient details were lacking, we reported unclear risk for these domains. Similarly, only a few trials reported blinding of participants and personnel. A few reported blinding but failed to explain the blinding process. In studies in which only personnel were blinded, results suggest that lack of participant blinding probably had minimal consequences for outcome assessment. In only a few studies was outcome assessment reportedly conducted by examiners blinded to treatment allocation. Contamination was another important

factor in this review. Many studies in this review were cluster-randomised trials, and although a few acknowledged the risk of contamination and its impact on study findings, it is often not possible to avoid contamination when community-based health promotion interventions are implemented. We further downgraded the quality of the evidence as a result of serious imprecision arising from small sample sizes, or from wide confidence intervals around estimated effects.

Potential biases in the review process

We must note certain limitations of this review. Although we conducted a comprehensive search for studies, we were able to include only studies published in some form. It is likely that important studies have been undertaken but remain unpublished in the public domain. Furthermore, studies with positive results favouring treatment were more likely to be published, and this fact could introduce bias into the results. As the result of resource constraints, we did not contact the authors of included studies to request missing data, and this could have resulted in exclusion of specific studies. To be included in this review, studies had to report on one or more of the primary outcomes while presenting baseline and post-intervention measurements, or change scores. Inclusion of studies based only on primary outcomes could have resulted in exclusion of certain types of studies.

Agreements and disagreements with other studies or reviews

This review presents results that are broadly consistent with those of previous reviews on this topic (Cooper 2013; Kay 1998; Marinho 2002; Marinho 2004; Marinho 2013; Tubert-Jeannin 2011), which found insufficient significant, high-quality evidence to measure efficacy of dental interventions for child oral health. This review examined different types of interventions than were studied in previous reviews, as we have examined only community-based interventions implemented outside of a dental clinical setting, while focusing primarily on effects of interventions on dental caries and gingival health of children from birth to 18 years of age. Previous reviews have studied the effects of interventions on child oral health while investigating a specific type of intervention, such as fluoride varnish (Marinho 2004; Marinho 2013) or fluoride supplement (Tubert-Jeannin 2011) and interventions that are not community-based nor delivered in clinical settings. Only one study, Saied-Moallemi 2009, was included in both this review and another review (Cooper 2013). Review authors rated risk of bias of this study equally, with the exception of reporting bias and other bias, both of which were rated as having unclear risk by the authors of this review, and as having high and low risk respectively in Cooper 2013. Similar to previous reviews (Cooper 2013; Kay 1998; Marinho 2004; Marinho 2013; Tubert-Jeannin 2011), we measured primary outcomes of dmfs/DMFS, dmft/DMFT and gingival index. Previous reviews found significant caries-inhibiting effects of interventions utilising fluoride varnish on both primary and permanent teeth (Marinho 2013), and of fluoride supplements on permanent teeth (Tubert-Jeannin 2011). The Kay 1998 review on effectiveness of dental health education interventions did not focus exclusively on interventions for children and identified studies that essentially focused on interventions directed towards individual behaviours.

The findings of this review are largely consistent with the findings of Cooper 2013 and confirm lack of cost-benefit analysis in the included studies. Consistent with the Petersen 2004 review,

we identified that the design and evaluation of community oral disease prevention programmes and oral health promotion programmes must be improved to improve the quality of the evidence upon which clinical decisions can be based. Further, we highlight the lack of consistency in community oral disease prevention programmes and health promotion programmes in relation to design, implementation and evaluation. Although we found regular use of theory in intervention development, we noted no consistency in application of these theories in terms of implementation or evaluation.

AUTHORS' CONCLUSIONS

Implications for practice

This review of studies published from January 1996 to April 2014 reveals testing of a range of interventions for promoting child oral health. We found little evidence that oral health education alone can make a difference in the level of tooth decay, although some studies have reported improvement in gum health, oral hygiene behaviours and oral cleanliness. Oral health promotion interventions combined with supervised toothbrushing with fluoridated toothpaste were generally found to be effective in reducing caries in children's deciduous teeth. Interventions consisting of oral health education provided in an educational setting combined with professional preventive oral care in a dental clinic were effective in reducing caries in children's permanent teeth. We found many studies that examined multi-component and multi-setting interventions. Although these interventions were varied in nature (oral health education coupled with interventions such as toothpaste provision, sugarless chewing gum, motivational interviewing, professional oral care, training of non-dental professionals, fluoride varnish application and fluoride supplements), most studies in this group reported positive impact. Interventions focused on diet and reduced sugar consumption also hold promise for reducing caries, but further research of this nature is needed. In addition, strong links between children's settings and community-based dental services are required to ensure that children receive the treatment or preventive services needed, as early as possible. In some studies, access to professional oral care was standard across the study population, and this was not tested as part of the intervention. In other studies, professional oral health care was included in the intervention programme, and investigators delivered a range of services in community or clinical settings.

Interventions included in this review were diverse and were delivered in a range of childhood settings including education, community, health care and home. It remains unclear which intervention approach is best suited to promote child oral health across a range of community contexts because of the small number of studies that have tested each intervention type. Although most of the interventions included in this review were delivered in educational settings, studies did not broadly report on the nature and extent of engagement with students, caregivers or oral health service providers. More work is needed to assist care providers in recognising the multiple influences of broader determinants linked to clinical oral health outcomes, for example, oral health knowledge, behaviours and practices, and healthcare systems including psychosocial environments. Further, the authors of this review could not determine who is best placed to deliver oral health promotion interventions. We suggest that the ability to integrate intervention strategies and

specific activities (such as oral hygiene practices, fluoride varnish application, curriculum-based teaching and policy) into current activities within specific settings and services may be dependent on the level of engagement, consultation and ownership of the programme implemented. Less reliance on dental professionals and researchers to deliver interventions and increased reliance on cross-sector multi-disciplinary teams should be tested if we are to progress to cost-effective and sustainable solutions for promoting child oral health. Activities underpinned by theory, such as the health promoting school approach, community capacity building and community engagement, in addition to known oral health promotion frameworks, would reveal best practice. Further, integration of oral health promotion interventions with approaches to improvement in other non-communicable diseases (e.g. smoking, cancer) is needed, as is implementation of interventions that address the broader social determinants of child oral health.

Key points

- Oral health education in isolation was not effective in reducing caries; the quality of evidence was low or very low.
- Integrating oral health education with supervised toothbrushing with fluoridated toothpaste or professional oral care practices can improve dmft and dmfs, but effects on DMFT and DMFS were smaller.
- Strong links between children's settings and community-based dental services are important for oral health promotion.
- Community context and the influence of broader determinants are important considerations.
- Stakeholder engagement and collaboration are important, given that interventions are implemented in a variety of child and community settings.

Implications for research

Researchers could strengthen the evidence base by applying scientific rigour and quality standards to the design, implementation, delivery and reporting of future intervention studies. Further, researchers must undertake analysis that expands our understanding of determinants, moderators and pathways involved in promoting oral health in children, while exploring relationships between and across multiple levels of influence that we know exist in relation to oral disease development and prevention. To enable this, investigators must provide data collected and reported according to factors such as age, gender, socio-economic status and geographical location.

Cost-effectiveness data are critical for policy makers, planners and public health service providers and have not been provided in oral health promotion intervention studies of the nature included in this review. Researchers must measure and report the ability to sustain both oral health promotion strategies implemented within specific settings and the impact of such interventions. In addition, we were unable to locate adequate evidence related to adverse or unintended consequences of interventions. Future intervention studies should attempt to answer important questions related to cost-effectiveness, long-term sustainability and adverse outcomes. Questions related to equitable impact of interventions also need urgent attention, given the large disparities in oral disease observed across many communities.

It is imperative that effective interventions are described in a manner that allows them to be replicated or at least assessed for suitability of use in other contexts. Available information must enable adaptations performed to suit community needs, without losing effective components of the interventions. Clear articulation of the following details of intervention studies is important to allow this.

- Process of intervention development (including stakeholder engagement, theoretical frameworks and community context).
- Intervention (and components) delivered (including by whom, resources and support needed to achieve effective implementation and intensity and frequency of delivery).
- Implementation duration (recognising that no end date of implementation for a policy intervention may be known).
- Sample recruitment, allocation and blinding.

Key points

- Researchers have tested a range of oral health promotion interventions, but available evidence on effectiveness of oral health promotion interventions for clinical oral health outcomes is generally limited and is not of high quality.
- Investigators found that oral health education in isolation was not effective in reducing caries.
- The most promising intervention approaches seem to include improving access to fluoride in its various forms or reducing sugar consumption, although evidence is limited.
- Future interventions would be improved by involvement of a variety of stakeholders in intervention development and implementation, and should be underpinned by theory while addressing the broader determinants of child oral health.
- Testing is needed for oral health promotion interventions that adopt a common risk factor approach, and oral health promotion must be integrated with approaches designed to improve other non-communicable disease.
- Most interventions tested were provided for one year or less; this limitation of the interventions reviewed does not allow determination of long-term impact.
- The evidence base would be strengthened by application of scientific rigour and quality standards to the design, implementation, delivery and reporting of future intervention studies.
- Cost-effectiveness data are critical for policy makers, planners and public health service providers and are currently insufficient.

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CHARACTERISTICS OF STUDIES
Characteristics of included studies [ordered by study ID]
Al-Jundi 2006

Methods	Study design: randomised controlled trial
	Conducted in: Jordan
	Unit of randomisation: schools
	Unit of analysis: individual
	Setting: 4 schools, Irbid City, Jordan

Al-Jundi 2006 (Continued)

Funded by: "Higher Council for Science and Technology sponsored the program"

Duration of the study: 4 years

Participants	<p>Inclusion criteria: all children in selected schools</p> <p>Exclusion criteria: children with fixed orthodontic appliances, those with advanced systemic or periodontal disease</p> <p>Age at baseline: 6 to 12-year-olds (age group 1 = 6.3 years; age group 2 = 11.7 years)</p> <p>N (controls baseline): 436</p> <p>N (controls follow-up): 397</p> <p>N (interventions baseline): 420</p> <p>N (interventions follow-up): 411</p> <p>Recruitment: from schools</p> <p>Gender: at baseline, male = 412, female = 444</p>
Interventions	<p>Intervention: All children were examined annually in September over 4 years. The intervention group received 30-minute oral hygiene instruction sessions on 5 consecutive school days. These included 10-minute lecture given by the main author on the importance and methods of oral hygiene using a colour poster, 10 minutes on the method of toothbrushing using a large model and 10 minutes of practiced toothbrushing using the horizontal scrub method under supervision. The other component was daily supervised brushing with fluoridated toothpaste</p> <p>Control: Children in the control group received the same oral hygiene instruction sessions, but without practical demonstration and application of toothbrushing technique</p> <p>Duration of intervention: 30-minute oral hygiene sessions</p>
Outcomes	DMFT ¹ /deft ² , percentage caries free
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: clinical examination tools, toothpaste, toothbrush, training, research assistant and dental hygienist</p> <p>Who delivered the intervention: main author, dental hygienist and research assistants</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: gender</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: The programme was deemed expensive because of the cost of providing supplies and disposable materials such as cups, napkins, etc., as well as paying the supervising person</p>
Notes	
Risk of bias	
Bias	Authors' judgement Support for judgement

Al-Jundi 2006 (Continued)

Random sequence generation (selection bias)	Unclear risk	Only limited information was provided: method of sequence generation not described - study states only "a random sample of male and female children in the first and sixth grades was drawn from lists provided by four schools"
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Arunakul 2012

Methods	Study design: randomised controlled trial Conducted in: Thailand Unit of randomisation: individual Unit of analysis: individual Setting: 3 schools for the deaf/hearing impaired Funded by: "The study was supported by the Faculty of Dentistry, Mahidol University" Duration of the study: 3 months
Participants	Inclusion criteria: not reported Exclusion criteria: not reported Age at baseline: 6 to 10 years N (controls baseline): 20 N (controls follow-up): 16 N (video presentation baseline): 20 N (video presentation follow-up): 17 N (illustrated book baseline): 20 N (illustrated book follow-up): 16 N (video + Illustrated book baseline): 20

Arunakul 2012 (Continued)

N (video + illustrated book follow-up): 17

Recruitment: Baseline study was conducted at 3 hearing impaired schools (Nonthamburi, Nakhon Pathom and Thungmahamek) in Thailand. After the baseline study, 80 hearing impaired students were randomly divided into 4 groups

Gender (M/F)

Video presentation = 15/5

Illustrated book = 13/7

Video + illustrated book = 13/7

Control group = 10/10

Interventions	<p>3 intervention groups included</p> <ul style="list-style-type: none"> Video presentation group: received oral health instruction via video presentation and toothbrushing instructions Illustrated book group: received oral health instruction via illustrated book and toothbrushing instructions Video presentation + illustrated book group: received oral health instruction via video and illustrated book and toothbrushing instructions <p>Control: received no oral health instruction</p> <p>Duration of intervention: not reported, but follow-up measurements were taken after 3 months</p>	
Outcomes	<p>Gingival index</p> <p>Gingival bleeding index</p>	
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: disability. Study participants had hearing impairment</p> <p>PROGRESS categories analysed at outcome: disability. Study participants had hearing impairment</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: Study targeted hearing impaired students</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Unclear
Allocation concealment (selection bias)	Unclear risk	Unclear

Arunakul 2012 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate was low (17.5%)
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

D'Cruz 2013

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: schools in Bangalore, India</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: individual</p> <p>Setting: school</p> <p>Funded by: not disclosed</p> <p>Duration of the study: 9 months</p>
Participants	<p>Inclusion criteria: school children 13 to 15 years of age, those willing to participate</p> <p>Exclusion criteria: school children with systemic diseases and conditions and under medication, those undergoing orthodontic treatment</p> <p>Age at baseline: 9 months</p> <p>N (control group) baseline: 300; follow-up: 284</p> <p>N (intervention group 1) baseline:150; follow-up: 140</p> <p>N (intervention group 2) baseline: 150; follow-up: 143</p> <p>Recruitment: Experimental and control schools were selected through a 2-stage random sampling method using a table of random numbers</p> <p>Gender</p> <p>I group 1: male = 47.5%, female = 52.5%</p> <p>I group 2: male = 47.6%; female = 52.4%</p> <p>C: male = 51.8%, female = 48.2%</p>
Interventions	<p>Interventions</p> <p>Intervention group 1: oral health education delivered through a PowerPoint presentation</p>

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D'Cruz 2013 (Continued)

Intervention group 2: oral health education delivered through a PowerPoint presentation combined with demonstration of toothbrushing using study models

Control: no intervention

Duration of intervention: not reported

Outcomes	Gingival index Plaque index
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Table of random numbers was used
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition was only 6% in experimental group 1, 4.7% in experimental group 2 and 5.3% in the control group
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Study is described as double-blind, but information related to blinding is unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Ekstrand 2000

Methods	<p>Study design: quasi-randomised trial</p> <p>Conducted in: Solntsevky, Russia</p> <p>Unit of randomisation: not applicable</p> <p>Unit of analysis: individual</p> <p>Setting: kindergartens in Solntsevky, a district in Moscow with high caries prevalence, Russia</p> <p>Funded by: not disclosed</p> <p>Duration: 2.5 years</p>
Participants	<p>Inclusion criteria: Inclusion criteria for children in groups B and C were that first/second permanent molars had begun to erupt or were just about to do so. Groups B and C were screened to find the 100 in the earliest stage of eruption of permanent first and second molars</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: group A: 3-year-olds, group B: 6-year-olds, group C: 11-year-olds</p> <p>N (controls baseline): group A: 0, group B: 50, group C: 50</p> <p>N (controls follow-up): group A: 45, group B: 50, group C: 49</p> <p>N (intervention baselines): group B: 50, group C: 50</p> <p>N (intervention follow-up): group A: 45, group B: 50, group C: 49</p> <p>Recruitment: through kindergarten</p> <p>Gender: Percentage of girls and boys was about 50% in each group A, B and C</p>
Interventions	<p>Interventions</p> <p>Group A: Education was given to the parents in two 45-minute lectures. Parents received information about caries, reducing sweets between mealtimes and brushing teeth twice per day. The second lecture was given to reinforce parents' knowledge of methods to prevent caries</p> <p>Group B: Programme was based on intensive patient and parent education, training and toothbrushing, professional tooth cleaning and local application of 2% sodium fluoride and sealants - all given according to individual requirements. Two 45-minute lectures with the same information as in group A were given. Information about plaque removal was given, and parents were asked to supervise brushing in the morning and to brush their child's teeth at night using fluoridated toothpaste</p> <p>Group C: Preventive programme was organised at the polyclinic, with two 45-minute lectures given to children. Emphasis on eruption period of second permanent molar</p> <p>Control: Children attending control groups B and C followed the dental service provided by the local public dental health service. This meant that none of the children were covered by any caries-preventive programme, but like all other children in the district, they were screened by dentists when they reached the ages of 6 and 11 years. Suggestions for treatment were given according to restorative treatment needs</p> <p>Duration of intervention: 2.5 years</p>
Outcomes	<p>Caries status and gingival status, caries status in primary dentition, caries status in permanent dentition, course of occlusal caries on permanent first molars, course of occlusal caries on permanent second molars</p>
Implementation related factors	<p>Theoretical basis: policy</p>

Ekstrand 2000 (Continued)

Resources for implementation: education sessions, parent training, toothbrushes, toothpaste (fluoridated and sodium fluoridated)

Who delivered the intervention: unclear

PROGRESS categories assessed at baseline: not reported

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Most participants were selected with the use of random methods in Groups B and C selecting every second child
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	High risk	Published report does not present data on all expected outcomes. Baseline and follow-up data were not reported for Groups A and C
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Feldens 2010

Methods

Study design: randomised controlled trial

Conducted in: Sao Leopoldo, Brazil

Unit of randomisation: hospital/home

Unit of analysis: mother-child pairs

Setting: municipal public health facilities and home

Feldens 2010 (Continued)

Funded by: "This project was supported by the Brazilian National Council for Scientific and Technological Development (CNPq). Manuscript writing was supported by the National Institute of Science and Technology for Health Technology Assessment (IATS)"

Duration of the study: 4 years

Participants

Inclusion criteria: mothers of apparently normal, single, full-term (37 weeks) babies with birth weight over 2500 g, mothers who gave birth from October 2001 to June 2002

Exclusion criteria: impediment to breastfeeding (HIV/AIDS) or congenital malformation

Age at baseline: 12.0 to 16.0 months

N (controls baseline): 300

N (controls follow-up): 199

N (interventions baseline): 200

N (interventions follow-up): 141

Recruitment: through hospitals based on time of delivery

Gender: 340 children were examined at follow-up at 4 years of age; 195 (57.4%) were boys

Interventions

Intervention: consisted of nutritional advice administered through home visits within 10 days of the child's birth, monthly visits up until 6 months, then visits at 8, 10 and 12 months. Advice was based on *Ten Steps for Healthy Feeding*, a Brazilian national health policy. Dietary advice was aimed at exclusive breast feeding for up to 6 months; after this point, mothers were encouraged to continue to breastfeed and to introduce foods gradually. Mothers were advised not to use bottles or pacifiers. All mothers were advised against addition of sugars to foods and against consumption of soft drinks, sweets and savoury snacks

Control: not reported

Duration of intervention: Monthly advice was given up to 6 months, then at 8 months, 10 months and 12 months

Outcomes

ECC³ and S-ECC⁴ (DMFT)

Implementation related factors

Theoretical basis: policy

Resources for implementation: staff, resources to conduct home visits, clinicians, clinical examination tools.

Who delivered the intervention: 12 university-level nutrition students implemented the intervention

PROGRESS categories assessed at baseline: gender, SES⁵, education

PROGRESS categories analysed at outcome: gender, SES, education

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: low socioeconomic.

Economic evaluation: not reported

Notes

500 mother-child pairs enrolled

Risk of bias

Bias

Authors' judgement

Support for judgement

Feldens 2010 (Continued)

Random sequence generation (selection bias)	Low risk	Randomisation was conducted by a researcher not involved in eligibility and entry of participants into the study, to warrant treatment allocation concealment. Mothers who had agreed to participate were sequentially included on a list on the basis of time of delivery, grouped in blocks of 5, and their names were separated and placed in opaque sealed envelopes. Two mothers from each block were assigned to the intervention group, and the others were allocated to the control group. This process was repeated for consecutive blocks
Allocation concealment (selection bias)	Low risk	Allocation was concealed
Incomplete outcome data (attrition bias) All outcomes	Low risk	Losses comprised 122 children (intervention: n = 42/200, 21%; controls: n = 80/300, 27%) at first year dental examination and 38 additional children (intervention: n = 17, 8.5%; controls: n = 21, 7.0%) at 4 years of age. Losses at assessment at 1 and 4 years of age were caused mainly by family relocation, inability to locate the address and refusal to participate. Study authors concluded: "due to the similarity in baseline characteristics between those lost and those not, between the treatment groups analysed, including their use of dental services, and the similar proportion of overall losses in each group (30% of the intervention group, 34% of controls) that selection bias was unlikely to be a major problem"
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Nutrition students not involved in the intervention and blinded to group allocation carried out face-to-face structured home interviews with the mothers of all children at 6 and 12 months post partum. Dental examinations at 4 years were performed by the same blinded examiner who performed first year follow-up
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Nutrition students not involved in the intervention and blinded to group allocation carried out face-to-face structured home interviews with the mothers of all children at 6 and 12 months post partum. Dental examinations at 4 years were performed by the same blinded examiner who performed first year follow-up

Frazão 2011

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: Sao Vicente, Brazil</p> <p>Unit of randomisation: preschools</p> <p>Unit of analysis: individual</p> <p>Setting: preschool</p> <p>Funded by: "Funding provided by the Foundation for the Support of Research of the State of São Paulo, Brazil and the Department of Health, Sao Vicente City Hall"</p> <p>Duration of the study: 18 months</p>
Participants	<p>Inclusion criteria: All children 5 years of age showing ≥ 1 permanent molar with ≥ 1 surface exposed were considered eligible</p>

Frazão 2011 (Continued)

Exclusion criteria: not reported

Age at baseline: mean age in control group: 68.40 months

Mean age in test group: 68.56 months

N (control baseline): 130

N (intervention baseline): 154

Carious lesions of enamel/dentin were analysed in 284 children who met eligibility criteria. Loss of eligible participants was 3.3% (3/90) and 2.7% (8/288), respectively, at first and third follow-up

Recruitment: not reported

Gender

- **Control:** F = 66/M = 64
- **Intervention:** F = 94/M = 60

Interventions

Intervention: On test drives, in addition to this conventional activity (oral health education), an oral health auxiliary was able to apply, with permanent molars erupted and both superiors and inferiors, the bucco-lingual brushing technique using the participant's brush

Control: Control units: Conventional programme composed of oral health education and presentation of plaque followed by brushing with fluoride toothpaste (1100 µg/g gF) overseen by a dental health aide was held 4 times a year. Educational component was developed through playful activity in the classroom, lasting 30 to 40 minutes, in which participants were encouraged to identify friends and enemies of the health of teeth. Children were provided with a children's toothbrush, and daily brushing was indirectly supervised by teachers in the covered patio of the school. This was carried out 4 times per year

Duration of intervention: 5 times per year

Outcomes

Dental caries (dmft⁶)

Implementation related factors

Theoretical basis: cost-effectiveness

Resources for implementation: not reported

Who delivered the intervention: dentists and teachers

PROGRESS categories assessed at baseline: age and gender

PROGRESS categories analysed at outcome: age and gender

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: low-income areas

Economic evaluation: For calculation of costs, direct expenses related to human and material resources were considered. Costs were calculated on the basis of the number of work hours and the units of brush and toothpaste consumed. Effectiveness was measured by the number of carious lesions found throughout the study (18 months). Calculation of cost-effectiveness was expressed by the marginal difference in actual expenditures for injury avoided. To allow comparison between programmes, spending were standardised for 18 months, and values were adjusted for each thousand children, with separate analyses for girls and boys. Values in Brazilian reais were converted on the basis of the commercial dollar exchange rate for the half the study period (29/Apr/2008-US \$ 1 = R \$1.70). Modified programme cost about \$3.04 per child, resulting in a marginal cost-effectiveness ratio of \$35.50 per avoided injury, with around \$10.00 per avoided injury among boys (highest risk group)

Notes

Frazão 2011 (Continued)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation occurred by preschool, and preschool children were distributed randomly to test and control groups. Although the study used preschool as the unit of randomisation to avoid contamination, the individual level was the primary focus of the study outcome and was adopted as the inference level
Allocation concealment (selection bias)	Low risk	Allocation concealment was not possible, given the nature of the intervention. All activities were similar in intervention and control groups, except cross-brushing on surfaces of first permanent, which was delivered to children in the intervention group. In the control group, oral health education and dental plaque dyeing followed by toothbrushing with fluoride dentifrice supervised directly by a dental assistant was undertaken 4 times per year. In addition to these activities, children in the test group undertook professional cross-brushing on surfaces of the first permanent molar delivered by a specially trained dental assistant 5 times per year
Incomplete outcome data (attrition bias) All outcomes	Low risk	The dropout rate in the study was very low. Rates were 3.3% and 2.7%, respectively, because of participant absence from preschool
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Examiner was kept masked to group assignment, and dental assistant in charge of the control units was kept blinded about differential characteristics of the intervention in test preschools. Participants were kept unaware of whether they belonged to control or test units
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Examiners were blinded to differential characteristics of the intervention in test preschools

Freeman and Oliver 2009

Methods	Study design: matched controlled trial Conducted in: Northern Ireland Unit of randomisation: N/A Unit of analysis: individual Setting: rural primary school Funded by: "This research project was funded by the NHS R&D Programme Primary Dental Care" Duration of the study: 24 months
Participants	Inclusion criteria: children in year 5 (9 years of age), whose parents consented to participate in the study Exclusion criteria: not reported

Freeman and Oliver 2009 (Continued)

Age at baseline: 9 years

N (controls baseline): 175

N (controls follow-up): 73

N (interventions baseline): 170

N (interventions follow-up): 74

Recruitment: invited to participate

Gender: not reported

Interventions

Intervention: school-based policy called 'Boosting Better Breaks' to reduce the consumption of sugary energy-dense foods. This policy entailed

- providing milk, water and fresh fruits during break time in BBB schools
- closing tuck shops where energy-dense sugary foods are sold during break times
- engaging teachers to prevent rewarding pupils with confectionery and sugar-sweetened drinks

Control: no intervention

Duration of intervention: 24 months

Outcomes

Decay experience (D_{3CV}MFT)

Implementation related factors

Theoretical basis: socio-ecological model: policy that embraced health promoting schools features (Boosting Better Breaks - BBB)

Resources for implementation: questionnaire, resources for 'rubbish bag method' collection, community dentist and dental nurse

Who delivered the intervention: teachers, school administrators and school policy makers

PROGRESS categories assessed at baseline: SES

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	No randomisation
Allocation concealment (selection bias)	Unclear risk	Children were blinded to the reason they were asked to take part to reduce bias
Incomplete outcome data (attrition bias) All outcomes	High risk	56% of children (96) were excluded from final analysis because of missing data and attendance at BBB schools; 58% (102) attended control schools

Freeman and Oliver 2009 (Continued)

Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Low risk	A single independent community dentist and dental nurse who were blinded to BBB participation status carried out dental examinations

Freitas-Fernandes 2002

Methods	<p>Study design: controlled before-and-after study</p> <p>Conducted in: Brazil</p> <p>Unit of randomisation: not applicable</p> <p>Unit of analysis: individual</p> <p>Setting: children living in a Santo Antonio orphanage in the city of Niteroi, located 14 km from the city of Rio de Janeiro, Brazil</p> <p>Funded by: "This study was financed by CAPES, Brazil. Partial support for the study was provided by Unigranrio (Duque de Caxias, Rio de Janeiro)"</p> <p>Duration of the study: 6 months</p>
Participants	<p>Inclusion criteria: children with all first molars erupted, children living at the orphanage</p> <p>Exclusion criteria: not stated</p> <p>Age at baseline: 7 to 11 years</p> <p>N (controls baseline): 14</p> <p>N (controls follow-up): 12</p> <p>N (interventions baseline): 28</p> <p>N (interventions follow-up): 25</p> <p>Recruitment: from an orphanage</p> <p>Gender: 100% female</p>
Interventions	<p>Intervention: professional teeth cleaning, oral hygiene instructions and prophylaxis programme. Children received education on the origin and prevention of gingivitis, instructions on how to brush their teeth, demonstrations on oral hygiene practice and individual instructions</p> <p>Control: not reported</p> <p>Duration of intervention: 6 months</p>
Outcomes	Plaque index and gingival index

Freitas-Fernandes 2002 (Continued)

Implementation related factors

Theoretical basis: social determinants of health, socio-ecological model and health promotion

Resources for implementation: oral hygiene instruction, prophylaxis, rubber cups and abrasive paste, dental floss and toothbrushes, education and disclosing solution

Who delivered the intervention: nuns at the orphanage

PROGRESS categories assessed at baseline: not reported

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	42 children with all first molars erupted were selected from 80. They were stratified by age and were divided into 2 groups: 14 children serving as controls, and 28 as an experimental group
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Frencken 2001

Methods

Study design: quasi-experimental

Conducted in: Zimbabwe

Unit of randomisation: school

Unit of analysis: individual

Setting: sub-Saharan Africa, Mutoko District in Mashonaland East Province

Frencken 2001 (Continued)

Funded by: unclear in terms of support/funding. However, the study stated, "Assistance for the study was provided by the following institutions: the Ministry of Health, Dental Department of Zimbabwe, Provincial Hospital Mashonaland East, District Hospital in Mutoko, District Education Office in Mutoko, headmaster and teachers of all participating schools in Mutoko District"

Duration of the study: 3.5 years (1992 to 1996)

Participants

Inclusion criteria: grade 2 and grade 4 children, children from schools accessible by vehicle that had representatives attending the oral health education (OHE⁷) programme

Exclusion criteria: not reported

Age at baseline: grade 2, mean age = 8.1 years; grade 4, mean age = 10.4 years

N (controls baseline): 488 (229 grade 2, 259 grade 4)

N (controls follow-up): 309 (133 grade 2, 176 grade 4)

N (interventions baseline): 477 (221 grade 2, 256 grade 4)

N (interventions follow-up): 297 (135 grade 2, 162 grade 4)

Recruitment: school

Gender: at baseline, 439 boys, 526 girls

Interventions

Intervention: oral health education workshop and information pack administered to 1 teacher and the headmaster of each school

Control: not attending workshops

Duration of intervention: 1.5 days

Outcomes

Plaque accumulation and caries increment

Implementation related factors

Theoretical basis: behaviour change

Resources for implementation: workshop on oral health and rehabilitation, teacher time, toothbrush and chewing sticks, fluoridated toothpaste, oral health instruction booklet and OHE lessons

Who delivered the intervention: ministry of health staff

PROGRESS categories assessed at baseline: not reported

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias
Bias
Authors' judgement
Support for judgement

Random sequence generation (selection bias)

High risk

A total of 9 rural schools were selected and were proportionately divided between those having attended the workshop (4 experimental) and those not attending the workshop (5 control)

Frencken 2001 (Continued)

Allocation concealment (selection bias)	Unclear risk	No concealment
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding of personnel. Researchers were involved in outcome measurement. "The evaluation could not be done blind, as the evaluators were involved in designing the study"
Blinding of outcome assessment (detection bias) All outcomes	High risk	No blinding

Haleem 2012

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Karachi, Pakistan</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individual</p> <p>Setting: private and public schools</p> <p>Funded by: "The preventive oral health care project for secondary school children, of which the present trial formed an evaluative component, was funded by the World Health Organization/Government of Pakistan Collaborative Program - Oral Health Component through Shaikh Zayed Medical Complex (Pakistan)"</p> <p>Duration of the study: 2 years</p>
Participants	<p>Inclusion criteria: all public and private schools with ≥ 1 section of class 6 and not fewer than 35 students per section in the cosmopolitan city of Karachi. Schools were eligible to participate if they were located in towns with socio-economic and ethnic homogeneity</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 10 to 11 years</p> <p>N (controls baseline): 8 schools, 324 children</p> <p>N (controls follow-up): 8 schools, 290 children</p> <p>N (dentist-led baseline): 8 schools, 333 children</p> <p>N (dentist-led follow-up): 8 schools, 303 children</p> <p>N (teacher-led baseline): 8 schools, 333 children</p> <p>N (teacher-led follow-up): 8 schools, 307 children</p>

Haleem 2012 (Continued)

N (peer-led baseline): 8 schools, 341 children

N (peer-led follow-up): 8 schools, 325 children

N (self learning baseline): 8 schools, 326 children

N (self learning follow-up): 8 schools, 292 children

Recruitment: All public and private schools with ≥ 1 section of class 6 and not fewer than 35 students per section in the cosmopolitan city of Karachi were eligible to participate

Gender: not reported

Interventions	<p>Oral health education was delivered to 4 groups distinguished by the person who delivered the intervention. These groups were dentist-led, teacher-led, peer-led and self learning.</p> <p>One hour of oral health education included education on functional and psychosocial roles of healthy teeth, anatomy of the teeth, dietary education and daily brushing with fluoridated toothpaste and demonstration of toothbrushing</p> <p>Control: received no oral health education</p> <p>Duration of intervention: 1-hour session</p>	
Outcomes	Periodontal health	
Implementation related factors	<p>Theoretical basis: social-cognitive theory</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: dentists, teachers, peer and self</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Lottery method was used to allocate schools to respective groups
Allocation concealment (selection bias)	Low risk	All clusters were randomised at once
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate was low (< 10%)
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear

Haleem 2012 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Dentist and dental assistant who conducted oral examination and structured interview, respectively, were kept blinded to group allocation of study participants right from baseline until the end of the study
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Schools were assigned numbers and alphabets to conceal the allocated school from outcome assessors and the data management team

Hochstetter 2007

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: Argentina</p> <p>Unit of randomisation: individual</p> <p>Unit of analysis: individual</p> <p>Setting: Buenos Aires</p> <p>Funded by: not disclosed or reported</p> <p>Duration of the study: 1 year</p>
Participants	<p>Inclusion criteria</p> <ul style="list-style-type: none"> • Parent's commitment to comply with the programme and participate in all activities • Children in good general/systemic health • No antibiotics or medications affecting salivary glands within 3 months before the study <p>Exclusion criteria: not reported</p> <p>Age at baseline: 4.17 ± 0.27 years</p> <p>Total at baseline: 58</p> <p>N (controls baseline): 29</p> <p>N (controls follow-up): 29</p> <p>N (interventions baseline): 29</p> <p>N (interventions follow-up): 29</p> <p>Recruitment: selected a state school in Buenos Aires serving children at social risk</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: preventive-educational programme for parents, teachers and children</p> <ul style="list-style-type: none"> • Educational programme for parents aimed at increasing awareness of children's dental health and supervision of child's daily oral hygiene • Educational programme for teachers aimed at developing their skills to supervise oral hygiene of children in the experimental group • Educational programme for children aimed at developing self care behaviours and education on the mouth, plaque-associated disease and plaque prevention. Application of acidulated sodium fluoride phosphate. Daily supervised toothbrushing using toothpaste containing 0.12% sodium fluoride

Hochstetter 2007 (Continued)

Control: preventive programme of application of acidulated sodium fluoride phosphate. Daily supervised toothbrushing with toothpaste containing 0.12% sodium fluoride

Duration of intervention: unclear

Outcomes	Caries increment, gingival and index
Implementation related factors	<p>Theoretical basis: life course, social determinants of health, socio-ecological model and health promotion</p> <p>Resources for implementation: educational materials for programme, training and trainer, fluoride varnish, toothpaste and toothbrushes, dentist</p> <p>Who delivered the intervention: dentists</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: selected a state school serving children at social risk</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The school was selected on the basis of including children at social risk. No mention of how random generation of participants was conducted
Allocation concealment (selection bias)	Unclear risk	No mention of how participants were allocated
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	All outcome data are reported as means and confidence intervals on a graph that has errors in labelling of control and experimental groups
Other bias	Unclear risk	Control and experimental groups went to the same school
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Examiners were blinded

Ismail 2011

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: Detroit, Michigan, USA</p> <p>Unit of randomisation: household (child + caregiver)</p> <p>Unit of analysis: children</p> <p>Setting: low-income African American population in Detroit, Michigan</p> <p>Funded by: "This study was supported with funding from the National Institute of Dental and Craniofacial Research, the Delta Dental Fund of Michigan, and the University of Michigan's Office of Vice Presidential Research"</p> <p>Duration of the study: 6 years</p>
Participants	<p>Inclusion criteria: housing units with families making < 250th percentile of the poverty line and having ≥ 1 African American child < 5 years old</p> <p>Exclusion criteria: only 1 child from birth to 5 years of age per family was selected for inclusion</p> <p>Age at baseline: intervention group = 4.63 years, control group = 4.51 years</p> <p>Total N at (baseline): 1021</p> <p>N (controls baseline): 515</p> <p>N (controls follow-up): 300</p> <p>N (interventions baseline): 506</p> <p>N (interventions follow-up): 299</p> <p>Recruitment: Participating families were recruited in a longitudinal study of determinants of dental caries in 1021 randomly selected children (0 to 5 years) and their caregivers</p> <p>Gender</p> <ul style="list-style-type: none"> • Intervention group: 55.5% = female, 44.5% = male • Control group: 53% = female, 47% = male
Interventions	<p>Intervention: 15-minute educational video and motivational interview session. Follow-up phone call within 6 months of receipt of the intervention by the caregiver. Personalised oral health brochure outlining child's oral health goals</p> <p>Control: 15-minute educational video</p> <p>Duration of intervention: 15-minute DVD + average 40-minute intervention sessions</p>
Outcomes	<p>New non-cavitated, new cavitated, new untreated lesions</p>
Implementation related factors	<p>Theoretical basis: social-cognitive theory, socio-ecological model, motivational interviewing</p> <p>Resources for implementation: 2-day training session covering basic principles of MI⁸, DVD, educational material such as glossy brochure and magnet, motivational interviewer</p> <p>Who delivered the intervention: trained motivational interviewer</p> <p>PROGRESS categories assessed at baseline: place, race, gender, SES, education</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p>

Ismail 2011 (Continued)

Intervention included strategies to address diversity or disadvantage: African American population, low socioeconomic group

Economic evaluation: approximate cost per Swedish crown provided (refer to page 90, Nylander 2001)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A random number was generated for each child using the RAND function in MS Excel. Random numbers were classified into odd and even numbers, and each child was assigned to 1 of the 2 groups
Allocation concealment (selection bias)	Low risk	Assignment of children was masked to participants, project staff (with the exception of co-ordination desk and interviewing staff), examining dentists and analysis
Incomplete outcome data (attrition bias) All outcomes	Low risk	A small number of missing values (< 4% for any single item) was imputed using IVEware (51), a SAS-callable software application. IVEware imputes missing and non-substantive ('don't know' or 'refused') responses using a multiple imputation method in which a sequence of regression models are fit, and values are drawn from predictive distributions. Missing values for dental outcomes were not imputed
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Assignment of children was masked to participants, project staff (with the exception of co-ordination desk and interviewing staff), examining dentists and analysis
Blinding of outcome assessment (detection bias) All outcomes	High risk	Examining dentists, desk co-ordinating officer and analysts were not blinded

Macpherson 2013

Methods	<p>Study design: interrupted time series</p> <p>Conducted in: Scotland</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individual</p> <p>Setting: nurseries participating in national toothbrushing programme</p> <p>Funded by: "Childsmile is funded by the Scottish Government. Data collections were funded by the National Health Service (NHS)"</p>
Participants	<p>Inclusion criteria: not applicable</p> <p>Exclusion criteria: not applicable</p>

Macpherson 2013 (Continued)

Age at baseline: 5 years

Total number of participants: 99,071 (multiple cross-sectional dental epidemiological surveys of 5-year-old children in Scotland between 1987 and 2009)

Recruitment: through nurseries participating in national toothbrushing programme

Gender: not reported

Interventions	<p>Intervention: daily supervised toothbrushing in nurseries. Distribution of fluoridate toothpaste through nurseries to encourage home toothbrushing</p> <p>Control: N/A</p> <p>Duration of intervention: 6 years (annual cross-sectional surveys)</p>
Outcomes	Caries (d3mft)
Implementation related factors	<p>Theoretical basis: national policy</p> <p>Resources for implementation: not published</p> <p>Who delivered the intervention: nursery staff</p> <p>PROGRESS categories assessed at baseline: SES</p> <p>PROGRESS categories analysed at outcome: SES</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: no. Study authors resent findings based on deprivation categories, using Castairs Socio-economic Deprivation Score (DepCat - DepCAT 1 was the most affluent, and DepCAT 7 the least affluent). In the post-intervention period for DepCat 6-7, children's mean d3mft decreased from 4.48 in the reference period to 2.77 in the period between year 10 and year 12, whereas for DepCat 1-2, the decrease was less profound - from 1.52 to 1.10</p> <p>Economic evaluation: not reported</p>
Notes	See Table 3 for Risk of bias table

Mbawalla 2013

Methods	<p>Study design: cluster-randomised trial</p> <p>Conducted in: Arusha, Tanzania</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: individual</p> <p>Setting: secondary schools</p> <p>Funded by: "This study was part-funded by a grant from the Norwegian Cooperation Programme for Development, Research and Education (NUFU) and in part from the Faculty of Medicine and Dentistry, University of Bergen"</p> <p>Duration of the study: 2 years</p>
Participants	<p>Inclusion criteria: public school with > 200 students, willing to participate in the project and become an HPS school</p> <p>Exclusion criteria: not reported</p>

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Mbawalla 2013 (Continued)

Age at baseline: not reported. 2 age groups: 12 to 15 years and 16 to 21 years

N (controls baseline): urban, 549; rural, 593

N (controls follow-up): urban, 436; rural, 426

N (interventions baseline): urban, 614; rural, 656

N (interventions follow-up): urban, 448; rural, 404

Recruitment: not reported

Gender

- **Intervention:** 60.3% female, 39.7% male
- **Control:** 54.6% male, 45.5% female

Interventions	<p>Interventions</p> <ul style="list-style-type: none"> • Oral health integrated with health promoting schools (HPS⁹). Self administered questionnaires at both baseline and follow-up • Oral health examinations. HPS activities based on the WHO¹⁰ principle • Oral health education sessions were conducted at all 10 intervention schools. 45-minute sessions were attended by both students and teachers. Key oral health messages included brushing with fluoride toothpaste, brushing for 3 minutes at least twice per day and replacing your toothbrush. Educational poster was offered to each intervention school to serve as a reminder after the oral health session <p>Control: oral health examination</p> <p>Duration of intervention: 1 year</p>
Outcomes	Dental caries, plaque calculus and gingival bleeding
Implementation related factors	<p>Theoretical basis: health promoting schools</p> <p>Resources for implementation: training package, trainer, toothbrush, wall-fit poster</p> <p>Who delivered the intervention: a team of 3 research assistants</p> <p>PROGRESS categories assessed at baseline: gender, residence, SES</p> <p>PROGRESS categories analysed at outcome: gender, place</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: none reported</p> <p>Economic evaluation: none reported</p>
Notes	
Risk of bias	
Bias	Authors' judgement Support for judgement
Random sequence generation (selection bias)	Low risk Cluster-randomised was stratified according to urban/rural location and was assigned by a table of random numbers with clusters assigned
Allocation concealment (selection bias)	Low risk All clusters were randomised at the same time

Mbawalla 2013 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	More males than females, more rural than urban residents and more older than younger students were lost to follow-up. Although the attrition rate was moderate, loss to follow-up was not a random process and thus might have consequences for the interpretability of findings
Selective reporting (reporting bias)	Low risk	All outcomes reported
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Monse 2013

Methods	<p>Study design: controlled before-and-after</p> <p>Conducted in: Philippines</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individual</p> <p>Setting: elementary schools</p> <p>Funded by: "The Fit for School Health Outcome Study in the Philippines is financed through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH"</p> <p>Duration of the study: 1 year</p>
Participants	<p>Inclusion criteria: Public elementary schools were selected on the basis of</p> <ul style="list-style-type: none"> • Location along a highway or no more than 1 km from a highway • No problems related to law and order in the surrounding community <p>Exclusion criteria: children with systemic medical conditions and other chronic infectious diseases, such as tuberculosis</p> <p>Age at baseline: 6 to 7 years</p> <p>N (controls baseline): 173</p> <p>N (controls follow-up): 173</p> <p>N (interventions baseline): 168</p> <p>N (interventions follow-up): 168</p> <p>Recruitment: Participants were recruited from 4 randomly selected public elementary schools that were randomly assigned to study groups</p> <p>Gender</p> <ul style="list-style-type: none"> • Intervention: male = 52.0%

Monse 2013 (Continued)

- **Control:** male = 47.1%

Interventions	<p>Intervention: Essential Health Care Programme (EHCP¹¹), which included the following: daily supervised handwashing with soap and clean water (as a scheduled group activity), daily supervised brushing with a fluoride toothpaste (0.3 mL; 1450 ppm free available fluoride, scheduled group activity) and biannual deworming with a single dose of albendazole (400 mg) as a mass drug administration at school. Daily supervised toothbrushing with fluoride toothpaste (0.03 mL; 1450 ppm)</p> <p>Control: standard health education programme as defined by the Department of Education. It consists of an annual physical examination, biannual deworming carried out by school nurses, the distribution of a single (10 mL) commercial toothpaste sachet, a toothbrush, an oral health message at the beginning of the school year and health education as part of the regular school curriculum</p> <p>Duration of intervention: 1 year</p>	
Outcomes	Caries (DMFS ¹²)	
Implementation related factors	<p>Theoretical basis: Fit for School Action Framework, which outlines principles of simplicity, scalability and sustainability</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: research staff and dentists</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
	Bias	Authors' judgement Support for judgement
	Random sequence generation (selection bias)	Unclear risk Unclear
	Allocation concealment (selection bias)	Unclear risk Unclear
	Incomplete outcome data (attrition bias) All outcomes	Unclear risk Unclear
	Selective reporting (reporting bias)	Unclear risk Unclear
	Other bias	Unclear risk Unclear
	Blinding of participants and personnel (performance bias) All outcomes	Low risk All examiners were blinded to different groups

Monse 2013 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear
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Nammontri 2013

Methods	<p>Study design: cluster-randomised trial</p> <p>Conducted in: Khonkaen, Thailand</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: individual</p> <p>Setting: schools</p> <p>Funded by: "This study was funded by the Royal Thai Government Ministry of Public Health,Thailand"</p> <p>Duration of the study: 3 months</p>
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Participants	<p>Inclusion criteria: Schools were eligible to participate if they were in a suburban area in Khonkaen, had 200 to 300 students, including 20 to 30 grade 5 students 10 to 12 years of age</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 10 to 12 years</p> <p>N (control baseline): 6 schools, 128 children</p> <p>N (control post intervention): 6 schools, 127 children</p> <p>N (control follow-up): 6 schools, 125 children</p> <p>N (intervention baseline): 6 schools, 133 children</p> <p>N (intervention post intervention): 6 schools, 133 children</p> <p>N (intervention follow-up): 6 schools, 132 children</p> <p>Recruitment: 12 schools were selected randomly to participate in the study. Schools were allocated to the 2 groups: control and intervention according to the sequence. Six schools formed an intervention group, and 6 a control group</p> <p>Gender: not reported</p>
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Interventions	<p>Interventions</p> <ul style="list-style-type: none"> • Oral health education delivered as seven 40 to 60-minute sessions over 2 months. The focus was on child participation and empowerment. The first 4 sessions consisted of didactic instructions, discussion, activities and games • Whole school participatory approach: The last 3 sessions were brainstorming, evaluation and planning, and involved the whole <p>Control: no intervention</p> <p>Duration of intervention: 2 months</p>
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Outcomes	<p>Gingival health</p> <p>DMFT</p>
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Nammontri 2013 (Continued)

Implementation related factors

Theoretical basis: sense of coherence

Resources for implementation: not reported

Who delivered the intervention: trained teachers

PROGRESS categories assessed at baseline: parent's occupation, family income and age

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random sequence of blocks was used to generate the allocation sequence for schools
Allocation concealment (selection bias)	Low risk	All clusters were randomised at the same time
Incomplete outcome data (attrition bias) All outcomes	Low risk	Only 1 participant was lost to follow-up
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Nylander 2001

Methods

Study design: controlled before-and-after study

Conducted in: Kumala, Sweden

Unit of randomisation: not applicable

Unit of analysis: individual

Setting: schools (starting in 7th grade)

Funded by: "Study was supported by a grant from the Orebro County Council"

Nylander 2001 (Continued)

Duration of the study: 1987 to 1992. Each year, new students entering the 7th grade were invited to participate in a school-based programme that lasted until 9th grade. Six cohorts of adolescents were created

Participants

Inclusion criteria: not reported

Exclusion criteria: not reported

Age at baseline: 13 years old

N (controls baseline): 139

N (controls follow-up): 129

N (interventions baseline): 874

N (interventions follow-up): 242

Six cohorts: 936

Recruitment: throughout school. Each year, new students entering the 7th grade were invited to participate in a school-based programme that lasted until 9th grade. Six cohorts of adolescents were created

Gender: male and female

Interventions

Intervention: School-based preventive programme that lasted until 9th grade. Programme introduced oral health promotion and oral hygiene instruction provided by dental hygienists, emphasising healthy eating habits. Focus on frequency of between-meal snacks and reduction of sucrose intake. Healthier alternatives were presented, and use of sugar substitutes was recommended. Counselling was carried out by dental hygienists in individual settings. Each semester, a saliva *Lactobacillus* count was performed to motivate sugar discipline and for use in individual diet counselling

Control: Reference group was selected as historical control not subjected to any saliva samplings; did not receive any school-based dental activities with the exception of a single diet lecture in 8th grade

Duration of intervention: 2 years completed between 7th and 9th grades

Outcomes

Caries increment

Implementation related factors

Theoretical basis: behaviour change

Resources for implementation: oral health promotion and oral hygiene instructions, clinical equipment, counselling sessions

Who delivered the intervention: unclear

PROGRESS categories assessed at baseline: gender

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias
Bias
Authors' judgement
Support for judgement

Nylander 2001 (Continued)

Random sequence generation (selection bias)	High risk	Not randomised. All students entering 7th grade were selected to participate. Children in the reference group were selected as historical controls
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Pakpour 2014

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Qazvin, Iran</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: individual</p> <p>Setting: high schools</p> <p>Funded by: "The study was supported by the Department of Public Health at Qazvin University of Medical Sciences. One of the authors (Sniehotta) is funded by Fuse, the Centre for Translational Research in Public Health, a UKCRC Public Health Research Centre of Excellence. Funding for Fuse was from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council, the National Institute for Health Research, under the auspices of the UK Clinical Research Collaboration"</p> <p>Duration of the study: 24 weeks</p>
Participants	<p>Inclusion criteria: Adolescents were eligible if they had not participated in any previous type of oral health education and promotion programmes and had not received orthodontic treatment</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 15 years old</p> <p>N (controls baseline): 122</p> <p>N (controls follow-up): 122</p> <p>N (gain-frame intervention group baseline): 124</p> <p>N (gain-frame intervention group follow-up): 124</p>

Pakpour 2014 (Continued)

N (loss-frame intervention group baseline): 126

N (loss-frame intervention group follow-up): 126

Recruitment: Investigators randomly selected 1 class in each school to participate in the study. All students in selected classes participated in the study

Gender

- **Gain-framed OHE:** male = 46.8%, female = 53.2%
- **Loss-framed OHE:** male = 51.6%, female = 48.4%
- **Control:** male = 48.4%, female = 51.6%

Interventions	Two intervention groups and 1 control group <ul style="list-style-type: none"> • Interventions were gain-framed pamphlets that delivered 6 positive messages about oral health • Loss-framed intervention delivered 6 negative messages about oral health • Control group received no intervention <p>Duration of intervention: 30 minutes</p>	
Outcomes	Periodontal health Plaque index	
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: gender, education, SES</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Schools were divided into zones, then were randomised. In each school, 1 class was randomly selected to participate, and all students in selected classes participated in the study
Allocation concealment (selection bias)	Low risk	All clusters were randomised at the same time
Incomplete outcome data (attrition bias) All outcomes	Low risk	Dropout rate was small (n = 17, 4.5%) owing to school absence
Selective reporting (reporting bias)	Low risk	Published article includes all expected outcomes

Pakpour 2014 (Continued)

Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Two trained dentists blinded to group allocation performed oral examinations in the classroom
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Peng 2004

Methods	<p>Study design: quasi-experimental, controlled before-and-after study</p> <p>Conducted in: Hongshan District of Wuhan City, Hubei Province, China</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individual</p> <p>Setting: primary school</p> <p>Funded by: "This study was supported by the Hubei Committee for Oral Health, PR China and the WHO Collaborating Centre for Community Oral Health Programs and Research, University of Copenhagen, Denmark"</p> <p>Duration of the study: 2 years</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 6.5 ± 0.4 years</p> <p>Total N at baseline: 1143</p> <p>N (controls baseline): group C, 370</p> <p>N (controls follow-up): not specified. Total dropout rate, 19.9%</p> <p>N (interventions baseline): group G, 363; group E, 410</p> <p>N (interventions follow-up): not specified (total dropout rate, 19.9%)</p> <p>Recruitment: All children in grade 1 were recruited</p> <p>Gender</p> <ul style="list-style-type: none"> • Group G = 54.8% male • Group E = 52% male • Group C = 53% male
Interventions	<p>Intervention: oral health education and sugar-free chewing gum programme. Two intervention groups: group G and group E</p> <p>Group E: WHO HPS approach (school teachers involved, classroom activities: 2-day training workshop, OHE package for teachers, OH instruction given monthly to children along with supervised toothbrushing, parent engagement sessions around OH instructions); implementation monitored by senior dental advisor every 3 months through school visits</p>

Peng 2004 (Continued)

Group G: all OHE in group E plus sugar-free gum (4 times/d, sessions supervised by teachers and parents); gum supplied by school to parents

Control: 1 control group C: no specific intervention. Head teachers were aware of intervention programme. Children received toothpaste at the end of the trial

Duration of intervention: 2 years

Outcomes	DMFS ¹² /DMFT Bleeding scores
Implementation related factors	<p>Theoretical basis: health promoting schools</p> <p>Resources for implementation: teacher time, sugar-free chewing gum, training package</p> <p>Who delivered the intervention: teachers and a senior public health dentist</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described - study states only: "nine primary schools were chosen at random from the district and all children from grade 1 were recruited"
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Low risk	Dropout rate was about 15% overall (14% group E; 13% G and 17% C groups) No reasons for dropouts were provided. Study authors considered that dropout rates would not have any serious effect on outcome evaluation
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Group G had higher caries level at baseline compared with groups C and E, although this difference was non-significant
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Examiners were blinded. Details of the intervention were explained to parents of the children and teachers. It may not have been possible to blind participants owing to the nature of the study design
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not blinded

Petersen 2004

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: China</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: individual</p> <p>Setting: evaluation study based on a demonstration project in China in the Hongshan District of Wuhan City, Hubei Province, in central China. Fluoride concentration of drinking water in this district is low (0.2 ppm). Dental care is offered mainly on demand by 1 dental hospital with about 100 dental units, and no organised school-based OHE programmes were established in the district</p> <p>Funded by: "This study was supported by the Hubei Committee for Oral Health, PR China and the WHO Collaborating Centre for Community Oral Health Programs and Research, University of Copenhagen, Denmark"</p> <p>Duration of the study: 3 years (September 1998 to October 2001)</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: grade 1 primary school, mean age not reported</p> <p>N (controls baseline): 399</p> <p>N (controls follow-up): 331</p> <p>N (interventions baseline): 404</p> <p>N (interventions follow-up): 335</p> <p>Recruitment: Six representative primary schools were chosen at random</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: All children in grade 1 attending experimental schools took part in a 3-year school-based OHE programme that was based on the concept of the WHO Health Promoting Schools Project and was aimed at a healthy environment and involvement of school teachers in classroom activities. These activities focused on integrating oral health education into the general curriculum of training and education for health</p> <p>Control: no intervention</p> <p>Duration of intervention: 3 years</p>
Outcomes	<p>dmft/dmfs¹³, DMFT/DMFS, bleeding scores</p>
Implementation related factors	<p>Theoretical basis: health promoting schools</p> <p>Resources for implementation: OHE programme, teacher time, classroom activities</p> <p>Who delivered the intervention: teachers and dentists</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p>

Petersen 2004 (Continued)

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Six representative primary schools were chosen at random – 3 were termed experimental and 3 control schools
Allocation concealment (selection bias)	Low risk	All clusters were randomised at the same time
Incomplete outcome data (attrition bias) All outcomes	Low risk	Dropout rate was low, and no significant differences were found between study groups
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Plutzer 2012

Methods	Study design: randomised controlled trial Conducted in: Adelaide, Australia Unit of randomisation: mother-baby pair Unit of analysis: individual Setting: public maternity hospitals Funded by: "The study was supported by the NHMRC Centre of Clinical Research Excellence, Adelaide, South Australia" Duration of the study: 7 years
Participants	Inclusion criteria: not reported Exclusion criteria: pregnant women at high risk and with multiple pregnancies, incomplete questionnaires and inability to comprehend written English Age at baseline: 18 months N (controls baseline): 322 N (controls follow-up): 136

Plutzer 2012 (Continued)

N (interventions baseline): 327

N (interventions follow-up): 141

Recruitment: Nulliparous women were recruited into the study in their 5th to 7th month of pregnancy during regular antenatal visits at participating health facilities

Gender: not reported

Interventions	<p>Intervention</p> <ul style="list-style-type: none"> Oral health education through 3 rounds of printed information. This included oral health education on oral health changes during pregnancy, use of pacifiers, oral hygiene during tooth eruption and feeding practices <p>Control: no intervention</p> <p>Duration of intervention: 1 year</p>	
Outcomes	Dental caries (dmft, dmfs)	
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: education, SES</p> <p>PROGRESS categories analysed at outcome: education, SES</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number tables were used to generate allocation sequence
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Low risk	Retention rates were similar in both intervention and control groups and were influenced by the same determinants. Attrition bias occurred to the same extent and for the same reasons in both arms of the trial
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	High risk	Study authors acknowledge that contamination occurred during examination at 20 months
Blinding of participants and personnel (performance bias)	Low risk	Examiners were unaware of the group to which the child belonged

Plutzer 2012 (Continued)

All outcomes

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear
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Rodrigues 1999

Methods

Study design: quasi-experimental, controlled before-and-after study

Conducted in: Recife, Brazil - metropolitan area in Brazil

Unit of randomisation: nursery

Unit of analysis: individual

Setting: non-fee-paying nurseries (kindergartens) in Brazil

Funded by: "The study was funded by CAPES"

Duration of the study: Baseline commenced September 1993

Follow-up examinations: September to November 1994

Participants

Inclusion criteria: Non-fee-paying nursery

Exclusion criteria: Fee-paying and part-time operated nurseries were not included in the study. Children with learning difficulties were excluded

Age at baseline: 36 to 47 months

N (controls baseline): 265 children in 17 control nurseries

N (controls follow-up): not reported

N (interventions baseline): 245 children in 12 intervention nurseries

N (interventions follow-up): not reported

Total N: 510 children; 78% of those approached were examined

Recruitment: through 29 selected kindergartens

Gender: not reported – sex of children in both groups similar

Interventions

Intervention: adopted guidelines on reduction of sugar intake

Control: did not adopt sugary guidelines

Duration of intervention: not clear – measurement of food at nurseries took place at an interval of 6 months

Outcomes

DMFT

Implementation related factors

Theoretical basis: policy

Resources for implementation: observer to weigh food, dietary guidelines

Who delivered the intervention: unclear

PROGRESS categories assessed at baseline: SES, education levels of parents, family income, age and gender

Rodrigues 1999 (Continued)

PROGRESS categories analysed at outcome: SES

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: low SES

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study authors randomly selected 29 of the 50 largest nurseries but did not specify the method of randomisation
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Independent observer weighed food in nurseries; other personnel not reported

Rong 2003

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: China</p> <p>Unit of randomisation: kindergarten</p> <p>Unit of analysis: children</p> <p>Setting: Miyun County, 100 km northeast of Beijing</p> <p>Funded by: Procter & Gamble provided 2 kinds of toothpaste for use in the study</p> <p>Duration of the study: 2 years</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 3 years</p>

Rong 2003 (Continued)

N (controls baseline): 370

N (controls follow-up): 256

N (interventions baseline): 361

N (interventions follow-up): 258

Recruitment: randomly assigned to test/control group; children recruited through kindergartens; all 3-year-old children in selected kindergartens were recruited

Gender

- **Intervention:** 47.1% male
- **Control:** 52.9% male

Interventions	<p>Interventions</p> <ul style="list-style-type: none"> • Oral health education programme administered to teachers, parents and children • Supervised twice-daily brushing of teeth in kindergarten with fluoridated toothpaste <p>Control: no type of treatment</p> <p>Duration of intervention: 2 years</p>	
Outcomes	Caries increment	
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: Procter & Gamble provided 2 kinds of toothpaste for use in the study</p> <p>Who delivered the intervention: dentist and teachers</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomly selected by drawing lots
Allocation concealment (selection bias)	Low risk	Toothpastes provided to experimental and the control groups were identical in taste, appearance and packaging, except that fluoride was included in the test toothpaste. Participants and examiners were not aware of the assignment of toothpastes
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear

Rong 2003 (Continued)

Selective reporting (reporting bias)	Low risk	All expected outcomes were reported
Other bias	Unclear risk	Unclear, but this study was funded by a commercial company, which could have resulted in other potential sources of bias
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participants and examiner were not aware of the assignment of toothpaste
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Examiner blindness to group assignment of children was maintained throughout the study

Saied-Moallemi 2009

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Iran</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individual</p> <p>Setting: urban area</p> <p>Funded by: "Financial support was provided by the Iran Center for Dental Research (ICDR)"</p> <p>Duration of the study: 3 months</p>
Participants	<p>Inclusion criteria: unclear</p> <p>Exclusion criteria: unclear</p> <p>Age at baseline: not reported (9-year-olds)</p> <p>N (controls baseline): 117</p> <p>N (controls follow-up): 116</p> <p>N (interventions baseline)</p> <ul style="list-style-type: none"> • Group 1: 115 • Group 2: 114 • Group 3: 111 <p>N (interventions follow-up)</p> <ul style="list-style-type: none"> • Group 1: 110 • Group 2: 112 • Group 3: 109 <p>Recruitment: through schools</p> <p>Gender: Each group included 2 boys' schools and 2 girls' schools</p>
Interventions	Interventions

Saied-Moallemi 2009 (Continued)

- **Group 1.** Class-work group. This intervention was applied in class by means of 7 various illustrative puzzles printed on A4 sheets, used as learning tools, including oral health messages guiding children to twice-daily toothbrushing and use of fluoride toothpaste
- **Group 2.** Parental-aid group. This intervention was provided by parents at home without additional instructions on oral health at school. A 2-page A4-size oral health leaflet and a brushing diary together with a cover letter prepared for the study were delivered by health counsellors to children to take home
- **Group 3.** Combined group. Intervention in this group was carried out both via class-work and by parents according to the programmes described above

Control: This group received no intervention but underwent clinical examination and completed the questionnaire

Duration of intervention: 3 months

Outcomes	Changes in gingival bleeding index and plaque index
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: clinical examinations, questionnaire, class-work group, parents' intervention, puzzles and class-based education sessions, oral health leaflets and use of fluoridated toothpaste</p> <p>Who delivered the intervention: dentist, home-base parents, teachers</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation were not described – clusters were not randomly assigned
Allocation concealment (selection bias)	Low risk	All clusters were randomised at the same time
Incomplete outcome data (attrition bias) All outcomes	Low risk	Numbers excluded from analysis are low and similar in each group. Reasons for missing outcome data are unlikely to be related to true outcomes
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Article states: "To avoid bias, the details of the interventions were not explained to the children"

Saied-Moallemi 2009 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Baseline clinical examinations were conducted by 1 of the study authors – it is unclear whether the baseline examiner was blinded. Post-intervention examinations were carried out by a separate dentist - a dentist not involved in study procedures and blinded to group assignment. Calibrations between examiners were carried out
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Schwarz 1998

Methods	<p>Study design: controlled before-and-after study</p> <p>Conducted in: China</p> <p>Unit of randomisation: kindergarten</p> <p>Unit of analysis: children</p> <p>Setting: kindergarten</p> <p>Funded by: "This study was financially supported by the University of Hong Kong (CRCG). The study received continuous material support from Colgate-Palmolive (HK) and Colgate (Guangzhou) Co. Ltd"</p> <p>Duration of the study: 3 years</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: Of 289 children, 94% were 3 years old, 4% were not yet 3 years old and 2% were 4 years old</p> <p>N (controls baseline): 121</p> <p>N (controls follow-up): 99</p> <p>N (interventions baseline): 168</p> <p>N (interventions follow-up): 152</p> <p>Recruitment: All children studying in grade 1 were recruited</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: received supervised toothbrushing and oral health education sessions. Research team paid a visit every 4 months to ensure that activities were on track, observations of classroom activities were conducted and meetings with teachers were set up to discuss ways of standardising the approach</p> <p>Control: No dental health education or other information/activities were provided for control kindergarten teachers. However, they were aware of ongoing activities</p> <p>Duration of intervention: 3 years</p>
Outcomes	Caries development (dmfs)
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: teacher and parent, dentist/dental hygienist</p> <p>Who delivered the intervention: teachers in kindergartens</p> <p>PROGRESS categories assessed at baseline: not reported</p>

Schwarz 1998 (Continued)

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	All children studying in grade 1 of the 3 largest kindergartens in the township were recruited into the study. Children in the largest kindergarten constituted the test group (n = 168), and those in the other 2 kindergartens formed control groups (n = 121)
Allocation concealment (selection bias)	High risk	Teachers from the control group were aware of ongoing activities in the intervention group
Incomplete outcome data (attrition bias) All outcomes	Low risk	Overall loss of less than 20% of children after 3 years was considered low. Assessments compared children who remained in the study versus those who dropped out with regard to baseline dmfs, parent education level and household income, with no significant differences noted. Thus, the dropout level was considered to not seriously affect outcome evaluations
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest for the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	High risk	Teachers who were among programme implementers from the control group were aware of ongoing activities in the intervention group
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Shenoy 2010

Methods

Study design: cross-over controlled before-and-after study

Conducted in: India

Unit of randomisation: not applicable

Unit of analysis: school

Setting: Mangalore City, Karnataka State, South Western coast of the Indian Peninsula

Funded by: Study declared source of support as "Nil"

Duration of the study: 36 weeks

Participants

Inclusion criteria

Community-based population-level interventions for promoting child oral health (Review)

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Shenoy 2010 (Continued)

- **Schools:** consent to participate in the study provided by school authorities, no past dental health education programme, children from all social classes from 1 to 5 with ≥ 50 children 12 to 13 years of age
- **Children:** Socioeconomic status of participants' parents was evaluated, and children of socioeconomic classes 1 and 5 were selected. Children had to be 12 to 13 years old and had to have intact permanent teeth and good general health

Exclusion criteria

- **Children:** presence of oral mucosal lesions, intake of medications affecting oral health (antibiotics, mouthwashes) in the 2 weeks leading up to the study and before each examination, presence of crowding/overlapping of teeth resulting in severe gingival inflammation, children undergoing orthodontic treatment and children requiring any emergency dental treatment

Age at baseline: children 12 to 13 years of age

Total at baseline: 450

Total at 36-week analysis: 415

N (controls baseline): 280

N (controls follow-up): 262

N (interventions baseline): 170

N (interventions follow-up): 153

Recruitment: through schools via convenience sampling

Gender: not reported

Interventions	<p>Intervention</p> <ul style="list-style-type: none"> • School Dental Health Education programme. Twenty-minute session using audiovisual aids on effects of diet on teeth, prevention of oral health disease, interaction between oral health and general health and benefits of regular brushing using proper techniques <p>Control: no intervention</p> <p>Duration of intervention: Sessions were delivered every 3 weeks</p>
Outcomes	<p>Gingival index</p> <p>Plaque index</p>
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: Dental Health Education programme materials including audiovisual aids, slide projector, dentoform model, charts, photo albums, posters and plaster models, training materials and educator (unclear from the article who administered DHE¹⁴)</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: SES, education</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: Only children from socioeconomic classes 1 and 5 were included in the study</p> <p>Economic evaluation: not reported</p>

Shenoy 2010 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Schools were not randomly allocated. Study authors used convenience sampling to select children
Allocation concealment (selection bias)	High risk	Schools and participants were selected on the basis of inclusion/exclusion criteria
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Two schools from each social class were taken as controls to prevent 'contamination' of the programme within schools caused by children talking to each other
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Slade 2011

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Australia</p> <p>Unit of randomisation: communities</p> <p>Unit of analysis: individuals</p> <p>Setting: Aboriginal communities of Australia's Northern Territory</p> <p>Funded by: "Funding was provided by project grant from the Australian National Health and Medical Research Council. Additional support for conduct of the study was provided by the Cooperative Research Centre for Aboriginal Health and the Northern Territory Government Department of Health and Families"</p> <p>Declaration of competing interests: Colgate-Palmolive Pty Limited of Australia provided free supplies of Duraphat varnish for the study and low-cost toothbrushes and toothpaste to community stores. One of the authors, Robert Thomson, is Director of the Dental Practice Education Research Unit at the University of Adelaide, which receives funding from Colgate-Palmolive Pty Limited. None of the authors or study personnel received or receive consulting payments nor any other form of personal benefit from Colgate-Palmolive Pty Limited</p> <p>Duration of the study: 2 years</p>
Participants	Inclusion criteria

Slade 2011 (Continued)

- **Communities:** remote location (> 100 km from Darwin), classified as Aboriginal (i.e. management by an indigenous council of community members), sufficient population (≥ 5 births per annum), signed informed consent to participate in the study received from community council
- **Children:** within participating communities as follows: Aboriginal identity, as declared by parent or family member; permanent residency in the community, not an outstation, as defined by the council's population list and updated after consultation with community leaders; age 18 months to less than 48 months; no reported history of asthma; signed informed consent of parent or family member

Exclusion criteria: not reported

Age at baseline

- **Control:** 33 months
- **Intervention:** 33.6 months

N (controls baseline): 322

N (controls follow-up): 262

N (interventions baseline): 344

N (interventions follow-up): 281

Recruitment: Communities were assigned at random to intervention or control groups. A total of 30 consenting communities were randomised to 15 control and 15 intervention communities. All children within any given community were to undergo the same study procedures

Gender

- Male control: 52%
- Male intervention: 50%

Interventions

Intervention: Three types of interventions were provided for all eligible children and communities in the intervention group

- Duraphat 3 fluoride varnish was applied to children's teeth once every 6 months for 2 years with the aim to complete 5 applications per child. The first application took place after the baseline dental epidemiological examination, and the final application was administered after follow-up examination
- Advice to parents and family groups about caries prevention was provided in 2 settings. The first was during varnish application when the clinician explained the causes of dental decay and methods to prevent it. This included advice about drinking water, limited sugar exposure, use of fluoride-containing toothpaste and toothbrushing. After a demonstration of toothbrushing, each parent family member was given the toothbrush, a tube of low-concentration fluoride toothpaste and a children's sized, reuseable water bottle. The second setting consisted of children's play groups and preschools, where the same information and products were provided to parents and family members
- Community health promotion engaged parents, store owners, community leaders and healthcare workers about oral health and prevention of dental decay in their community. This took place in settings ranging from 'face painting days' to formal presentations at community council meetings
- In addition to reinforcing information presented to parents and family groups, information was provided about community-wide activities to promote oral health. Recognising that Aboriginal health workers are the principal healthcare providers who promote traditional health practices, we explained the process of tooth decay to them, placing emphasis on the potential caries-preventive benefits of traditional health practices and 'bush tucker' (i.e. food gathered from the land). Reinforcement of the same health promotion messages was conveyed to primary healthcare workers at health centres. Health centre staff were trained in oral disease recognition and referral of children with dental decay to school dental services. Training was supported with chart books and DVD instruction

Control: no type of intervention

Duration of intervention: 2 years

Slade 2011 (Continued)

Outcomes	Dental caries	
Implementation related factors	<p>Theoretical basis: socio-ecological model</p> <p>Resources for implementation: training package, staff time, dental materials. Colgate-Palmolive Pty Limited of Australia provided free supplies of Duraphat varnish and low-cost toothbrushes and tooth-paste</p> <p>Who delivered the intervention: clinical study personnel: dental therapists or dentists, health centre personnel trained in clinical procedures by the research team</p> <p>PROGRESS categories assessed at baseline: Gender, Residence, Race</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: Programme targeted remote indigenous communities, families and children</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Before randomisation, 6 strata were formed on the basis of 3 characteristics of study communities - timing of community consent; population size; and geographical region. Within each stratum, communities were block-allocated at random to achieve equal numbers of intervention and control communities within strata. A random allocation algorithm was created by a consultant statistician using Stata software
Allocation concealment (selection bias)	Low risk	Concealment was not possible. Community-level health promotion activities were self evident, and no attempt was made to conceal community allocation from children, community groups or study personnel
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Song 2004

Methods	<p>Study design: quasi-experimental, controlled before-and-after study</p> <p>Conducted in: Korea</p> <p>Unit of randomisation: unclear</p> <p>Unit of analysis: children</p> <p>Setting: kindergarten</p> <p>Funded by: not disclosed</p> <p>Duration of the study: April 2001 to November 2001</p>
Participants	<p>Inclusion criteria: unclear</p> <p>Exclusion criteria: unclear</p> <p>Age at baseline: 5-year-olds attending kindergarten</p> <p>Total at baseline: 67</p> <p>N (controls baseline): 34</p> <p>N (controls follow-up): not reported</p> <p>N (interventions baseline): 33</p> <p>N (interventions follow-up): not reported</p> <p>Recruitment: unclear</p> <p>Gender: Gender breakdown for boys was not reported, proportions of girls between both groups were similar</p>
Interventions	<p>Intervention: oral health education programme</p> <ul style="list-style-type: none"> • 20-minute oral health education session once per week for 4 weeks • Follow-up after 28 weeks. <p>Control: unclear</p> <p>Duration of intervention: 4-week intervention period</p>
Outcomes	Dmft and plaque index
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: unclear</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: unclear</p> <p>PROGRESS categories analysed at outcome: unclear</p> <p>Outcomes related to harms/unintended effects: unclear</p> <p>Intervention included strategies to address diversity or disadvantage: unclear</p> <p>Economic evaluation: unclear</p>
Notes	

Song 2004 (Continued)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Unclear
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Tai 2009

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Xiling District of Yichang City Hubei Province, China</p> <p>Unit of randomisation: schools</p> <p>Unit of analysis: children</p> <p>Setting: kindergartens</p> <p>Funded by: "The study was supported by the Guangzhou Colgate Palmolive Company Limited, and the National Key Technologies R&D Programme of the Eleventh Five-Year Plan conducted by the Ministry of Science and Technology of China"</p> <p>Duration of the study: 3 years</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 6 to 7 years old</p> <p>N (controls baseline): 810</p> <p>N (controls follow-up): not reported</p> <p>N (interventions baseline): 806</p> <p>N (interventions follow-up): not reported</p>

Tai 2009 (Continued)

Recruitment: schools, first grade

Gender

- **Intervention:** 53.6% male, 46.4% female
- **Control:** 51.5% male, 48.5% female

Interventions

Intervention: 3-year oral health promotion programme

- 30-minute oral health education instruction delivered by school teachers, biweekly for 3 years. Instruction consisted of tooth structure and function, cause and development of dental caries and gingivitis and toothbrushing methods and caries-reducing effects of fluoride
- Oral health education booklet for use by children
- Annual poster presentation
- Oral examination by dentist in the classroom once per year

Control: received none of the intervention

Duration of intervention: 3 years

Outcomes

Net caries increments of children (DMFT/DMFS) and OH¹⁵ status, including changes in plaque index

Implementation related factors

Theoretical basis: health promoting schools

Resources for implementation: training, training packages, teacher and clinical staff time

Who delivered the intervention: teachers and clinicians

PROGRESS categories assessed at baseline: gender, SES, education

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: not reported

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Unit of randomisation was the school, and all children in the first grade participated. Fifteen schools were randomly assigned to intervention group (n = 7) or control group (n = 8). Randomisation was performed via a block randomisation method by a researcher not involved with the study
Allocation concealment (selection bias)	Low risk	All dentists were blind to group allocation of children throughout the study
Incomplete outcome data (attrition bias) All outcomes	Low risk	Participant attrition rate by the end of the study period was 18% for the intervention group and 14% for the control group. Loss of children from the study was caused by their transfer to other schools. To assess attrition effects, distributions of children both with and without a follow-up exam were compared with regard to gender, age, oral health behaviour, socioeconomic status and baseline caries variables. No significant difference was observed between the 2 groups

Tai 2009 (Continued)

Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear, but this study was funded by a commercial company, which could have resulted in other potential sources of bias
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Teachers and local dentists in the intervention group were trained in the OHP programme and were aware of their school's test status
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All dentists were blinded to group allocation of children throughout the study

Toassi 2002

Methods	Study design: before-and-after study (2 active arms) Conducted in: Brazil Unit of randomisation: individual Unit of analysis: individual Setting: schools, Santa Teresa Funded by: not disclosed or reported Duration of the study: Study commenced in 1999 - end period not reported
Participants	Inclusion criteria: not reported Exclusion criteria: not reported Age at baseline: between 5 and 14 years Total at baseline: 135 N (controls baseline): 61 N (controls follow-up): 61 N (interventions baseline): 74 N (interventions follow-up): 74 Recruitment: not reported Gender: 59% male, 41% female
Interventions	Intervention: dental caries preventive programme <ul style="list-style-type: none"> • Delivery of toothbrushes and toothpaste every 3 months, daily toothbrushing in schools, weekly mouthwash fluoride solution at 0.2%, quarterly application of fluoride gel on the toothbrush and quarterly health education and motivational interviewing Control: dental caries preventive program but no motivational interviewing

Toassi 2002 (Continued)

Duration of intervention: Group A received 1 motivational session, and Group B received 4 motivational sessions (no specific time period reported)

Outcomes	Plaque index, gingival bleeding index
Implementation related factors	<p>Theoretical basis: pedagogical motivational approaches</p> <p>Resources for implementation: educational materials, toothbrushes, toothpaste, audiovisual resources</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: income</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Students were randomly divided into 2 groups
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Tubert-Jeannin 2008

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: France</p> <p>Unit of randomisation: schools</p>
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Community-based population-level interventions for promoting child oral health (Review)

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Tubert-Jeannin 2008 (Continued)

	<p>Unit of analysis: individuals</p> <p>Setting: schools selected as having high risk of caries, in city of Clermont-Ferrand, France</p> <p>Funded by: "Executive Committee of the Regional Health Auvergne Shares funded this project through the National Fund for Prevention and Health Education"</p> <p>Duration of the study: 1 year (2005 to 2006)</p>
Participants	<p>Inclusion criteria: unclear</p> <p>Exclusion criteria: unclear</p> <p>Age at baseline: unclear</p> <p>N (controls baseline): 144</p> <p>N (controls follow-up): 121</p> <p>N (interventions baseline): 207</p> <p>N (interventions follow-up): 164</p> <p>Recruitment: unclear</p> <p>Gender: unclear</p>
Interventions	<p>Intervention: oral health promotion programme aimed at parents, teachers and children</p> <ul style="list-style-type: none"> Educational sessions with a panel of experts for parents to attend, focusing on prevention and care of dental caries in young children Two educational sessions facilitated by a teacher and a dental student carried out in each classroom, aimed at building child's personal skills in toothbrushing. Each child received a brush kit that was left at school <p>Control: not reported</p> <p>Duration of intervention: not reported</p>
Outcomes	Plaque index
Implementation related factors	<p>Theoretical basis: social determinants, socio-ecological model</p> <p>Resources for implementation: brush kit, workshop materials, training sessions and trainer</p> <p>Who delivered the intervention: teachers and dentists</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: unclear</p> <p>Intervention included strategies to address diversity or disadvantage: unclear</p> <p>Economic evaluation: not reported</p>
Notes	
Risk of bias	
Bias	Authors' judgement Support for judgement

Tubert-Jeannin 2008 (Continued)

Random sequence generation (selection bias)	High risk	No randomisation. Schools were selected on the basis of their high risk of caries
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Turrioni 2012

Methods	Study design: randomised controlled trial Conducted in: Brazil Unit of randomisation: individual Unit of analysis: individual Setting: school Funded by: not disclosed or reported Duration of the study: 4 months
Participants	Inclusion criteria: not reported Exclusion criteria: not reported Age at baseline: not reported Participant numbers N (intervention group 1 baseline): not reported N (intervention group 1 follow-up): 55 N (intervention group 2 baseline): not reported N (intervention group 2 follow-up): 13 N (intervention group 3 baseline): not reported N (intervention group 3 follow-up): 12

Turrioni 2012 (Continued)

Recruitment: The study was conducted in the area of family health unit (USF) Antenor Garcia, with teenagers studying in 5as and 8as municipal school series "Arthur Natalino Derigge". The study was considered by the São Paulo Social Vulnerability Index (IPVS) - an area of very high vulnerability (grade 6)

Gender: not reported

Interventions

Intervention: Questionnaire was completed by a researcher in the form of an interview at school to assess oral health and eating habits. The questionnaire was completed again after the 4-month period, and a second clinical examination took place

- After completion of the questionnaire, a clinical examination was carried out at the school dental office, using a probe and mirror, to assess quantity of plaque (2-0 scores) and gingival condition (scores from 0 to 3) in all participants. It is important to note that all adolescents evaluated belonged to the school and passed through clinical examination and interview
 - Group 1 (school) – educational activities developed in school
 - Group 2 (school + home) – oral health guidance for families during home visits
 - Group 3 – attended a weekly guidance group for improving quality of life; 6 meetings held

Control: no control group

Duration of intervention: 4 months

- Group 3 attended 6 meetings
- Groups 1 and 2 not specified

Outcomes

Gingival index

Implementation related factors

Theoretical basis: education

Resources for implementation: not reported

Who delivered the intervention: researcher and school dental office for clinical examination

PROGRESS categories assessed at baseline: not reported

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: adolescents from low SES and highly vulnerable communities

Economic evaluation: not reported

Notes
Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random selection process used
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear

Turrioni 2012 (Continued)

Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Ueno 2012

Methods	<p>Study design: controlled before-and-after study</p> <p>Conducted in: Tokyo</p> <p>Unit of randomisation: grade</p> <p>Unit of analysis: individual</p> <p>Setting: senior high school in the “Encourage School” programme</p> <p>Funded by: not disclosed</p> <p>Duration of the study: 1 year</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 15 to 17 years</p> <p>N (controls baseline): 135</p> <p>N (controls follow-up): 135</p> <p>N (interventions baseline): 163</p> <p>N (interventions follow-up): 163</p> <p>Recruitment: All students in grade 1 acted as the intervention group. All students in grade 2 acted as the control group</p> <p>Gender</p> <ul style="list-style-type: none"> Intervention: male = 79, female = 84 Control: male = 65, female = 70
Interventions	<p>Intervention</p> <ul style="list-style-type: none"> Two 100-minute sessions of oral health education. Sessions contained detailed explanations of cause, treatment and prevention of malodour. Visual materials such as photographs, figures and dental models were used <p>Control: routine school oral health education</p>

Ueno 2012 (Continued)

Duration of intervention: 1 year

Outcomes	Decayed teeth Gingivitis
Implementation related factors	<p>Theoretical basis: not reported</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: research staff and dentists</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: 'Encourage School' is a school programme specifically targeted at students with lower levels of academic and social achievement</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Two grades from a school were selected. All grade 1 students formed the intervention group, and all grade 2 students served as the control group
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	High risk	Intervention was delivered at the same school, and it is possible for allocated units (grades) to become contaminated
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

van Palenstein 1997

Methods	Study design: quasi-experimental, controlled before-and-after study
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van Palenstein 1997 (Continued)

	<p>Conducted in: Tanzania</p> <p>Unit of randomisation: school</p> <p>Unit of analysis: individuals clustered by school</p> <p>Setting: Morogoro</p> <p>Funded by: "The research was supported by grants from the Netherlands through NUFFIC and from Denmark through DANIDA"</p> <p>Duration of the study: 3 years</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: not reported</p> <p>N (controls baseline): 200</p> <p>N (controls follow-up): 122</p> <p>N (interventions baseline): 400</p> <p>N (interventions follow-up): 309</p> <p>Recruitment: through schools</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: school-based oral health education (OHE) programme</p> <ul style="list-style-type: none"> • One-day workshop administered to the head teacher and to 1 teacher at each participating school • Included: information on good oral hygiene practice, demonstrations of good oral hygiene behaviour and implementation of regular supervised toothbrushing sessions at school. Teachers then undertook weekly toothbrushing sessions and monthly lessons about causes and prevention of caries and gingivitis. These lessons incorporated traditional methods of schooling in Tanzania such as use of songs, dance and drama <p>Control: schools where representatives did not attend the OHE workshop</p> <p>Duration of intervention: 1-day workshop, then ongoing throughout duration of grade 4</p>
Outcomes	Dental caries, plaque, calculus, gingival bleeding
Implementation related factors	<p>Theoretical basis: social determinants of health, socio-ecological model</p> <p>Resources for implementation: workshop, training, staff time</p> <p>Who delivered the intervention: teachers</p> <p>PROGRESS categories assessed at baseline: gender</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: specifically designed low-budget OHE programme for application in semi industrialised Tanzania</p> <p>Economic evaluation: The school-based OHE programme was designed as a low-budget programme. Study authors inferred that the cost-effectiveness of the intervention was questionable</p>

van Palenstein 1997 (Continued)

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Process of randomisation not reported
Allocation concealment (selection bias)	Unclear risk	First 2 randomly selected schools were assigned as participating schools for assessment of clinical outcome effects (n = 8). The third school randomly selected from each quarter section was assigned as a non-participating school to serve as control (n = 4)
Incomplete outcome data (attrition bias) All outcomes	Low risk	Of a total of 400 children at baseline in participating schools, 91 dropped out during the course of the study. In control schools, 200 children were examined at baseline. One control school (M = 50) had to be withdrawn from the study because the school had started a similar OHE programme on its own initiative. Of the remaining 150 control children at baseline, 28 dropped out. Most dropouts were caused by transfer to other schools. Some were due to illness or occurred because students were moved back to a lower grade
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear, but article states, "the examiner did not know which schools were the controls"

Vichayanrat 2012

Methods	<p>Study design: quasi-experimental</p> <p>Conducted in: Chon Buri Province, Thailand</p> <p>Unit of randomisation: subdistricts</p> <p>Unit of analysis: individual</p> <p>Setting: health centres and homes</p> <p>Funded by: Funding was not disclosed. However, study authors declared, "Lion (Thailand) and Colgate-Palmolive (Thailand) Ltd and Diethelm & Co contributed toothbrushes and toothpaste for the study"</p> <p>Duration of the study: 1 year</p>
Participants	<p>Inclusion criteria: Children and their caregivers were included in the study if children were 6 to 36 months of age, and caregivers had no systemic disease and would routinely bring the child for vaccination</p>

Vichayanrat 2012 (Continued)

Exclusion criteria: Children and their caregivers were excluded if they were unwilling to participate or did not complete the questionnaire

Age at baseline: 6 to 36 months

N (controls baseline): 52

N (controls follow-up): 52

N (interventions baseline): 62

N (interventions follow-up): 62

Recruitment: Experimental and control districts were selected on the basis of comparable population structure, caries prevalence and no existing oral health programmes at health centres

Gender: not reported

Interventions	<p>Interventions</p> <ul style="list-style-type: none"> • Oral health education and services at health centres. Health centre staff presented oral health education, prescribed fluoride supplements and provided toothbrushes • Home visits by lay health workers provided social support, information and appraisal, as well as emotional support, to caregivers, to enable them to improve child oral health • Community mobilisation was designed to create awareness about early childhood caries <p>Control: provision of toothbrushes and routine health care</p> <p>Duration of intervention: 1 year</p>	
Outcomes	Dental caries (dmft)	
Implementation related factors	<p>Theoretical basis: self efficacy theory, health belief model and social support and organisational change theory</p> <p>Resources for implementation: lay health worker salaries, toothpastes and toothbrushes</p> <p>Who delivered the intervention: lay health workers</p> <p>PROGRESS categories assessed at baseline: parent's occupation and family income and age</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>	
Notes		
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	No randomisation process was involved (quasi-experimental design)
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias)	Unclear risk	Unclear

Vichayanrat 2012 (Continued)

All outcomes

Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Weber-Gasparoni 2013

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: USA</p> <p>Unit of randomisation: mother-child dyad</p> <p>Unit of analysis: individual</p> <p>Setting: home</p> <p>Funded by: "The study was funded by the NIDCR and the University of Iowa College of Dentistry Research Seed Grant"</p> <p>Duration of the study: 6 months</p>
Participants	<p>Inclusion criteria: Mothers were required to be ≥ 18 years old, with children between 12 and 49 months of age</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 12 to 49 months (1 to 4 years)</p> <p>N (controls baseline): 132</p> <p>N (controls follow-up): 78</p> <p>N (controls follow-up): 6-month: 86</p> <p>N (interventions baseline): 283</p> <p>N (interventions follow-up): 155</p> <p>N (interventions follow-up): 6-month: 181</p> <p>Recruitment: Mother-child dyads were recruited from 2 Women, Infants and Children (WIC¹⁶) Supplemental Food Programmes</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: 15-minute oral health education delivered through a video message informed by the self-determination theory (SDT¹⁷) that covered the following issues: process of tooth decay, oral hygiene practices, dietary habits that affect caries susceptibility and checking the child's teeth for early signs of caries</p>

Weber-Gasparoni 2013 (Continued)

Control: paper brochure on oral health education

Duration of intervention: 15 minutes

Outcomes	Caries status
Implementation related factors	<p>Theoretical basis: self determination theory</p> <p>Resources for implementation: not reported</p> <p>Who delivered the intervention: unclear</p> <p>PROGRESS categories assessed at baseline: not reported</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Mother-child dyads were randomly assigned, via a randomisation table, to 1 of 2 groups
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Low risk	All children were examined by the study principal investigator, who was blinded to group assignment, both at baseline and at 6-month follow-up
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Weinstein 2006

Methods	<p>Study design: randomised controlled trial</p> <p>Conducted in: community in Surrey, British Columbia</p> <p>Unit of randomisation: household</p>
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Weinstein 2006 (Continued)

	<p>Unit of analysis: mother and child</p> <p>Setting: mothers from Punjabi-speaking (South Asian) community in Surrey, British Columbia, Canada</p> <p>Funded by: "The study was supported by the National Institute of Dental and Craniofacial Research grant"</p> <p>Duration of the study: 1 year (2004 to 2005)</p>
Participants	<p>Inclusion criteria: not reported</p> <p>Exclusion criteria: history of serious acute or chronic disease that would interfere with ability to examine the child, or with ability of the child and parent to participate fully</p> <p>Age at baseline: recruited when child was 6 to 18 months old</p> <p>N (controls baseline): not reported</p> <p>N (controls follow-up): not reported</p> <p>N (interventions baseline): not reported</p> <p>N (interventions follow-up): not reported</p> <p>Recruitment: Temples and fairs in the South Asian Punjabi speaking community (total participants: n = 240; study does not provide a breakdown of participant numbers in terms of intervention and control groups)</p> <p>Gender: not reported</p>
Interventions	<p>Intervention: pamphlet and video plus 45-minute counselling, 2 follow-up telephone calls within 6 weeks, 4 follow-up calls within 20 weeks and postcards</p> <p>Control: education pamphlet and video</p> <p>Duration of intervention: not directly reported</p>
Outcomes	<p>Caries/New caries lesions (decayed or filled surfaces)</p>
Implementation related factors	<p>Theoretical basis: motivational Interviewing, behaviour change</p> <p>Resources for implementation: educational material, video, pamphlet, interviewing, postcards</p> <p>Who delivered the intervention: 3 trained local South Asian women who acted as counsellors</p> <p>PROGRESS categories assessed at baseline: yes</p> <p>PROGRESS categories analysed at outcome: not reported</p> <p>Outcomes related to harms/unintended effects: not reported</p> <p>Intervention included strategies to address diversity or disadvantage: not reported</p> <p>Economic evaluation: not reported</p>
Notes	<p>240 healthy infants 6 to 18 months of age were recruited; 205 (85%) total were analysed</p>
Risk of bias	
Bias	<p>Authors' judgement Support for judgement</p>

Weinstein 2006 (Continued)

Random sequence generation (selection bias)	Low risk	Participants were assigned to motivational counselling or to a health education group via a table of random numbers, after children had been stratified into 2 age groups (6 to 12 months and older than 12 months)
Allocation concealment (selection bias)	Unclear risk	Unclear
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	Unclear risk	Unclear
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Unclear
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear

Yazdani 2009

Methods	<p>Study design: cluster-randomised controlled trial</p> <p>Conducted in: Iran</p> <p>Unit of randomisation: school class</p> <p>Unit of analysis: individual</p> <p>Setting: public schools in Tehran</p> <p>Funded by: not disclosed</p> <p>Duration of the study: 12 weeks</p>
Participants	<p>Inclusion criteria: not reported (public schools)</p> <p>Exclusion criteria: not reported</p> <p>Age at baseline: 15 years</p> <p>N (baseline): 417</p> <p>N (controls baseline): 130</p> <p>N (controls follow-up): 123</p> <p>N (interventions baseline): total n = 287</p> <ul style="list-style-type: none"> • Group 1 (leaflet) = 148 • Group 2 (videotape) = 139 <p>N (interventions follow-up): total n = 265</p>

Yazdani 2009 (Continued)

- Group 1 (leaflet) = 135
- Group 2 (videotape) = 130

Recruitment: selection of schools from a list provided by the Head Office for Education of Tehran

Gender: n = 205 boys, n = 212 girls at baseline

Interventions

Intervention: Intervention was based on exposing students to oral health knowledge through a leaflet and a videotape designed for this study. Educational key messages were the same in both materials: the importance of oral health, the role of microbial plaque, frequency and methods of proper tooth-brushing and flossing, importance of regular dental attendance, a healthy diet and proper use of fluorides

- **Group 1 (leaflet):** The leaflet was pocket sized with coloured pictures and illustrations for each topic to maintain the student's attention and interest. It was delivered to the leaflet group twice: at baseline and at the sixth week of the intervention period
- **Group 2 (videotape):** The videotape was a 17-minute film shown in the classroom. It was presented twice: at baseline and at the sixth week of intervention

Control: The control group underwent the dental examination but received no educational intervention at all

Duration of intervention: 12 weeks

Outcomes

Dental plaque, gingival bleeding

Implementation related factors

Theoretical basis: not reported

Resources for implementation: Producing educational materials for this study was inexpensive: for the leaflet, 2000 Rials (0.15 €) each, and for the videotape, 3000 Rials (0.2 €) per student, along with clinical equipment for examinations

Who delivered the intervention: Interventions were carried out in co-operation with school authorities and volunteer teachers

PROGRESS categories assessed at baseline: not reported

PROGRESS categories analysed at outcome: not reported

Outcomes related to harms/unintended effects: not reported

Intervention included strategies to address diversity or disadvantage: not reported

Economic evaluation: Producing educational materials for this study was inexpensive: for the leaflet, 2000 Rials (0.15 €) each, and for the videotape, 3000 Rials (0.2 €) per student

Notes
Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	At each of the 14 schools, among 2 to 5 classes of 15-year-olds, 1 class was selected randomly. Then, 14 classes (n = 417; boys, n = 205; girls, n = 212) were randomly divided into 3 groups: a leaflet group (2 boys' classes and 3 girls' classes, n = 148), a videotape group (3 boys' classes and 2 girls' classes, n = 139) and a control group (2 boys' classes and 2 girls' classes, n = 130)
Allocation concealment (selection bias)	Low risk	All clusters were randomised at the same time

Yazdani 2009 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear
Selective reporting (reporting bias)	Low risk	Published report presents all expected outcomes of interest to the review
Other bias	High risk	Allocated to classes that were closely located, and contamination was likely to occur
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Students were unaware in advance of examination and intervention dates
Blinding of outcome assessment (detection bias) All outcomes	Low risk	At baseline 1 of the study authors and at follow-up another experienced blinding of dentist to study groups when clinical examination was carried out

¹DMFT = Decayed, Missing and Filled Teeth

²deft = decayed, extracted and filled teeth

³ECC = early childhood caries

⁴S-ECC = severe early childhood caries

⁵SES = socioeconomic status

⁶dmft = decayed, missing and filled teeth

⁷OHE = oral health education

⁸MI = motivational interview

⁹HPS = health promoting schools

¹⁰WHO = World Health Organization

¹¹EHCP = Essential Health Care Programme

¹²DMFS = Decayed, Missing and Filled Surfaces

¹³dmfs = decayed, missing and filled surfaces

¹⁴DHE = Dental Health Education

¹⁵OH = oral health

¹⁶WIC = Women, Infants and Children Supplemental Food Programmes

¹⁷SDT = self-determination theory

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Achembong 2014	No primary outcomes on dental caries or periodontal disease reported
Aleksejuniene 2012	No primary outcomes on dental caries or periodontal disease reported
Alkarimi 2012	This is a clinical study. No primary outcomes on dental caries or periodontal disease relevant to this review reported
Antonio 2007	This is an uncontrolled before-and-after study The study evaluated long-term effects of an oral health promotion programme for school children 24 months after interruption of educational activities
Anttonen 2011	No primary outcomes on dental caries or periodontal disease reported

Study	Reason for exclusion
	The study reported outcomes on effects of a dietary intervention on school children's eating habits and laser fluorescence values of teeth
Bhardwaj 2013	The study did not have a control group
Brukiene 2012	<p>Primary outcomes on dental caries or periodontal disease not reported</p> <p>This study examined whether oral health behaviour modification based on authoritative parenting modelling is more effective than conventional approaches</p>
Calisir 2012	Primary outcomes on dental caries or periodontal disease not reported
Chaffee 2013	Baseline measures on dental caries not provided
Chedid 2012	This is a clinically based study
Choi 2012	<p>Primary outcomes on dental caries or periodontal disease not reported</p> <p>The study identified effects of mothers' involvement in a dental health programme involving elementary school children</p>
Clifford 2012	Primary outcomes on dental caries or periodontal disease not reported. The study tested whether oral health education improves knowledge and changes behaviour intentions
Cook 2013	<p>Primary outcomes on dental caries or periodontal disease not reported</p> <p>This study evaluated motivational interviewing training based on the intervention's reach, effectiveness, adoption, implementation and maintenance</p>
Drosen 2010	Baseline data on dental caries for children not reported
Evans 2013	Primary outcomes on dental caries or periodontal disease not reported, no control group
Fernando 2013	<p>Primary outcomes on dental caries or periodontal disease not reported</p> <p>The study sought to improve oral health knowledge and practices of preschool teachers and to promote oral health among preschool children</p>
Fracasso 2005	Baseline data on dental caries for children not reported
Freeman 2001	Control group data on dental caries not reported. Data on intervention and control groups not reported separately, and combined data as a whole for both Intervention and control groups presented
Freudenthal 2010	<p>Primary outcomes on dental caries or periodontal disease not reported</p> <p>Measures reported included valuing dental health, permissiveness, convenience and change difficulty or openness to health information</p>
Gomez 2001	<p>Baseline data on dental caries for children not reported</p> <p>This is a cross-sectional study evaluating the effectiveness of a mother-child caries preventive programme</p>
Gomez 2001a	<p>Data on dental caries for children reported only at 5 to 6 years of age</p> <p>The study evaluated the effectiveness of a preventive programme by comparing caries prevalence among participating mothers and their children after 6 years</p>

Study	Reason for exclusion
Gunay 1998	This is a prospective clinical study - interventions were delivered in a clinical setting The study reported on effects of primary-primary preventive measures on the oral health of children (preventing transmission of cariogenic bacteria from mother to child)
Hajimiri 2010	Primary outcomes on dental caries or periodontal disease not reported. Study reported on dental plaque
Harnacke 2012	Intervention tested consists of a toothbrushing technique only
Harrison 2007	Baseline measurements on dental caries not provided - only post-intervention measures on dental caries reported
Harrison 2010	This is a study protocol
Harrison 2012	Baseline measurements on dental caries not provided
Hartono 2002	Baseline data on dental caries not reported
Hedman 2013	Primary outcomes on dental caries and periodontal disease not reported The paper described adolescents' experiences of participating in a school-based oral health intervention programme
Holmes 2013	Primary outcomes on dental caries and periodontal disease not reported The study relates to dental public health competencies such as strategy development and implementation, leadership and collaboration for improving oral and general health outcomes
Hull 2014	Primary outcomes on dental caries or periodontal disease not reported The study describes a community-based intervention targeting oral health self care practices among Hispanic children in the United States
Kaakko 2002	Primary outcomes on dental caries and periodontal disease not reported Study reported on dental service utilisation rates, program expenditures and oral health effects of the programme. Post-test only method was used to evaluate oral health status
Kara 2006	This is a clinical study The study reported on the association between oral malodour and periodontal disease parameters
Karlsson 2007	The study is of a clinical nature (remineralisation of white spot lesions, salivary bacterial counts) and a chemical nature (amine fluoride gel and amine fluoride toothpaste)
Kramer 2007	Intervention was breastfeeding, which was not relevant to this review The study focused on effects of prolonged and exclusive breastfeeding on dental caries among children
Kumar 2012	The intervention being tested was fluoridated toothpaste. Both groups received the oral health education component
Källestål 2000	The study reports results only from baseline screening
Källestål 2005	The study examined preventive methods in clinical practice - interventions provided were chemical based (fluoride varnish, fluoride lozenge) and were clinically administered (cleaning)

Study	Reason for exclusion
Laine 2014	Primary outcomes on dental caries or periodontal disease not reported
Lawrence 2004	Baseline data on children's dental caries not reported The study used cross-sectional and longitudinal approaches to compare children in communities with different levels of participation in the dental component of the prenatal nutrition programme. Communities were classified as "high" intervention or "low" intervention on the basis of frequency of contact and content of contact between nutrition educators and women
Luis 2008	Primary outcomes on dental caries or periodontal disease not reported The study evaluated outcomes of clinical and community dental hygiene activities for dentition status and motivation towards oral health of children
Macnab 2012	Primary outcomes on dental caries and periodontal disease not reported
Mazzocchi 1997	Primary outcomes on dental caries or periodontal disease not reported The study presents results of a preventive programme based on a children's book carried out in the elementary schools
Merrick 2012	This is a study protocol
Meyer 2010	This is a clinical intervention study conducted in a clinical setting
Minah 2008	The study was conducted in a clinical setting with interventions delivered by dental personnel
Mohamadkhah 2013	Primary outcomes on dental caries and periodontal disease not reported. The study examined the impact of an oral health educational film on students' oral health behaviour
Muralidharan 2012	This is an uncontrolled intervention trial
Nelson 2012	Primary outcomes on dental caries and periodontal disease not reported. The study describes the design and recruitment strategies of a health promotion programme
Pakhomov 1997	This is a toothpaste trial The study reported on caries-reducing effects of an amine fluoride toothpaste
Pattussi 2006	No intervention, cross-sectional study on the association between neighbourhood empowerment, a scale of social capital and oral health, assessed in terms of dental caries, in adolescents
Pereira 2012	Primary outcomes on dental caries and periodontal disease not reported. The study focuses on oral health indicators of the prevalence of oral diseases, their treatment coverage, access to health care and preventive actions in oral health
Pienihakkinen 2002	The intervention was clinically administered The study involved clinical and microbiological outcomes of risk-based management of dental caries in comparison with routine prevention in young children
Pienihakkinen 2005	The intervention was clinically administered - the study examined clinical and economic findings 7 years after cessation of the caries prevention programme
Pieper 2013	Baseline data on dental caries not reported
Plonka 2013	Data on the outcome measure not collected at baseline

Study	Reason for exclusion
Pulkallus 2013	Primary outcomes on dental caries and periodontal disease not reported. This paper reports costs and patient outcomes of a caries prevention programme
Ramos-Gomez 2012	Intervention is of a chemical nature (chlorhexidine mouthwash and fluoride varnish)
Redmond 1999	Primary outcomes on dental caries and periodontal disease not reported Mean proportion of sites with plaque and changes in oral health knowledge and behaviour reported
Roberts-Thomson 2010	The study involved only a visual assessment of gum health The study reports the impact of the intervention on oral health promotion activities in community and personal oral health practices of children
Rodrigues 2003	Primary outcomes on dental caries and periodontal disease not reported - the study reported outcomes on dental plaque
Rosema 2012	Baseline data on bleeding index not reported
Sgan-Cohen 2001	Primary outcomes on dental caries not reported The study evaluated effects of a community health education programme on reported compliance of parents related to modification of bottle feeding practices and tooth cleaning practices of infants
Silveira 2002	The study did not include a control group The study evaluated reduction on the visible plaque index and on the gum bleeding index in children
Sundell 2013	Predominantly clinic based and chemical in nature
Tagliaferro 2013	The intervention tested is given between different chemical treatments. All groups received the oral health education component
Weinstein 2011	Not a primary research study, editorial
Wennhall 2005	The study uses a historic non-intervention reference group - no baseline data reported for reference group
Whittle 2008	Baseline data or data gathered during the intervention period not reported - data reported only 3 years after the intervention and again at 5 years
Wilson 2013	Primary outcomes on dental caries and periodontal disease not reported
Worthington 2001	Primary outcomes on dental caries and periodontal disease not reported - reported outcomes include dental knowledge, diet and plaque scores
Yekaninejad 2012	Primary outcomes on dental caries and periodontal disease not reported
Yusof 2013	Primary outcomes on dental caries and periodontal disease not reported
Zanata 2003	The effects of the intervention on child decay were not presented and were not the focus of the study

Study	Reason for exclusion
Zimmer 2001	Although participants were recruited from schools, interventions (fluoride varnish, oral hygiene instructions) were provided within a clinical setting (dental school) by dental professionals

Characteristics of studies awaiting assessment [ordered by study ID]

Hashemian 2012

Methods	Study design: cluster-randomised controlled study Conducted in: Iran Setting: Iranian senior high school Duration of the study: April 2010 to November 2010
Participants	Inclusion criteria: not reported Exclusion criteria: not reported Age at baseline: not reported N (control baseline): 153 N (controls follow-up): not reported N (intervention baseline): 153 N (intervention follow-up): not reported
Interventions	Intervention: The impact of the intervention programme was assessed after 24 weeks, and the gingival index of each student was recorded for both groups before and after intervention. Appropriate instruments and the intervention programme were designed with the purpose of improving stages of interdental cleaning behaviour, perceived benefits and self efficacy, as well as reducing perceived barriers and gingival index Control: not reported Duration of intervention: 24 weeks
Outcomes	Gingival index
Notes	

DATA AND ANALYSES

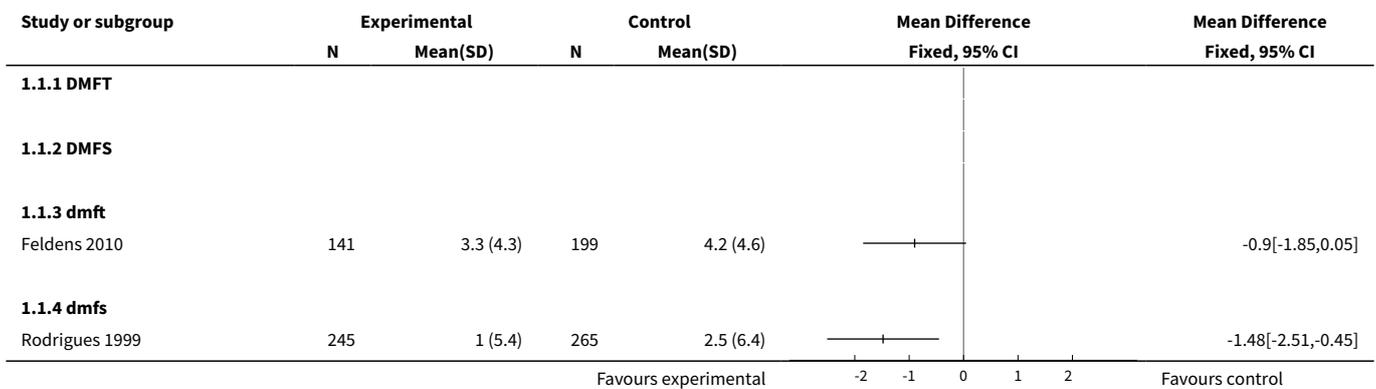
Comparison 1. Interventions and dental caries

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dietary	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

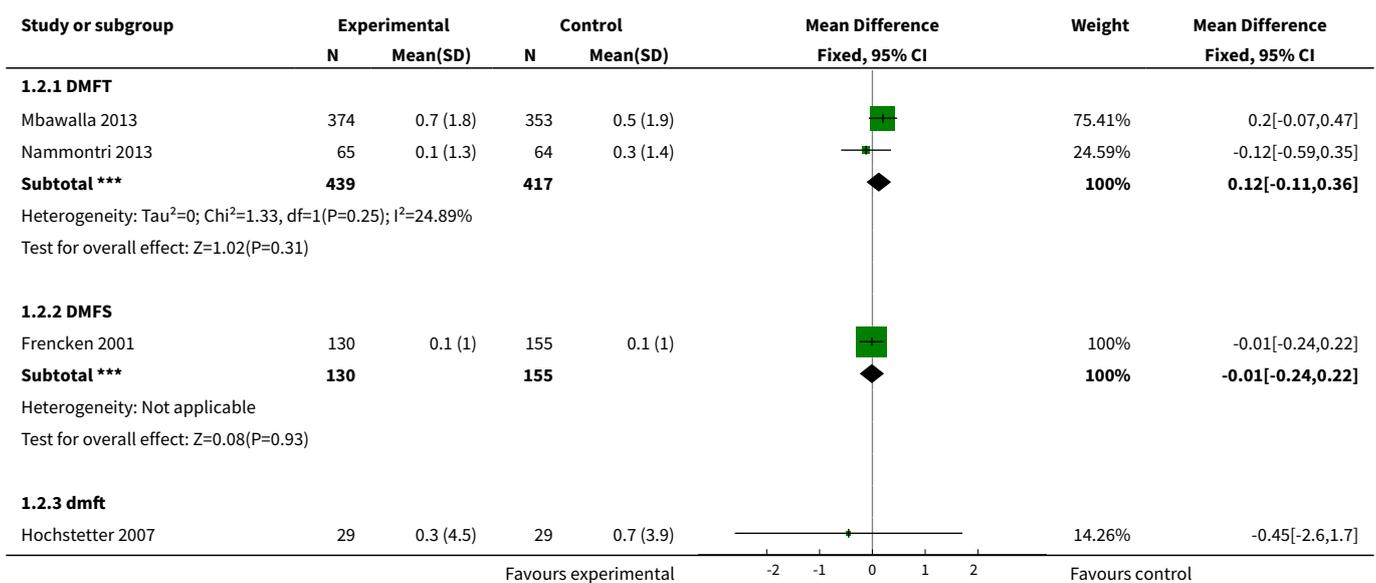
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 DMFT	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 DMFS	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 dmft	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.4 dmfs	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Oral health education	6		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 DMFT	2	856	Mean Difference (IV, Fixed, 95% CI)	0.12 [-0.11, 0.36]
2.2 DMFS	1	285	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.24, 0.22]
2.3 dmft	3	276	Mean Difference (IV, Fixed, 95% CI)	-0.30 [-1.11, 0.52]
3 Oral health education + supervised toothbrushing with fluoridated toothpaste	8		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 DMFT	3	1004	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.11, 0.07]
3.2 DMFS	2	443	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.13, 0.10]
3.3 dmft	2	99481	Mean Difference (IV, Fixed, 95% CI)	-0.97 [-1.06, -0.89]
3.4 dmfs	3	500	Mean Difference (IV, Fixed, 95% CI)	-1.59 [-2.67, -0.52]
4 Oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 DMFT	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 DMFS	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 dmft	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.4 dmfs	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 School-based OHE and toothpaste provision + clinic-based professional preventive oral care	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 DMFT	2	1458	Mean Difference (IV, Fixed, 95% CI)	-0.09 [-0.10, -0.08]
5.2 DMFS	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.3 dmft	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.4 dmfs	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

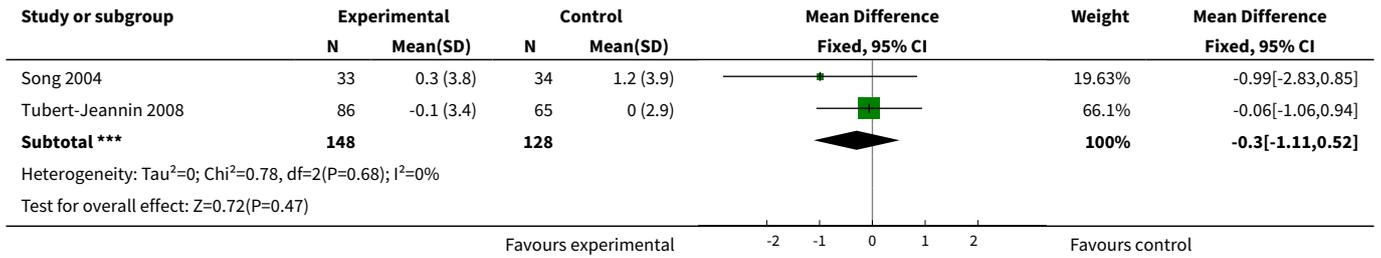
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6 Oral health education + chewing gum	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 DMFT	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.2 DMFS	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.3 dmft	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.4 dmfs	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Analysis 1.1. Comparison 1 Interventions and dental caries, Outcome 1 Dietary.

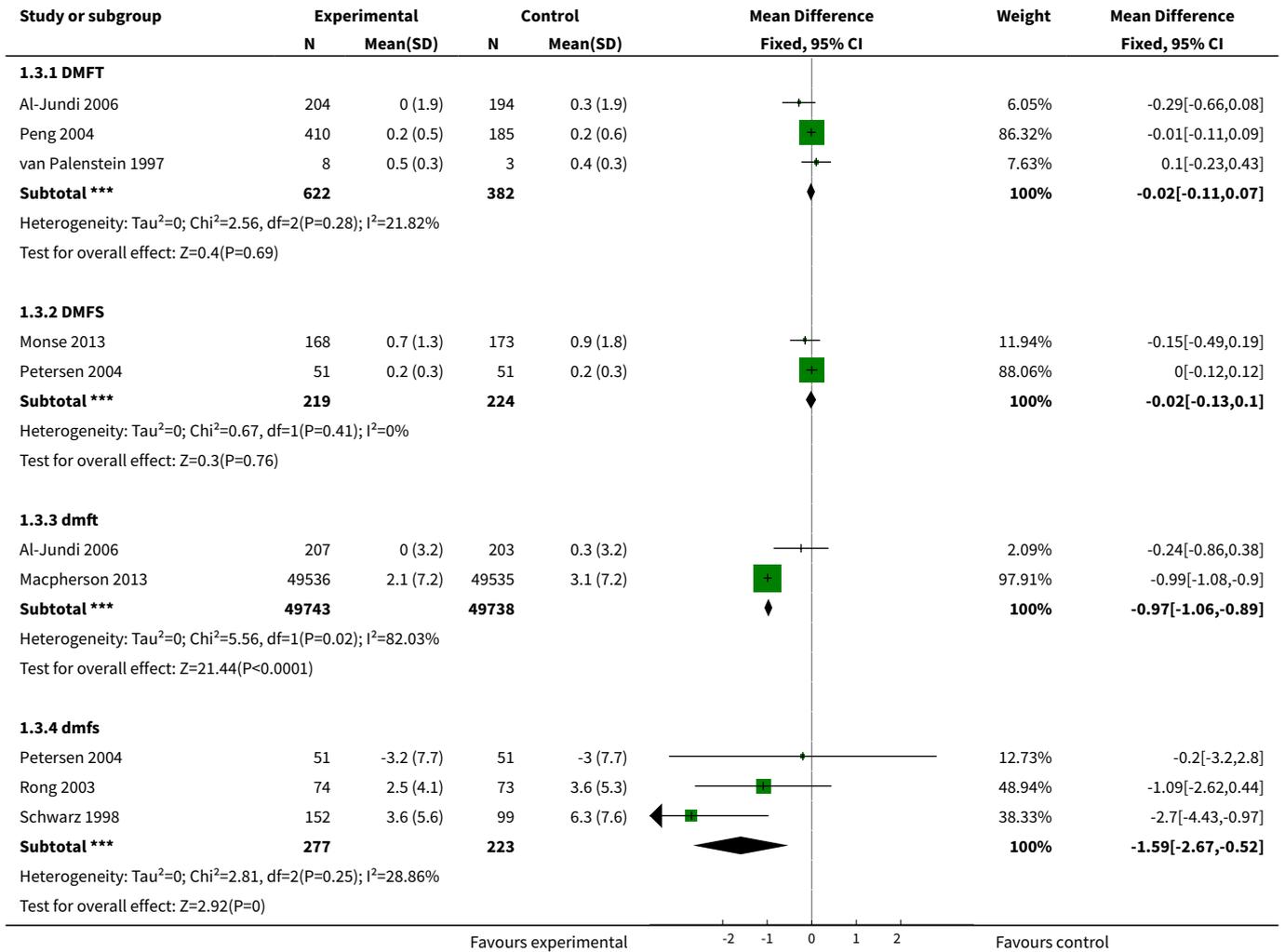


Analysis 1.2. Comparison 1 Interventions and dental caries, Outcome 2 Oral health education.

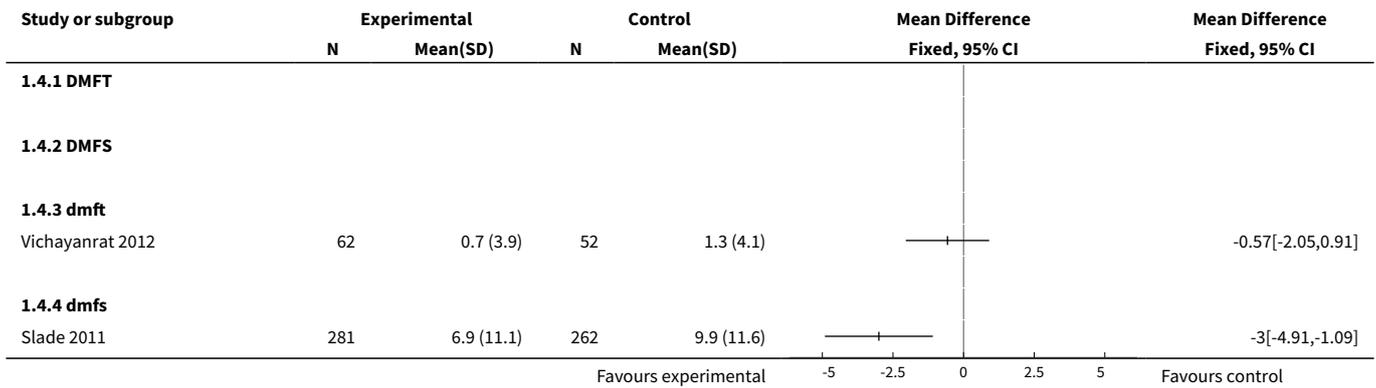




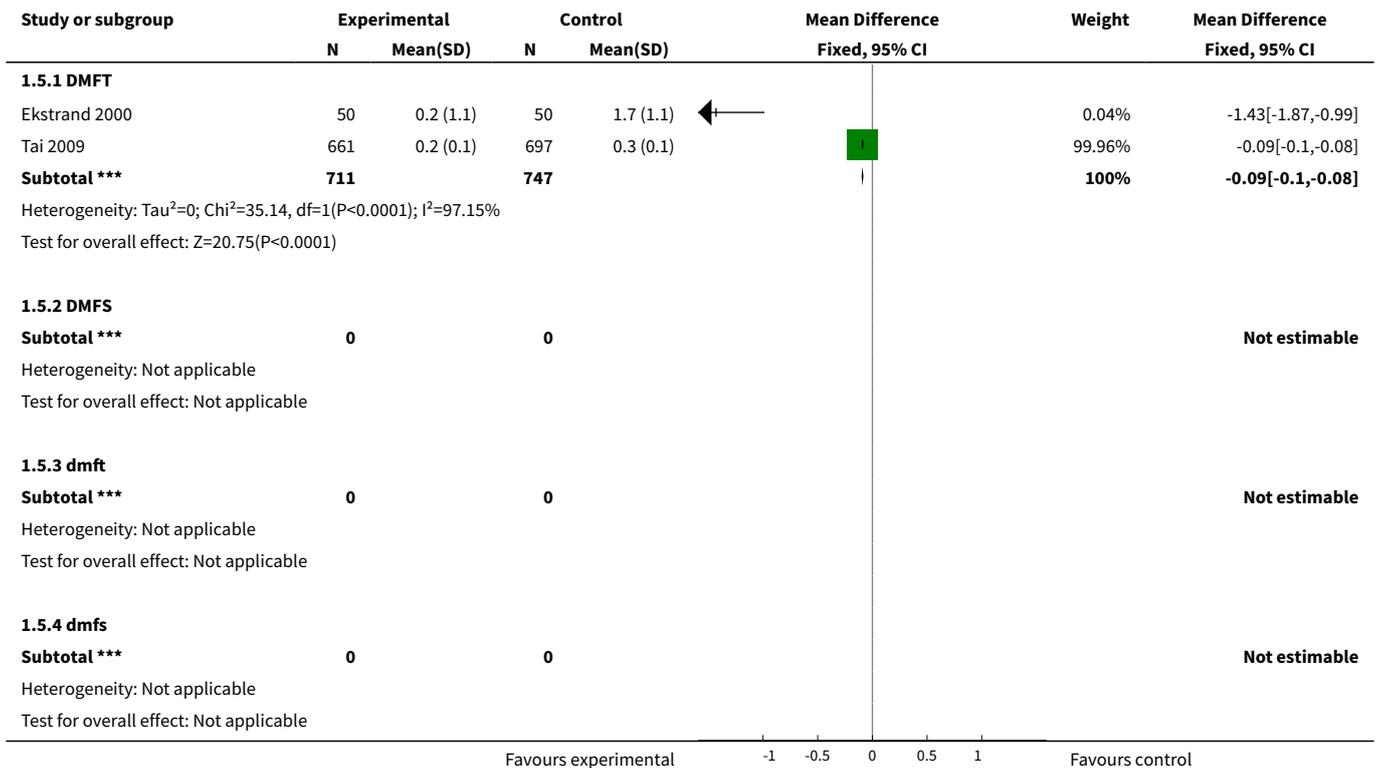
Analysis 1.3. Comparison 1 Interventions and dental caries, Outcome 3 Oral health education + supervised toothbrushing with fluoridated toothpaste.



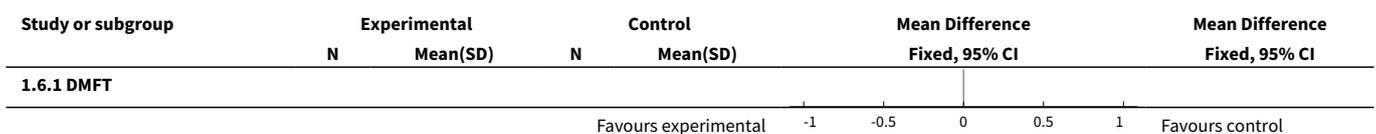
Analysis 1.4. Comparison 1 Interventions and dental caries, Outcome 4 Oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic.

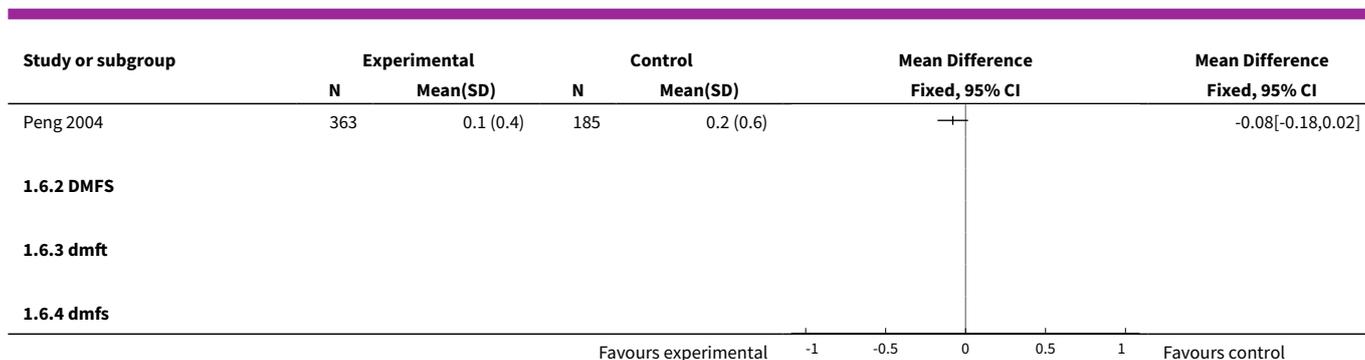


Analysis 1.5. Comparison 1 Interventions and dental caries, Outcome 5 School-based OHE and toothpaste provision + clinic-based professional preventive oral care.



Analysis 1.6. Comparison 1 Interventions and dental caries, Outcome 6 Oral health education + chewing gum.





ADDITIONAL TABLES

Table 1. Domains of influence on child oral health

Level of influence	Domains of influence	Examples of factors influencing oral health outcomes of children
Community	Social environment	Educational attainment, neighbourhood stability
	Dental care system	Access to dental care, affordability and costs, insurance, logistics
	Healthcare system	Access to health care
	Physical safety	Neighbourhoods, transport, community facilities (e.g. playgrounds)
	Physical environment	Public water fluoridation, healthy options in local grocery stores, access to healthy foods, geographical location
	Community oral health environment	Oral health promotion initiatives (schools/community), healthy public policy
	Social capital	Networks, social relationships, access to information and resources
Family	Culture	Belief systems, customs, oral health service habits
	Socio-economic status	Parent education attainment, household income, access to healthy food, health literacy
	Social support	Family, peers, community, services
	Physical safety	Abuse, trauma

Table 1. Domains of influence on child oral health *(Continued)*

	Health status of parents	General health, mental health, oral health
	Culture	Language, dietary habits, traditional practices and beliefs
	Health behaviours and practices	Parents modelling behaviour for child, dental hygiene habits
Child (0 to 18 years)	Biological and genetic endowment	Genetic defects, familial history
	Use of dental care	Attendance at dental practice, fluorides, varnish, preventive oral health measures
	Physical and demographic attributes	Race, ethnicity, socio-economic status, disability
	Health behaviours and practices	Dietary behaviours, tobacco and alcohol use, toothbrushing, dental hygiene and oral care

 Adapted from [Fisher-Owens 2007](#)

Table 2. Overview of characteristics of included studies

Study ID	Type	Country	Guiding theoretical frameworks	Setting	Target age group (years, at baseline)	Intervention period (years)	Study design
Al-Jundi 2006	OH education and toothbrushing programme	Jordan	NR	Education	6-12	≤ 1 year	RCT
Arunakul 2012	OH education	Thailand	NR	Education	6-12	≤ 1 year	RCT
D'Cruz 2013	OH education	India	NR	Education	13-18	≤ 1 year	RCT
Ekstrand 2000	OH education and toothpaste and fluoridated varnish and oral prophylaxis and preventive oral care	Russia	Policy	Education and health service	3, 6 and 11	≤ 1 year	Quasi-experimental
Feldens 2010	Dietary (focus on breastfeeding and sugar)	Brazil	Policy	Education and community	0-5	≤ 1 year	RCT
Frazão 2011	OH education and toothbrushing programme	Brazil	Cost-effectiveness	Education	5	> 1-2 years	RCT
Freeman and Oliver 2009	Dietary (focus on snacking at school)	Ireland	SEM, policy, HPS	Education	6-12	> 1-2 years	Matched controlled trial
Freitas-Fernandes 2002	OH education and oral prophylaxis	Brazil	SD, SEM, HP	Care	6-12	≤ 1 year	Controlled before-and-after study
Frencken 2001	OH education	Zimbabwe	Behaviour change	Education	6-12	≤ 1 year	Quasi-experimental
Haleem 2012	OH education	Pakistan	Social-cognitive theory	Education	6-12	≤ 1 year	Cluster RCT
Hochstetter 2007	OH education	Argentina	HP, SD, SEM	Education	0-5	≤ 1 year	RCT
Ismail 2011	OH education and MI	USA	SCT, SEM	Home and community	0-5	≤ 1 year	RCT
Macpherson 2013	OH education and toothbrushing programme	Scotland	National policy	Care	0-5	> 2 years	ITS

Table 2. Overview of characteristics of included studies (Continued)

Mbawalla 2013	OH education	Tanzania	HPS	Education	13-18	> 1-2 years	Cluster RCT
Monse 2013	OH education and toothbrushing programme	Phillipines	Fit for School Action framework	Education	6-12	≤ 1 year	Controlled before-and-after study
Nammontri 2013	OH education	Thailand	Sense of coherence	Education	6-12	≤ 1 year	Cluster RCT
Nylander 2001	OH education and diet (sugar)	Sweden	Behaviour change	Education	13-18	> 2 years	Controlled before-and-after study
Pakpour 2014	OH education	Iran	NR	Education	15	≤ 1 year	Cluster RCT
Peng 2004	OH education and sugar-free chewing gum or toothbrushing programme	China	HPS	Education	6-12	> 1-2 years	Quasi-experimental, controlled before-and-after study
Petersen 2004	OH education and toothbrushing programme	China	HPS	Education	6-12	> 2 years	Cluster RCT
Plutzer 2012	OH education	Australia	Anticipatory guidance	Health service and home	0-5	≤ 1 year	RCT
Rodrigues 1999	Dietary (focus on sugar)	Brazil	Policy	Care	0-5	≤ 1 year	Quasi-experimental, controlled before-and-after study
Rong 2003	OH education and toothbrushing programme	China	NR	Education	0-5	> 1-2 years	Cluster RCT
Saied-Moallemi 2009	OH education	Iran	NR	Education and home	6-12	≤ 1 year	Cluster RCT
Schwarz 1998	OH education and toothbrushing programme	China	NR	Education	0-5	> 2 years	Controlled before-and-after study
Shenoy 2010	OH education	India	NR	Education	13-18	≤ 1 year	Cross-over controlled before-and-after study
Slade 2011	OH education and fluoridated varnish and PD	Australia	SEM	Health service, com-	0-5	> 1-2 years	Cluster RCT

Table 2. Overview of characteristics of included studies (Continued)

Song 2004	OH education	Korea	NR	Education	0-5	≤ 1 year	Quasi-experimental, controlled before-and-after study
Tai 2009	OH education and toothpaste and preventive/curative oral care	China	HPS	Education	6-12	> 2 years	Cluster RCT
Toassi 2002	OH education and MI	Brazil	Pedagogical motivational approaches	Education	6-12	≤ 1 year	Before-and-after study (2 active arms)
Tubert-Jeannin 2008	OH education	France	SD, SEM	Education	6-12	≤ 1 year	Cluster RCT
Turrioni 2012	OH education	Brazil	Education	Education and home	13-18	≤ 1 year	RCT
Ueno 2012	OH education	Tokyo	Encourage School programme	Education	13-18	≤ 1 year	Controlled before-and-after study
van Palenstein 1997	OH education and toothbrushing programme	Tanzania	SD, SEM	Education	6-12	> 1-2 years	Quasi-experimental, controlled before-and-after study
Vichayanrat 2012	OH education and fluoridated supplements and social support	Thailand	Self efficacy theory, health belief model and social support and organisational change theory	Health service and home	0-5	≤ 1 year	Quasi-experimental, controlled before-and-after study
Weber-Gasparoni 2013	OH education	USA	Self determination theory	Home	0-5	≤ 1 year	RCT
Weinstein 2006	OH education and MI	Canada	Behaviour change, MI	Home	0-5	≤ 1 year	RCT
Yazdani 2009	OH education	Iran	NR	Education	13-18	≤ 1 year	Cluster RCT

Table 3. Macpherson (2013): risk of bias assessment for interrupted time series (ITS) studies

Domain	Risk of bias <i>Low/ High/Unclear</i>	Support for judgement
Was the intervention independent of other changes?	Low	No change in access to fluoride varnish, supplements or water fluoridation during the study period
Was the shape of the intervention effect pre-specified?	Unclear	Study authors stated that aim was to test whether intervention reduced caries
Was the intervention unlikely to affect data collection?	Low	Intervention did not interfere with data collection, as dental data were generated as part of the Scottish Government's oral health monitoring system for school children. For nursery toothbrushing data, the percentages of nurseries in each Health Board participating in the toothbrushing programme over time (the 'intensity of toothbrushing') were derived from various sources and were supplemented with individual data requests from Health Boards
Was knowledge of allocated interventions adequately prevented during the study?	Low	This is a national-level intervention, and it is not possible to blind participants to the intervention. Dental data were generated as part of the Scottish Government's oral health monitoring system for school children
Were incomplete outcome data adequately addressed?	Low	Records of children with a missing deprivation score were excluded from analyses by deprivation category but were included in all other analyses. Deprivation scores were not available before the 1993 dental inspection, and from 1993, 5.1% of records were without a DepCat score
Was the study free from selective outcome reporting?	Low	Dental data were generated as part of the Scottish Government's oral health monitoring system for school children
Was the study free from other risks of bias?	Unclear	Unclear

Table 4. Sensitivity analyses by commercial funding

Intervention type		Number of studies	Caries WMD	Effect P value	Het. P value	I ²
Oral health education + supervised toothbrushing with fluoridated toothpaste	All trials	8	-0.11 (-0.17 to -0.05)	0.0002	0.13	35%
	Commercially supported ^a	2	-0.30 (-0.48 to -0.12)	0.001	0.23	31%
Oral health education + fluoride (varnish/supplement) + training/support in a non-dental clinic	All trials	2	-0.24 (-0.40 to -0.09)	0.002	0.56	0%

Table 4. Sensitivity analyses by commercial funding (Continued)

	Commercially supported ^b	2	-0.24 (-0.40 to -0.09)	0.002	0.56	0%
School-based OHE and toothpaste provision + clinic-based professional preventive oral care	All trials	2	-1.12 (-1.23, -1.01)	< 0.0001	0.53	0%
	Commercially supported ^c	1	-1.11 (-1.23 to -1.00)	< 0.0001	n/a	n/a

^a Rong 2003 and Schwarz 1998; ^b Slade 2011 and Vichayanrat 2012; ^c Tai 2009

Table 5. Outcomes of included studies

Study ID	Primary outcomes	Secondary outcomes
Al-Jundi 2006	<p>Measures: caries indices (DMFT/deft and % caries free)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: oral health education (OHE) and daily supervised toothbrushing</p> <p>Control group: OHE with no supervised toothbrushing</p> <p>I_A & C_A: mean age 6.3 years (SD = 0.29)</p> <p>I_B & C_B: mean age 11.7 years (SD = 0.87)</p> <p>deft: mean (SD)</p> <p>I_A: baseline: 4.58 (3.2); follow-up: 4.6 (3.2)</p> <p>% change from baseline: +0.43%</p> <p>C_A: baseline: 4.99 (3.3); follow-up: 5.25 (3.2)</p> <p>% change from baseline: +5.2%</p> <p>P value for difference between groups at baseline = 0.2</p> <p>P value for difference between groups at follow-up = 0.001</p> <p>DMFT: mean (SD)</p> <p>I_B: baseline: 1.69 (1.9); follow-up: 1.7 (1.9)</p> <p>% change from baseline: +0.59%</p> <p>C_B: baseline: 1.70 (2.0); follow-up: 2.0 (1.9)</p> <p>% change from baseline: +17.6%</p> <p>P value for difference between groups at baseline = 0.7</p> <p>P value for difference between groups at follow-up = 0.001</p> <p>Percentage (%) caries free</p> <p>I_A: baseline: 14.7%; follow-up: 14%</p> <p>% change from baseline: -5%</p>	None reported

Table 5. Outcomes of included studies (Continued)

	C_A : baseline: 12.7%; follow-up: 9.4% % change from baseline: -25.9% I_B : baseline: 43.6%; follow-up: 43.6% % change from baseline: 0% C_B : baseline: 42.8%; follow-up: 33.0% % change from baseline: -22.8%	
Arunakul 2012	Measures: gingival health (gingival index and gingival bleeding index) Outcomes: Outcomes were assessed in relation to I_A : video-based OHE I_B : illustrated book OHE I_C : video presentation + illustrated book OHE Control: no OHE I_A : mean age: 8 years and 6 months I_B : mean age: 8 years and 6 months I_C : mean age: 8 years and 4 months C : mean age: 8 years and 5 months Gingival index scores: mean (SD) I_A : baseline: 0.98 (0.33); follow-up: 0.56 (0.22) I_B : baseline: 0.91 (0.26); follow-up: 0.54 (0.14) I_C : baseline: 0.95 (0.25); follow-up: 0.58 (0.27) C : baseline: 0.90 (0.24); follow-up: 0.52 (0.15) Gingival bleeding index: mean (SD) I_A : baseline: 0.187 (0.088); follow-up: 0.018 (0.025) I_B : baseline: 0.216 (0.099); follow-up: 0.006 (0.014) I_C : baseline: 0.198 (0.074); follow-up: 0.024 (0.046) C : baseline: 0.192 (0.092); follow-up: 0.026 (0.042)	Plaque index I_A : baseline: 3.50 (0.49) Follow-up: 2.71 (0.44) I_B : baseline: 3.42 (0.58) Follow-up: 2.67 (0.63) I_C : baseline: 3.47 (0.32) Follow-up: 2.60 (0.36) C : baseline: 3.78 (0.47) Follow-up: 3.14 (0.30)
D'Cruz 2013	Measures: gingival health (gingival index) Outcomes: Outcomes were assessed in relation to I_A : study group 1: OHE only I_B : study group 2: OHE and toothbrushing demonstration Control group: toothbrush provision I_A : age range 13-15 years	Plaque index I_A : baseline: 3.91 (0.31); post intervention: 3.59 (0.24); follow-up: 3.02 (0.13) I_B : baseline: 3.90 (0.30); post intervention: 3.59 (0.25); follow-up: 2.79 (0.3)

Table 5. Outcomes of included studies (Continued)

	I_B : age range 13-15 years C : age range 13-15 years Gingival index: mean (SD) I_A : baseline: 1.46 (0.26); post intervention: 1.40 (0.22); follow-up: 1.31 (0.25) I_B : baseline: 1.44 (0.25); post intervention: 1.37 (0.19); follow-up: 1.07 (0.11) C : baseline: 1.46 (0.25); post intervention: 1.43 (0.25); follow-up: 1.35 (0.23) P value for difference between groups at baseline < 0.050 P value for difference between groups post intervention < 0.001	C : baseline: 3.95 (0.30); post intervention: 3.91 (0.31); follow-up: 3.59 (0.31)
Ekstrand 2000	Measures: caries indices (deft/defs/dmft/DMFS) and gingival status I_A : intervention group A (3-year-old): OHE + toothbrushing training C_A : control group A: no intervention I_B : intervention group B (6- to 8-year-old): OHE + toothbrushing training + clinical procedure C_B : control group B: no intervention I_C : intervention group C (11-year-old): OHE + supervised toothbrushing + clinical procedure C_C : control group B: no intervention def-s: mean (SE) I_A : baseline: not reported; follow-up: 4.91 (0.57) C_A : baseline: not reported; follow-up: 8.60 (0.88) P value for difference between groups at follow-up: P value < 0.05 I_B : baseline: 8.36; follow-up: 5.66 C_B : baseline: 7.74; follow-up: 3.38 def-t: mean (SE) I_A : baseline: not reported; follow-up: 3.62 (0.38) C_A : baseline: not reported; follow-up: 5.67 (0.41) P value for difference between groups at follow-up: P value < 0.05 I_B : baseline: 5.82; follow-up: 5.48 C_B : baseline: 5.22; follow-up: 3.94 P value for difference between groups at baseline and at follow-up for def-s and def-t: P value < 0.001 DMFS: mean I_B : baseline: 0.06; follow-up: 0.28 C_B : baseline: 0.19; follow-up: 2.24	Plaque status The number of children with thick plaque was significantly higher in C_A compared with I_A (P value < 0.001) (<i>data not reported</i>) In groups B and C, no difference between I_B & C_B at baseline, but plaque status was significantly worse in C_B compared with I_B (P value < 0.01) (<i>data not reported</i>) In groups B and C, no difference between I_C & C_C at baseline, but plaque status was significantly worse in C_C compared with I_C (P value < 0.01) (<i>data not reported</i>)

Table 5. Outcomes of included studies (Continued)

	P value for difference between groups at baseline: P value < 0.001 I_C : baseline: not reported; follow-up: 3.12 C_C : baseline: not reported; follow-up: 6.35 P value for difference between groups at follow-up: P value < 0.001 Gingival status (% of children with no gingival inflammation) I_A : baseline: not reported; follow-up; not reported C_A : baseline: not reported; follow-up: not reported P value for difference between groups at follow-up: P value < 0.05 I_B : baseline: 8%; follow-up: 94% C_B : not reported; follow-up: 50% P value for difference between groups at baseline: P value < 0.001 I_C : baseline: 56%; follow-up: 96% C_C : baseline: 48%; follow-up: 22% P value for difference between groups at follow-up: P value < 0.001	
Feldens 2007, Feldens 2010	Measures: teeth affected by caries (d_{1+mfs}) Proportion of children with early childhood caries Outcomes: Outcomes were assessed in relation to Intervention group: dietary advice Control group: no intervention Teeth affected by caries: mean (SD) Intervention: at age 1 (DS): 0.37 (1.37); at age 4 (d_{1+mfs}): 3.25 (4.25) Control: at age 1 (DS): 0.63 (1.62); at age 4 (d_{1+mfs}): 4.15 (4.57) Proportion of children with early childhood caries: n (%) Intervention: at age 1: 16 (10.2); at age 4: 76 (53.9) Control: at age 1: 40 (18.3); at age 4: 138 (69.3) At age 1, OR dental caries (C vs I): 0.52 (95% CI 0.27 to 0.97), P value = 0.03 At age 4, RR dental caries (C vs I): 0.78 (95% CI 0.65 to 0.93), P value = 0.004 P value for difference in DS among study and control groups at 1 year = 0.03 P value for difference in d_{1+mft} among study and control groups at 1 year = 0.023	None reported
Frazão 2011	Measures: dental caries Outcomes: Outcomes were assessed in relation to Intervention group: oral health education + bucco-lingual brushing technique	Cost-effectiveness

Table 5. Outcomes of included studies (Continued)

	<p>Control group: oral health education</p> <p>Intervention: mean age in months 68.56 (SD 4.93)</p> <p>Control: mean age in months 68.40 (SD 4.67)</p> <p>dmft at baseline</p> <p>Intervention: 2.27 (SD 3.41)</p> <p>Control: 2.02 (SD 2.99)</p> <p>dmft = 0</p> <p>Intervention: 5.6 (2.8 to 8.4)</p> <p>Control: 6.6 (4.0 to 9.3)</p> <p>dmft > 0</p> <p>Intervention: 13.0 (9.4 to 16.5)</p> <p>Control: 16.1 (11.9 to 20.2)</p> <p>Incidence density for caries (per 1000 exposed surfaces/month) according to gender</p> <p>Intervention: female: 11.8 (8.4 to 15.3); male: 5.7 (3.0 to 8.4)</p> <p>Control: female: 10.4 (6.7 to 14.1); male: 12.0 (8.3 to 15.6)</p>	
Freeman and Oliver 2009	<p>Measures: decay experience (decay into dentine, D_{3CV})</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: “Boosting Better Breaks” (BBB), a healthy snacking break-time policy</p> <p>Control group: This group received no intervention</p> <p>Decay into dentine, D_{3CV}: mean (SE)</p> <p>Intervention: baseline: 0.33 (0.32)</p> <p>Control: baseline: 0.49 (0.11)</p> <p>Decay into dentine for intervention school decreased by 0.31 (0.15) units compared with control school at 24-month follow-up = -0.31 (0.15), P value < 0.05</p>	Not reported
Freitas-Fernandes 2002	<p>Measures: gingival index and % of bleeding papillae</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + prophylaxis with abrasive paste and toothbrush/dental floss provision</p> <p>Control group: toothbrush/dental floss provision</p> <p>% of bleeding papillae</p> <p>Intervention: baseline: 28.1 (22.9); post intervention: 10.0 (7.7)</p> <p>Control: baseline: 29.9 (26.8); post intervention: 24.4 (22.4)</p> <p>P value for difference between groups post intervention: P value < 0.01</p>	<p>Mean % of surfaces without visible plaque</p> <p>Intervention: baseline: 2.3 (8.0)</p> <p>Post intervention: 36.2 (28.5)</p> <p>Control: baseline: 10.8 (13.5)</p> <p>Post intervention: 15.1 (20.3)</p>

Table 5. Outcomes of included studies (Continued)

		P value for difference between groups at baseline: P value < 0.05
Frencken 2001	<p>Measures: caries increment</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OH education</p> <p>Control group: no intervention</p> <p>DMFS score: mean (SD)</p> <p>Intervention: baseline: 0.24 (0.62); follow-up: 0.33 (1.35)</p> <p>Control: baseline: 0.24 (0.90); follow-up: 0.34 (1.16)</p>	<p>Plaque score: mean (SD)</p> <p><i>Grades 2 to 4</i></p> <p>Intervention: baseline: 1.21 (0.39); 1-year follow-up: 1.37 (0.39); 2-year follow-up: 1.42 (0.47)</p> <p>Control: baseline: 1.28 (0.41); 1-year follow-up: 1.42 (0.38); 2-year follow-up: 1.49 (0.41)</p> <p><i>Grades 4 to 6</i></p> <p>Intervention: baseline: 1.04 (0.39); 1-year follow-up: 1.26 (0.44); 2-year follow-up: 1.22 (0.45)</p> <p>Control: baseline: 1.20 (0.43); 1-year follow-up: 1.18 (0.44); 2-year follow-up: 1.24 (0.46)</p>
Haleem 2012	<p>Measures: periodontal health (periodontal index)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>I_A: dentist-led OHE</p> <p>I_B: teacher-led OHE</p> <p>I_C: peer-led OHE</p> <p>I_D: self learning OHE</p> <p>Control: no OHE</p> <p>Age range: 10 to 11 years</p> <p>Periodontal index: mean (95% CI)</p> <p>I_A: baseline: 2.25 (1.82 to 2.68); follow-up: 1.59 (1.27 to 1.92)</p> <p>I_B: baseline: 2.23 (1.80 to 2.65); follow-up: 1.18 (0.86 to 1.50)</p> <p>I_C: baseline: 2.34 (1.91 to 2.76); follow-up: 1.06 (0.75 to 1.38)</p> <p>I_D: baseline: 2.18 (1.74 to 2.61); follow-up: 2.19 (1.87 to 2.52)</p> <p>C: baseline: 2.30 (1.86 to 2.73); follow-up: 2.52 (2.19 to 2.85)</p>	<p>Plaque index: mean (95% CI)</p> <p>I_A: baseline: 5.02 (4.55 to 5.48)</p> <p>Follow-up: 3.77 (3.29 to 4.25)</p> <p>I_B: baseline: 5.48 (5.02 to 5.94)</p> <p>Follow-up: 4.33 (3.85 to 4.81)</p> <p>I_C: baseline: 5.23 (4.78 to 5.68)</p> <p>Follow-up: 4.22 (3.74 to 4.69)</p> <p>I_D: baseline: 3.44 (2.98 to 3.90)</p> <p>Follow-up: 4.21 (3.73 to 4.70)</p> <p>C: baseline: 4.91 (4.44 to 5.38)</p> <p>Follow-up: 4.64 (4.16 to 5.13)</p>
Hochstetter 2007	<p>Measures: caries experience (dmfs and dmft) and gingival index</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + supervised toothbrushing + sodium fluoride phosphate application</p>	<p>Plaque index: mean (95% CI)</p> <p>Intervention: baseline: 1.5 (1.25 to 1.75)</p>

Table 5. Outcomes of included studies (Continued)

<p>Control group: supervised toothbrushing + sodium fluoride phosphate application only</p> <p>dmft: mean (95% CI)</p> <p>Intervention: baseline: 5.2 (3.6 to 7.2)</p> <p>12 months post intervention: 5.4 (4.0 to 7.2)</p> <p>Control: baseline: 5.2 (4.2 to 6.8)</p> <p>12 months post intervention: 6.2 (4.8 to 8.0)</p> <p>P value for change from baseline in control group: P value < 0.001</p> <p>P value for change from baseline in study group: P value < 0.0001</p> <p>dmfs: mean (95%CI)</p> <p>Intervention: baseline: 11.0 (6.0 to 17.0)</p> <p>12 months post intervention: 12 (7.0 to 18.0)</p> <p>Control: baseline: 11.0 (7.0 to 15.0)</p> <p>12 months post intervention: 15 (11.0 to 18.0)</p> <p>P value for change from baseline in control group: P value < 0.005</p> <p>P value for change from baseline in study group: P value < 0.005</p> <p>Gingival index: mean (95%CI)</p> <p>Intervention: baseline: 0.8 (0.65 to 0.9)</p> <p>6 months post intervention: 0.4 (0.25 to 0.45)</p> <p>12 months post intervention: 0.15 (0.05 to 0.25)</p> <p>Control: baseline: 0.30 (0.25 to 0.45)</p> <p>6 months post intervention: 0.4 (0.3 to 0.5)</p> <p>12 months post intervention: 0.7 (0.65 to 0.9)</p>	<p>6 months post intervention: 0.75 (0.6 to 0.8)</p> <p>12 months post intervention: 0.6 (0.4 to 0.8)</p> <p>Control: baseline: 1.2 (0.8 to 1.4)</p> <p>6 months post intervention: 1.5 (1.2 to 1.6)</p> <p>12 months post intervention: 1.75 (1.5 to 2.0)</p> <p>P value for change from baseline in control group: P value < 0.01</p> <p>P value for change from baseline in study group: P value < 0.0001</p>
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[Ismail 2011](#)

Measures: caries status (number of new non-cavitated, new cavitated and new untreated lesions)

Outcomes: Outcomes were assessed in relation to

Intervention group: motivational interviewing (MI) and OHE

Control group: only OHE

Number of non-cavitated lesions (n)

Intervention: baseline: 3.5; follow-up: 4.0

Control: baseline: 3.45; follow-up: 4.1

Number of cavitated lesions

Intervention: baseline: 2.15; follow-up: 2.5

Control: baseline: 2.14; follow-up: 2.3

Toothbrushing habits

* % of children brushing twice a day

* % of children brushing every day at bedtime

OR for % of children brushing twice a day (**C** vs **I**) = 1.2

OR for % of children brushing every day at bedtime (**C** vs **I**) = 1.1

[Macpherson 2012](#)

Measures: d2mft

Community-based population-level interventions for promoting child oral health (Review)

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Table 5. Outcomes of included studies (Continued)

	<p>Six time points before intervention</p> <p>Six time points after intervention</p> <p>The slope of the uptake in toothbrushing was correlated with the slope in reduction of d3mft</p> <p>Mean d3mft in years -2 to 0 (relative to that in start-up year 0) was 3.06, and was reduced to 2.07 in years 10 to 12 (difference = -0.99; 95% CI -1.08 to -0.90; P value < 0.001). The uptake of toothbrushing correlated with the decline in d3mft (correlation = -0.64; -0.86 to -0.16; P value = 0.011)</p> <p>The most deprived children showed a greater decrease in mean d3mft in post-intervention periods compared with the least deprived children. In the post-intervention period DepCat 6-7, children's mean d3mft decreased from 4.48 in the reference period (year -2 to year 0) to 2.77 in the period from year 10 to year 12, whereas for DepCat 1-2 children, the decrease was less profound, from 1.52 to 1.10</p>	
Mbawalla 2013	<p>Measures: caries score (DT)</p> <p>Bleeding score</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: oral health education, dietary advice and supervised toothbrushing instructions</p> <p>Control group: no intervention</p> <p>decayed teeth (DT): mean (SD)</p> <p>Intervention: baseline: 1.0 (-1.5); follow-up: 1.7 (2.2)</p> <p>Mean change from baseline: -0.7 (95% CI -0.9 to -0.5)</p> <p>Control: baseline: 1.2 (1.9); follow-up: 1.7 (2.2)</p> <p>Mean change from baseline: -0.6 (95% CI -0.7 to -0.2)</p> <p>P value for mean decayed teeth score in study group at follow-up: P value < 0.001</p> <p>Bleeding score: mean (SD)</p> <p>Intervention: baseline: 0.5 (0.9); follow-up: 0.3 (0.6)</p> <p>Mean change from baseline: 0.3 (95% CI 0.1 to 0.5)</p> <p>Control: baseline: 0.4 (0.7); follow-up: 0.5 (1.1)</p> <p>Mean change from baseline: -0.1 (95% CI -0.2 to 0.03)</p> <p>P value for mean bleeding score in the study group at follow-up: P value < 0.001</p> <p>P value for mean change in bleeding score from baseline in the control group: P value < 0.05</p>	<p>Plaque score: mean (SD)</p> <p>Intervention: baseline: 3.3 (2.7); follow-up: 2.0 (2.5)</p> <p>Mean change from baseline: 1.2 (95% CI 0.9 to 1.5)</p> <p>Control: baseline: 3.3 (2.6); follow-up: 2.2 (2.5)</p> <p>Mean change from baseline: 1.1 (95% CI 0.7 to 1.4)</p> <p>P value for mean plaque score in the study group at follow-up: P value < 0.001</p> <p>P value for mean change from baseline in control group: P value < 0.05</p>
Monse 2013	<p>Measures: caries (DMFS)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: daily supervised toothbrushing</p>	<p>None reported</p>

Table 5. Outcomes of included studies (Continued)

	<p>Control group: provision of toothpaste and toothbrushing</p> <p>Intervention: mean age 7.56 years (SD = 0.4)</p> <p>Control: mean age 7.47 years (SD = 0.4)</p> <p>DMFS: mean (SE)</p> <p>Intervention: baseline: 0.82 (0.12)</p> <p>Post intervention: 1.54 (0.17)</p> <p>Change from baseline: 0.72 (0.10)</p> <p>Control: baseline: 1.12 (0.16)</p> <p>Post intervention: 1.99 (0.24)</p> <p>Change from baseline: 0.87 (0.14)</p>	
Nammontri 2013	<p>Measures</p> <p>DMFT and gingival health (% with no gingivitis)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE and school participatory approach</p> <p>Control group: no intervention</p> <p>Age range: 10 to 12 years</p> <p>DMFT: mean (SD)</p> <p>Intervention: baseline: 1.13 (1.21); follow-up: 1.27 (1.37)</p> <p>Control: baseline: 1.18 (1.37); follow-up: 1.44 (1.52)</p> <p>P value for difference between groups at baseline < 0.050</p> <p>P value for difference between groups post intervention < 0.01</p> <p>Findings were not corrected for clustering. The intervention group comprised 133 children in 6 schools, and the control group included 127 children in 6 schools. The effective sample size of intervention and control groups was calculated as 65 and 64</p> <p>Gingival health (% with no gingivitis)</p> <p>Intervention: baseline: 18.9%; follow-up: 31.81%</p> <p>Control: baseline: 24.0%; follow-up: 19.51%</p>	<p>Oral health beliefs</p> <p>Intervention: baseline: 20.01 (2.73); follow-up: 21.63 (2.31)</p> <p>Control: baseline: 20.36 (2.83); follow-up: 19.79 (3.55)</p>
Nylander 2001	<p>Measures: caries index (decayed and filled surface, DFS)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + dietary advice</p> <p>Control group: no intervention</p> <p>DFS: mean (SD)</p> <p>Intervention: baseline: 3.5 (3.8)</p> <p>3-year change from baseline: 1.7 (2.4)</p>	<p>None reported</p>

Table 5. Outcomes of included studies (Continued)

	5-year change from baseline: 4.0 (3.5)	
	Control: baseline: 3.4 (3.0)	
	3-year change from baseline: 2.0 (2.2)	
	5-year change from baseline: 4.6 (3.3)	
Pakpour 2014	Measures: periodontal health	Plaque index
	Outcomes: Outcomes were assessed in relation to	I_A: baseline: 2.5 (0.108)
	I_A: gain frame condition OH education	Follow-up: 2.205 (0.114)
	I_B: loss frame condition OHE	I_B: baseline: 2.617 (0.085)
	Control: no OHE	Follow-up: 1.817 (0.092)
	I_A: mean age: 15.25 (1.06)	C: baseline: 2.417 (0.098)
	I_B: mean age: 15.52 (1.41)	Follow-up: 2.563 (0.108)
	C: mean age: 15.23 (0.71)	
	Periodontal index scores: mean (SD)	
	I_A: baseline: 1.158 (0.081); follow-up: 1.117 (0.080)	
	I_B: baseline: 1.258 (0.069); follow-up: 1.208 (0.076)	
	C: baseline: 1.250 (0.073); follow-up: 1.244 (0.074)	
Peng 2004	Measures: dental caries increment (DMFT and DMFS) and gingival bleeding	None reported
	Outcomes: Outcomes were assessed in relation to	
	Intervention group A: OHE + sugar-free chewing gum	
	Intervention group B: OHE only	
	Control group: no specific intervention	
	DMFS: mean (SD)	
	I_A: baseline: 0.07 (0.32); follow-up: 0.22 (0.55)	
	Change from baseline: 0.15 (0.42)	
	I_B: baseline: 0.06 (0.27); follow-up: 0.32 (0.80)	
	Change from baseline: 0.26 (0.67)	
	C: baseline: 0.05 (0.30); follow-up: 0.31 (0.84)	
	Change from baseline: 0.26 (0.75)	
	Overall P value: baseline (0.30); follow-up (0.11); increment (0.22)	
	P value between groups G and E	
	At baseline: P value = 0.45	
	At follow-up: P value = 0.12	
	Change from baseline: P value = 0.03	

Table 5. Outcomes of included studies (Continued)

DMFT: mean (SD)
I_A: baseline: 0.06 (0.29); follow-up: 0.20 (0.48)

Change from baseline: 0.14 (0.39)

I_B: baseline: 0.05 (0.26); follow-up: 0.26 (0.59)

Change from baseline: 0.21 (0.49)

C: baseline: 0.04 (0.23); follow-up: 0.26 (0.65)

Change from baseline: 0.22 (0.60)

Overall P value: baseline: P value = 0.57

Follow-up: P value = 0.24

Change from baseline: P value = 0.06

P value between groups G and E: baseline: P value = 0.58; follow-up: P value = 0.22; change from baseline: P value = 0.08

Gingival bleeding
I_A: baseline: 13.6 (21.1); follow-up: 18.8 (22.6)

Change from baseline: 5.3 (28.6)

I_B: baseline: 11.7 (20.8); follow-up: 22.4 (24.0)

Change from baseline: 10.7 (31.6)

Control: baseline: 12.3 (24.3); follow-up: 30.8 (34.1)

Change from baseline: 18.5 (42.9)

Overall P value: baseline: P value = 0.48

Follow-up: P value < 0.01

Change from baseline: P value < 0.01

Petersen 2004

Measures: dental caries experience (DMFS) and bleeding score

Outcomes: Outcomes were assessed in relation to

Intervention group: OHE

Control group: no intervention

dmfs: mean
Intervention: baseline: 8.1; follow-up: 4.9

Control: baseline: 8.1; follow-up: 5.1

DMFS: mean
Intervention: baseline: 0.1; follow-up: 0.3

Control: baseline: 0.1; follow-up: 0.3

No significant differences in DMFS increments in both groups (P value not reported)

% of children brushing their teeth twice a day
Intervention: baseline: 35.5; follow-up: 60.9

Control: baseline: 31.3; follow-up: 49.8

% of children using fluoride toothpaste
Intervention: baseline: 74.9; follow-up: 86.3

Control: baseline: 73.1; follow-up: 78.2

Table 5. Outcomes of included studies (Continued)

% scored teeth with gingival bleeding
Intervention: baseline: 11.5; follow-up: 25.0

Control: baseline: 12.4; follow-up: 32.2

P value for overtime difference in change from baseline between study group and control group: P value < 0.05

Findings were not corrected for clustering. The intervention group comprised 335 children in 3 schools, and the control group included 331 children in 3 schools. Effective sample size of intervention and control groups was calculated as 51 and 51

Plutzer 2008, Plutzer 2012	<p>Measures: dental caries (cumulative incidence of severe early childhood caries (S-ECC), d₃mfs, d₃mft)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE</p> <p>Control group: no OHE</p> <p>Intervention: mean age 82.6 months (9.9)</p> <p>Control: mean age 82.5 months (10)</p> <p>Dental caries</p> <p>Intervention: baseline: cumulative incidence of S-ECC: 1.7%</p> <p>Post intervention</p> <p>d₃mfs: 1.46 (2.59 [ML1])</p> <p>d₃mft: 0.99 (1.81)</p> <p>C: baseline: cumulative incidence of S-ECC: 9.6%</p> <p>Post Intervention</p> <p>d₃mfs: 2.45 (6.65)</p> <p>d₃mft: 1.29 (2.66)</p>	None reported
Rodrigues 1999	<p>Measures: caries levels (dmfs)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: dietary advice</p> <p>Control group: no intervention</p> <p>dmfs: mean (SD)</p> <p>Intervention: baseline: 2.75 (5.39); follow-up: 3.72</p> <p>Control: baseline: 3.21 (6.44); follow-up: 5.66</p> <p>OR for caries risk (C vs I): 4.87 (95% CI 1.99 to 11.92) (P value < 0.001)</p>	None reported
Rong 2003	<p>Measures: caries experience (dmfs)</p> <p>Outcomes: Outcomes were assessed in relation to</p>	<p>Oral health habits in children (%)</p>

Table 5. Outcomes of included studies (Continued)

Intervention group: OHE + supervised toothbrushing

Control group: no intervention

dmfs: mean(SD)

Intervention: baseline: 5.54 (7.08); increment: 2.47 (4.09)

Control: baseline: 5.96 (7.74); increment: 3.56 (5.30)

Differences between groups after the programme = 1.09 (95% CI 0.27 to 1.91), P value = 0.009

P value for difference between groups at baseline: P value > 0.05

Findings were not corrected for clustering. Included children were 514 students from 10 schools. The effective sample size of intervention and control groups was calculated as 74 and 73

Brushing their teeth every day

Intervention: baseline: 42.6; post intervention: NR

Control: baseline: 35.3; post intervention: NR

Brushing their teeth twice a day

Intervention: baseline: NR; post intervention: 87.6

Control: baseline: NR; post intervention: 69.0

Brushing their teeth before going to bed

Intervention: baseline: 79.6; post intervention: 77.0

Control: baseline: 81.0; post intervention: 77.2

Taking sweet snacks

Intervention: baseline: 79.6; post intervention: 77.0

Control: baseline: 81.0; post intervention: 77.2

Oral health attitudes in parents (%)

Believe that primary teeth were important

Intervention: baseline: 45.7; post intervention: 98.7

Control: baseline: 47.8; post intervention: 95.3

Believe that children should start brushing their teeth before 3 years old

Intervention: baseline: 43.9; post intervention: 92.6

Control: baseline: 44.8; post intervention: 82.8

Believe that fluoride tooth-paste could prevent caries

Intervention: baseline: NR; post intervention: 91.3

Control: baseline: NR; post intervention: 83.6

Table 5. Outcomes of included studies (Continued)

		<p>Oral health knowledge in parents (%)</p> <p>Knew how much toothpaste should be used for their children's brushing</p> <p>Intervention: baseline: NR; post intervention: 83.9</p> <p>Control: baseline: NR; post intervention: 61.2</p> <p>Knew the causes of caries</p> <p>Intervention: baseline: 47.8; post intervention: 70.9</p> <p>Control: baseline: 58.2; post intervention: 58.2</p>
<p>Saied-Moallemi 2009, Saied-Moallemi 2014</p>	<p>Measures: gingival bleeding index</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention A (class-work group): classroom OHE</p> <p>Intervention B (parental-aid group): home-based OHE</p> <p>Intervention C (combined group): classroom-based and home-based OHE</p> <p>Control group: This group received no intervention</p> <p>Bleeding index: mean (SD)</p> <p>I_A: baseline: 4.01 (1.3); change from baseline: 2.97 (1.67)</p> <p>I_B: baseline: 4.54 (1.1); change from baseline: 4.24 (1.16)</p> <p>I_C: baseline: 3.83 (1.2); change from baseline: 3.20 (1.55)</p> <p>C: baseline: 4.05 (1.4); change from baseline: 2.09 (2.20)</p> <p>P value for difference between groups at baseline: P value < 0.001</p> <p>P value for difference between groups for change from baseline: P value < 0.001</p>	<p>Plaque index</p> <p>I_A: baseline: 10.89 (1.3)</p> <p>Change from baseline: -0.05 (2.17)</p> <p>I_B: baseline: 11 (1.3)</p> <p>Change from baseline: 2.52 (3.48)</p> <p>I_C: baseline: 10.97 (1.3)</p> <p>Change from baseline: 1.08 (3.10)</p> <p>C: baseline: 10.97 (1.6)</p> <p>Change from baseline: 0.16 (2.71)</p> <p>P value for difference between groups at baseline: P value = 0.42</p> <p>P value for difference between groups for change from baseline: P value < 0.001</p>
<p>Schwarz 1998</p>	<p>Measures: dmfs</p> <p>Outcomes: Outcomes were assessed in relation to the intervention group. Supervised toothbrushing program in kindergartens with fluoridated toothpaste</p> <p>Control group: no organised preventive programme</p> <p>DMFS: mean (SE)</p> <p>Intervention: increment</p> <p>New active caries: 6.0 (0.46)</p>	<p>None reported</p>

Table 5. Outcomes of included studies *(Continued)*

Caries reactivations: 0.2 (0.05)

Subtotal: 6.2 (0.47)

Reversals

Arrested caries: 8.3 (0.77)

Examiner reversals: 0.7 (0.10)

Subtotal: 2.6 (0.31)

Net increment 3.6 (0.45)

Control: increment

New active caries: 8.3 (0.77)

Caries reactivations: 0.1 (0.05)

Subtotal: 8.4 (0.79)

Reversals

Arrested caries: 1.1 (0.18)

Examiner reversals: 1.0 (0.13)

Subtotal: 2.1 (0.25)

Net Increment: 6.3 (0.76)

P value: difference between groups
Increment

New active caries: 0.011

Caries reactivations: 0.430

Subtotal: 0.016

Reversals

Arrested caries: 0.022

Examiner reversals: 0.154

Subtotal: 0.260

Net Increment: 0.002

Intervention: surface type

Occlusal 1.1 (0.14)

Control: 1.2 (0.16)

P value = 0.523

Buccal and lingual: 0.7 (.015)

Control: 1.5 (0.27)

P value = 0.010

Approximal: 1.8 (0.29)

Table 5. Outcomes of included studies (Continued)

	Control: 3.6 (0.44) P value = 0.001 All surfaces: 3.6 (0.45) Control: 6.3 (0.76) P value = 0.002	
Shenoy 2010	Measures: gingival index Outcomes: Outcomes were assessed in relation to Intervention group (School 1A and School 2A): OHE Control group (School 1B, School 2B, School 1C, School 2C): no intervention Gingival index: mean (SD) Intervention group * School 1A Baseline: 0.95 (0.45) Post intervention at 18 weeks: 0.81 (0.40) * School 2A Baseline: 0.92 (0.40) Post intervention at 18 weeks: 0.78 (0.35) Control group * School 1B Baseline: 0.98 (0.47) Post intervention at 18 weeks: 0.94 (0.38) * School 2B Baseline: 0.95 (0.46) Post intervention at 18 weeks: 0.96 (0.33) * School 1C Baseline: 0.98 (0.43) Post intervention at 18 weeks: 0.98 (0.43) * School 2C Baseline: 0.95 (0.50) Post intervention at 18 weeks: 0.94 (0.45) P value for differences between baseline and 18 weeks for School 1A and School 2A: P value < 0.01 1A vs 1B vs 1C vs 2A vs 2B vs 2 C: P value > 0.05	Plaque index Control schools (Schools 1C and 2C) showed no significant changes in plaque index Plaque index: mean (SD) Intervention group * School 1A Baseline: 1.09 (0.40) Post intervention at 18 weeks: 0.87 (0.35) * School 2A Baseline: 1.08 (0.30) Post intervention at 18 weeks: 0.90 (0.23) Control group * School 1B Baseline: 1.06 (0.43) Post intervention at 18 weeks: 1.07 (0.37) * School 2B Baseline: 1.05 (0.42) Post intervention at 18 weeks: 1.05 (0.32) * School 1C Baseline: 1.04 (0.37) Post intervention at 18 weeks: 1.08 (0.36) * School 2C Baseline: 1.03 (0.34) Post intervention at 18 weeks: 1.08 (0.26) P value for differences between baseline and 18 weeks

Table 5. Outcomes of included studies (Continued)

		for School 1A and School 2A: P value < 0.01
Slade 2011,	Measures: net dental caries increment (d ₃ mfs)	Not reported
Divaris 2013	<p>Outcomes: Outcomes were assessed in relation to</p> <p>Study group: community-based oral health promotion (OHP) with family involvement and fluoride varnish application</p> <p>Control group: routine dental care</p> <p>Number of surface with caries experience per child (d₃mfs): mean (95% CI)</p> <p>Intervention: baseline: 4.9 (4.2 to 5.6) net caries increment: 6.9 (5.5 to 8.2)</p> <p>Control: baseline: 4.6 (3.9 to 5.2) Net caries increment: 9.9 (8.5 to 11.3)</p> <p>Difference in adjusted net d₃mfs increment per child: -3.0 (-4.9 to -1.2)</p> <p>P value for difference between I and C at baseline: P value = 0.55</p> <p>Secondary analysis stratifying according to tooth anatomy/location and baseline pathology showed that the intervention had greatest efficacy on surfaces that were sound at baseline. Among those sound surfaces, maxillary anterior facials received greatest caries-preventive benefit</p>	
Song 2004	<p>Measures: caries experience (dmft)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE</p> <p>Control group: no intervention</p> <p>dmft: mean (SD)</p> <p>Intervention: baseline: 4.48 (3.74) Post intervention 1: 4.73 (3.83) Post intervention 2: 4.79 (3.85) Post intervention 3: 5.18 (3.92)</p> <p>C: Baseline :4.55 (3.86); Post intervention 1 :5.79 (3.90) Post Intervention 2: 5.82 (4.09) Post intervention 3: 5.94 (4.04)</p> <p>P value for change from baseline in study group: P value = 0.000</p> <p>P value for change from baseline in control group: P value = 0.013</p>	<p>Plaque index: mean (SD)</p> <p>Intervention: baseline: 1.66 (0.34) Post intervention 1: 1.93 (0.43) Post intervention 2: 1.73 (0.41) Post intervention 3: 1.69 (0.53)</p> <p>Control: baseline: 1.74 (0.35) Post intervention 1: 1.89 (0.44) Post intervention 2: 1.68 (0.42) Post intervention 3: 1.73 (0.67)</p> <p>P value for change from baseline in study group: P value = 0.743</p> <p>P value for change from baseline in control group: P value = 0.024</p>

Table 5. Outcomes of included studies (Continued)

<p>Tai 2009</p>	<p>Measures: caries increment (DMFT/DMFS)</p> <p>Gingival/sulcus bleeding</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + toothpaste provision + provision of sealants and fissures</p> <p>Control group: no intervention</p> <p>DMFT: mean (SD)</p> <p>Intervention: baseline: 0.07 (0.31); net increment: 0.19 (0.07)</p> <p>Control: baseline: 0.05 (0.27); net increment: 0.28 (0.09)</p> <p>P value for difference at baseline between groups: P value = 0.45</p> <p>P value for difference between groups post intervention: P value = 0.056</p> <p>DMFS: mean (SD)</p> <p>Intervention: baseline: 0.08 (0.50); net increment: 0.22 (0.09)</p> <p>Control: baseline: 0.06 (0.33); net increment: 0.35 (0.08)</p> <p>P value for difference at baseline between groups: P value = 0.42</p> <p>P value for difference between groups post intervention: P value = 0.013</p> <p>Sulcus bleeding index: mean (SD)</p> <p>Intervention: baseline: 0.44 (0.47); net increment: 0.14 (0.04)</p> <p>Control: baseline: 0.47 (0.50); net increment: 0.08 (0.04)</p> <p>Mean difference between groups (95% CI) 0.06 (0.02 to 0.10), P value = 0.005</p> <p>P value for difference at baseline between groups: P value = 0.31</p>	<p>Measures: plaque score</p> <p>Plaque index: mean (SD)</p> <p>Intervention: baseline: 1.01 (0.98)</p> <p>Change from baseline: 0.32 (0.08)</p> <p>Control: baseline: 1.10 (1.01)</p> <p>Change from baseline: 0.21 (0.07)</p> <p>Mean difference in change from baseline between groups (95% CI) 0.11 (0.03 to 0.21), P value = 0.013</p> <p>P value for difference at baseline between groups: P value = 0.13</p>
<p>Toassi 2002</p>	<p>Measures: gingival index and % of bleeding papillae</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: 4 sessions of MI</p> <p>Control group: 1 session of MI</p> <p>% of children with bleeding gum</p> <p>Intervention: baseline: 4%; post intervention: 4%; increased rate of bleeding: 0%; decreased rate of bleeding: 96%</p> <p>Control: baseline: 65%; post intervention: 65%; increased rate of bleeding: 11.5%; decreased rate of bleeding: 23%</p>	<p>% visible plaque index</p> <p>Intervention: baseline</p> <p>0-25% VPI: 73%</p> <p>26%-50% VPI: 26%</p> <p>51%-75% VPI: 1%</p> <p>76%-100% VPI: 0%</p> <p>Post intervention</p> <p>0-25% VPI: 100%</p> <p>26%-50% VPI: 0%</p> <p>51%-75% VPI: 0%</p> <p>76%-100% VPI: 0%</p> <p>Control: baseline</p> <p>0-25% VPI: 90%</p>

Table 5. Outcomes of included studies (Continued)

		26%-50% VPI: 10%
		51%-75% VPI: 0%
		76%-100% VPI: 0%
		Post intervention
		0-25% VPI: 100%
Tubert-Jeannin 2008, Tubert-Jeannin 2012	<p>Measures: cariogenic state (dmft)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + toothbrush and toothpaste provision</p> <p>Control group: no intervention</p> <p>dmft: mean (SD)</p> <p>Intervention: baseline: 2.00 (3.49); post intervention: 1.94 (3.26)</p> <p>Control: baseline: 1.71 (2.94); post intervention: 1.71 (2.96)</p> <p>P value for change from baseline in intervention group: P value = 0.004</p> <p>P value for change from baseline in control group: P value > 0.05</p> <p>Findings were not corrected for clustering. The intervention group comprised 159 children in 9 schools, and the control group included 114 children in 7 schools. Effective sample size of intervention and control groups was calculated as 86 and 65</p> <p>Follow-up conducted in 2009 showed that the oral health programme has done little to reduce disparities in oral health</p>	<p>Plaque index: mean (SD)</p> <p>Intervention: baseline: 0.81 (0.93)</p> <p>Post intervention: 0.42 (0.71)</p> <p>Change from baseline: -0.42 (0.97)</p> <p>Control: baseline: 0.88 (0.99)</p> <p>Post intervention: 0.87 (0.99)</p> <p>Change from baseline: -0.01 (1.24)</p> <p>P value for change from baseline in intervention group: P value < 0.0001</p> <p>P value for change from baseline in control group: P value > 0.0</p> <p>P value for difference in change from baseline between groups: P value < 0.01</p>
Turrioni 2012	<p>Measures: gingivitis (% with healthy gums and mild inflammation)</p> <p>Outcomes: Outcomes assessed in relation to changes from baseline in each intervention group</p> <p>Baseline</p> <ul style="list-style-type: none"> * I A: 38.1 * I B: 30.8 * I C: 50 <p>Post intervention</p> <ul style="list-style-type: none"> * I A: 74.6 (P value < 0.001; change from baseline) * I B: 76.9 (P value = 0.03; change from baseline) * I C: 75.0 (P value = 0.25; change from baseline) 	<p>Oral hygiene (% with good hygiene)</p> <p>Baseline</p> <ul style="list-style-type: none"> * I A: 32.7 * I B: 38.5 * I C: 16.6 <p>Post intervention</p> <ul style="list-style-type: none"> * I A: 63.6 (P value = 0.002; change from baseline) * I B: 76.9 (P value = 0.06; change from baseline) * I C: 41.6 (P value = 0.25; change from baseline) <p>Consumption of sweets (% consuming sweets 'always')</p> <p>Baseline</p>

Table 5. Outcomes of included studies (Continued)

* **I A:** 58.2
 * **I B:** 53.8
 * **I C:** 83.3

Post intervention

* **I A:** 29.1 (P value < 0.001; change from baseline)
 * **I B:** 30.8 (P value = 0.38; change from baseline)
 * **I C:** 33.3 (P value = 0.03; change from baseline)

Frequency of brushing (% brushing twice per day)

Baseline

* **I A:** 61.8
 * **I B:** 76.9
 * **I C:** 91.6

Post intervention

* **I A:** 83.6 (P value = 0.01; change from baseline)
 * **I B:** 84.6 (P value = 1.0; change from baseline)
 * **I C:** 91.6 (P value = 1.0; change from baseline)

Ueno 2012

Measures: absence or presence of decayed teeth

None reported

Gingivitis

Outcomes: Outcomes were assessed in relation to

Intervention group: 'Encourage School' OHE

Control group: routine OHE

Intervention: mean age 15.01 years (SD = 0.1)

Control: mean age 16.0 years (SD = 0.1)

Decayed teeth (%)

Intervention: baseline

Absence of decayed teeth: 46.6

Presence of decayed teeth: 53.4

Post intervention

Positive change: 33.7

Negative change: 66.3

Control: baseline:

Absence of decayed teeth: 49.6

Presence of decayed teeth: 50.4 [ML1]

Table 5. Outcomes of included studies (Continued)

	<p>Post intervention</p> <p>Positive change: 44.4</p> <p>Negative change: 55.6</p> <p>Gingivitis (%)</p> <p>Intervention: baseline: 0 = 47.9%; 1 = 38.7%; 2 = 6.7%</p> <p>Post intervention</p> <p>Positive change: 47.2</p> <p>Negative change: 52.8</p> <p>Control: baseline: 0 = 50.4%; 1 = 40.7%; 2 = 8.9%</p> <p>Post intervention:</p> <p>Positive change: 32.6</p> <p>Negative change: 67.4</p>	
van Palenstein 1997	<p>Measures: gingival bleeding and DMFT</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE and supervised toothbrushing instructions</p> <p>Control group: no intervention</p> <p>Gingival bleeding: mean (SD)</p> <p>Intervention: baseline: 4.9 (0.9); change from baseline: -0.1 (0.5)</p> <p>Control: baseline: 4.2 (0.3); change from baseline: 0.7 (0.2)</p> <p>Difference in change from baseline between groups is statistically significant (P value not reported)</p> <p>DMFT: mean (SD)</p> <p>Intervention: baseline: 0.4 (0.2); change from baseline: 0.9 (0.3)</p> <p>Control: baseline: 0.5 (0.2); change from baseline: 0.9 (0.3)</p> <p>Difference in change from baseline between both groups is not statistically significant (P value not reported)</p>	<p>Plaque score: mean (SD)</p> <p>Intervention: baseline: 20.5 (1.2)</p> <p>Change from baseline: -4.3 (2.5)</p> <p>Control: baseline: 18.9 (0.4)</p> <p>Change from baseline: -0.3 (0.5)</p> <p>Difference in change from baseline between groups is not statistically significant (P value not reported)</p>
Vichayanrat 2012	<p>Measures: caries indices (dmft and % caries)</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE and toothbrush provision and social support and community mobilisation</p> <p>Control group: toothbrush provision</p> <p>Intervention: mean age 19.16 months (SD = 8.74)</p> <p>Control: mean age 18 months (SD = 9.30)</p> <p>dmft: mean (SD)</p> <p>Intervention: baseline: 2.34 (3.81); post Intervention: 3.04 (3.90)</p>	<p>Oral health practices</p> <p>Any toothbrushing during the week (%)</p> <p>Intervention: baseline: 59.7</p> <p>Post intervention: 93.5</p> <p>Control: baseline: 45.1</p> <p>Post intervention: 80.4</p> <p>Brushing with adult supervision (%)</p> <p>Intervention: baseline: 50.0</p>

Table 5. Outcomes of included studies (Continued)

	<p>Control: baseline: 2.22 (4.26); post intervention: 3.49 (3.97)</p> <p>P value for difference between groups at baseline: P value = 0.28</p> <p>P value for difference between groups post intervention: P value = 0.99</p> <p>Percentage (%) caries</p> <p>Intervention: baseline: 47.6; post intervention: 60.7</p> <p>Control: baseline: 34.7; post intervention: 63.6</p>	<p>Post intervention: 91.4</p> <p>Control: baseline: 40.4</p> <p>Post intervention: 85.7</p>
<p>Weber-Gasparoni 2013</p>	<p>Measures: caries status</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: video OHE</p> <p>Control group: brochure OHE</p> <p>Overall mean age: 26.8 months for children (10.9)</p> <p>% of children with no caries lesions</p> <p>Intervention: baseline: 50%</p> <p>Post intervention: not reported</p> <p>Control: baseline: 60%</p> <p>Post intervention: not reported</p> <p>The study reports no differences between groups in the proportions of children with carious lesions at baseline, post intervention or at follow-up (data not provided)</p>	<p>Daily tooth brushing: % (P value)</p> <p>Intervention: baseline: 74</p> <p>Post intervention: 87 (< 0.001)</p> <p>Follow-up: 87 (< 0.001)</p> <p>Control: baseline: 68</p> <p>Post intervention: 84 (0.002)</p> <p>Change from baseline: 79 (0.06)</p> <p>% of children with visible plaque</p> <p>Intervention: baseline: 74%</p> <p>Post intervention: not reported</p> <p>Control: baseline: 74%</p> <p>Post intervention: not reported</p>
<p>Weinstein 2004; Weinstein 2006</p>	<p>Measures: caries incidence and likelihood of new caries lesions</p> <p>Outcomes: Outcomes were assessed in relation to</p> <p>Intervention group: OHE + MI</p> <p>Control group: OHE only</p> <p>At baseline, no statistically significant differences in caries incidence between study and control groups (P value > 0.10)</p> <p>Cariou surfaces (DFS): mean (SD)</p> <p>Intervention: baseline: 0.71 (2.8); follow-up: NR</p> <p>Control: baseline: 1.91 (4.8); follow-up: NR</p> <p>P value for difference between groups at baseline: P value < 0.01</p> <p>Likelihood of new caries lesions: OR (95% CI), P value</p> <p>Baseline: OR for new caries lesions (C vs I): 1.93 (0.97 to 3.84), P value = 0.062</p>	<p>None reported</p>

Table 5. Outcomes of included studies (Continued)

Follow-up: OR for new caries lesions (I vs C): 0.35 (0.15 to 0.83)

Percentage of infants with new dfs
Intervention: baseline (0); baseline:15.2%; follow-up: 35.2%

Control: baseline (0); baseline: 26%; follow-up: 52%

Yazdani 2009

Measures: gingival index (gingival bleeding scores)

Outcomes: Outcomes were assessed in relation to

Intervention A: video OHE

Intervention B: leaflet OHE

Control group: no intervention

Gingival bleeding score: mean (SD)
I_A: boys: baseline: 3.9 (1.9)

Reduction from baseline: 2.2 (2.1)

I_A: girls: baseline: 4.0 (1.6)

Reduction from baseline: 1.9 (2.0)

I_A: anterior teeth: baseline: 0.7 (0.9)

Post intervention: 0.2 (0.6)

% change: 71%

I_A: posterior teeth:

Baseline: 3.3 (1.2)

Post intervention: 1.7 (1.4)

% change: 48%
I_B: boys: baseline: 4.3 (1.7)

Reduction from baseline: 2.4 (2.1)

I_B: girls: baseline: 3.8 (1.6)

Reduction from baseline: 2.4 (2.1)

I_B: anterior teeth: baseline: 0.7 (0.9)

Post intervention :0.4 (0.7)

% change: 43%
I_B: posterior teeth: baseline: 3.3 (1.2)

Post intervention: 1.2 (1.5)

% change: 64%
Control: boys: baseline: 4.2 (1.2)

Reduction from baseline: -0.1 (2.2)

Plaque score: mean (SD)
I_A: boys: baseline: 8.6 (2.7)

Reduction from baseline: 4.2 (3.2)

I_A: girls: baseline: 8.2 (2.5)

Reduction from baseline: 1.5 (2.9)

I_A: anterior teeth

Baseline: 1.8 (1.4)

Post intervention: 0.8 (1.1)

% change: 55%
I_A: posterior teeth

Baseline: 6.9 (1.6)

Post intervention: 4.7 (2.0)

% change: 32%
I_B: boys: baseline: 9.3 (3.0)

Reduction from baseline: 4.2 (3.2)

I_B: girls: baseline: 8.3 (2.5)

Reduction from baseline: 4.3 (3.0)

I_B: anterior teeth: baseline: 2.0 (1.6)

Post intervention: 0.6 (1.1)

% change: 70%
I_B: posterior teeth

Baseline: 6.9 (1.5)

Post intervention: 4.7 (2.0)

% change: 43%
Control: boys: baseline: 9.6 (2.4)

Table 5. Outcomes of included studies (Continued)

<p>Control: girls: baseline: 3.4 (2.0)</p> <p>Reduction from baseline: 0.7 (2.2)</p> <p>Control: anterior teeth: baseline: 0.9 (0.9)</p> <p>Post intervention: 0.6 (0.8)</p> <p>% change: 33%</p> <p>Control: posterior teeth</p> <p>Baseline: 3.0 (1.3)</p> <p>Post intervention: 3.9 (1.2)</p> <p>% change: 30%</p> <p>P value for differences between intervention groups: P value < 0.001</p> <p>P value for differences in gender in each intervention group: P value = 0.745 (I_B); P value = 0.364 (I_A) and P value = 0.048 (C)</p>	<p>Reduction from baseline:- 0.9 (2.6)</p> <p>Control: girls: baseline: 8.7 (2.1)</p> <p>Reduction from baseline: 1.4 (2.2)</p> <p>Control: anterior teeth: baseline: 2.2 (1.3)</p> <p>Post intervention: 2.0 (1.5)</p> <p>% change :9%</p> <p>Control: posterior teeth</p> <p>Baseline: 7.0 (1.2)</p> <p>Post intervention : 6.9 (1.5)</p> <p>% change: 1.4%</p> <p>P value for differences between intervention groups: P value < 0.001</p> <p>P value for differences in gender in each intervention group: P value = 0.911 (I_B), P value < 0.001 (I_A) and P value < 0.001 (C)</p>
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APPENDICES

Appendix 1. CENTRAL search strategy

1. Child or Infant or Newborn or Adolescent or Students or Famil* or Communit*
2. (Rural or urban or vulnerable or minority) AND Population
3. or/1-2
4. ("Public Health" or community or Evidence or preventive) AND dentistry
5. ("Periodontal Disease?" or Dental Caries or plaque) AND (Prevention or Control)
6. Chlorhexidine or "Pit and Fissure Sealants" or varnish* or "mouth rinse?" or toothpaste? or dentifrice? or "chewing gum?" or toothbrush or floss
7. ((home? or school? maternal or prenatal or postnatal or "primary health care") NEAR/4 (dental or mouth or "dental screening?" or "oral screening?"))
8. (((outreach or mobile) NEAR/3 (service? or program* or initiative? or strateg*)) and dental)
9. (("anticipatory guidance" or "motivational interview*") NEAR/4 ("dental health" or "oral health" or plaque or dental carie?))
10. "Health Education, Dental" or "Health Education" or "Capacity Building" or "Health Literacy" or "Health Communication" or "oral health literacy"
11. "Health Promotion" or "Public Health" or "Dental Health Promotion" or "Oral Health Promotion"

12. ((caries or “dental caries” or “early childhood caries” or plaque* or gingiv*) NEAR/3 (“risk management” or “disease management” or management or prevention or control))
13. ((sugar? or fizzy or sweet* or carbonated or “sweetening agent?” or flavo*) NEAR/2 (drink? or beverage? or food? or juice?))
14. ((Developed countr* or developing countr* or “low income countr*” or “middle income countr*” or “high income countr*” or local or federal or state) NEAR/4 (intervention? or strateg* or program? or policy or policies or legislation? or dental))
15. (((International or Nonprofit or “Non Profit” or “Not for profit” or Voluntary or “Non government” or Government) NEAR/3 (Organi? ation? or Agenc* or Institution? or Initiative? or Strateg*)) and Dental or Health or Oral)
16. ((Staff or Professional? or Teacher? or General Practitioner? or GP? or Health Practitioner? or Doctor? or Dentist? or Parent?) NEAR/3 (Dental or Health or “Oral Health”))
17. (((Behavio*r? or Life Style? or Support or Education* or Counsel* or Theraph*) NEAR/3 (Diet or Feeding or Food? or “Cariogenic food” or “Cariogenic diet”)) and Dental or Health or “Oral Health”)
18. (Gymnasi* or “Health Spa?” or “Leisure Center?” or “Fitness Center?” or “Swimming pool?” or “Social Activ*” or “Youth Center?” or “Sports Center?” or Church or Chapel? or Mosque? or Synagogue? or Temple? or “Religious Setting?”) AND dental
19. or/4-18
20. “Oral Health” or “Dental Carie?” or Toothache or “Tooth Disease?” or “Tooth pain” or “Tooth Discoloration” or "Tooth Loss" or Halitosis or “Bleeding Gums” or “White Spot Lesion?”
21. "Periodontal Diseases" or "Gingival Diseases" or "Gingivitis" or "Dental Plaque" or "Dental Deposits" or "Periodontitis"
22. ((Dental or Teeth or Tooth or Enamel) NEAR/2 (Missing or Loss or Filling? or Cavit* or Decay or Demineral* or Rot* or Lesion? or Mobil*))
23. ((Gum? or Gingiv* or Periodont* or Periapical or Oral or Dental or Mouth) NEAR/4 (Infection? or Inflammation?))
24. “Periodontal Index” or “Dental Plaque Index” or DMFT or dmft or DMFS or dmfs or “Oral Hygiene Index”
25. ((Rampant or Nursing Bottle or Baby Bottle or “Early Childhood” or Childhood) NEAR/6 (Carie? or Cavit* or Decay or “Tooth Decay” or “Rot” or lesion? or Demineral*))
26. ((“Primary Dentition” or “Deciduous Dentition” or “Milk Teeth” or “Milk Tooth” or “Primary Tooth” or “Primary Teeth” or “Mixed Dentition” or “Permanent Dentition”) NEAR/4 (Missing or Loss or Filling? or Cavit* or Decay? or Rot or Demineral* or Lesion? or Carie?))
27. ((“Quality of life” or “Self Rated” or “Self Reported” or “Self Perceived”) NEAR/5 (“Oral Health” or “Dental Health”))
28. or/20-27
29. "Randomized Controlled Trials" or “Cluster randomised trial” or “Intervention Studies”
30. “Controlled Clinical Trial?” or “Controlled trial?” or “Parallel group trial?” or “Quasi Experiment?” or “Quasi Random Allocation” or “Interrupted time series”
31. "Evaluation Research" or "Validation Studies" or "Program Evaluation" or "Comparative Studies"
32. "Multicenter Studies" or "Pilot Studies" or "Cross Sectional Studies" or “Follow up studies” or “Prospective Studies” or “Epidemiologic Studies” or “Controlled before and after study” or “Cross Over Stud*”
33. “Random Allocation” or “Clinical Trial” or “Single Blind Method” or “Double Blind Method” or “Control Groups” or “Stratified Randomi? ation” or Stratification or Randomi?ed or Placebo or Randomly or Control or Control Group? or Comparison Group? or Intervention Group? or Matching or “Follow Up Assessment”
34. “Cluster Analysis” or “Small Area Analysis” or “Space Time Clustering” or “Matched Pair Analysis” or “Intention to treat”
35. “Community Based Participatory Research” or “Community Based Participatory Research stud*” or “Community Trial?”
36. “Time adj Series” or “Time Series Analyses” or “Pre Test” or Pretest or “Pre Intervention” or “Post Intervention” or Posttest or “Post Test”
37. “Cost Benefit Analysis” or “Cost Effectiveness Analysis” or “Cost Utility Analysis”
38. or/29-37

39. 3 AND 19 AND 28 AND 38

Appendix 2. MEDLINE search strategy

Revised search strategy

1. exp Child/ or exp Child, preschool/ or exp Infant/ or exp Infant, Newborn/ or exp Adolescent/ or exp Students/
2. (babies or infant\$1 or kid\$1 or children or teen\$ or adolescent\$1 or youth or youngster\$1 or girl\$1 or boy\$1 or young people or parent \$1).ti,ab.
3. (family or family unit\$ or families or community or communities or community unit\$).ti,ab.
4. Rural Population/ or Suburban Population/ or Urban Population/ or Vulnerable Populations/ or Minority Groups/
5. or/1- 4
6. exp Preventive Dentistry/
7. exp Dental Prophylaxis/ or exp Dental Scaling/
8. exp Fluoridation/
9. exp Public Health Dentistry/ or exp Community Dentistry/ or exp Evidence-Based Dentistry/
10. exp Pediatric Dentistry/ or exp Dental Care for Children/ or exp Dental Care/
11. Periodontal Diseases/pc or Dental Caries/pc
12. exp Cariostatic Agents/ or exp Sodium Fluoride/ or exp Fluorides, Topical/ or exp Tin Fluorides/ or exp Calcium Fluoride/
13. exp Chlorhexidine/
14. exp "Pit and Fissure Sealants"/
15. ((varnish\$ or product\$ or sealant\$ or mouth rinse\$ or mouth wash\$ or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$1 or chewing gum \$) adj4 Fluorid\$).ti,ab.
16. ((home or school or community) adj4 (dental screening\$ or oral screening\$ or mouth\$ screening\$)).ti,ab.
17. (((outreach or mobile or enhanced) adj3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental).ti,ab.
18. ((anticipatory guidance or needs assessment) adj4 (dental health or oral health or perodont\$)).ti,ab.
19. exp Health Education, Dental/ or exp Health Education/ or exp Education, Nonprofessional/
20. exp Capacity Building/ or exp Health Literacy/ or exp Health Communication/
21. exp Health Promotion/ or exp Public Health/ or exp Health Planning/
22. exp Tooth Remineralization/
23. exp Dental Caries Activity Tests/
24. ((caries or periodon\$) adj3 risk management).ti,ab.
25. exp Dental Health Surveys/ or exp Health Care Surveys/ or exp Needs Assessment/or exp Health Services Research/
26. Population Surveillance/ or Sentinel Surveillance/
27. ((oral health or dental health) adj2 (promotion or integrated)).ti,ab.
28. ((water or milk or salt or drink\$ or beverage\$ or environment) adj3 (fluorid\$)).ti,ab.
29. ((sugar\$ or fizzy or sweet\$ or carbonated or sweetening agent\$ or flavo\$) adj2 (drink\$ or beverage\$ or food\$ or juice\$)).ti,ab
30. (media or mass media or social marketing or television or advert\$ or campaign\$ or awareness raising).ti,ab.

31. ((oral health or dental health or oral disease or dental disease or dental caries or periodon\$ or gingiv\$) adj3 (prevent\$ or program\$ or initiative\$ or educat\$ or improv\$ or intervention\$)).ti,ab.
32. ((Developed countr\$ or developing countr\$ or low income countr\$ or middle income countr\$ or high income countr\$) adj4 (intervention \$1 or strateg\$ or program\$1 or policy or policies or legislation\$)).ti,ab.
33. Maternal Health Services/ or Child Health Services/ or Adolescent Health Services/ or School Health Services/ or Community Health Services/
34. Public Sector/ or Private Sector/ or Health Services/ or Health Facilities/
35. Child Day Care Centers/ or Child Care/ or Schools, Nursery/
36. exp Dental Health Services/ or exp Primary Health Care/ or exp Dental Service Hospital/ or exp Health Planning Councils/ or exp "State Health Planning and Development Agencies"/ or exp Health Systems Agencies/
37. "Health Care Economics and Organisations"/ or Health Care Rationing/ or Health Care Reform/ or Health Resources/ or National Health Programs/ or Regional Health Planning/ or Health Fairs/
38. Government/ or Government Agencies/ or Local government/ or State Government/ or Federal Government/ or Government Programs/
39. International Agencies/ or Public-Private Sector Partnerships/ or Organisations, Nonprofit/ or Voluntary Health Agencies/
40. exp Insurance, Health/ or exp Insurance, Dental/ or Policy/ or Health Policy/ or Public Policy/ or Legislation/ or Legislation as Topic/
41. (community based or community level or family based or family level or population based or population level).ti,ab.
42. (Peer education or support group\$ or support program\$ or education\$ program\$).ti,ab.
43. (clinic\$1 or hospital\$1 or medical practice\$ or dental practice\$).ti,ab.
44. (health staff or health professional\$1 or teacher\$1 or General practitioners or GP or health practitioner\$1 or doctor\$1 or dentist\$1).ti,ab.
45. (school\$1 or play school\$ or child care service\$ or home or pre natal service\$ or post natal service\$ or kindergarten or after school hours care or curriculum or extracurricular).ti,ab.
46. ((health education or healthy environment or health promot\$ or healthy canteen or health polic\$ or health program\$) adj3 school \$).ti,ab.
47. ((oral health or dental health or food or drink\$ or beverage\$ or nutrition\$) adj4 (school\$ or day care or pre school or home)).ti,ab.
48. expToothpastes/ or exp Toothbrushing/ or exp Mouthwashes/ or exp Dentifrices/
49. exp Diet, Cariogenic/ or Diet Therapy/ or Feeding Behavior/ or Health Behavior/ or Life Style/
50. (sugar free gum\$1 or sugarfree gum\$1 or xylitol or sugarless chewing gum\$1).ti,ab.
51. exp "Tobacco Use Cessation"/ or exp Smoking Cessation/
52. ((tobacco cessation or smokeless tobacco cessation or nicotine) adj3 (intervention\$1 or law\$ or strate\$ or program\$ or initiative\$ or policy or policies)).ti,ab.
53. ((tobacco or nicotine or cigarette\$ or tobacco product\$) adj4 (marketing or social marketing or advert\$ or media or campaign\$ or package\$ or awareness)).ti,ab.
54. (supermarket\$ or grocery store\$ or shop\$ or shopping mall or library or libraries).ti,ab.
55. (gymnasia\$ or health spa\$ or leisure center\$ or fitness center\$ or swimming pool\$ or social activ\$ or youth center\$ or sports center).ti,ab.
56. (church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or religious setting\$).ti,ab.
57. or/6-56
58. exp Oral Health/
59. exp Dental Caries/ or exp Toothache/ or exp Tooth Diseases/ or exp Tooth Discoloration/

60. exp Tooth Demineralization/ or exp Dentin Sensitivity/ or exp Dental Pulp Diseases/ or exp Tooth Wear/ or exp Tooth Loss/
61. exp Periodontal Diseases/ or exp Gingival Diseases/ or exp Gingivitis/ or exp Dental Plaque/ or exp Dental Deposits/ or exp Periodontitis/
62. exp Dental Caries Susceptibility/ or exp Dental Enamel Solubility/ or exp Tooth Mobility/ or exp Tooth Permeability/
63. ((dental or teeth or tooth or enamel) adj2 (missing or loss or filling\$ or cavit\$ or decay or demineral\$ or rot\$ or lesion\$)).ti,ab.
64. ((gum\$1 or gingiv\$ or periodont\$ or periapical or oral or dental or mouth) adj4 (infection\$ or inflammation\$)).ti,ab.
65. ((dental caries or periodont\$ or gingiv\$ or oral infection\$ or oral inflammation\$ or dental infection\$ or dental inflammation\$) adj8 (tobacco or nicotine or smokeless tobacco or cigarette smoke\$)).ti,ab.
66. exp Halitosis/
67. exp Gingival Hemorrhage/ or exp Gingival Recession/
68. exp Periodontal Index/ or exp Dental Plaque Index/ or exp DMF Index/ or exp Oral Hygiene Index/
69. CPITN.ti,ab.
70. (gum recession or gingival pocket or periodontal pocket or clinical attachment loss or bleeding gums).ti,ab.
71. ((rampant or nursing bottle or baby bottle or early childhood) and (carie\$1or cavit\$ or decay or tooth decay or teeth decay or rot or lesion\$ or demineral\$)).ti,ab.
72. ((primary dentition or deciduous dentition or milk teeth or milk tooth or primary tooth or primary teeth) adj4 (missing or loss or filling \$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie\$)).ti,ab.
73. ((mixed dentition or permanent dentition) adj4 (missing or loss or filling\$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie \$)).ti,ab.
74. (white spot lesion\$ or dmft or DMFT or dmfs or DMFS).ti,ab.
75. ((quality of life or self rated or self reported or self perceived) adj5 (oral health or dental health)).ti,ab.
76. or/58-75
77. Randomized Controlled Trial.pt.
78. Cluster randomised trial.ti,ab.
79. Interrupted time series.ti,ab.
80. Controlled Clinical Trial.pt.
81. Controlled trial.ti,ab.
82. Parallel group trial.ti,ab.
83. Comparative Study.pt.
84. Intervention Studies/
85. Evaluation Studies/ or Validation Studies/
86. Program Evaluation/
87. Multicenter Study/
88. Pilot Projects/
89. Feasibility Studies/
90. Cross-Sectional Studies/
91. Cohort studies/ or Longitudinal Studies/ or Follow-Up Studies/ or Prospective Studies/
92. Intention-to-treat.ti,ab.

93. Epidemiologic Studies/
94. Case-Control Studies/
95. (Controlled before and after study).ti,ab.
96. Case series.ti,ab.
97. Random Allocation/ or Clinical Trial/ or Single-Blind Method/ or Double-Blind Method/ or Control Groups/
98. Cluster Analysis/ or Small-Area Analysis/ or Space-Time Clustering/ or Matched-Pair Analysis/
99. (Community-Based Participatory Research or Community-Based Participatory Research stud\$ or Community Trials).ti,ab.
100. Cross-Over Studies.ti,ab.
101. (Stratified randomisation or Stratification).ti,ab.
102. sequential trial.ti,ab.
103. (randomized or randomised or placebo or randomly or control or control group\$ or comparison group\$ or intervention group\$ or matching).ti,ab.
104. (time adj series).ti,ab.
105. (quasi-experiment\$ or Quasi-random allocation).ti,ab.
106. (pre test or pretest or pre-intervention or post-intervention or posttest or post test).ti,ab.
107. (cost-benefit analysis or cost-effectiveness analysis or cost-utility analysis).ti,ab.
108. (experimental intervention or experimental study).ti,ab.
109. follow-up-assessment.ti,ab.
110. ((evaluat\$ or intervention or interventional or treatment) and (control or controlled or study or program\$ or comparison or "before and after" or comparative)).ti,ab.
111. ((intervention or interventional or process or program) adj5 (evaluat\$ or effect\$ or outcome\$)).ab,ti.
112. (secondary analys\$).ti,ab.
113. or/77-112
114. 5 and 57 and 76 and 113

Appendix 3. Embase search strategy

1. 'child'/exp OR 'preschool child'/exp OR 'infant'/exp OR 'newborn'/exp OR 'adolescent'/exp OR 'student'/exp
2. baby:ab,ti OR infant*:ab,ti OR kid*:ab,ti OR child*:ab,ti OR teen*:ab,ti OR adolescent*:ab,ti OR youth:ab,ti OR youngster*:ab,ti OR girl*:ab,ti OR boy*:ab,ti OR 'young people':ab,ti OR parent:ab,ti
3. famil*:ab,ti OR 'family unit':ab,ti OR communit*:ab,ti OR 'community unit':ab,ti
4. 'rural population'/de OR 'population'/de OR 'urban population'/de OR 'vulnerable population'/de OR 'minority group'/de
5. #1 - #4 combine using OR
6. 'preventive dentistry'/exp
7. 'dental prophylaxis':ab,ti OR 'dental scaling':ab,ti
8. 'fluoridation'/exp
9. 'public health service'/exp OR 'evidence based dentistry'/exp OR 'community dentistry'
10. 'dentistry'/exp OR 'pediatric dentistry'

11. 'periodontal disease'/exp OR 'dental caries'/exp
12. 'anticaries agent'/exp OR 'fluoride sodium'/exp OR 'fluoride varnish'/exp OR 'tin fluoride'/exp OR 'calcium fluoride'/exp
13. 'chlorhexidine'/exp
14. 'pit and fissure sealant'/exp OR 'pit and fissure sealants'
15. (fluoride NEXT/4 (varnish* OR product* OR sealant* OR mouthwash OR 'mouth hygiene' OR 'chewing gum' OR toothpaste* OR dentifrice* OR tablet* OR drop*)):ab,ti
16. ((home OR school OR community) NEXT/4 ('dental screening' OR 'oral screening' OR 'mouth screening')):ab,ti
17. ((outreach OR mobile OR enhanced) NEXT/3 (service* OR program* OR initiative* OR support OR strateg*)):ab,ti AND dental:ab,ti
18. (('anticipatory guidance' OR 'needs assessment') NEXT/4 ('dental health' OR 'oral health' OR periodont*)):ab,ti
19. 'dental health education'/exp OR 'health education'/exp OR 'nonprofessional education'
20. 'capacity building'/exp OR 'health literacy'/exp OR 'health communication'
21. 'health promotion'/exp OR 'public health'/exp OR 'health care planning'/exp
22. 'tooth remineralization'
23. 'Dental caries activity tests'
24. ((caries OR periodon*) NEXT/3 'risk management'):ab,ti
25. 'dental health survey' OR 'health care survey'/exp OR 'needs assessment'/exp OR 'health services research'/exp
26. 'sentinel surveillance'/exp OR 'population surveillance'
27. (('oral health' OR 'dental health') NEXT/2 (promotion OR integrated)):ab,ti
28. ((water OR milk OR salt OR drink* OR beverage* OR environment) NEXT/3 fluorid*):ab,ti
29. ((sugar* OR fizzy OR sweet* OR carbonated OR 'sweetening agent' OR flavo*) NEXT/2 (drink* OR beverage* OR food* OR juice*)):ab,ti
30. media:ab,ti OR 'mass media':ab,ti OR 'social marketing':ab,ti OR television:ab,ti OR advert*:ab,ti OR campaign*:ab,ti OR 'awareness raising':ab,ti
31. (('oral health' OR 'dental health' OR 'oral disease' OR 'dental disease' OR 'dental caries' OR periodon* OR gingiv*) NEXT/3 (prevent* OR program* OR initiative* OR educat* OR improv* OR intervention*)):ab,ti
32. (('developed country' OR 'developing country' OR 'low income country' OR 'middle income country' OR 'high income country') NEXT/4 (intervention* OR strateg* OR program* OR policy OR policies OR legislation*)):ab,ti
33. 'maternal health service' OR 'child health care'/exp OR 'school health service'/exp OR 'community care'/exp
34. 'public sector' OR 'private sector' OR 'health service'/de OR 'health care facility'/de
35. 'day care'/de OR 'child care'/de OR 'nursery school'/de
36. 'dental health services'/de OR 'dental service hospital'/de OR 'primary health care'/exp OR 'state health planning and development agencies'/de OR 'health systems agencies'/de
37. 'health care economics and organisations' OR 'health care policy'/de OR 'health resources' OR 'national health programs' OR 'health care rationing' OR 'regional health planning'
38. 'government'/exp OR 'government agencies' OR 'government programs'
39. 'international agencies' OR 'public-private partnership' OR 'non profit organisation'/de OR 'voluntary health agencies'
40. 'health insurance'/exp OR 'dental insurance' OR 'public policy'/de OR 'health care policy'/de OR 'law'/exp OR 'law'/mj
41. 'community based':ab,ti OR 'community level':ab,ti OR 'family based':ab,ti OR 'family level':ab,ti OR 'population based':ab,ti OR 'population level':ab,ti

42. 'peer education':ab,ti OR 'support group':ab,ti OR 'support program':ab,ti OR 'education program':ab,ti
43. clinic*:ab,ti OR hospital*:ab,ti OR 'medical practice':ab,ti OR 'dental practice':ab,ti
44. 'health staff':ab,ti OR 'health professional':ab,ti OR teacher*:ab,ti OR 'general practitioners':ab,ti OR gp:ab,ti OR 'health practitioner':ab,ti OR doctor*:ab,ti OR dentist*:ab,ti
45. school:ab,ti OR 'play school':ab,ti OR 'child care services':ab,ti OR home:ab,ti OR 'pre natal services':ab,ti OR 'post natal services':ab,ti OR kindergarten:ab,ti OR 'after school hours care':ab,ti OR curriculum:ab,ti OR extracurricular:ab,ti
46. (('health education' OR 'healthy environment' OR 'health promotion' OR 'healthy canteen' OR 'health policy' OR 'health program') NEXT/3 school*):ab,ti
47. (('oral health' OR 'dental health' OR food OR drink* OR beverage* OR nutrition*) NEXT/4 (school* OR 'day care' OR 'pre school' OR home)):ab,ti
48. 'dentifrices'/de OR 'tooth brushing'/exp OR 'mouthwash'/exp
49. 'cariogenic diet'/exp OR 'diet therapy'/de OR 'feeding behavior'/de OR 'health behavior'/de OR 'lifestyle'/de
50. 'sugar free gum':ab,ti OR 'sugarfree gum':ab,ti OR xylitol:ab,ti OR 'sugarless chewing gum':ab,ti
51. 'smoking cessation'/exp OR 'tobacco use cessation'
52. (('tobacco cessation' OR 'smokeless tobacco cessation' OR nicotine) NEXT/3 (intervention* OR law* OR strate* OR program* OR initiative* OR policy OR policies)):ab,ti
53. ((tobacco OR nicotine OR cigarette* OR 'tobacco product') NEXT/4 (marketing OR 'social marketing' OR advert* OR media OR campaign* OR package* OR awareness)):ab,ti
54. supermarket*:ab,ti OR 'grocery store':ab,ti OR shop*:ab,ti OR 'shopping mall':ab,ti OR library:ab,ti OR libraries:ab,ti
55. gymnasium*:ab,ti OR 'health spa':ab,ti OR 'leisure center':ab,ti OR 'fitness center':ab,ti OR 'swimming pools':ab,ti OR 'social activities':ab,ti OR 'youth center':ab,ti OR 'sports center':ab,ti
56. church:ab,ti OR chapel*:ab,ti OR mosque*:ab,ti OR synagogue*:ab,ti OR temple*:ab,ti OR 'religious setting':ab,ti
57. #6 - #56 combine using OR
58. 'dental health'/exp OR 'oral health'
59. 'dental caries'/exp OR 'tooth pain'/exp OR 'tooth disease'/exp OR 'tooth discoloration'/exp
60. 'tooth disease'/exp OR 'dentin sensitivity'/exp OR 'tooth pulp disease'/exp OR 'periodontal disease'/exp
61. 'periodontal disease'/exp OR 'gingiva disease'/exp OR 'gingivitis'/exp OR 'tooth plaque'/exp OR 'tooth calculus'/exp OR 'periodontitis'/exp OR 'dental caries'/exp OR 'enamel'/exp OR 'tooth permeability'/exp
62. 'Dental Caries Susceptibility'/exp OR 'Dental Enamel Solubility'/exp OR 'Tooth Mobility'/exp OR 'Tooth Permeability'/exp
63. ((dental OR teeth OR tooth OR enamel) NEXT/2 (missing OR loss OR filling* OR cavit* OR decay OR demineral* OR rot* OR lesion*)):ab,ti
64. ((gum* OR gingiv* OR periodont* OR periapical OR oral OR dental OR mouth) NEXT/4 (infection* OR inflammation*)):ab,ti
65. (('dental caries' OR periodont* OR gingiv* OR 'oral infection' OR 'oral inflammation' OR 'dental infection' OR 'dental inflammation') NEXT/8 (tobacco OR nicotine OR 'smokeless tobacco' OR 'cigarette smoke')):ab,ti
66. 'halitosis'/exp
67. 'gingiva bleeding'/exp OR 'gingiva disease'/exp
68. 'Periodontal index' OR 'dmf index' OR 'dental plaque index' OR 'oral hygiene index'
69. cpitn:ab,ti
70. 'gum recession':ab,ti OR 'gingival pocket':ab,ti OR 'periodontal pocket':ab,ti OR 'clinical attachment loss':ab,ti OR 'bleeding gums':ab,ti

71. rampant:ab,ti OR 'nursing bottle':ab,ti OR 'baby bottle':ab,ti OR 'early childhood':ab,ti AND (carie*:ab,ti OR cavit*:ab,ti OR decay:ab,ti OR 'tooth decay':ab,ti OR 'teeth decay':ab,ti OR rot:ab,ti OR lesion*:ab,ti OR demineral*:ab,ti)
72. (('primary dentition' OR 'deciduous dentition' OR 'milk teeth' OR 'milk tooth' OR 'primary tooth' OR 'primary teeth') NEXT/4 (missing OR loss OR filling* OR cavit* OR decay* OR rot OR demineral* OR lesion* OR carie*)):ab,ti
73. (('mixed dentition' OR 'permanent dentition') NEXT/4 (missing OR loss OR filling* OR cavit* OR decay* OR rot OR demineral* OR lesion* OR carie*)):ab,ti
74. 'white spot lesion':ab,ti OR dmft:ab,ti OR dmfs:ab,ti
75. (('quality of life' OR 'self rated' OR 'self reported' OR 'self perceived') NEXT/5 ('oral health' OR 'dental health')):ab,ti
76. #58 - #75 combine using OR
77. 'randomized controlled trial':ab,ti
78. 'cluster randomized trial':ab,ti
79. 'interrupted time series':ab,ti
80. 'controlled clinical trial':ab,ti
81. 'controlled trial':ab,ti
82. 'parallel group trial':ab,ti
83. 'comparative study':ab,ti
84. 'intervention study'/de
85. 'evaluation'/de OR 'validation study'/de
86. 'health care quality'/de OR 'program evaluation'
87. 'multicenter study'/de
88. 'pilot study'/de
89. 'feasibility study'/de
90. 'cross-sectional study'/de
91. 'cohort analysis'/de OR 'longitudinal study'/de OR 'follow up'/de OR 'prospective study'/de
92. 'intention-to-treat':ab,ti
93. 'epidemiologic studies'
94. 'case control study'/de
95. 'controlled before and after study':ab,ti
96. 'case series':ab,ti
97. 'randomisation'/de OR 'clinical trial'/de OR 'single blind procedure'/de OR 'double blind procedure'/de OR 'control group'/de
98. 'cluster analysis'/de OR 'small area analysis' OR 'space time clustering' OR 'matched pair analysis'
99. 'community-based participatory research':ab,ti OR 'community-based participatory research study':ab,ti OR 'community trials':ab,ti
100. 'cross-over studies':ab,ti
101. 'stratified randomisation':ab,ti OR stratification:ab,ti
102. 'sequential trial':ab,ti
103. randomized:ab,ti OR randomised:ab,ti OR placebo:ab,ti OR randomly:ab,ti OR control:ab,ti OR 'control group':ab,ti OR 'comparison group':ab,ti OR 'intervention group':ab,ti OR matching:ab,ti

104. (time next/1 series):ab,ti
105. 'quasi-experiments':ab,ti OR 'quasi-random allocation':ab,ti
106. 'pre test':ab,ti OR pretest:ab,ti OR 'pre-intervention':ab,ti OR 'post intervention':ab,ti OR posttest:ab,ti OR 'post test':ab,ti
107. 'cost-benefit analysis':ab,ti OR 'cost-effectiveness analysis':ab,ti OR 'cost-utility analysis':ab,ti
108. 'experimental intervention':ab,ti OR 'experimental study':ab,ti
109. 'follow up assessment':ab,ti
110. evaluat*:ab,ti OR intervention:ab,ti OR interventional:ab,ti OR treatment:ab,ti AND (control:ab,ti OR controlled:ab,ti OR study:ab,ti OR program*:ab,ti OR comparison:ab,ti OR 'before and after':ab,ti OR comparative:ab,ti)
111. ((intervention OR interventional OR process OR program) NEXT/5 (evaluat* OR effect* OR outcome*)):ab,ti
112. 'secondary analysis':ab,ti
113. #77 - #112 combine using OR
114. #5 AND #57AND #76 AND #113
115. #5 AND #57 AND #76 AND #113 AND [embase]/lim AND [1996-2014]/py

Appendix 4. CINAHL search strategy

1. Child or Child, preschool or Infant or Infant, Newborn or Adolescent or Students
2. Babies or Infant? or Kid? or Children or Teen* or Adolescent? or Youth or Youngster? or Girl? or Boy? or Young People or Parent?
3. Family or "Family Unit?" or Families or Community or Communities or "Community Unit?"
4. "Rural Population" or "Suburban Population" or "Urban Population" or "Vulnerable Population" or "Minority Groups"
5. 1-4 search with OR
6. Preventive N4 Dentistry
7. "Dental Prophylaxis" or "Dental Scaling"
8. Fluoridation
9. "Public Health Dentistry" or "Community Dentistry" or "Evidence Based Dentistry"
10. "P#ediatric Dentistry" or "Dental Care for Children" or "Dental Care"
11. (MH "Periodontal Diseases/PC") or (MH "Dental Caries/PC")
12. "Cariostatic Agent?" or "Sodium Fluoride?" or Fluoride? or Fluoride?, Topical or "Tin Fluoride?" or "Calcium Fluoride?" or "Systemic Fluoride?"
13. Chlorhexidine
14. (MH "Pit and Fissure Sealants")
15. ((varnish* or "tooth product?" or sealant? or "mouth rinse?" or "oral rinse?" or "mouth wash*" or toothpaste? or dentifrice? or tablet? or drop? or "chewing gum?") N4 Fluorid*)
16. ((home? or school? or communit*) N4 (dental or mouth or oral or teeth or tooth or "dental screening?" or "oral screening?" or "mouth Screening?"))
17. (((outreach or mobile or enhanced) N3 (service? or program* or initiative? or support or strateg*)) and dental)
18. (("anticipatory guidance" or "needs assessment") N4 ("dental health" or "oral health" or perodont* or dental carie?))
19. Health Education, Dental or "Health Education" or Education, Nonprofessional
20. "Capacity Building" or "Health Literacy" or "Health Communication" or "oral health literacy" or "dental health literacy"

21. "Health Promotion" or "Public Health" or "Health Planning" or "Dental Health Planning" or "Oral Health Planning" or "Dental Health Promotion" or "Oral Health Promotion"
22. "Tooth Remineralization"
23. (MH "Dental Caries Activity Tests")
24. ((caries or "dental caries" or "early childhood caries" or periodon* or gingiv*) N3 ("risk management" or "disease management" or management or prevention or control))
25. "Dental Health Survey?" or "Oral Health Survey?" or "Health Care Survey?" or "Needs Assessment" or "Health Service Research"
26. "Population Surveillance" or "Sentinel Surveillance" or "Dental Health Surveillance" or "Oral Health Surveillance" or "Caries Surveillance" or "Periodontal Disease Surveillance" or "Caries Monitoring System?" or "Periodontal Disease Monitoring system"
27. (("oral health" or "dental health" or Health) N2 (promotion or integrated))
28. ((water or milk or salt or drink? or beverage? or environment) N3 (fluorid*))
29. ((sugar? or fizzy or sweet* or carbonated or "sweetening agent?" or flavo*) N2 (drink? or beverage? or food? or juice?))
30. media or "mass media" or "social marketing" or television or advert* or campaign* or "health awareness raising"
31. ((oral health or dental health or oral disease or dental disease or dental caries or periodon* or gingiv*) N3 (prevent* or program* or initiative? or educat* or improve* or intervention?))
32. (("Developed countr*" or "developing countr*" or "low income countr*" or "middle income countr*" or "high income countr*") N4 (intervention? or strateg* or program? or policy or policies or legislation?))
33. "Maternal Health Service?" or "Prenatal Health Service?" or "Postnatal Health Service?" or "Child Health Service?" or "Adolescent Health Service?" or "School Health Service?" or "Community Health Service?" or "Dental Health Service?" or "Oral Health Service?" or "Integrated Health Service?" or "Health Service?"
34. "Public Sector?" or "Private Sector?" or "Health Facilit*" or "Dental Health Facilit*" or "Oral Health Facilit*" or "Private Public Sector?"
35. "Child Day Care Cent*" or "Child Care Servic*" or Schools, Nursery or Universit*
36. "Primary Health Care" or "Dental Service Hospital" or "Health Planning Council?" or "State Health Planning and Development Agenc*" or "Health Systems Agenc*"
37. (("Health Care" or "Dental Care") N4 (Economic? or Organi?ation? or Rationing or Reform or Resource))
38. ((National or Regional or Rural or Urban or Remote or Suburban or School or College or Universit*) N4 (Program* or Fair? or Planning or Service? or Health or "Dental Health" or "Oral Health"))
39. (((Local or Federal or State) N3 (Polic* or Program? or Agenc* or legislation? or law? or Service? or Initiative? or Strateg*)) and Dental or Health or Oral or Government?)
40. (((International or Nonprofit or "Non Profit" or "Not for profit" or Voluntary or "Non government" or Government) N3 (Organi?ation? or Agenc* or Institution? or Initiative? or Strateg*)) and Dental or Health or Oral)
41. ((Insurance or Public or Private or Legislation or Law? or Polic*) N3 (Dental or Health or Medical* or "Oral Health"))
42. (((Community or Family or Population or Individual) N4 (Intervention? or Program? or Strateg* or Polic* or Innitiative* or Organi?tion? or Agenc* or Level or Based)) and Dental or Health or "Oral Health" or "General Health")
43. (((Peer or Group? or Community) N3 (Education or Support? or Program* or Network*)) and Dental or Oral Health or Health)
44. ((Clinic? or Hospital? or Practice) N3 (Medical or Dental or Health or "Oral Health"))
45. ((Staff or Professional? or Teacher? or General Practitioner? or GP? or Health Practitioner? or Doctor? or Dentist? or Parent?) N3 (Dental or Health or "Oral Health"))
46. ((School? or "Play school?" or "Child Care Service?" or Home or "Pre Natal Service?" or "Post Natal Service?" or Kindergarten or "After School Hours Care" or School or Curriculum or Extracurricular) N3 (Health or "Oral Health" or Dental))
47. ((Health or Healthy or Dental or "Oral Health") N3 (Education or Environment? or Canteen? or Behavio#r?))

48. (((Food? or Drink? or Beverage? or Nutrition*) N3 (School? or "Day Care" or Home)) and Dental or Health or "Oral Health")
49. Toothpastes or Toothbrush* or Mouthwash* or Mouthrinse? or Dentifrice? or Dental Floss*
50. (((Behavio#r? or Life Style? or Support or Education* or Counsel* or Theraph*) N3 (Diet or Feeding or Food? or Diet, Cariogenic)) and Dental or Health or "Oral Health")
51. "Sugar Free Gum?" or "Sugarfree Gum?" or "Xylitol" or "Sugarless chewing gum?"
52. ((Tobacco or Smoking or Cigarette Smoking or Nicotine or "Smokeless Tobacco") N4 (Cessation or Counselling or Intervention? or Therapy or Program* or Nicotine Patches" or "Nicotine Replacement" or Control))
53. ((Tobacco Cessation or Smokeless Tobacco Cessation or Cigarette or Nicotine or Tobacco) N3 (Law? or Strateg* or Program* or Initiative? or Polic*))
54. ((Tobacco or Nicotine or Cigarette? or Smokeless Tobacco) N4 (Marketing or "Social Marketing" or Advert* or Media or Campaign* or Package* or Awareness))
55. ((Supermarket? or "Grocery Store?" or Shop? or "Shopping Mall?" or Retailer*) and (Tobacco or Cigarette or Nicotine or Smokeless Tobacco))
56. Gymnasi* or "Health Spa?" or "Leisure Center?" or "Fitness Center?" or "Swimming pool?" or "Social Activ**" or "Youth Center?" or "Sports Center?"
57. Church or Chapel? or Mosque? or Synagogue? or Temple? or "Religious Setting?"
58. 6-57 Search with OR
59. "Oral Health"
60. "Dental Carie?" or Toothache or "Tooth Disease?" or "Tooth Discoloration"
61. (MH "Tooth Demineralization") or (MH "Dentin Sensitivity") or (MH "Dental Pulp Diseases") or (MH "Tooth Abrasion") or (MH "Tooth Loss")
62. (MH "Periodontal Diseases") or (MH "Gingival Diseases") or (MH "Gingivitis") or (MH "Dental Plaque") or (MH "Dental Deposits") or (MH "Periodontitis")
63. "Dental Caries Susceptibility" or "Dental Enamel Solubility" or "Tooth Mobility" or "Tooth Permeability"
64. ((Dental or Teeth or Tooth or Enamel) N2 (Missing or Loss or Filling? or Cavit* or Decay or Demineral* or Rot* or Lesion? or Mobil*))
65. ((Gum? or Gingiv* or Periodont* or Periapical or Oral or Dental or Mouth) N4 (Infection? or Inflammation?))
66. ((("Dental Caries" or Periodont* or Gingiv* or "Oral Infection?" or "Oral Inflammation?" or "Dental Infection?") N8 (Tobacco or Nicotine or "Smokeless Tobacco" or "Cigarette Smok**"))
67. (MH "Halitosis")
68. "Gingival H#emorrhage" or "Gingival Recession" or "Bleeding Gums"
69. "Periodontal Index" or "Dental Plaque Index" or "DMF Index" or "Oral Hygiene Index"
70. CPITN
71. "Gum Recession" or "Gingival Pocket" or "Periodontal Pocket?" or "Clinical Attachment Loss"
72. ((Rampant or "Nursing Bottle" or "Baby Bottle" or "Early Childhood") and (Carie? or Cavit* or Decay or "Tooth Decay" or "Teeth Decay*" or "Rot" or "lesion?" or Deminerali*))
73. ((("Primary Dentition" or "Deciduous Dentition" or "Milk Teeth" or "Milk Tooth" or "Primary Tooth" or "Primary Teeth") N4 (Missing or Loss or Filling? or Cavit* or Decay? or Rot or Demineral* or Lesion? or Carie?))
74. ((("Mixed Dentition" or "Permanent Dentition") N4 (Missing or Loss or Filling? or Cavit* or Decay? or Rot or Demineral* or Lesion? or Carie?))
75. "White Spot Lesion?" or dmft or DMFT or dmfs or DMFS

76. (("Quality of life" or "Self Rated" or "Self Reported" or "Self Perceived") N5 ("Oral Health" or "Dental Health"))
77. 59-76 Search with OR
78. (MH "Randomized Controlled Trials")
79. "Cluster randomised trial"
80. "Interrupted time series"
81. "Controlled Clinical Trial?"
82. "Controlled trial?"
83. "Parallel group trial?"
84. (MH "Comparative Studies")
85. "Intervention Studies"
86. (MH "Evaluation Research") or (MH "Validation Studies")
87. (MH "Program Evaluation")
88. (MH "Multicenter Studies")
89. (MH "Pilot Studies")
90. "Feasibility Studies"
91. (MH "Cross Sectional Studies")
92. "Cohort studies" or "Longitudinal Studies" or "Follow up studies" or "Prospective Studies"
93. "Intention to treat"
94. "Epidemiologic Studies"
95. (MH "Case Control Studies")
96. "Controlled before and after study"
97. "Case series"
98. "Random Allocation" or "Clinical Trial" or "Single Blind Method" or "Double Blind Method" or "Control Groups"
99. "Cluster Analysis" or "Small Area Analysis" or "Space Time Clustering" or "Matched Pair Analysis"
100. "Community Based Participatory Research" or "Community Based Participatory Research stud*" or "Community Trial?"
101. "Cross Over Stud*"
102. "Stratified Randomi?ation" or Stratification
103. "Sequential Trial?"
104. Randomi?ed or Placebo or Randomly or Control or Control Group? or Comparison Group? or Intervention Group? or Matching
105. "Quasi Experiment?" or "Quasi Random Allocation"
106. "Time adj Series" or "Time Series Analyses"
107. "Pre Test" or Pretest or "Pre Intervention" or "Post Intervention" or Posttest or "Post Test"
108. "Cost Benefit Analysis" or "Cost Effectiveness Analysis" or "Cost Utility Analysis"
109. "Experimental Intervention" or "Experimental Study"
110. "Follow Up Assessment"

111. ((Evaluat* or Intervention or Interventional or Treatment) and (Control or Controlled or Study or Program? or Comparison or "Before and After" or Comparative))
112. ((Intervention or Interventional or Process or Program) N5 (Evaluat* or Effect? or Outcome?))
113. "Secondary Analysis"
114. 78-113 Search with OR
115. 5 and 58 and 77 and 114 Limiters

Appendix 5. ERIC via OVID search strategy

1. exp Child/ or exp Child, preschool/ or exp Infant/ or exp Infant, Newborn/ or exp Adolescent/ or exp Students/
2. (babies or infant\$1 or kid\$1 or children or teen\$ or adolescent\$1 or youth or youngster\$1 or girl\$1 or boy\$1 or young people or parent \$1).ti,ab.
3. (family or family unit\$ or families or community or communities or community unit\$).ti,ab.
4. Rural Population/ or Suburban Population/ or Urban Population/ or Vulnerable Populations/ or Minority Groups/
5. or/1- 4
6. "Preventive Dentistry"
7. "Dental Prophylaxis" or "Dental Scaling"
8. "Fluoridation"
9. "Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry"
10. "P#diatric Dentistry" or "Dental Care for Children" or "Dental Care"
11. "Periodontal Diseases" or "Dental Caries"
12. "Cariostatic Agent?" or "Sodium Fluoride?" or "Fluoride Topical" or "Tin Fluoride?" or "Calcium Fluoride?"
13. (("antibacterial oral rinse" or "antibacterial mouth wash" or "antibacterial mouth rinse") N3 chlorhexidine)
14. exp "Pit and Fissure Sealants"
15. ((varnish* or "tooth product?" or sealant? or "mouth rinse?" or "mouth wash?" or "oral rinse" or toothpaste? or dentifrice? or tablet? or drop? or "chewing gum?") N4 Fluorid*)
16. ((home or school or community) N4 (dental screening? or oral screening? or mouth? Screening?))
17. (((outreach or mobile or enhanced) N3 (service? or program? or initiative? or support or strateg*)) and dental)
18. (((outreach or mobile or enhanced) N3 (service? or program? or initiative? or support or strateg*)) and dental)
19. (("anticipatory guidance" or "needs assessment") N4 ("dental health" or "oral health" or perodont*) N4 (or "dental carie?"))
20. Health Education, Dental or "Health Education" or "Education, Nonprofessional"
21. Capacity Building or exp Health Literacy or Health Communication or oral health literacy or dental health literacy
22. Health Promotion or Public Health or Health Planning or dental health planning or dental health promotion or oral health promotion
23. (Remineralisation) N2 Tooth)
24. Dental Caries Activity Tests
25. ((caries or periodon*) N3 (risk management or disease management))
26. Dental Health Surveys or Health Care Surveys or Needs Assessment or Health Services Research
27. "Population Surveillance" or "Sentinel Surveillance" or "dental health surveillance" or "oral health surveillance" or "carie? risk surveillance" or "periodontal disease surveillance"

28. ((oral health or dental health) N2 (promotion or integrated))
29. ((water or milk or salt or drink? or beverage? or environment) N3 (fluorid#))
30. ((sugar? or fizzy or sweet? or carbonated or sweetening agent? or flavo#) N2 (drink? or beverage? or food? or juice?))
31. (media or mass media or social marketing or television or advert# or campaign? or awareness raising)
32. ((oral health or dental health or oral disease or dental disease or dental caries or periodon? or gingiv#) N3 (prevent? or program? or initiative? or educat? or improv# or intervention?))
33. ((Developed countr# or developing countr# or low income countr# or middle income countr# or high income countr#) adj4 (intervention? or strateg# or program# or policy or policies or legislation?))
34. Maternal Health Service? or Child Health Service? or Adolescent Health Service? or School Health Service? or Community Health Service?
35. Public Sector or Private Sector or Health Service? or Health Facilitie?
36. Child Day Care Center? or Child Care or School?, Nursery
37. Dental Health Service? or Primary Health Care or Dental Service Hospital Health Planning Council? or "State Health Planning and Development Agencies" or Health Systems Agenc#
38. Health Care Economics and Organi?ation? or Health Care Rationing or Health Care Reform or Health Resources or National Health Program? or Regional Health Planning or Health Fairs
39. Government or Government Agenc# or Local government or State Government or Federal Government or Government Programs
40. International Agenc# or Public-Private Sector Partnerships or Organi?ation?, Nonprofit or Voluntary Health Agencies
41. Insurance, Health or Insurance, Dental or Policy or Health Policy or Public Policy or Legislation or Legislation as Topic
42. (community based or community level or family based or family level or population based or population level)
43. (Peer education or support group? or support program? or education? program?)
44. (clinic? or hospital? or medical practice? or dental practice?)
45. (health staff or health professional? or teacher? or General practitioner? or GP or health practitioner? or doctor? or dentist?)
46. (school? or play school? or child care service? or home or pre natal service? or post natal service? or kindergarten or after school hours care or curriculum or extracurricular)
47. ((health education or healthy environment or health promot# or healthy canteen or health polic# or health program?) N3 school?)
48. ((oral health or dental health or food or drink? or beverage? or nutrition) N4 (school? or day care or pre school or home))
49. Toothpaste? or Toothbrushing or Mouthwash# or Dentifrices
50. Diet, Cariogenic or Diet Therap# or Feeding Behavi#r or Health Behavi#r or Life Style
51. (sugar free gum? or sugarfree gum? or xylitol or sugarless chewing gum?)
52. "Tobacco Use Cessation" or Smoking Cessation
53. ((tobacco cessation or smokeless tobacco cessation or nicotine) N3 (intervention? or law? or strate# or program? or initiative? or policy or policies))
54. ((tobacco or nicotine or cigarette? or tobacco product?) N4 (marketing or social marketing or advert? or media or campaign? or package? or awareness))
55. (supermarket? or grocery store? or shop? or shopping mall or library or libraries)
56. (gymnasia# or health spa? or leisure center? or fitness center? or swimming pool? or social activ? or youth center? or sports center)
57. (church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or religious setting\$).ti,ab.

58. or/6-57
59. exp Oral Health/
60. exp Dental Caries/ or exp Toothache/ or exp Tooth Diseases/ or exp Tooth Discoloration/
61. exp Tooth Demineralization/ or exp Dentin Sensitivity/ or exp Dental Pulp Diseases/ or exp Tooth Wear/ or exp Tooth Loss/
62. exp Periodontal Diseases/ or exp Gingival Diseases/ or exp Gingivitis/ or exp Dental Plaque/ or exp Dental Deposits/ or exp Periodontitis/
63. exp Dental Caries Susceptibility/ or exp Dental Enamel Solubility/ or exp Tooth Mobility/ or exp Tooth Permeability/
64. ((dental or teeth or tooth or enamel) adj2 (missing or loss or filling\$ or cavit\$ or decay or demineral\$ or rot\$ or lesion\$)).ti,ab.
65. ((gum\$1 or gingiv\$ or periodont\$ or periapical or oral or dental or mouth) adj4 (infection\$ or inflammation\$)).ti,ab.
66. ((dental caries or periodont\$ or gingiv\$ or oral infection\$ or oral inflammation\$ or dental infection\$ or dental inflammation\$) adj8 (tobacco or nicotine or smokeless tobacco or cigarette smoke\$)).ti,ab.
67. exp Halitosis/
68. exp Gingival Hemorrhage/ or exp Gingival Recession/
69. exp Periodontal Index/ or exp Dental Plaque Index/ or exp DMF Index/ or exp Oral Hygiene Index/
70. CPITN.ti,ab.
71. (gum recession or gingival pocket or periodontal pocket or clinical attachment loss or bleeding gums).ti,ab.
72. ((rampant or nursing bottle or baby bottle or early childhood) and (carie\$1or cavit\$ or decay or tooth decay or teeth decay or rot or lesion\$ or demineral\$)).ti,ab.
73. ((primary dentition or deciduous dentition or milk teeth or milk tooth or primary tooth or primary teeth) adj4 (missing or loss or filling \$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie\$)).ti,ab.
74. ((mixed dentition or permanent dentition) adj4 (missing or loss or filling\$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie \$)).ti,ab.
75. (white spot lesion\$ or dmft or DMFT or dmfs or DMFS).ti,ab.
76. ((quality of life or self rated or self reported or self perceived) adj5 (oral health or dental health)).ti,ab.
77. or/59-76
78. Randomized Controlled Trial.pt.
79. Cluster randomised trial.ti,ab.
80. Interrupted time series.ti,ab.
81. Controlled Clinical Trial.pt.
82. Controlled trial.ti,ab.
83. Parallel group trial.ti,ab.
84. Comparative Study.pt.
85. Intervention Studies/
86. Evaluation Studies/ or Validation Studies/
87. Program Evaluation/
88. Multicenter Study/
89. Pilot Projects/
90. Feasibility Studies/

91. Cross-Sectional Studies/
92. Cohort studies/ or Longitudinal Studies/ or Follow-Up Studies/ or Prospective Studies/
93. Intention-to-treat.ti,ab.
94. Epidemiologic Studies/
95. Case-Control Studies/
96. (Controlled before and after study).ti,ab.
97. Case series.ti,ab.
98. Random Allocation/ or Clinical Trial/ or Single-Blind Method/ or Double-Blind Method/ or Control Groups/
99. Cluster Analysis/ or Small-Area Analysis/ or Space-Time Clustering/ or Matched-Pair Analysis/
100. (Community-Based Participatory Research or Community-Based Participatory Research stud\$ or Community Trials).ti,ab.
101. Cross-Over Studies.ti,ab.
102. (Stratified randomisation or Stratification).ti,ab.
103. sequential trial.ti,ab.
104. (randomized or randomised or placebo or randomly or control or control group\$ or comparison group\$ or intervention group\$ or matching).ti,ab.
105. (time adj series).ti,ab.
106. (quasi-experiment\$ or Quasi-random allocation).ti,ab.
107. (pre test or pretest or pre-intervention or post-intervention or posttest or post test).ti,ab.
108. (cost-benefit analysis or cost-effectiveness analysis or cost-utility analysis).ti,ab.
109. (experimental intervention or experimental study).ti,ab.
110. follow-up-assessment.ti,ab.
111. ((evaluat\$ or intervention or interventional or treatment) and (control or controlled or study or program\$ or comparison or "before and after" or comparative)).ti,ab.
112. ((intervention or interventional or process or program) adj5 (evaluat\$ or effect\$ or outcome\$)).ab,ti.
113. (secondary analys\$).ti,ab.
114. or/78-113
115. 5 and 58 and 77 and 114

Appendix 6. BIOSIS Previews search strategy

1. TS = (Child or "preschool child" or infant or "newborn infant" or adolescent or student*)
2. TS=(babies or infant\$ or kid\$ or children or teen\$ or adolescent\$ or youth or youngster\$ or girl\$ or boy\$ or young people or parent\$)
3. TS=(famil* or "family unit" or communit* or "community unit")
4. TS=("rural population" or "suburban population" or "urban population" or "vulnerable populations" or "minority groups")
5. #1 - #4 combine with OR
6. TS="preventive dentistry"
7. TS=("dental prophylaxis" or "dental scaling")
8. TS=fluoridation

9. TS=("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry")
10. TS=("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care")
11. TS=("periodontal diseases" or "dental caries")
12. TS=("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride")
13. TS=chlorhexidine
14. TS="pit and fissure sealants"
15. TS=((varnish* or product\$ or sealant\$ or "mouth rinse" or "mouth wash" or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$ or "chewing gum") near/4 fluoride)
16. TS=((home or school or community) near/4("dental screening" or "oral screening" or "mouth screening"))
17. TS((((outreach or mobile or enhanced) near/3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental)
18. TS(("anticipatory guidance" or "needs assessment") near/4 ("dental health" or "oral health" or periodont\$))
19. TS=("Health Education" or Dental or "Health Education" or "Nonprofessional Education")
20. TS=("Capacity Building" or "Health Literacy" or "Health Communication")
21. TS(("Health Promotion" or "Public Health" or "Health Planning"))
22. TS="Tooth Remineralization"
23. TS="Dental Caries Activity Tests"
24. TS=((caries or periodont*) near/3 "risk management")
25. TS(("Dental Health Surveys" or "Health Care Surveys" or "Needs Assessment" or "Health Services Research"))
26. TS(("Population Surveillance" or "Sentinel Surveillance"))
27. TS(("oral health" or "dental health") near/2 (promotion or integrated))
28. TS=((water or milk or salt or drink\$ or beverage\$ or environment) near/3 fluorid\$)
29. TS=((sugar\$ or fizzy or sweet\$ or carbonated or "sweetening agent" or flavo\$) near/2 (drink\$ or beverage\$ or food\$ or juice\$))
30. TS=(media or "mass media" or "social marketing" or television or advert\$ or campaign\$ or "awareness raising")
31. TS(("oral health" or "dental health" or "oral disease" or "dental disease" or "dental caries" or periodon\$ or gingiv\$) near/3 (prevent\$ or program\$ or initiative\$ or educat* or improv\$ or intervention\$))
32. TS(("Developed country" or "developing country" or "low income country" or "middle income country" or "high income country") near/4 (intervention\$ or strateg* or program\$ or polic* or legislation\$))
33. TS(("Maternal Health Services" or "Child Health Services" or "Adolescent Health Services" or "School Health Services" or "Community Health Services"))
34. TS(("Public Sector" or "Private Sector" or "Health Services" or "Health Facilities"))
35. TS=("Child Day Care Centers" or "Child Care" or "nursery schools")
36. TS(("Dental Health Services" or "Primary Health Care" or "Dental Service Hospital" or "Health Planning Councils" or "State Health Planning and Development Agencies" or "Health Systems Agencies"))
37. TS=("Health Care Economics and Organisations" or "Health Care Rationing" or "Health Care Reform" or "Health Resources" or "National Health Programs" or "Regional Health Planning" or "Health Fairs")
38. TS=(Government or "Government Agencies" or "Local government" or "State Government" or "Federal Government" or "Government Programs")
39. TS(("International Agencies" or "Public-Private Sector Partnerships" or "Nonprofit Organisations" or "Voluntary Health Agencies"))

40. TS=(“Health Insurance” or “Dental Insurance” or Policy or “Health Policy” or “Public Policy” or Legislation)
41. TS=(“community based” or “community level” or “family based” or “family level” or “population based” or “population level”)
42. TS=(“Peer education” or “support group” or “support program” or “education program”)
43. TS=(clinic\$ or hospital\$ or “medical practice” or “dental practice”)
44. TS=(“health staff” or “health professional\$” or teacher\$ or “General practitioners” or GP or “health practitioner” or doctor\$ or dentist\$)
45. TS= (school\$ or “play school” or “child care service” or home or “pre natal service” or “post natal service” or kindergarten or “after school hours care” or curriculum or extracurricular)
46. TS=(“health education” or “healthy environment” or “health promotion” or “healthy canteen” or “health policy” or “health program”) near/3 school)
47. TS=(“oral health” or “dental health” or food or drink\$ or beverage\$ or nutrition*) near/4 (school\$ or “day care” or “pre school” or home))
48. TS=(Toothpaste\$ or Toothbrushing or Mouthwashes\$ or Dentifrices)
49. TS=(“Cariogenic diet” or “Diet Therapy” or “Feeding Behavior” or “Feeding Behaviour” or “Health Behavior” or “Health Behaviour” or “Life Style”)
50. TS=(“sugar free gum” or “sugarfree gum” or xylitol or “sugarless chewing gum”)
51. TS=(“Tobacco Use Cessation” or “Smoking Cessation”)
52. TS=(“tobacco cessation” or “smokeless tobacco cessation” or nicotine) near/3 (intervention\$ or law\$ or strate* or program\$ or initiative \$ or polic*)
53. TS=((tobacco or nicotine or cigarette\$ or “tobacco product”) near/4 (marketing or “social marketing” or advert* or media or campaign \$ or package\$ or awareness))
54. TS=(supermarket\$ or “grocery store” or shop\$ or “shopping mall” or library*)
55. TS=(gymnasi* or “health spa” or “leisure center” or “fitness center” or “swimming pool” or “social activity” or “youth center” or “sports center”)
56. TS=(church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or “religious setting”)
57. #6 - #56 combine with OR
58. TS=”Oral Health”
59. TS=(“Dental Caries” or Toothache or “Tooth Diseases” or “Tooth Discoloration”)
60. TS=(“Tooth Demineralization” or “Dentin Sensitivity” or “Dental Pulp Diseases” or “Tooth Wear” or “Tooth Loss”)
61. TS=(“Periodontal Diseases” or “Gingival Diseases” or Gingivitis or “Dental Plaque” or “Dental Deposits” or Periodontitis)
62. TS=(“Dental Caries Susceptibility” or “Dental Enamel Solubility” or “Tooth Mobility” or “Tooth Permeability”)
63. TS=((dental or teeth or tooth or enamel) near/2 (missing or loss or filling\$ or cavit* or decay or demineral* or rot* or lesion\$))
64. TS=((gum\$ or gingiv* or periodont* or periapical or oral or dental or mouth) near/4 (infection\$ or inflammation\$))
65. TS=(“dental caries” or periodont* or gingiv* or “oral infection” or “oral inflammation” or “dental infection” or “dental inflammation”) near/8 (tobacco or nicotine or “smokeless tobacco” or “cigarette smoke”))
66. TS=Halitosis
67. TS=(“Gingival Hemorrhage” or “Gingival Recession”)
68. TS=(“Periodontal Index” or “Dental Plaque Index” or “DMF Index” or “Oral Hygiene Index”)
69. TS=”CPITN”
70. TS=(“gum recession” or “gingival pocket” or “periodontal pocket” or “clinical attachment loss” or “bleeding gums”)

71. TS=((rampant or “nursing bottle” or “baby bottle” or “early childhood”) and (carie\$ or cavit* or decay or “tooth decay” or “teeth decay” or rot or lesion\$ or demineral*))
72. TS=((“primary dentition” or “deciduous dentition” or “milk teeth” or “milk tooth” or “primary tooth” or “primary teeth”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
73. TS=((“mixed dentition” or “permanent dentition”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion \$ or carie\$))
74. TS=(“white spot lesion” or “dmft” or “DMFT” or “dmfs” or “DMFS”)
75. TS=((“quality of life” or “self rated” or “self reported” or “self perceived”) near/5 (“oral health” or “dental health”))
76. #58 - #75 combine with OR
77. TS=”Randomized Controlled Trial”
78. TS=”Cluster randomised trial”
79. TS=”Interrupted time series”
80. TS=”Controlled Clinical Trial”
81. TS=”Controlled trial”
82. TS=”Parallel group trial”
83. TS=”Comparative Study”
84. TS=”Intervention Studies”
85. TS=(“Evaluation Studies” or “Validation Studies”)
86. TS=”Program Evaluation”
87. TS=”Multicenter Study”
88. TS=”Pilot Projects”
89. TS=”Feasibility Studies”
90. TS=”Cross-Sectional Studies”
91. TS=(“Cohort studies” or “Longitudinal Studies” or “Follow-Up Studies” or “Prospective Studies”)
92. TS=”Intention-to-treat”
93. TS=”Epidemiologic Studies”
94. TS=”Case-Control Studies”
95. TS=”Controlled before and after study”
96. TS=”Case series”
97. TS=(“Random Allocation” or “Clinical Trial” or “Single-Blind Method” or “Double-Blind Method” or “Control Groups”)
98. TS=(“Cluster Analysis” or “Small-Area Analysis” or “Space-Time Clustering” or “Matched-Pair Analysis”)
99. TS=(“Community-Based Participatory Research” or “Community-Based Participatory Research study” or “Community Trials”)
100. TS=”Cross-Over Studies”
101. TS=(“Stratified randomisation” or Stratification)
102. TS=”sequential trial”
103. TS=(randomized or randomised or placebo or randomly or control or “control group” or “comparison group” or “intervention group” or matching)

104. TS=(time near series)
105. TS=(“quasi-experimental” or “Quasi-random allocation”)
106. TS=(“pre test” or pretest or “pre-intervention” or “post-intervention” or posttest or “post test”)
107. TS=(“cost-benefit analysis” or “cost-effectiveness analysis” or “cost-utility analysis”)
108. TS=(“experimental intervention” or “experimental study”)
109. TS=“follow-up-assessment”
110. TS=((evaluat* or intervention or interventional or treatment) and (control or controlled or study or program* or comparison or "before and after" or comparative))
111. TS=((intervention or interventional or process or program) near/5 (evaluat* or effect\$ or outcome\$))
112. TS=“secondary analysis”
113. #77 - #112 combine with OR
114. 5 AND 57 AND 76 AND 113

Appendix 7. Web of Science search strategy

1. TS = (Child or "preschool child" or infant or "newborn infant" or adolescent or student*)
2. TS=(babies or infant\$ or kid\$ or children or teen\$ or adolescent\$ or youth or youngster\$ or girl\$ or boy\$ or young people or parent\$)
3. TS=(famil* or "family unit" or communit* or "community unit")
4. TS=("rural population" or "suburban population" or "urban population" or "vulnerable populations" or "minority groups")
5. #1 - #4 Combine with OR
6. TS="preventive dentistry"
7. TS=("dental prophylaxis" or "dental scaling")
8. TS=fluoridation
9. TS=("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry")
10. TS=("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care")
11. TS=("periodontal diseases" or "dental caries")
12. TS=("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride")
13. TS=chlorhexidine
14. TS="pit and fissure sealants"
15. TS=((varnish* or product\$ or sealant\$ or "mouth rinse" or "mouth wash" or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$ or "chewing gum") near/4 fluoride)
16. TS=((home or school or community) near/4("dental screening" or "oral screening" or "mouth screening"))
17. TS((((outreach or mobile or enhanced) near/3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental)
18. TS(("anticipatory guidance" or "needs assessment") near/4 ("dental health" or "oral health" or periodont\$))
19. TS=("Health Education" or Dental or "Health Education" or "Nonprofessional Education")
20. TS=("Capacity Building" or "Health Literacy" or "Health Communication")
21. TS=(“Health Promotion” or “Public Health” or “Health Planning”)
22. TS=(“Tooth Remineralization”)

23. TS=(“Dental Caries Activity Tests”)
24. TS=((caries or periodont*) near/3 “risk management”)
25. TS=(“Dental Health Surveys” or “Health Care Surveys” or “Needs Assessment” or “Health Services Research”)
26. TS=(“Population Surveillance” or “Sentinel Surveillance”)
27. TS=(“oral health” or “dental health”) near/2 (promotion or integrated))
28. TS=((water or milk or salt or drink\$ or beverage\$ or environment) near/3 fluorid\$)
29. TS=((sugar\$ or fizzy or sweet\$ or carbonated or “sweetening agent” or flavo\$) near/2 (drink\$ or beverage\$ or food\$ or juice\$))
30. TS=(media or “mass media” or “social marketing” or television or advert\$ or campaign\$ or “awareness raising”)
31. TS=(“oral health” or “dental health” or “oral disease” or “dental disease” or “dental caries” or periodon\$ or gingiv\$) near/3 (prevent\$ or program\$ or initiative\$ or educat* or improv\$ or intervention\$))
32. TS=(“Developed country” or “developing country” or “low income country” or “middle income country” or “high income country”) near/4 (intervention\$ or strateg* or program\$ or polic* or legislation\$))
33. TS=(“Maternal Health Services” or “Child Health Services” or “Adolescent Health Services” or “School Health Services” or “Community Health Services”)
34. TS=(“Public Sector” or “Private Sector” or “Health Services” or “Health Facilities”)
35. TS=(“Child Day Care Centers” or “Child Care” or “nursery schools”)
36. TS=(“Dental Health Services” or “Primary Health Care” or “Dental Service Hospital” or “Health Planning Councils” or “State Health Planning and Development Agencies” or “Health Systems Agencies”)
37. TS=(“Health Care Economics and Organisations” or “Health Care Rationing” or “Health Care Reform” or “Health Resources” or “National Health Programs” or “Regional Health Planning” or “Health Fairs”)
38. TS=(Government or “Government Agencies” or “Local government” or “State Government” or “Federal Government” or “Government Programs”)
39. TS=(“International Agencies” or “Public-Private Sector Partnerships” or “Nonprofit Organisations” or “Voluntary Health Agencies”)
40. TS=(“Health Insurance” or “Dental Insurance” or Policy or “Health Policy” or “Public Policy” or Legislation)
41. TS=(“community based” or “community level” or “family based” or “family level” or “population based” or “population level”)
42. TS=(“Peer education” or “support group” or “support program” or “education program”)
43. TS=(clinic\$ or hospital\$ or “medical practice” or “dental practice”)
44. TS=(“health staff” or “health professional\$” or teacher\$ or “General practitioners” or GP or “health practitioner” or doctor\$ or dentist\$)
45. TS=(school\$ or “play school” or “child care service” or home or “pre natal service” or “post natal service” or kindergarten or “after school hours care” or curriculum or extracurricular)
46. TS=(“health education” or “healthy environment” or “health promotion” or “healthy canteen” or “health policy” or “health program”) near/3 school)
47. TS=(“oral health” or “dental health” or food or drink\$(beverage\$ or nutrition*) near/4 (school\$ or “day care” or “pre school” or home))
48. TS=(Toothpaste\$ or Toothbrushing or Mouthwashe\$ or Dentifrices)
49. TS=(“Cariogenic diet” or “Diet Therapy” or “Feeding Behavior” or “Feeding Behaviour” or “Health Behavior” or “Health Behaviour” or “Life Style”)
50. TS=(“sugar free gum” or “sugarfree gum” or xylitol or “sugarless chewing gum”)
51. TS=(“Tobacco Use Cessation” or “Smoking Cessation”)

52. TS=((“tobacco cessation” or “smokeless tobacco cessation” or nicotine) near/3 (intervention\$ or law\$ or strate* or program\$ or initiative \$ or polic*))
53. TS=((tobacco or nicotine or cigarette\$ or “tobacco product”) near/4 (marketing or “social marketing” or advert* or media or campaign \$ or package\$ or awareness))
54. TS=(supermarket\$ or “grocery store” or shop\$ or “shopping mall” or library*)
55. TS=(gymnasi* or “health spa” or “leisure center” or “fitness center” or “swimming pool” or “social activity” or “youth center” or “sports center”)
56. TS=(church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or “religious setting”)
57. #6 – #56 Combine with OR
58. TS=”Oral Health”
59. TS=(“Dental Caries” or Toothache or “Tooth Diseases” or “Tooth Discoloration”)
60. TS=(“Tooth Demineralization” or “Dentin Sensitivity” or “Dental Pulp Diseases” or “Tooth Wear” or “Tooth Loss”)
61. TS=(“Periodontal Diseases” or “Gingival Diseases” or Gingivitis or “Dental Plaque” or “Dental Deposits” or Periodontitis)
62. TS=(“Dental Caries Susceptibility” or “Dental Enamel Solubility” or “Tooth Mobility” or “Tooth Permeability”)
63. TS=((dental or teeth or tooth or enamel) near/2 (missing or loss or filling\$ or cavit* or decay or demineral* or rot* or lesion\$))
64. TS=((gum\$ or gingiv* or periodont* or periapical or oral or dental or mouth) near/4 (infection\$ or inflammation\$))
65. TS=((“dental caries” or periodont* or gingiv* or “oral infection” or “oral inflammation” or “dental infection” or “dental inflammation”) near/8 (tobacco or nicotine or “smokeless tobacco” or “cigarette smoke”))
66. TS=Halitosis
67. TS=(“Gingival Hemorrhage” or “Gingival Recession”)
68. TS=(“Periodontal Index” or “Dental Plaque Index” or “DMF Index” or “Oral Hygiene Index”)
69. TS=”CPITN”
70. TS=(“gum recession” or “gingival pocket” or “periodontal pocket” or “clinical attachment loss” or “bleeding gums”)
71. TS=((rampant or “nursing bottle” or “baby bottle” or “early childhood”) and (carie\$ or cavit* or decay or “tooth decay” or “teeth decay” or rot or lesion\$ or demineral*))
72. TS=((“primary dentition” or “deciduous dentition” or “milk teeth” or “milk tooth” or “primary tooth” or “primary teeth”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
73. TS=((“mixed dentition” or “permanent dentition”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion \$ or carie\$))
74. TS=(“white spot lesion” or “dmft” or “DMFT” or “dmfs” or “DMFS”)
75. TS=((“quality of life” or “self rated” or “self reported” or “self perceived”) near/5 (“oral health” or “dental health”))
76. #58 – #75 combine with OR
77. TS=”Randomized Controlled Trial”
78. TS=”Cluster randomised trial”
79. TS=”Interrupted time series”
80. TS=”Controlled Clinical Trial”
81. TS=”Controlled trial”
82. TS=”Parallel group trial”

83. TS="Comparative Study"
84. TS="Intervention Studies"
85. TS=("Evaluation Studies" or "Validation Studies")
86. TS="Program Evaluation"
87. TS="Multicenter Study"
88. TS="Pilot Projects"
89. TS="Feasibility Studies"
90. TS="Cross-Sectional Studies"
91. TS=("Cohort studies" or "Longitudinal Studies" or "Follow-Up Studies" or "Prospective Studies")
92. TS="Intention-to-treat"
93. TS="Epidemiologic Studies"
94. TS="Case-Control Studies"
95. TS="Controlled before and after study"
96. TS="Case series"
97. TS=("Random Allocation" or "Clinical Trial" or "Single-Blind Method" or "Double-Blind Method" or "Control Groups")
98. TS=("Cluster Analysis" or "Small-Area Analysis" or "Space-Time Clustering" or "Matched-Pair Analysis")
99. TS=("Community-Based Participatory Research" or "Community-Based Participatory Research study" or "Community Trials")
100. TS="Cross-Over Studies"
101. TS=("Stratified randomisation" or Stratification)
102. TS="sequential trial"
103. TS=(randomized or randomised or placebo or randomly or control or "control group" or "comparison group" or "intervention group" or matching)
104. TS=(time near series)
105. TS=("quasi-experimental" or "Quasi-random allocation")
106. TS=("pre test" or pretest or "pre-intervention" or "post-intervention" or posttest or "post test")
107. TS=("cost-benefit analysis" or "cost-effectiveness analysis" or "cost-utility analysis")
108. TS=("experimental intervention" or "experimental study")
109. TS="follow-up-assessment"
110. TS=((evaluat* or intervention or interventional or treatment) and (control or controlled or study or program* or comparison or "before and after" or comparative))
111. TS=((intervention or interventional or process or program) near/5 (evaluat* or effect\$ or outcome\$))
112. TS="secondary analysis"
113. #77 - #112 combine with OR
114. #5 AND #57 AND #76 AND #113

Appendix 8. DARE via OVID search strategy

1. (child or "preschool child" or infant or "newborn infant" or adolescent or student\$).af.

2. (babies or infant\$1 or kid\$1 or children or teen\$ or adolescent\$1 or youth or youngster\$1 or girl\$1 or boy\$1 or young people or parent \$1).af.
3. (family or "family unit\$" or families or community or communities or "community unit\$").af.
4. ("Rural Population" or "Suburban Population" or "Urban Population" or "Vulnerable Populations" or "Minority Groups").af.
5. #1 - # 4 combine with OR
6. "Preventive Dentistry".af.
7. ("Dental Prophylaxis" or "Dental Scaling").af.
8. Fluoridation.af.
9. ("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry").af.
10. ("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care").af.
11. ("periodontal diseases" or "dental caries").af.
12. ("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride").af.
13. chlorhexidine.af.
14. "pit and fissure sealants".af.
15. (varnish\$ or product\$ or sealant\$ or mouth rinse\$ or mouth wash\$ or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$1 or chewing gum \$) adj4 Fluorid\$.af.
16. ("dental screening" or "oral screening" or "mouth screening").af.
17. (service\$ or program\$ or initiative\$ or support or strateg\$) adj3 (dental) .af.
18. ("anticipatory guidance" or "needs assessment") adj4 ("dental health" or "oral health" or periodont\$).af.
19. ("Dental Health Education" or "Health Education" or "Nonprofessional Education").af.
20. ("Capacity Building" or "Health Literacy" or "Health Communication").af.
21. ("Health Promotion" or "Public Health" or "Health Planning").af.
22. "tooth remineralization".af.
23. "dental caries activity tests".af.
24. (caries or periodon\$) adj3 "risk management".af.
25. ("dental health surveys" or "health care surveys" or "needs assessment" or "health services research").af.
26. ("Population Surveillance" or "Sentinel Surveillance").af.
27. ("oral health" or "dental health") adj2 (promotion or integrated).af.
28. (water or milk or salt or drink\$ or beverage\$ or environment) adj3 fluorid\$.af.
29. (sugar\$ or fizzy or sweet\$ or carbonated or sweetening agent\$ or flavo\$) adj2 (drink\$ or beverage\$ or food\$ or juice\$).af.
30. (media or "mass media" or "social marketing" or television or advert\$ or campaign\$ or "awareness raising").af.
31. ("oral health" or "dental health" or "oral disease" or "dental disease" or "dental caries" or periodon\$ or gingiv\$) adj3 (prevent\$ or prgram\$ or initiative\$ or educat\$ or improv\$ or intervention\$).af.
32. ("Developed countr\$" or "developing countr\$" or "low income countr\$" or "middle income countr\$" or "high income countr\$") adj4 (intervention\$1 or strateg\$ or program\$1 or polic\$ or legislation\$).af.
33. ("Maternal Health Services" or "Child Health Services" or "Adolescent Health Services" or "School Health Services" or "Community Health Services").af.

34. ("Public Sector" or "Private Sector" or "Health Services" or "Health Facilities").af.
35. ("Child Day Care Centers" or "Child Care" or "Nursery Schools").af.
36. ("Dental Health Services" or "Primary Health Care" or "Dental Service Hospital" or "Health Planning Councils" or "State Health Planning and Development Agencies" or "Health Systems Agencies").af.
37. ("Health Care Economics and Organisations" or "Health Care Rationing" or "Health Care Reform" or "Health Resources" or "National Health Programs" or "Regional Health Planning" or "Health Fairs").af.
38. (Government or "Government Agencies" or "Local government" or "State Government" or "Federal Government" or "Government Programs").af.
39. ("International Agencies" or "Public-Private Sector Partnerships" or "Nonprofit Organisations" or "Voluntary Health Agencies").af.
40. ("Health Insurance" or "Dental Insurance" or Policy or "Health Policy" or "Public Policy" or Legislation).af.
41. ("community based" or "community level" or "family based" or "family level" or "population based" or "population level").af.
42. ("Peer education" or "support group\$" or "support program\$" or education\$ program\$).af.
43. (clinic\$1 or hospital\$1 or "medical practice\$" or "dental practice\$").af.
44. ("health staff" or "health professional\$1" or teacher\$1 or "General practitioners" or GP or "health practitioner\$1" or doctor\$1 or dentist \$1).af.
45. (school\$1 or "play school\$" or "child care service\$" or home or "pre natal service\$" or "post natal service\$" or kindergarten or "after school hours care" or curriculum or extracurricular).af.
46. ("health education" or "healthy environment" or "health promot\$" or "healthy canteen" or "health polic\$" or "health program\$") adj3 school\$.af.
47. ("oral health" or "dental health" or food or drink\$ or beverage\$ or nutrition\$) adj4 (school\$ or "day care" or "pre school" or home).af.
48. (Toothpastes or Toothbrushing or Mouthwashes or Dentifrices).af.
49. ("Cariogenic Diet" or "Diet Therapy" or "Feeding Behavior?" or "Health Behavior?" or "Life Style").af.
50. ("sugar free gum\$1" or "sugarfree gum\$1" or xylitol or "sugarless chewing gum\$1").af.
51. ("Tobacco Use Cessation" or "Smoking Cessation").af.
52. (intervention\$1 or law\$ or strate\$ or program\$ or initiative\$ or polic\$) adj3 ("tobacco cessation" or "smokeless tobacco cessation" or nicotine).af.
53. (marketing or "social marketing" or advert\$ or media or campaign\$ or package\$ or awareness) adj4 (tobacco or cigarette or "tobacco product").af.
54. (supermarket\$ or grocery store\$ or shop\$ or "shopping mall" or library or libraries).af.
55. (gymnasia\$ or "health spa\$" or "leisure center\$" or "fitness center\$" or "swimming pool\$" or "social activ\$" or "youth center\$" or "sports center").af.
56. (church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or "religious setting\$").af.
57. # 6 - # 56 combine with OR
58. "Oral Health".af.
59. ("Dental Caries" or Toothache or "Tooth Diseases" or "Tooth Discolo?ration").af.
60. ("Tooth Demineralization" or "Dentin Sensitivity" or "Dental Pulp Diseases" or "Tooth Wear" or "Tooth Loss").af.
61. ("Periodontal Diseases" or "Gingival Diseases" or Gingivitis or "Dental Plaque" or "Dental Deposits" or Periodontitis).af.
62. ("Dental Caries Susceptibility" or "Dental Enamel Solubility" or "Tooth Mobility" or "Tooth Permeability").af.
63. (missing or loss or filling\$ or cavit\$ or decay or demineral\$ or rot\$ or lesion\$) adj2 (dental or t##th or enamel).af.

64. (gum\$1 or gingiv\$ or periodont\$ or periapical or oral or dental or mouth) adj4 (infection or inflammation).af.
65. (dental caries or periodont\$ or gingiv\$ or "oral infection\$" or "oral inflammation\$" or "dental infection\$" or "dental inflammation\$") adj8 (tobacco or nicotine or "smokeless tobacco" or "cigarette smoke").af.
66. Halitosis.af.
67. ("Gingival Hemorrhage" or "Gingival Recession").af.
68. ("Periodontal Index" or "Dental Plaque Index" or "DMF Index" or "Oral Hygiene Index").af.
69. "CPITN".af.
70. ("gum recession" or "gingival pocket" or "periodontal pocket" or "clinical attachment loss" or "bleeding gums").af.
71. (rampant or nursing bottle or baby bottle or "early childhood") and (carie\$1 or cavit\$ or decay or "tooth decay" or "teeth decay" or rot or lesion\$ or demineral\$).af.
72. ("primary dentition" or "deciduous dentition" or "milk t##th" or "primary t##th") adj4 (missing or loss or filling\$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie\$).af.
73. ("mixed dentition" or "permanent dentition") adj4 (missing or loss or filling\$ or cavit\$ or decay\$ or rot or demineral\$ or lesion\$ or carie\$).af.
74. ("white spot lesion\$" or dmft or DMFT or dmfs or DMFS).af.
75. ("quality of life" or "self rated" or "self reported" or "self perceived") adj5 ("oral health" or "dental health").af.
76. # 58 - #75 combine with OR
77. "Randomized Controlled Trial".af.
78. "Cluster randomised trial".af.
79. "Interrupted time series".af.
80. "Controlled Clinical Trial".af.
81. "Controlled trial".af.
82. "Parallel group trial".af.
83. "Comparative Study".af.
84. "Intervention Studies".af.
85. ("evaluation stud\$" or "validation stud\$").af.
86. "Program Evaluation".af.
87. "Multicenter Study".af.
88. "Pilot Projects".af.
89. "Feasibility Studies".af.
90. "Cross-Sectional Studies".af.
91. ("Cohort studies" or "Longitudinal Studies" or "Follow-Up Studies" or "Prospective Studies").af.
92. "Intention-to-treat".af.
93. "Epidemiologic Studies".af.
94. "Case-Control Studies".af.
95. "Controlled before and after study".af.
96. "Case series".af.

97. ("Random Allocation" or "Clinical Trial" or "Single-Blind Method" or "Double-Blind Method" or "Control Groups").af.
98. ("Cluster Analysis" or "Small-Area Analysis" or "Space-Time Clustering" or "Matched-Pair Analysis").af.
99. ("Community-Based Participatory Research" or "Community-Based Participatory Research stud\$" or "Community Trials").af.
100. "Cross-Over Studies".af.
101. ("Stratified randomisation" or Stratification).af.
102. "sequential trial".af.
103. (randomi?ed or placebo or randomly or control or "control group\$" or "comparison group\$" or "intervention group\$" or matching).af.
104. (time adj series).af.
105. ("quasi-experiment\$" or "Quasi-random allocation").af.
106. ("pre test" or pretest or "pre-intervention" or "post-intervention" or posttest or "post test").af.
107. ("cost-benefit analysis" or "cost-effectiveness analysis" or "cost-utility analysis").af.
108. ("experimental intervention" or "experimental study").af.
109. "follow-up-assessment".af.
110. ((evaluat\$ or intervention or interventional or treatment) and control) or (controlled or study or program\$ or comparison or "before and after study" or comparative).af.
111. (intervention or interventional or process or program) adj5 (evaluat\$ or effect\$ or outcome\$).af.
112. "secondary analys\$".af.
113. # 77 - #112 combine with OR
114. 5 AND 57 AND 76 AND113

Appendix 9. Social Sciences Citation Index search strategy

1. TS = (Child or "preschool child" or infant or "newborn infant" or adolescent or student*)
2. TS=(babies or infant\$ or kid\$ or children or teen\$ or adolescent\$ or youth or youngster\$ or girl\$ or boy\$ or young people or parent\$)
3. TS=(famil* or "family unit" or communit* or "community unit")
4. TS=("rural population" or "suburban population" or "urban population" or "vulnerable populations" or "minority groups")
5. #1 - #4 Combine with OR
6. TS="preventive dentistry"
7. TS=("dental prophylaxis" or "dental scaling")
8. TS=fluoridation
9. TS=("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry")
10. TS=("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care")
11. TS=("periodontal diseases" or "dental caries")
12. TS=("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride")
13. TS=chlorhexidine
14. TS="pit and fissure sealants"
15. TS=((varnish* or product\$ or sealant\$ or "mouth rinse" or "mouth wash" or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$ or "chewing gum") near/4 fluoride)

16. TS=((home or school or community) near/4("dental screening" or "oral screening" or "mouth screening"))
17. TS=((outreach or mobile or enhanced) near/3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental)
18. TS(("anticipatory guidance" or "needs assessment") near/4 ("dental health" or "oral health" or periodont\$))
19. TS=("Health Education" or Dental or "Health Education" or "Nonprofessional Education")
20. TS=("Capacity Building" or "Health Literacy" or "Health Communication")
21. TS=("Health Promotion" or "Public Health" or "Health Planning")
22. TS=("Tooth Remineralization")
23. TS=("Dental Caries Activity Tests")
24. TS=((caries or periodont*) near/3 "risk management")
25. TS=("Dental Health Surveys" or "Health Care Surveys" or "Needs Assessment" or "Health Services Research")
26. TS=("Population Surveillance" or "Sentinel Surveillance")
27. TS(("oral health" or "dental health") near/2 (promotion or integrated))
28. TS=((water or milk or salt or drink\$ or beverage\$ or environment) near/3 fluorid\$)
29. TS=((sugar\$ or fizzy or sweet\$ or carbonated or "sweetening agent" or flavo\$) near/2 (drink\$ or beverage\$ or food\$ or juice\$))
30. TS=(media or "mass media" or "social marketing" or television or advert\$ or campaign\$ or "awareness raising")
31. TS=((("oral health" or "dental health" or "oral disease" or "dental disease" or "dental caries" or periodon\$ or gingiv\$) near/3 (prevent\$ or program\$ or initiative\$ or educat* or improv\$ or intervention\$))
32. TS=((("Developed country" or "developing country" or "low income country" or "middle income country" or "high income country") near/4 (intervention\$ or strateg* or program\$ or polic* or legislation\$))
33. TS=("Maternal Health Services" or "Child Health Services" or "Adolescent Health Services" or "School Health Services" or "Community Health Services")
34. TS=("Public Sector" or "Private Sector" or "Health Services" or "Health Facilities")
35. TS=("Child Day Care Centers" or "Child Care" or "nursery schools")
36. TS=("Dental Health Services" or "Primary Health Care" or "Dental Service Hospital" or "Health Planning Councils" or "State Health Planning and Development Agencies" or "Health Systems Agencies")
37. TS=("Health Care Economics and Organisations" or "Health Care Rationing" or "Health Care Reform" or "Health Resources" or "National Health Programs" or "Regional Health Planning" or "Health Fairs")
38. TS=(Government or "Government Agencies" or "Local government" or "State Government" or "Federal Government" or "Government Programs")
39. TS=("International Agencies" or "Public-Private Sector Partnerships" or "Nonprofit Organisations" or "Voluntary Health Agencies")
40. TS=("Health Insurance" or "Dental Insurance" or Policy or "Health Policy" or "Public Policy" or Legislation)
41. TS=("community based" or "community level" or "family based" or "family level" or "population based" or "population level")
42. TS=("Peer education" or "support group" or "support program" or "education program")
43. TS=(clinic\$ or hospital\$ or "medical practice" or "dental practice")
44. TS=("health staff" or "health professional\$" or teacher\$ or "General practitioners" or GP or "health practitioner" or doctor\$ or dentist\$)
45. TS= (school\$ or "play school" or "child care service" or home or "pre natal service" or "post natal service" or kindergarten or "after school hours care" or curriculum or extracurricular)

46. TS=((“health education” or “healthy environment” or “health promotion” or “healthy canteen” or “health policy” or “health program”) near/3 school)
47. TS=((“oral health” or “dental health” or food or drink\$ or beverage\$ or nutrition*) near/4 (school\$ or “day care” or “pre school” or home))
48. TS=(Toothpaste\$ or Toothbrushing or Mouthwashe\$ or Dentifrices)
49. TS=((“Cariogenic diet” or “Diet Therapy” or “Feeding Behavior” or “Feeding Behaviour” or “Health Behavior” or “Health Behaviour” or “Life Style”)
50. TS=(“sugar free gum” or “sugarfree gum” or xylitol or “sugarless chewing gum”)
51. TS=(“Tobacco Use Cessation” or “Smoking Cessation”)
52. TS=((“tobacco cessation” or “smokeless tobacco cessation” or nicotine) near/3 (intervention\$ or law\$ or strate* or program\$ or initiative \$ or polic*))
53. TS=((tobacco or nicotine or cigarette\$ or “tobacco product”) near/4 (marketing or “social marketing” or advert* or media or campaign \$ or package\$ or awareness))
54. TS=(supermarket\$ or “grocery store” or shop\$ or “shopping mall” or library*)
55. TS=(gymnasi* or “health spa” or “leisure center” or “fitness center” or “swimming pool” or “social activity” or “youth center” or “sports center”)
56. TS=(church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or “religious setting”)
57. #6 – #56 Combine with OR
58. TS=”Oral Health”
59. TS=(“Dental Caries” or Toothache or “Tooth Diseases” or “Tooth Discoloration”)
60. TS=(“Tooth Demineralization” or “Dentin Sensitivity” or “Dental Pulp Diseases” or “Tooth Wear” or “Tooth Loss”)
61. TS=(“Periodontal Diseases” or “Gingival Diseases” or Gingivitis or “Dental Plaque” or “Dental Deposits” or Periodontitis)
62. TS=(“Dental Caries Susceptibility” or “Dental Enamel Solubility” or “Tooth Mobility” or “Tooth Permeability”)
63. TS=((dental or teeth or tooth or enamel) near/2 (missing or loss or filling\$ or cavit* or decay or demineral* or rot* or lesion\$))
64. TS=((gum\$ or gingiv* or periodont* or periapical or oral or dental or mouth) near/4 (infection\$ or inflammation\$))
65. TS=((“dental caries” or periodont* or gingiv* or “oral infection” or “oral inflammation” or “dental infection” or “dental inflammation”) near/8 (tobacco or nicotine or “smokeless tobacco” or “cigarette smoke”))
66. TS=Halitosis
67. TS=(“Gingival Hemorrhage” or “Gingival Recession”)
68. TS=(“Periodontal Index” or “Dental Plaque Index” or “DMF Index” or “Oral Hygiene Index”)
69. TS=”CPITN”
70. TS=(“gum recession” or “gingival pocket” or “periodontal pocket” or “clinical attachment loss” or “bleeding gums”)
71. TS=((rampant or “nursing bottle” or “baby bottle” or “early childhood”) and (carie\$ or cavit* or decay or “tooth decay” or “teeth decay” or rot or lesion\$ or demineral*))
72. TS=((“primary dentition” or “deciduous dentition” or “milk teeth” or “milk tooth” or “primary tooth” or “primary teeth”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
73. TS=((“mixed dentition” or “permanent dentition”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion \$ or carie\$))
74. TS=(“white spot lesion” or “dmft” or “DMFT” or “dmfs” or “DMFS”)
75. TS=((“quality of life” or “self rated” or “self reported” or “self perceived”) near/5 (“oral health” or “dental health”))

76. #58 – #75 combine with OR
77. TS="Randomized Controlled Trial"
78. TS="Cluster randomised trial"
79. TS="Interrupted time series"
80. TS="Controlled Clinical Trial"
81. TS="Controlled trial"
82. TS="Parallel group trial"
83. TS="Comparative Study"
84. TS="Intervention Studies"
85. TS=("Evaluation Studies" or "Validation Studies")
86. TS="Program Evaluation"
87. TS="Multicenter Study"
88. TS="Pilot Projects"
89. TS="Feasibility Studies"
90. TS="Cross-Sectional Studies"
91. TS=("Cohort studies" or "Longitudinal Studies" or "Follow-Up Studies" or "Prospective Studies")
92. TS="Intention-to-treat"
93. TS="Epidemiologic Studies"
94. TS="Case-Control Studies"
95. TS="Controlled before and after study"
96. TS="Case series"
97. TS=("Random Allocation" or "Clinical Trial" or "Single-Blind Method" or "Double-Blind Method" or "Control Groups")
98. TS=("Cluster Analysis" or "Small-Area Analysis" or "Space-Time Clustering" or "Matched-Pair Analysis")
99. TS=("Community-Based Participatory Research" or "Community-Based Participatory Research study" or "Community Trials")
100. TS="Cross-Over Studies"
101. TS=("Stratified randomisation" or Stratification)
102. TS="sequential trial"
103. TS=(randomized or randomised or placebo or randomly or control or "control group" or "comparison group" or "intervention group" or matching)
104. TS=(time near series)
105. TS=("quasi-experimental" or "Quasi-random allocation")
106. TS=("pre test" or pretest or "pre-intervention" or "post-intervention" or posttest or "post test")
107. TS=("cost-benefit analysis" or "cost-effectiveness analysis" or "cost-utility analysis")
108. TS=("experimental intervention" or "experimental study")
109. TS="follow-up-assessment"

110. TS=((evaluat* or intervention or interventional or treatment) and (control or controlled or study or program* or comparison or "before and after" or comparative))

111. TS=((intervention or interventional or process or program) near/5 (evaluat* or effect\$ or outcome\$))

112. TS="secondary analysis"

113. #77 - #112 combine with OR

114. #5 and #57 and #76 and #113

Appendix 10. PsycInfo search strategy

1. Child or Child, preschool or Infant or Infant, Newborn or Adolescent or Students
2. Babies or Infant? or Kid? or Children or Teen* or Adolescent? or Youth or Youngster? or Girl? or Boy? or Young People or Parent?
3. Family or "Family Unit?" or Families or Community or Communities or "Community Unit?"
4. "Rural Population" or "Suburban Population" or "Urban Population" or "Vulnerable Population" or "Minority Groups"
5. or/1- 4
6. "Preventive Dentistry"
7. "Dental Prophylaxis" or "Dental Scaling"
8. Fluoridation
9. "Public Health Dentistry" or "Community Dentistry" or "Evidence Based Dentistry"
10. "P#ediatric Dentistry" or "Dental Care for Children" or "Dental Care"
11. ("Periodontal Disease?" or Dental Caries) AND (Prevention or Control)
12. "Cariostatic Agent?" or "Sodium Fluoride?" or Fluoride? or Fluoride?, Topical or "Tin Fluoride?" or "Calcium Fluoride?" or "Systemic Fluoride?"
13. Chlorhexidine or "antibacterial mouth wash" or "antibacterial mouth rinse" or "antibacterial oral rinse"
14. "Pit and Fissure Sealants"
15. ((varnish* or "tooth product?" or sealant? or "mouth rinse?" or "oral rinse?" or "mouth wash*" or toothpaste? or dentifrice? or tablet? or drop? or "chewing gum?") N4 Fluorid*)
16. ((home? or school? or communit*) N4 (dental or mouth or oral or teeth or tooth or "dental screening?" or "oral screening?" or "mouth Screening?"))
17. (((outreach or mobile or enhanced) N3 (service? or program* or initiative? or support or strateg*)) and dental)
18. (("anticipatory guidance" or "needs assessment") N4 ("dental health" or "oral health" or perodont* or dental carie?))
19. Health Education, Dental or "Health Education" or Education, Nonprofessional
20. "Capacity Building" or "Health Literacy" or "Health Communication" or "oral health literacy" or "dental health literacy"
21. "Health Promotion" or "Public Health" or "Health Planning" or "Dental Health Planning" or "Oral Health Planning" or "Dental Health Promotion" or "Oral Health Promotion"
22. Remineralization N2 Tooth
23. "Dental Caries Activity Tests"
24. ((caries or "dental caries" or "early childhood caries" or periodon* or gingiv*) N3 ("risk management" or "disease management" or management or prevention or control))
25. "Dental Health Survey?" or "Oral Health Survey?" or "Health Care Survey?" or "Needs Assessment" or "Health Service Research"

26. "Population Surveillance" or "Sentinel Surveillance" or "Dental Health Surveillance" or "Oral Health Surveillance" or "Carie? Surveillance" or "Periodontal Disease Surveillance" or "Carie? Monitoring System?" or "Periodontal Disease Monitoring system"
27. (("oral health" or "dental health" or Health) N2 (promotion or integrated))
28. ((water or milk or salt or drink? or beverage? or environment) N3 (fluorid*))
29. ((sugar? or fizzy or sweet* or carbonated or "sweetening agent?" or flavo*) N2 (drink? or beverage? or food? or juice?))
30. media or "mass media" or "social marketing" or television or advert* or campaign* or "health awareness raising"
31. ((oral health or dental health or oral disease or dental disease or dental caries or periodon* or gingiv*) N3 (prevent* or program* or initiative? or educat* or improve* or intervention?))
32. (("developed countr*" or "developing countr*" or "low income countr*" or "middle income countr*" or "high income countr*") N4 (intervention? or strateg* or program? or policy or policies or legislation?))
33. ((Maternal or Prenatal or Postnatal or Child or Adolescent or School or Community or Dental or Oral or Integrated) N4 "Health Service?")
34. "Public Sector?" or "Private Sector?" or "Health Facilit*" or "Dental Health Facilit*" or "Oral Health Facilit*" or "Private Public Sector?"
35. "Child Day Care Cent*" or "Child Care Servic*" or Schools, Nursery or Universit*
36. "Primary Health Care" or "Dental Service Hospital" or "Health Planning Council?" or "State Health Planning and Development Agenc*" or "Health Systems Agenc*"
37. (("Health Care" or "Dental Care") N4 (Economic? or Organi?ation? or Rationing or Reform or Resource))
38. ((National or Regional or Rural or Urban or Remote or Suburban or School or College or Universit*) N4 (Program* or Fair? or Planning or Service? or Health or "Dental Health" or "Oral Health"))
39. (((Local or Federal or State) N3 (Polic* or Program? or Agenc* or legislation? or law? or Service? or Initiative? or Strateg*)) and Dental or Health or Oral or Government?)
40. (((International or Nonprofit or "Non Profit" or "Not for profit" or Voluntary or "Non government" or Government) N3 (Organi?ation? or Agenc* or Institution? or Initiative? or Strateg*)) and Dental or Health or Oral)
41. ((Insurance or Public or Private or Legislation or Law? or Polic*) N3 (Dental or Health or Medical* or "Oral Health"))
42. (((Community or Family or Population or Individual) N4 (Intervention? or Program? or Strateg* or Polic* or Ininitiative* or Organi?tion? or Agenc* or Level or Based)) and Dental or Health or "Oral Health" or "General Health")
43. (((Peer or Group? or Communit*) N3 (Education or Support? or Program* or Network*)) and Dental or Oral Health or Health)
44. ((Clinic? or Hospital? or Practice) N3 (Medical or Dental or Health or "Oral Health"))
45. ((Staff or Professional? or Teacher? or General Practitioner? or GP? or Health Practitioner? or Doctor? or Dentist? or Parent?) N3 (Dental or Health or "Oral Health"))
46. ((School? or "Play school?" or "Child Care Service?" or Home or "Pre Natal Service?" or "Post Natal Service?" or Kindergarten or "After School Hours Care" or School or Curriculum or Extracurricular) N3 (Health or "Oral Health" or Dental))
47. ((Health or Healthy or Dental or "Oral Health") N3 (Education or Environment? or Canteen? or Behavio#r?))
48. (((Food? or Drink? or Beverage? or Nutrition*) N3 (School? or "Day Care" or Home)) and Dental or Health or "Oral Health")
49. Toothpastes or Toothbrush* or Mouthwash* or Mouthrinse? or Dentifrice? or Dental Floss*
50. (((Behavio#r? or Life Style? or Support or Education* or Counsel* or Theraph*) N3 (Diet or Feeding or Food? or Diet, Cariogenic)) and Dental or Health or "Oral Health")
51. "Sugar Free Gum?" or "Sugarfree Gum?" or "Xylitol" or "Sugarless chewing gum?"
52. ((Tobacco or Smoking or Cigarette Smoking or Nicotine or "Smokeless Tobacco") N4 (Cessation or Counselling or Intervention? or Therapy or Program* or Nicotine Patches" or "Nicotine Replacement" or Control))

53. ((Tobacco Cessation or Smokeless Tobacco Cessation or Cigarette or Nicotine or Tobacco) N3 (Law? or Strateg* or Program* or Initiative? or Polic*))
54. ((Tobacco or Nicotine or Cigarette? or Smokeless Tobacco) N4 (Marketing or "Social Marketing" or Advert* or Media or Campaign* or Package* or Awareness))
55. ((Supermarket? or "Grocery Store?" or Shop? or "Shopping Mall?" or Retailer*) and (Tobacco or Cigarette or Nicotine or Smokeless Tobacco))
56. Gymnasi* or "Health Spa?" or "Leisure Center?" or "Fitness Center?" or "Swimming pool?" or "Social Activ*" or "Youth Center?" or "Sports Center?"
57. Church or Chapel? or Mosque? or Synagogue? or Temple? or "Religious Setting?"
58. or/6-57
59. "Oral Health"
60. "Dental Carie?" or Toothache or "Tooth Disease?" or "Tooth Discoloration"
61. "Tooth Demineralization" or "Dentin Sensitivity" or "Dental Pulp Diseases" or "Tooth Abrasion" or "Tooth Loss"
62. "Periodontal Diseases" or "Gingival Diseases" or Gingivitis or "Dental Plaque" or "Dental Deposits" or Periodontitis
63. "Dental Caries Susceptibility" or "Dental Enamel Solubility" or "Tooth Mobility" or "Tooth Permeability"
64. ((Dental or Teeth or Tooth or Enamel) N2 (Missing or Loss or Filling? or Cavit* or Decay or Demineral* or Rot* or Lesion? or Mobil*))
65. ((Gum? or Gingiv* or Periodont* or Periapical or Oral or Dental or Mouth) N4 (Infection? or Inflammation?))
66. (("Dental Caries" or Periodont* or Gingiv* or "Oral Infection?" or "Oral Inflammation?" or "Dental Infection?") N8 (Tobacco or Nicotine or "Smokeless Tobacco" or "Cigarette Smok*"))
67. Halitosis
68. "Gingival Hemorrhage" or "Gingival Recession" or "Bleeding Gums"
69. "Periodontal Index" or "Dental Plaque Index" or "DMF Index" or "Oral Hygiene Index"
70. CPITN or "Community periodontal index treatment needs" or CPI "Community periodontal index"
71. "Gum Recession" or "Gingival Pocket" or "Periodontal Pocket?" or "Clinical Attachment Loss"
72. ((Rampant or "Nursing Bottle" or "Baby Bottle" or "Early Childhood") and (Carie? or Cavit* or Decay or "Tooth Decay" or "Teeth Decay*" or "Rot" or "lesion?" or Demineral*))
73. (("Primary Dentition" or "Deciduous Dentition" or "Milk Teeth" or "Milk Tooth" or "Primary Tooth" or "Primary Teeth" or "deciduous teeth: or "deciduous tooth") N4 (Missing or Loss or Filling? or Cavit* or Decay? or Rot or Demineral* or Lesion? or Carie?))
74. (("Mixed Dentition" or "Permanent Dentition") N4 (Missing or Loss or Filling? or Cavit* or Decay? or Rot or Demineral* or Lesion? or Carie?))
75. "White Spot Lesion?" or dmft or DMFT or dmfs or DMFS
76. (("Quality of life" or "Self Rated" or "Self Reported" or "Self Perceived") N5 ("Oral Health" or "Dental Health"))
77. or/59-76
78. "Randomized Controlled Trials"
79. "Cluster randomised trial"
80. "Interrupted time series"
81. "Controlled Clinical Trial?"
82. "Controlled trial?"

83. "Parallel group trial?"
84. "Comparative Studies"
85. "Intervention Studies"
86. "Evaluation Research" or "Validation Studies"
87. "Program Evaluation"
88. "Multicenter Studies"
89. "Pilot Studies"
90. "Feasibility Studies"
91. "Cross Sectional Studies"
92. "Cohort studies" or "Longitudinal Studies" or "Follow up studies" or "Prospective Studies"
93. "Intention to treat"
94. "Epidemiologic Studies"
95. "Case Control Studies"
96. "Controlled before and after study"
97. "Case series"
98. "Random Allocation" or "Clinical Trial" or "Single Blind Method" or "Double Blind Method" or "Control Groups"
99. "Cluster Analysis" or "Small Area Analysis" or "Space Time Clustering" or "Matched Pair Analysis"
100. "Community Based Participatory Research" or "Community Based Participatory Research stud*" or "Community Trial?"
101. "Cross Over Stud*"
102. "Stratified Randomi?ation" or Stratification
103. "Sequential Trial?"
104. Randomi?ed or Placebo or Randomly or Control or Control Group? or Comparison Group? or Intervention Group? or Matching
105. "Quasi Experiment?" or "Quasi Random Allocation"
106. "Time adj Series" or "Time Series Analyses"
107. "Pre Test" or Pretest or "Pre Intervention" or "Post Intervention" or Posttest or "Post Test"
108. "Cost Benefit Analysis" or "Cost Effectiveness Analysis" or "Cost Utility Analysis"
109. "Experimental Intervention" or "Experimental Study"
110. "Follow Up Assessment"
111. ((Evaluat* or Intervention or Interventional or Treatment) and (Control or Controlled or Study or Program? or Comparison or "Before and After" or Comparative))
112. ((Intervention or Interventional or Process or Program) N5 (Evaluat* or Effect? or Outcome?))
113. "Secondary Analysis"
114. or/78-113
115. 5 and 58 and 77 and 114

Appendix 11. ProQuest Dissertations and Theses search strategy

1. "child oral health" or "adolescent oral health" or "community oral health"
2. "tobacco prevention strategies" or "oral health promotion" or "oral health policies"
3. "oral health" or "oral disease in children" or "dental caries in children" or periodontal or "quality of life"
4. "randomised controlled trial" or "controlled clinical trial" or "comparative study" or intervention
5. 1 AND 2 AND 3 AND 4

Appendix 12. Science Direct

(pub-date > 1996 and ("oral health" OR "dental caries" OR "periodontal disease" OR toothache OR "gingival disease" OR gingivitis OR "dental plaque" OR "tooth loss" OR periodontitis OR dmft OR "plaque index" OR "white spot lesions" OR dmft OR dmfs OR icdas)) AND (pub-date > 1996 and (prevention OR preventive OR "health promotion" OR "preventive dentistry" OR home OR school OR community OR "community based" OR family OR "family level" OR "population based" OR "tobacco use cessation")) AND (pub-date > 1996 and (child OR preschool OR adolescent OR infant OR newborn OR students)) AND (pub-date > 1996 and ("randomized controlled trial" OR "intervention study" OR "cluster randomised trial" OR "controlled trial" OR "cross-sectional study" OR "case-control study" OR "epidemiologic study" OR "cohort study" OR "longitudinal study" OR "prospective study"))

Appendix 13. Conference Proceedings Citation Index Science search strategy

1. TS = (Child or "preschool child" or infant or "newborn infant" or adolescent or student*)
2. TS=(babies or infant\$ or kid\$ or children or teen\$ or adolescent\$ or youth or youngster\$ or girl\$ or boy\$ or young people or parent\$)
3. TS=(famil* or "family unit" or communit* or "community unit")
4. TS=("rural population" or "suburban population" or "urban population" or "vulnerable populations" or "minority groups")
5. #1 - #4 combine with OR
6. TS="preventive dentistry"
7. TS=("dental prophylaxis" or "dental scaling")
8. TS=fluoridation
9. TS=("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry")
10. TS=("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care")
11. TS=("periodontal diseases" or "dental caries")
12. TS=("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride")
13. TS=chlorhexidine
14. TS="pit and fissure sealants"
15. TS=((varnish* or product\$ or sealant\$ or "mouth rinse" or "mouth wash" or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$ or "chewing gum") near/4 fluoride)
16. TS=((home or school or community) near/4("dental screening" or "oral screening" or "mouth screening"))
17. TS=(((outreach or mobile or enhanced) near/3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental)
18. TS(("anticipatory guidance" or "needs assessment") near/4 ("dental health" or "oral health" or periodont\$))
19. TS=("Health Education" or Dental or "Health Education" or "Nonprofessional Education")
20. TS=("Capacity Building" or "Health Literacy" or "Health Communication")
21. TS=("Health Promotion" or "Public Health" or "Health Planning")
22. TS="Tooth Remineralization"

23. TS="Dental Caries Activity Tests"
24. TS=((caries or periodont*) near/3 "risk management")
25. TS=("Dental Health Surveys" or "Health Care Surveys" or "Needs Assessment" or "Health Services Research")
26. TS=("Population Surveillance" or "Sentinel Surveillance")
27. TS(("oral health" or "dental health") near/2 (promotion or integrated))
28. TS=((water or milk or salt or drink\$ or beverage\$ or environment) near/3 fluorid\$)
29. TS=((sugar\$ or fizzy or sweet\$ or carbonated or "sweetening agent" or flavo\$) near/2 (drink\$ or beverage\$ or food\$ or juice\$))
30. TS=(media or "mass media" or "social marketing" or television or advert\$ or campaign\$ or "awareness raising")
31. TS(("oral health" or "dental health" or "oral disease" or "dental disease" or "dental caries" or periodon\$ or gingiv\$) near/3 (prevent\$ or program\$ or initiative\$ or educat* or improv\$ or intervention\$))
32. TS(("Developed country" or "developing country" or "low income country" or "middle income country" or "high income country") near/4 (intervention\$ or strateg* or program\$ or polic* or legislation\$))
33. TS=("Maternal Health Services" or "Child Health Services" or "Adolescent Health Services" or "School Health Services" or "Community Health Services")
34. TS=("Public Sector" or "Private Sector" or "Health Services" or "Health Facilities")
35. TS=("Child Day Care Centers" or "Child Care" or "nursery schools")
36. TS=("Dental Health Services" or "Primary Health Care" or "Dental Service Hospital" or "Health Planning Councils" or "State Health Planning and Development Agencies" or "Health Systems Agencies")
37. TS=("Health Care Economics and Organisations" or "Health Care Rationing" or "Health Care Reform" or "Health Resources" or "National Health Programs" or "Regional Health Planning" or "Health Fairs")
38. TS=(Government or "Government Agencies" or "Local government" or "State Government" or "Federal Government" or "Government Programs")
39. TS=("International Agencies" or "Public-Private Sector Partnerships" or "Nonprofit Organisations" or "Voluntary Health Agencies")
40. TS=("Health Insurance" or "Dental Insurance" or Policy or "Health Policy" or "Public Policy" or Legislation)
41. TS=("community based" or "community level" or "family based" or "family level" or "population based" or "population level")
42. TS=("Peer education" or "support group" or "support program" or "education program")
43. TS=(clinic\$ or hospital\$ or "medical practice" or "dental practice")
44. TS=("health staff" or "health professional\$" or teacher\$ or "General practitioners" or GP or "health practitioner" or doctor\$ or dentist\$)
45. TS=(school\$ or "play school" or "child care service" or home or "pre natal service" or "post natal service" or kindergarten or "after school hours care" or curriculum or extracurricular)
46. TS(("health education" or "healthy environment" or "health promotion" or "healthy canteen" or "health policy" or "health program") near/3 school)
47. TS(("oral health" or "dental health" or food or drink\$(or beverage\$ or nutrition*) near/4 (school\$ or "day care" or "pre school" or home))
48. TS=(Toothpaste\$ or Toothbrushing or Mouthwashe\$ or Dentifrices)
49. TS=("Cariogenic diet" or "Diet Therapy" or "Feeding Behavior" or "Feeding Behaviour" or "Health Behavior" or "Health Behaviour" or "Life Style")
50. TS=("sugar free gum" or "sugarfree gum" or xylitol or "sugarless chewing gum")
51. TS=("Tobacco Use Cessation" or "Smoking Cessation")

52. TS=((“tobacco cessation” or “smokeless tobacco cessation” or nicotine) near/3 (intervention\$ or law\$ or strate* or program\$ or initiative \$ or polic*))
53. TS=((tobacco or nicotine or cigarette\$ or “tobacco product”) near/4 (marketing or “social marketing” or advert* or media or campaign \$ or package\$ or awareness))
54. TS=(supermarket\$ or “grocery store” or shop\$ or “shopping mall” or library*)
55. TS=(gymnasi* or “health spa” or “leisure center” or “fitness center” or “swimming pool” or “social activity” or “youth center” or “sports center”)
56. TS=(church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or “religious setting”)
57. #6 - #56 combine with OR
58. TS=”Oral Health”
59. TS=(“Dental Caries” or Toothache or “Tooth Diseases” or “Tooth Discoloration”)
60. TS=(“Tooth Demineralization” or “Dentin Sensitivity” or “Dental Pulp Diseases” or “Tooth Wear” or “Tooth Loss”)
61. TS=(“Periodontal Diseases” or “Gingival Diseases” or Gingivitis or “Dental Plaque” or “Dental Deposits” or Periodontitis)
62. TS=(“Dental Caries Susceptibility” or “Dental Enamel Solubility” or “Tooth Mobility” or “Tooth Permeability”)
63. TS=((dental or teeth or tooth or enamel) near/2 (missing or loss or filling\$ or cavit* or decay or demineral* or rot* or lesion\$))
64. TS=((gum\$ or gingiv* or periodont* or periapical or oral or dental or mouth) near/4 (infection\$ or inflammation\$))
65. TS=((“dental caries” or periodont* or gingiv* or “oral infection” or “oral inflammation” or “dental infection” or “dental inflammation”) near/8 (tobacco or nicotine or “smokeless tobacco” or “cigarette smoke”))
66. TS=Halitosis
67. TS=(“Gingival Hemorrhage” or “Gingival Recession”)
68. TS=(“Periodontal Index” or “Dental Plaque Index” or “DMF Index” or “Oral Hygiene Index”)
69. TS=”CPITN”
70. TS=(“gum recession” or “gingival pocket” or “periodontal pocket” or “clinical attachment loss” or “bleeding gums”)
71. TS=((rampant or “nursing bottle” or “baby bottle” or “early childhood”) and (carie\$ or cavit* or decay or “tooth decay” or “teeth decay” or rot or lesion\$ or demineral*))
72. TS=((“primary dentition” or “deciduous dentition” or “milk teeth” or “milk tooth” or “primary tooth” or “primary teeth”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
73. TS=((“mixed dentition” or “permanent dentition”) near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion \$ or carie\$))
74. TS=(“white spot lesion” or “dmft” or “DMFT” or “dmfs” or “DMFS”)
75. TS=((“quality of life” or “self rated” or “self reported” or “self perceived”) near/5 (“oral health” or “dental health”))
76. #58 - #75 combine with OR
77. TS=”Randomized Controlled Trial”
78. TS=”Cluster randomised trial”
79. TS=”Interrupted time series”
80. TS=”Controlled Clinical Trial”
81. TS=”Controlled trial”
82. TS=”Parallel group trial”

83. TS="Comparative Study"
84. TS="Intervention Studies"
85. TS=("Evaluation Studies" or "Validation Studies")
86. TS="Program Evaluation"
87. TS="Multicenter Study"
88. TS="Pilot Projects"
89. TS="Feasibility Studies"
90. TS="Cross-Sectional Studies"
91. TS=("Cohort studies" or "Longitudinal Studies" or "Follow-Up Studies" or "Prospective Studies")
92. TS="Intention-to-treat"
93. TS="Epidemiologic Studies"
94. TS="Case-Control Studies"
95. TS="Controlled before and after study"
96. TS="Case series"
97. TS=("Random Allocation" or "Clinical Trial" or "Single-Blind Method" or "Double-Blind Method" or "Control Groups")
98. TS=("Cluster Analysis" or "Small-Area Analysis" or "Space-Time Clustering" or "Matched-Pair Analysis")
99. TS=("Community-Based Participatory Research" or "Community-Based Participatory Research study" or "Community Trials")
100. TS="Cross-Over Studies"
101. TS=("Stratified randomisation" or Stratification)
102. TS="sequential trial"
103. TS=(randomized or randomised or placebo or randomly or control or "control group" or "comparison group" or "intervention group" or matching)
104. TS=(time near series)
105. TS=("quasi-experimental" or "Quasi-random allocation")
106. TS=("pre test" or pretest or "pre-intervention" or "post-intervention" or posttest or "post test")
107. TS=("cost-benefit analysis" or "cost-effectiveness analysis" or "cost-utility analysis")
108. TS=("experimental intervention" or "experimental study")
109. TS="follow-up-assessment"
110. TS=((evaluat* or intervention or interventional or treatment) and (control or controlled or study or program* or comparison or "before and after" or comparative))
111. TS=((intervention or interventional or process or program) near/5 (evaluat* or effect\$ or outcome\$))
112. TS="secondary analysis"
113. #77 - #112 combine with OR
114. 5 AND 57 AND 76 AND 113

Appendix 14. Web of Science

Population

1. TS = (Child or "preschool child" or infant or "newborn infant" or adolescent or student*)
2. TS=(babies or infant\$ or kid\$ or children or teen\$ or adolescent\$ or youth or youngster\$ or girl\$ or boy\$ or young people or parent\$)
3. TS=(famil* or "family unit" or communit* or "community unit")
4. TS=("rural population" or "suburban population" or "urban population" or "vulnerable populations" or "minority groups")
5. #1 - #4 Combine with OR

Intervention or setting

6. TS="preventive dentistry"
7. TS=("dental prophylaxis" or "dental scaling")
8. TS=fluoridation
9. TS=("Public Health Dentistry" or "Community Dentistry" or "Evidence-Based Dentistry")
10. TS=("Pediatric Dentistry" or "Dental Care for Children" or "Dental Care")
11. TS=("periodontal diseases" or "dental caries")
12. TS=("Cariostatic Agents" or "Sodium Fluoride" or "Topical Fluorides" or "Tin Fluorides" or "Calcium Fluoride")
13. TS=chlorhexidine
14. TS="pit and fissure sealants"
15. TS=((varnish* or product\$ or sealant\$ or "mouth rinse" or "mouth wash" or toothpaste\$ or dentifrice\$ or tablet\$ or drop\$ or "chewing gum") near/4 fluoride)
16. TS=((home or school or community) near/4("dental screening" or "oral screening" or "mouth screening"))
17. TS((((outreach or mobile or enhanced) near/3 (service\$ or program\$ or initiative\$ or support or strateg\$)) and dental)
18. TS(("anticipatory guidance" or "needs assessment") near/4 ("dental health" or "oral health" or periodont\$))
19. TS=("Health Education" or Dental or "Health Education" or "Nonprofessional Education")
20. TS=("Capacity Building" or "Health Literacy" or "Health Communication")
21. TS(("Health Promotion" or "Public Health" or "Health Planning"))
22. TS(("Tooth Remineralization"))
23. TS(("Dental Caries Activity Tests"))
24. TS=((caries or periodont*) near/3 "risk management")
25. TS(("Dental Health Surveys" or "Health Care Surveys" or "Needs Assessment" or "Health Services Research"))
26. TS(("Population Surveillance" or "Sentinel Surveillance"))
27. TS(("oral health" or "dental health") near/2 (promotion or integrated))
28. TS=((water or milk or salt or drink\$ or beverage\$ or environment) near/3 fluorid\$)
29. TS=((sugar\$ or fizzy or sweet\$ or carbonated or "sweetening agent" or flavo\$) near/2 (drink\$ or beverage\$ or food\$ or juice\$))
30. TS=(media or "mass media" or "social marketing" or television or advert\$ or campaign\$ or "awareness raising")
31. TS(("oral health" or "dental health" or "oral disease" or "dental disease" or "dental caries" or periodont\$ or gingiv\$) near/3 (prevent\$ or program\$ or initiative\$ or educat* or improv\$ or intervention\$))

32. TS=((“Developed country” or “developing country” or “low income country” or “middle income country” or “high income country”) near/4 (intervention\$ or strateg* or program\$ or polic* or legislation\$))
33. TS=(“Maternal Health Services” or “Child Health Services” or “Adolescent Health Services” or “School Health Services” or “Community Health Services”)
34. TS=(“Public Sector” or “Private Sector” or “Health Services” or “Health Facilities”)
35. TS=(“Child Day Care Centers” or “Child Care” or “nursery schools”)
36. TS=(“Dental Health Services” or “Primary Health Care” or “Dental Service Hospital” or “Health Planning Councils” or “State Health Planning and Development Agencies” or “Health Systems Agencies”)
37. TS=(“Health Care Economics and Organisations” or “Health Care Rationing” or “Health Care Reform” or “Health Resources” or “National Health Programs” or “Regional Health Planning” or “Health Fairs”)
38. TS=(Government or “Government Agencies” or “Local government” or “State Government” or “Federal Government” or “Government Programs”)
39. TS=(“International Agencies” or “Public-Private Sector Partnerships” or “Nonprofit Organisations” or “Voluntary Health Agencies”)
40. TS=(“Health Insurance” or “Dental Insurance” or Policy or “Health Policy” or “Public Policy” or Legislation)
41. TS=(“community based” or “community level” or “family based” or “family level” or “population based” or “population level”)
42. TS=(“Peer education” or “support group” or “support program” or “education program”)
43. TS=(clinic\$ or hospital\$ or “medical practice” or “dental practice”)
44. TS=(“health staff” or “health professional\$” or teacher\$ or “General practitioners” or GP or “health practitioner” or doctor\$ or dentist\$)
45. TS=(school\$ or “play school” or “child care service” or home or “pre natal service” or “post natal service” or kindergarten or “after school hours care” or curriculum or extracurricular)
46. TS=(“health education” or “healthy environment” or “health promotion” or “healthy canteen” or “health policy” or “health program”) near/3 school)
47. TS=(“oral health” or “dental health” or food or drink\$ or beverage\$ or nutrition*) near/4 (school\$ or “day care” or “pre school” or home))
48. TS=(Toothpaste\$ or Toothbrushing or Mouthwashes\$ or Dentifrices)
49. TS=(“Cariogenic diet” or “Diet Therapy” or “Feeding Behavior” or “Feeding Behaviour” or “Health Behavior” or “Health Behaviour” or “Life Style”)
50. TS=(“sugar free gum” or “sugarfree gum” or xylitol or “sugarless chewing gum”)
51. TS=(“Tobacco Use Cessation” or “Smoking Cessation”)
52. TS=(“tobacco cessation” or “smokeless tobacco cessation” or nicotine) near/3 (intervention\$ or law\$ or strate* or program\$ or initiative \$ or polic*)
53. TS=((tobacco or nicotine or cigarette\$ or “tobacco product”) near/4 (marketing or “social marketing” or advert* or media or campaign \$ or package\$ or awareness))
54. TS=(supermarket\$ or “grocery store” or shop\$ or “shopping mall” or library*)
55. TS=(gymnasi* or “health spa” or “leisure center” or “fitness center” or “swimming pool” or “social activity” or “youth center” or “sports center”)
56. TS=(church or chapel\$ or mosque\$ or synagogue\$ or temple\$ or “religious setting”)
57. #6 – #56 Combine with OR

Outcomes

58. TS=“Oral Health”
59. TS=(“Dental Caries” or Toothache or “Tooth Diseases” or “Tooth Discoloration”)

60. TS=(“Tooth Demineralization” or “Dentin Sensitivity” or “Dental Pulp Diseases” or “Tooth Wear” or “Tooth Loss”)
61. TS=(“Periodontal Diseases” or “Gingival Diseases” or Gingivitis or “Dental Plaque” or “Dental Deposits” or Periodontitis)
62. TS=(“Dental Caries Susceptibility” or “Dental Enamel Solubility” or “Tooth Mobility” or “Tooth Permeability”)
63. TS=((dental or teeth or tooth or enamel) near/2 (missing or loss or filling\$ or cavit* or decay or demineral* or rot* or lesion\$))
64. TS=((gum\$ or gingiv* or periodont* or periapical or oral or dental or mouth) near/4 (infection\$ or inflammation\$))
65. TS=(("dental caries" or periodont* or gingiv* or "oral infection" or "oral inflammation" or "dental infection" or "dental inflammation") near/8 (tobacco or nicotine or "smokeless tobacco" or "cigarette smoke"))
66. TS=Halitosis
67. TS=(“Gingival Hemorrhage” or “Gingival Recession”)
68. TS=(“Periodontal Index” or “Dental Plaque Index” or “DMF Index” or “Oral Hygiene Index”)
69. TS=”CPITN”
70. TS=(“gum recession” or “gingival pocket” or “periodontal pocket” or “clinical attachment loss” or “bleeding gums”)
71. TS=((rampant or “nursing bottle” or “baby bottle” or “early childhood”) and (carie\$ or cavit* or decay or “tooth decay” or “teeth decay” or rot or lesion\$ or demineral*))
72. TS=(("primary dentition" or "deciduous dentition" or "milk teeth" or "milk tooth" or "primary tooth" or "primary teeth") near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
73. TS=(("mixed dentition" or "permanent dentition") near/4 (missing or loss or filling\$ or cavit* or decay* or rot or demineral* or lesion\$ or carie\$))
74. TS=(“white spot lesion” or “dmft” or “DMFT” or “dmfs” or “DMFS”)
75. TS=(("quality of life" or "self rated" or "self reported" or "self perceived") near/5 (“oral health” or “dental health”))
76. #58 – #75 combine with OR

Studies

77. TS=”Randomized Controlled Trial”
78. TS=”Cluster randomised trial”
79. TS=”Interrupted time series”
80. TS=”Controlled Clinical Trial”
81. TS=”Controlled trial”
82. TS=”Parallel group trial”
83. TS=”Comparative Study”
84. TS=”Intervention Studies”
85. TS=(“Evaluation Studies” or “Validation Studies”)
86. TS=”Program Evaluation”
87. TS=”Multicenter Study”
88. TS=”Pilot Projects”
89. TS=”Feasibility Studies”
90. TS=”Cross-Sectional Studies”
91. TS=(“Cohort studies” or “Longitudinal Studies” or “Follow-Up Studies” or “Prospective Studies”)

92. TS="Intention-to-treat"
93. TS="Epidemiologic Studies"
94. TS="Case-Control Studies"
95. TS="Controlled before and after study"
96. TS="Case series"
97. TS=("Random Allocation" or "Clinical Trial" or "Single-Blind Method" or "Double-Blind Method" or "Control Groups")
98. TS=("Cluster Analysis" or "Small-Area Analysis" or "Space-Time Clustering" or "Matched-Pair Analysis")
99. TS=("Community-Based Participatory Research" or "Community-Based Participatory Research study" or "Community Trials")
100. TS="Cross-Over Studies"
101. TS=("Stratified randomisation" or Stratification)
102. TS="sequential trial"
103. TS=(randomized or randomised or placebo or randomly or control or "control group" or "comparison group" or "intervention group" or matching)
104. TS=(time near series)
105. TS=("quasi-experimental" or "Quasi-random allocation")
106. TS=("pre test" or pretest or "pre-intervention" or "post-intervention" or posttest or "post test")
107. TS=("cost-benefit analysis" or "cost-effectiveness analysis" or "cost-utility analysis")
108. TS=("experimental intervention" or "experimental study")
109. TS="follow-up-assessment"
110. TS=((evaluat* or intervention or interventional or treatment) and (control or controlled or study or program* or comparison or "before and after" or comparative))
111. TS=((intervention or interventional or process or program) near/5 (evaluat* or effect\$ or outcome\$))
112. TS="secondary analysis"
113. #77 - #112 combine with OR
114. #5 AND #57 AND #76 AND #113

Appendix 15. Sociological Abstracts

all("oral health" OR "dental caries" OR "periodontal disease" OR toothache OR "gingival disease" OR gingivitis OR "dental plaque" OR "tooth loss" OR periodontitis OR dmft OR "plaque index" OR "white spot lesions" OR dmft OR dmfs OR icdas) AND all("health education" OR "education" OR prevent* OR "health promotion" OR "preventive dentistry" OR home OR school OR community OR "community based" OR family OR "family level" OR "population based" OR "tobacco use cessation" prevention OR preventive OR "health promotion" OR "preventive dentistry" OR home OR school OR community OR "community based" OR family OR "family level" OR "population based" OR "tobacco use cessation" prevention OR preventive OR "health promotion" OR "preventive dentistry" OR home OR school OR community OR "community based" OR family OR "family level" OR "population based" OR "tobacco use cessation" OR varnish* OR product* OR sealant* OR "mouth rinse*" OR "mouth wash" OR toothpaste* OR dentifrice* OR tablet* OR drop[*1] OR "sugar free gum" OR xylitol OR "peer education") AND all(child* OR preschool OR adolescent OR infant* OR newborn OR students OR babies OR infant[*1] OR kid[*1] OR children OR teen* OR adolescent[*1] OR youth OR youngster[*1] OR girl[*1] OR boy[*1] OR "young people") AND all("Cohort studies" OR "Longitudinal Studies" OR "Follow-Up Studies" OR "Prospective Studies" OR "randomi*ed control* trial" OR "epidemiologic studies" OR "controlled trials" OR "cross-sectional study*" OR "case-control study" OR "intervention studies" OR "cross-over studies" OR "case series" OR "evaluation Studies" OR "Validation Studies")

Appendix 16. SCOPUS

(TITLE-ABS-KEY(child OR preschool OR adolescent OR infant OR newborn OR students) AND PUBYEAR > 1995) AND (TITLE-ABS-KEY(prevention OR preventive OR "health promotion" OR "preventive dentistry" OR home OR school OR community OR "community

Community-based population-level interventions for promoting child oral health (Review)

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based" OR family OR "family level" OR "population based" OR "tobacco use cessation") AND PUBYEAR > 1995) AND (TITLE-ABS-KEY("oral health" OR "dental caries" OR "periodontal disease" OR toothache OR "gingival disease" OR gingivitis OR "dental plaque" OR "tooth loss" OR periodontitis OR dmft OR "plaque index" OR "white spot lesions" OR dmft OR dmfs OR icdas) AND PUBYEAR > 1995) AND (TITLE-ABS-KEY("randomized controlled trial" OR "intervention study" OR "cluster randomised trial" OR "controlled trial" OR "cross-sectional study" OR "case-control study" OR "epidemiologic study" OR "cohort study" OR "longitudinal study" OR "prospective study") AND PUBYEAR > 1995)

CONTRIBUTIONS OF AUTHORS

Andrea de Silva, Shalika Hegde and Lauren Prosser drafted the protocol with input from other review authors. Shalika Hegde developed the search strategy with input from Lauren Prosser and Andrea de Silva and a librarian from the University of Melbourne. We have outlined below the roles of all review authors (Andrea de Silva (AdS), Shalika Hegde (SH), Bridget Akudo Nwagbara (BN), Hanny Calache (HC), Mark G Gussy (MG), Mona Nasser (MN), Hannah R Morrice (HM), Elisha Riggs (ER), Pam Leong (PL), Lisa Meyenn (LM), Reza Yousefi-Nooraie (RYN)).

AdS: supervised and co-ordinated the entire review, drafted the protocol, undertook screening (titles/abstracts and full-text articles), extracted data from included studies, developed overview of characteristics of included studies and summary of findings tables, conducted meta-analysis, interpreted findings, wrote up the review, addressed editorial comments and undertook review revisions.

SH: supervised, co-ordinated, managed and led the entire review, drafted the protocol, ran the database search, managed search results, undertook screening (titles/abstracts and full-text articles), developed the data extraction form, extracted data from included studies, developed a table for excluded studies and an outcome table for included studies, undertook analysis and interpretation of findings, wrote up the review, addressed editorial comments and undertook review revisions.

BN: ran searches of databases and grey literature, undertook screening (titles/abstracts and full-text articles), extracted data from included studies, contributed to the development of outcome tables, the summary of findings table and the meta-analysis and contributed to designated sections of the review write-up.

HC: provided input into protocol development and feedback on review drafts.

MG: provided input into protocol development and feedback on review drafts.

MN: provided input into protocol development and feedback on review drafts.

RB: provided input into protocol development and feedback on review drafts.

HM: undertook grey literature search, screened full-text articles, extracted data from included studies, contributed to designated sections of the review write-up and reviewed final version of the review.

ER: provided input into protocol development and feedback on review drafts.

PL: provided input into protocol development and feedback on review drafts.

LM: undertook grey literature search and screening of full text, extracted data from included studies and contributed to designated sections of the review write-up.

RYN: revised meta-analyses to address issues raised by the review group, updated corresponding sections of the review and approved the final draft.

DECLARATIONS OF INTEREST

In varied capacities, the authors involved in this review are currently employed or received grants to work on research interventions that could potentially be included in this review, although the review authors are not investigators and are not authors of any of the included studies.

AdS at the time was Director, Centre Applied Oral Health Research, at Dental Health Services Victoria, Royal Dental Hospital Melbourne; and holds an honorary position of Associate Professor at Melbourne Dental School, University of Melbourne. AdS is currently Director, Partner Engagement Institute for Safety, Compensation and Recovery Research (ISCRR), Monash University.

SH is a Research Fellow at Dental Health Services Victoria, Royal Dental Hospital Melbourne. SH also holds academic teaching positions (Lecturer and Tutor) at Deakin University (School of Health and Social Development) and at Melbourne Institute of Business Management. SH is the newsletter editor for the Oral Health Special Interest Group, Public Health Association of Australia.

BN, at the time of writing and working on this review, was a paid Research Assistant with the Jack Brockhoff Child Health and Wellbeing Program, University of Melbourne. She also holds a Research Associate position with the Nigerian Branch of the South African Cochrane Centre in Nigeria.

HC at the time was Director of Clinical Leadership at Dental Health Services Victoria. He is currently Honorary Professor and Head, Oral Health Research Stream, Deakin Health Economics, Deakin University. He holds an Adjunct Professor position at the School of Dentistry and Oral Health, La Trobe University, and an Honorary Senior Fellow position at the Melbourne Dental School, University of Melbourne.

MG is Professor of Oral Health and Head of the Department of Dentistry and Oral Health, at La Trobe Rural Health School, La Trobe University. He is an Honorary Senior Fellow at the Melbourne School of Global and Population Health, University of Melbourne.

MN is a Clinical Lecturer on Evidence-Based Dentistry at Plymouth University Peninsula Schools in Medicine and Dentistry. She is an affiliated researcher with the Cognition Institute, Plymouth University, and is a member of the management team at the Institute for Sustainability Solution Research (ISSR). She is the co-convenor of the Cochrane Agenda and Priority Setting Methods Group and is a Steering Group member of the Cochrane Collaboration and Evidence-Based Research Network.

HM, at the time of writing and working on this review, was a paid Research Assistant at the Jack Brockhoff Child Health and Wellbeing Program, University of Melbourne, and a paid Research Assistant at the Australian Population Health Improvement Research Strategy for Oral Health, Dental Health Services Victoria. HM is currently Media and Communications Officer and at the time was the Executive Assistant to late Professor Elizabeth Waters at the Jack Brockhoff Child Health and Wellbeing Program, University of Melbourne.

ER is a Research Fellow at the Murdoch Childrens Research Institute, and holds an honorary appointment at the Department of General Practice Primary Health Care Academic Centre at the University of Melbourne.

PL holds a post-doctoral position at Murdoch Childrens Research Institute (MCRI), Royal Childrens Hospital, Melbourne. Pam co-ordinates a large epigenetic twins study at MCRI and is a guest lecturer at the University of Melbourne.

LM is a Research Assistant at Dental Health Services Victoria, Royal Dental Hospital Melbourne. LM is also a Research Assistant at the Turning Point Alcohol and Drug Centre, Eastern Health, working on the Victorian Ambulance Project to research alcohol and drug-related ambulance attendances in Victoria along with a Movember/Beyond Blue Men's mental health project.

AdS at the time was a co-researcher on a pilot study (commenced March 2015) sponsored by the Alliance for a Cavity Free Future, at Colgate-Palmolive Pty Ltd (NSW), through a grant to DHSV. AdS has no competing interests to disclose.

MN was a Co-investigator on a systematic review funded by the National Institute of Health and Clinical Excellence (NICE) in the UK on oral health promotion approaches for dental practitioners (2014-2015). This review focused on oral health messages delivered in dental practice. MN has no competing interests to disclose.

RB is the current recipient of a National Health and Medical Research Council (Australia) postgraduate scholarship (2013-2015) and has no competing interests to disclose.

RYN is a Post-doctoral Fellow at the Institute of Health Policy, Management, and Evaluation, University of Toronto, and serves as statistical editor for the Cochrane Public Health Group.

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Internal sources

- Dental Health Services Victoria, Australia.
Research and Innovation grant and salary support for conducting the review

External sources

- National Institute of Health Research, UK, Other.
Small grant for undertaking the systematic review

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Exclusion criteria: We added the following exclusion criteria post protocol publication: interventions of a chemical nature alone (e.g. fluoride varnish only), delivered primarily in a clinical setting, or solely fluoridation (in water, milk, salt, etc.). We adapted the exclusion criteria from the published protocol to narrow the focus of the review and reduce duplication with newly emerging Cochrane reviews. As an example, [Marinho 2013](#) published a review that evaluated the effectiveness of fluoride varnish in preventing dental caries in children and adolescents; this was an updated review of [Marinho 2004](#), which compared the effectiveness of topical fluoride therapy (TPT) in addition to toothpaste versus just toothpaste alone. Both the original review and the updated review found that fluoride varnish or TPT yielded positive results for caries prevention. [Tubert-Jeannin 2011](#) evaluated the efficacy of fluoride supplements (tablets, drops, lozenges and chewing gum) for preventing dental caries in children. [Hiiri 2010](#) compared the effectiveness of pit and fissure sealants versus fluoride varnish in preventing occlusal dental decay in children and adolescents. [James 2010](#) has published a protocol to examine the use of chlorhexidine mouthrinse as adjunctive treatment for gingival health.

Databases searched: As the result of library access restrictions, we were unable to run searches in two databases - British Library Document Supply Centre inside serials and conference proceedings (EBSCOHost) and ASSIA applied Social Sciences Index and Abstracts (CSA).

Outcomes: To strengthen this review, we added plaque index as a secondary outcome, and changed self reported or parent-reported oral health from a primary to a secondary outcome.

Data synthesis: We made a post-protocol decision to include only primary outcomes related to dental caries (tooth and surface-level data) in SoF tables. Owing to insufficient data related to other primary outcomes (gingival and periodontal disease), we excluded outcomes other than dental caries from the SoF table.

Subgroup analysis: Data were insufficient to allow planned subgroup analyses based on length of the intervention (long vs short), intervention settings, child age groups and socio-economic status. We performed only subgroup analyses based on types of interventions to explore heterogeneity.

Sensitivity analysis: We included a sensitivity analysis on funding of included studies.

Measures of treatment effect: For measures of treatment effect, we used only continuous outcomes. Information pertaining to dichotomous outcomes as detailed in the protocol was not applicable.

Missing data: We used data available in published papers, and we did not contact authors of included studies to request missing data because of resource constraints.

INDEX TERMS

Medical Subject Headings (MeSH)

*Health Promotion; *Oral Health

MeSH check words

Child; Humans