



Effective Interventions to Prevent Dental Caries in Preschool Children

A Rapid Review

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Key Messages

1. Topical fluoride varnish application is effective in preventing or reducing caries in preschool children ages 0 to 3 years old. It is encouraged to have twice-yearly application.
2. Supervised toothbrushing in combination with oral health education showed a positive effect on preventing or reducing caries in daycare or school settings. The suggested dose of fluoride in toothpaste is standard (1000-1500ppmf).
3. The distribution of oral health materials in addition to oral health education has shown a positive effect on caries. There is mixed evidence on providing oral health education only.
4. Revising nutritional guidelines to reduce sugar intake in daycare or school settings may be an effective policy change.
5. Some negative effects of fluoride supplements and xylitol were observed; these clinical interventions are not encouraged for children under the age of 6 years old.

Executive Summary

Research Question

What are effective oral health interventions to prevent or reduce the rate of caries in preschool children?

Issue and Context

The prevalence of caries in children is an ongoing concern as it is a preventable chronic condition. In Peel, one out of three screened children in JK, SK and Grade 2 have already experienced caries. National data indicates that dental surgery in preschool children for advanced caries accounts for 31% of all surgeries making it the leading cause of day surgery in this age group. With recent changes to Region of Peel-Public Health's oral health delivery model, there is an opportunity to address the emerging issue of caries earlier in a child's life. The purpose of this rapid review is to better understand what types of interventions are most effective to prevent or reduce caries in this population.

Methods

A search for published and unpublished literature generated 65 results. Of these, 47 were considered non-relevant after further review. After full-text analysis, seven remained and six articles qualified for critical appraisal based on the inclusion/exclusion criteria. This resulted in five articles being selected: one guideline and four systematic reviews.

Synthesis of findings

- The most promising interventions to prevent or reduce caries in preschool children are the application of fluoride varnish, supervised toothbrushing, and the distribution of oral health materials. Oral health education is encouraged in addition to these interventions.
- There is mixed evidence on the effectiveness of providing oral health education to parents/caregivers without any preventive services.
- There is limited evidence on the effectiveness of unique clinical interventions (e.g., silver diamine fluoride or povidone iodine). Some xylitol trials resulted in adverse outcomes and are not suitable for children in this age group.

Recommendations

1. Identify ways to increase access to fluoride varnish for high-risk preschool children.
2. Increase awareness of supervised toothbrushing by educating parents/caregivers on good oral health behaviours.
3. Support policy implementation of supervised toothbrushing in various settings for children 0 to 3 years old.
4. Explore opportunities to offer oral health education and materials to parents/caregivers in addition to preventive services.

Glossary of key termsⁱ:

Cavitated lesions: visual breakdown (e.g., cavity) of a tooth surface, also referred to as “cavitated carious lesions”

Decayed, missing and filled teeth (dmft): The number of decayed, missing and filled teeth as the time of assessment

Decayed, missing, filled surfaces (dmfs): The number of decayed, missing and filled surfaces

Establishment of a dental home: Ongoing relationship between the dentist and the patient that is comprehensive, accessible and coordinated. The dental home should be established no later than 12 months of age. (1)

ⁱ Unless indicated, definitions were retrieved from: <https://medical-dictionary.thefreedictionary.com>

1 Issue

Region of Peel-Public Health is mandated by the Ontario Public Health Standards (OPHS) to screen elementary school children for oral health issues, navigate access to oral health care through the Healthy Smiles Ontario Program (HSO), and provide oral health preventive services. Screening data from 2015 to 2017 has consistently shown that one in three Peel children have experienced dental caries by the time they reach JK, SK or Grade 2 (2). In 2016/2017, 15.9% of these children had urgent dental conditions and 31% required preventive treatment. Children with previous caries experience are at increased risk for future tooth decay in permanent teeth or other dental-related costs (3). It is clear that despite dental screening in elementary schools, community fluoridation and expansion of Public Health's oral health programming; there is a need for preventive efforts in preschool aged children. This allows a more upstream approach to be established, engagement with children, parents, and community partners at earlier stages of life. The aim of this rapid review is to determine the most effective interventions to prevent caries in preschool children.

Anecdote

Although Public Health is mandated by the OPHS to address oral health needs in children zero to 17 years of age, limited attention is paid to preschool children. Over the years, the Oral Health Team has engaged with Family Health, Human Services and other departments who work with preschool children to discuss programming; however, it was unclear as to what approach would be most effective. The Oral Health Status Report (2017) also indicated that there is limited data on the health status of preschoolers, but program data indicates that almost 30% of children start school with a

caries experience (dmft >1) (2). With the recent reinvestment of the dental treatment fee administration from the Region in 2017, the expansion of services to preschoolers is now possible. Accordingly, this Rapid Review will support the *Nurturing the Next Generation Priority*ⁱⁱ and the oral health program outcome of “reducing tooth decay in children and youth under the age of 18 years of age in Peel”.

2 Context

It is well established that dental caries is the most prevalent and preventable chronic disease among children (4). Preschool years are a critical period of development; poor oral health can create life-long consequences for one’s overall health outcomes. If oral health needs are not addressed earlier, it may negatively impact a child’s ability to eat, sleep, learn or socialise, further damaging the child’s psychological and social dimensions of well-being (3-4). Another negative outcome is the need for dental surgery as it accounts for 31% of all surgeries among children under the age of 6 (5). Caries in childhood is a predictor for adult oral health; this may affect other health conditions such as diabetes or cardiovascular disease over time (3).

Caries is a multifactorial chronic disease influenced by biological, lifestyle, and behaviour factors (6). Risk factors for early childhood caries include: bacteria transmission from mother to infant (7); the social determinants of health (3); parental knowledge (8), attitudes and behaviours towards oral health (e.g., diet, pacifier use, and daily tooth brushing); prolonged bottle-feeding practices (9), and cultural beliefs around primary or “milk teeth” (10-11). The Canadian Dental Association suggests an infant should have their first dental visit by their first birthday or within six months after the first

ⁱⁱ Please see Peel’s Nurturing the Next Generation for more information: <https://www.peelregion.ca/health/nurturing/>

tooth emergesⁱⁱⁱ (12). As oral health is delivered privately in Canada, it may lead to families resorting to primary care providers due to the cost associated with dental care (3). The rate of visits to a family physician for oral health related concerns is highest among children 0-3 years of age as reported in Public Health's Oral Health Status Report (2017) (2). Oral health is connected to socioeconomic status; those with higher income are more likely to access a dentist and have dental insurance coverage (2, 10).

In the past 12 months, Public Health's oral health delivery model has changed resulting in an expansion of programs and service delivery. This consisted of six provincially funded low-income children's dental programs integrating into one program called "Healthy Smiles Ontario". These recent changes provided an opportunity to address oral health concerns in preschool children. Historically, funding has been directed towards screening and service delivery to elementary school children. With the recent reinvestment of the dental treatment fee administration from the Region along with the amalgamation of the Healthy Smiles Ontario program, the expansion of services to preschoolers is possible. It is important to identify effective interventions targeting preschool children in order to collaborate with the Family Health Division, other Regional departments, and community partners to meet the emerging oral health needs of our community.

ⁱⁱⁱ Local data from a Toronto study concluded that less than 1% of children aged 12 months had seen a dentist. Accessed from <http://pediatrics.aappublications.org/content/133/6/e1594>

3 Conceptual Framework

Oral health outcomes are determined by various lifestyle, behavioural and biological factors that contribute to functional, psychological and social dimensions of a child's well-being (3-4). Fisher Owens (2007) formed a conceptual model (Appendix A) that shows these interconnected relationships and the breadth of risk factors that play a role in good oral health outcomes for a child (10). The oral health team refers to this model when planning programs for children. The key message from this model is that oral health starts in early life and has an impact on overall health and quality of life.

4 Literature Review Question

The question addressed in this rapid review is: what are effective oral health interventions to prevent or reduce caries in preschool children? The following table displays the question in PICO format:

Population (P):	Preschool children, children 0-6 years old ^{iv} , pregnant women, caregivers of children 0-6 years old
Intervention (I):	Preventative oral health services (e.g., fluoride varnish, toothbrushing); treatment by dental professionals and other health/social service professionals; health promotion interventions (e.g., education or counselling; policy, including implementation of changes in programming
Comparison (C):	Any
Outcome (O):	Primary: changes in rate of caries; secondary: changes in oral health behaviours/knowledge; change in growth or nutrition; changes in rate of dental visits; establishment of dental home

^{iv} In Canada, preschool children are considered ages 0-3 years old, however, this may vary. To accommodate this, the range of the search strategy included children from ages 0-6 years old

5 Literature Search

The search for published and grey literature was completed in June 2017 by PPH librarians. The search included the following databases: PubMed, Global Health, TRIP, Health Evidence, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Library, Nursing & Allied Health, and PsycINFO. Grey literature was located by exploring the following websites: The Community Guide (CDC), World Health Organization (WHO), Health Canada, American Academy of Pediatric Dentistry, The National Institute for Health and Care Excellence (NICE), Scottish Intercollegiate Guidelines Network (SIGN), Canadian Dental Association, and Public Health Agency of Canada - Canadian Best Practices Portal. The search included only English language publications and synthesised literature from the past 10 years. Any single studies or studies with children who have special needs or chronic conditions or were over six years old were excluded. The detailed search strategy can be found in Appendix B.

6 Relevance Assessment

Two reviewers assessed the search results according to the relevance criteria. Differences were resolved by discussion or the involvement of a third reviewer. Articles qualified for the review were screened to determine eligibility using the following criteria

- Inclusion criteria: English language, synthesized evidence (i.e., guidelines or systematic reviews), and focused on children 0 to 6 years old, measured rate of caries as primary outcome.
- Exclusion criteria: expert opinions, non-relevant populations (i.e., children over the age of six), reviews that score below 6 when critically appraised.

7 Results of the Search

The search strategy identified 65 potentially relevant articles consisting of five guidelines and 60 reviews (Appendix C). Forty-seven articles did not meet relevance criteria based on title and abstract screening. Eleven articles were further excluded after full-text screening: six did not meet relevance criteria and five were duplicates. In total one guideline and six reviews met inclusion and were critically appraised.

8 Critical Appraisal

Two independent reviewers used the Health Evidence *Quality Assessment Tool-Review Articles* and the AGREE II tool to assess the quality of the systematic reviews and guideline. The following reviews scored 'strong': Santos et al. (2013); Chou et al. (2013); de Silva et al. (2016); and El Fadl et al. (2016). The reviews conducted by Vamos et al. (2015) and Salzer et al. (2017) both scored 'moderate' and were excluded because they scored below six. The SIGN 138 guideline (2014) scored 'moderate' and was included in this paper as it was the most recent and highest level of synthesized evidence. This resulted in five articles being included in this review.

9 Description of Included Studies

9.1. de Silva et al. (2016): *Community-based population-level interventions for promoting child oral health* (14).

This Cochrane systematic review included 38 studies that examined the effectiveness of community-based oral health promotion interventions for preventing caries and gum disease among children from birth to 18 years of age. Only 13 of these studies met the

relevance criteria and were included in this rapid review. Since specific articles were extracted for this review, the meta-analyses were not applicable. The trials took place in Brazil (n=3), China (n=2), Australia (n=2), United States (n=2), Argentina (n=1), Thailand (n=1), Canada (n=1), and Russia (n=1). The target populations consisted of children, parents and/or teachers. The articles had either single or multicomponent interventions. The articles varied in types of interventions: oral health education on oral hygiene, diet and nutrition offered through home visits, pamphlets, or videos (n=7); supervised tooth brushing in addition to oral health education (n=3); and preventive oral health services (fluoride varnish, dental screening or sealants) (n=3). The method of measuring caries also varied (e.g., dmfs/dmft, number of cavitated lesions or defs/deft). Most studies were conducted in a nursery/school setting (n=7). Other settings included clinics (n=3) and home (n=3).

9.2. Chou et al. (2013): *Preventing dental caries in children < 5 years: systematic review updating USPSTF recommendation* (15).

This updated systematic review included 20 studies aimed at delivering screening or preventive interventions by primary care providers to reduce caries in children 5 years and younger. Of these studies, only 16 met the relevance assessment and PICO of this rapid review. Some studies also measured adverse effects. Most trials took place in the United States (n=8) while others varied China (n=3), Canada (n=1), Japan (n=1), Sweden (n=1), Saudi Arabia (n=1), and Finland (n=1). All interventions were unique in delivery, method and setting. Studies included the following interventions: parental education on oral hygiene; benefits of early dental referrals; effectiveness of preventive treatment (e.g., fluoride varnish); and any adverse effects reported in the interventions.

Most studies took place in clinical settings (n=8); other studies took place in community (n=3) or schools/daycare settings (n=5).

9.3. Santos et al. (2013): *Effects of low and standard fluoride toothpastes on caries and fluorosis: systematic review and meta-analysis* (16).

This systematic review included five studies that compared the effects of using low versus standard fluoride toothpaste on: (1) caries rates in the primary dentition of preschoolers; and/or (2) the risk of developing moderate fluorosis in permanent dentition. There is concern that preschool children may develop dental fluorosis with the use of fluoridated toothpaste, this has resulted in the use of low fluoridated toothpaste. Trials took place in England (n=2); Sweden (n=1); Germany (n=1); and Brazil (n=1). Although all studies compared low to standard fluoride toothpaste, each study varied in the formula (i.e., dose of fluoride). Low fluoride standard toothpastes ranged from 250 ppm to 550 ppm whereas standard fluoride toothpaste was from 1000 to 1450 ppm. Most trials took place within the home (n=4); one trial took place in a school setting.

9.4. El Fadl et al. (2016): *Integrating Maternal and Children's Oral Health Promotion into Nursing and Midwifery Practice-A Systematic Review* (17).

This systematic review included 21 studies that assessed the effectiveness of oral health promotion delivered by nurses and midwives for expecting women and children to reduce caries, increase dental use and oral health knowledge. Of these studies, 16 met the PICO. Majority of the studies were from the United States (n=8); some from U.K. (n=3); and others varied in location Brazil (n=1); Iran (n=1); Belgium (n=1); Australia (n=1); and India (n=1). Studies included the following types of interventions: oral health education on various topics (e.g., oral health hygiene, diet or bottle-feeding);

preventive services (e.g., dental screening or fluoride varnish) in addition to oral health education; and multicomponent interventions consisting of a combination of home visits, counselling, oral health print information or oral health kits. Most trials took place within homes (n=6) and community centres (n=4); some took place in clinics (n=5); and one trial consisted of a home and clinic setting.

9.5. Scottish Intercollegiate Guidelines Network (SIGN) Guideline 138. *Dental interventions to prevent caries in children* (18).

This guideline included 40 studies to support their best practice recommendations on dental interventions at the individual level to prevent caries in children and youth aged 0 to 18 years. This guideline is an update to SIGN Guideline 47 on *Preventing dental caries in children at high risk of caries* and SIGN Guideline 83 on *Prevention and management of dental decay in preschool children*. Only 14 out of the 40 studies were included in this rapid review as some studies did not meet PICO (n=19); or did not form any recommendations (n=6). Recommendations varied from: oral health promotion (e.g., education on diet or toothbrushing); appropriate dose of fluoridated toothpaste; supervised toothbrushing; and fluoride varnish application. Exact settings were not reported; however overall trials took place in clinical (e.g., dental office); and nonclinical (e.g., home or schools) settings.

10 Synthesis of Findings

This section will include key findings of the data synthesis (Table 1); a more detailed synthesis table can be found in Appendix E.

10.1 The most promising interventions to prevent or reduce caries in preschool children (0-6 years old) are to provide fluoride varnish, supervised toothbrushing, and the provision of oral health materials. It is encouraged to include an oral health educational component in addition to these interventions (14, 17-18)

- **Preschool children who received twice-yearly 2.26% fluoride varnish application experienced a reduction in caries by 37 to 59% (15, 18).** Other topical fluoride applications (e.g., silver diamine fluoride, acidulated phosphate fluoride foam) were tested at different frequencies. However, multiple applications varying from 1 year or 6 months or 2 weeks did not make a significant difference in the rate of caries (15).
 - **Providing oral health education in addition to preventive services specifically fluoride varnish, reduced dmfs by -3.00 (95% CI -4.91, -1.09) (14).** Oral health education topics varied from nutrition (i.e., unhealthy diet) or toothbrushing (i.e., how to supervise toothbrushing, frequency, type of toothpaste, age of commencement) (17).
- **Children who were supervised by parents/caregivers for toothbrushing experienced a mean difference in caries ranging from -2.70 to 1.09 (95% CI -4.43, 1.91) (14, 18).** Oral health education was provided to train parents and children on the importance of toothbrushing, process of decay and nutrition/diet.
 - **Children who used standard fluoridated toothpaste (i.e., 1000-1500ppmf) experienced a 31% reduction in caries (95% CI: 18 to 43%) (14).** If children used low fluoridated toothpaste it increased the risk of

caries (RR=1.13, 95% CI: 1.07-1.20) and did not decrease the risk of developing fluorosis (RR=0.32, 95% CI: 0.03-2.97) (16). It was also reported that the frequency of toothbrushing (i.e., two times daily versus more frequently) did not make a difference on fluorosis (OR=0.88, 95% CI: 0.71-1.08) (16).

- **Children whose parents/caregivers received oral health education and oral health materials reported a moderately positive effect in caries (17).** Oral health topics and method of delivery varied across all trials. Topics such as nutrition/diet, importance of toothbrushing was delivered through educational pamphlets or videos or counselling. Oral health materials were provided: dental registration vouchers, oral health videos, and oral health kits consisting of toothbrushes and toothpastes.

10.2 Implementation of a policy change in nutritional guidelines in nursery or school settings may be effective in preventing or reducing caries.

- Although evidence is limited, a revised nutrition and diet guideline created by a nutritionist reduced sugar intake resulting in a decrease in dmfs by -1.48 (95% CI: 2.51 - -0.45) (14).

10.3 Providing oral health education only to parents/caregivers of preschool children has mixed results in its effectiveness of reducing caries but a positive effect on oral health knowledge and dental utilization.

- Only 1 out of 4 trials reported on the effect size with and found a reduction in caries dmfs by 46% (14); 4 out of 5 trials reported a positive effect on oral health knowledge (effect size NR).

- Oral health education was provided on a variety of topics such as: breastfeeding, pacifier use, diet and nutrition, oral hygiene practices according to age or the process of tooth decay (17). Methods of delivery were also unique such as one-on-one counselling, motivational interviewing, home visits, print information (i.e., pamphlets or brochures) and video sessions (i.e., weekly modules).

10.4 There was limited and mixed evidence on the effectiveness of other clinical interventions; some (n=5) reported on fluorosis and adverse side effects.

- Chou and colleagues (2013) reported on unique trials including an intervention using 40% chlorhexidine acetate varnish every 6 months and a 10% povidone iodine solution every 2 months that reduced caries by an increment of 24 to 37%.
 - Provision of fluoride supplements to preschool children resulted in an increased risk of developing fluorosis (OR=10.8, 95% CI: 1.9 to 62) (15).
 - Consumption of xylitol in various forms and doses had mixed results. The most effective trial used xylitol wipes three times per day for one year that reduced caries increment by 91% ($p<0.05$) (15). Two trials reported that 11% of participants experienced adverse outcomes such as diarrhea or loose stool (15).

Table 1. Data Synthesis^v

Types of interventions	Outcomes	Effect	Summary
Fluoridated toothpaste <i>Santos et al., 2013: (n=5); SIGN 138, 2014: (n=2)</i>	Caries experience	↑ (n=1)	<ul style="list-style-type: none"> Standard fluoridated toothpaste (i.e., 1000-1500 ppmf) reduced caries by 31% (95% CI: 18-43%). Low fluoridated toothpaste (250-550ppmf) increased risk of caries (RR=1.13, 95% CI: 1.07-1.20) and did not decrease the risk of fluorosis (RR=0.32, 95% CI: 0.03-2.97).
	Fluorosis	↓ (n=2) ↔ (n=5)	
Topical fluoride varnish <i>Chou et al., 2013: (n=6); SIGN 138., 2014: (n=4)</i>	Caries experience	↑ (n=7) ↔ (n=3)	<ul style="list-style-type: none"> Twice- yearly application of 2.26% fluoride varnish reduced caries by 37-59%.
Other clinical interventions <i>Chou et al., 2013: (n=9)</i>	Caries experience	↑ (n=5) ↔ (n=3)	<ul style="list-style-type: none"> Reduced caries increment by 24-37%. Increased risk of fluorosis (OR=10.8, 95% CI: 1.9 - 62) due to consumption of fluoride supplements among children under 5 years old. Intake of xylitol had mixed results; two trials reported 11% of participants with diarrhea.
	Fluorosis	↓ (n=1)	
	Adverse effects	↓ (n=2)	
Policy change: nutritional guideline <i>de Silva et al., 2016 (n=1)</i>	Caries experience	↑ (n=1)	<ul style="list-style-type: none"> Reduced dmfs by -1.48 (95% CI: -2.51 - -0.45).
Oral health education + supervised toothbrushing <i>SIGN 138, 2014 (n=6); de Silva et al., 2016 (n=3)</i>	Caries experience	↑ (n=9)	<ul style="list-style-type: none"> Mean difference in caries ranging from -2.70 to 1.09 (95% CI: -4.43-1.91).
Oral health education + preventive services <i>El Fadl et al., 2016 (n=6); de Silva et al., 2016 (n=4)</i>	Caries experience	↑ (n=3) ↔ (n=3)	<ul style="list-style-type: none"> Oral health education in addition to fluoride varnish reduced dmfs by of -3.00 (95% CI: -4.91- -1.09) and reduced caries increment by 2.3-3.5 surfaces per child.
	Dental utilization	↑ (n=3)	
	Oral health knowledge	↑ (n=2)	
Oral health education + oral health materials <i>El Fadl et al., 2016 (n=5); de Silva et al., 2016 (n=2); Chou et al., 2013 (n=1)</i>	Caries experience	↑ (n=5) ↔ (n=2)	<ul style="list-style-type: none"> Five out of seven trials reported a positive effect on caries experience. Effect size NR.
	Dental utilization	↔ (n=1)	
Oral health education only <i>El Fadl et al., 2016 (n=5); de Silva et al., 2016 (n=3); SIGN 138, 2014 (n=2)</i>	Caries experience	↑ (n=4) ↔ (n=4)	<ul style="list-style-type: none"> Mixed results: only 1 out of 4 trials reported the effect size with a reduction in caries dmfs by 46%. Limited evidence on dental use and oral health knowledge. Effect size NR.
	Dental utilization	↑ (n=1) ↔ (n=1)	
	Oral health knowledge	↑ (n=3) ↔ (n=1)	

^v Note: Number of studies in each cell represents the number of single studies in the systematic review. Some studies measured more than one outcome.

↑= positive effect, ↓ negative effect, ↔ not significant.

11. Applicability and Transferability

The rapid review team met with Public Health supervisors, frontline staff and external stakeholders to discuss the applicability and transferability of the findings and recommendations in this review. A summary of the facilitated discussion is below:

Applicability

Political acceptability/Leverage

- The recommendations are mostly viewed as politically acceptable as similar targeted pilot projects are currently taking place within the Oral Health team such as supervised toothbrushing, dental screening and preventive services (i.e., fluoride varnish application) in daycares and/or EarlyON Centres.
- Application of fluoride varnish works alongside community water fluoridation to prevent caries in Peel. Community water fluoridation is currently a topic of interest at Region Council; this may impact its acceptability at Council.
- There could be anticipated changes to the Child Early Years Act or the Ministry of Education that may or may not affect the uptake of the recommendations.
- Advocacy for oral health among children aged 0-3 years old is encouraged Regionally and provincially through policy platforms, dentists and relevant community partners.

Social acceptability

- The recommendations (i.e., fluoride varnish or supervised toothbrushing) are ethical, non-invasive and require less time.
- Further positive oral health messaging is required on topics such as the benefits of fluoride varnish, bottle-feeding/pacifier use, and importance of a child's first dental visit before the first birthday and/or importance of prevention at an early age to promote oral health over the life course.
- It is also suggested that oral health messaging be culturally relevant to the community of Peel. It is important to consider cultural norms and beliefs around 'milk teeth', fluoride, alcohol in fluoride varnish or fasting practices.

Available resources and capacity

- The recommendations conform to the Ontario Public Health Standards and Public Health's 'Nurturing the Next Generation' and the Oral Health team's strategic priority of reducing caries in children 0-18 years of age.
- Currently, with the revamped Healthy Smiles Ontario program, the Oral Health team has the resources and staff training to expand pilot projects (e.g., fluoride varnish application or supervised toothbrushing) in daycare settings.
- The cost of dental treatment and surgery is well-documented throughout the literature. Intervening earlier in a child's life is a cost-effective approach towards good oral health.

- Additional costs for training and education may be taken into consideration with relevant regional departments and external partners (e.g., daycare providers) if they deliver any of the recommended interventions.
- Fluoride varnish application is not a controlled act, therefore there is potential for other healthcare providers (i.e., public health nurse, family visitor or trained volunteers) across departments to participate.
- There may be an opportunity to reach children who may not be in daycare settings by moving forward with ongoing initiatives with regional departments such as Human Services and Family Health-Healthy Babies, Healthy Children.

Transferability

Magnitude of Health Issue in Local Setting

- Consistently Peel data has shown that one in three Peel Children in JK, SK, and Gr.2 have experienced caries, this is why it is important to intervene at an earlier stage in the child's life. Early oral health outcomes become predictors of adult oral health and overall wellbeing.
- Risk factors for caries are multifaceted and prevalent in Peel such as social determinants of health, bacterial transmission from mother to infant, bottle feeding and pacifier use.

Magnitude of Reach and Cost Effectiveness of Interventions

- Currently, the Oral Health team reaches the 0-3 population through daycares and EarlyON centres connected to schools. To increase the reach of the recommended interventions, it is important to strategically explore options to increase uptake by engaging with EarlyON centres in the community, community agencies, primary care providers, and parents. Ongoing education on the importance of preventive services should be provided to these partners.
- Explore options to introduce a referral process or active consent for dental screening upon registration to a daycare facility.

Target Population Characteristics

- Most studies included in this paper were reflective of Peel's diverse population. Although Peel's oral health clinics do not collect client's ethnicity data, ethno-cultural factors may contribute to oral health outcomes and need to be considered in program planning and service delivery.

12. Recommendations

1. Identify ways to increase access to fluoride varnish for high-risk preschool children.
2. Increase awareness of supervised toothbrushing by educating parents/caregivers on good oral health behaviours.
3. Support policy implementation of supervised toothbrushing in various settings for children 0 to 3 years old.
4. Explore opportunities to offer oral health education and materials to parents/caregivers in addition to preventive services.

References

- (1) American Academy of Pediatric Dentistry. Definition of a Dental Home. Aapd.org. 2015. Accessed from:
http://www.aapd.org/media/policies_guidelines/d_dentalhome.pdf.
- (2) Peel Public Health. Oral Health in Peel: A Taste of Risk Factors and Oral Health Outcomes. 2017. Accessed from:
<https://www.peelregion.ca/health/resources/pdf/2017-oral-health-report.pdf>
- (3) Legg A. Oral health care for children – a call for action. Canadian Paediatric Society. 2016; 18(1):37-43. Accessed from: <https://www.cps.ca/en/documents/position/oral-health-care-for-children>.
- (4) Anil S, Anand PS. Early childhood caries: prevalence, risk factors, and prevention. *Frontiers in pediatrics*. 2017 Jul 18;5:157
- (5) Canadian Institute for Health Information. Treatment of Preventable Dental Cavities in Preschoolers: A Focus on Day Surgery under General Anesthesia. Ottawa, ON: CIHI; 2013. Accessed from:
<https://secure.cihi.ca/estore/productSeries.htm?pc=PCC948>
- (6) Leong, P.M., Gussy, M.G., Barrow, S.L., De Silva-Sanigorski, A., Waters, E. (2012). A systematic review of risk factors during first year of life for early childhood caries. *International Journal of Paediatric Dentistry*; 23: 235-250.
- (7) de Abreu da Silva Bastos, V. et al. (2015). Mother-to-child transmission of *Streptococcus mutans*: A systematic review and meta-analysis. *Journal of Dentistry*, 43, 181-191.
- (8) Themessi-Huber, M., Freeman, R., Humphris, G., MacGillivray, S. & Terzi, N. (2010). Empirical evidence of the relationship between parental and child dental fear: A structured review and meta-analysis. *International Journal of Paediatric Dentistry*; 20: 83-101.
- (9) Hooley, M., Skouteris, H., Boganin, C., Satur, J., & Kilpatrick, N. (2012). Parental influence and the development of dental caries in children aged 0-6 years: A systematic review. *Journal of Dentistry*; 40: 73-885.
- (10) Fisher-Owens et al., (2007). Influences on Children's Oral Health: A Conceptual Model. *Pediatrics*; 120 (3): e510-e520.

- (11) Kumar, S., Tadakamadla, J., Kroon, J., Johnson, N.W. (2016). Impact of parent-related factors on dental caries in the permanent dentition of 6-12-year-old children: A systematic review. *Journal of Dentistry*; Mar; 46:1-11.
- (12) VanMalsen J., & C. (2017). Effectiveness of early pediatric dental homes: A scoping review. *Canadian Journal of Dental Hygiene*, 51, 16-22. Accessed from: <http://www.cdha.ca/pdfs/Profession/Journal/v51n1.pdf>
- (13) Canadian Dental Association. *The State Of Oral Health In Canada.*; 2017. Accessed from: <https://www.cda-adc.ca/stateoforalhealth/ files/TheStateofOralHealthinCanada.pdf>
- (14) de Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, Morrice HR, Riggs E, Leong PM, Meyenn LK, et al. Cochrane Database Systematic Reviews. 2016.; 15;9:CD009837
- (15) Chou R, Cantor A, Zakher B, Mitchell JP, Pappas M. Preventing dental caries in children < 5 years: systematic review updating USPSTF recommendation. *Pediatrics*. 2013: peds-2013.
- (16) Santos AP, Oliveira BH, Nadanovsky P. Effects of low and standard fluoride toothpastes on caries and fluorosis: systematic review and meta-analysis. *Caries research*. 2013; 47(5):382-90.
- (17) El Fadl RA, Blair M, Hassounah S. Integrating Maternal and Children's Oral Health Promotion into Nursing and Midwifery Practice-A Systematic Review. *PLoS one*. 2016 Nov 23;11(11):e0166760
- (18) Scottish Intercollegiate Guidelines Network (SIGN). (2014). Dental Interventions to prevent caries in children (SIGN publication no.138). Scotland: Author. Accessed from <http://www.sign.ac.uk/assets/sign138.pdf>

Appendices

Appendix A: Concept Model

Appendix B: Search Strategy

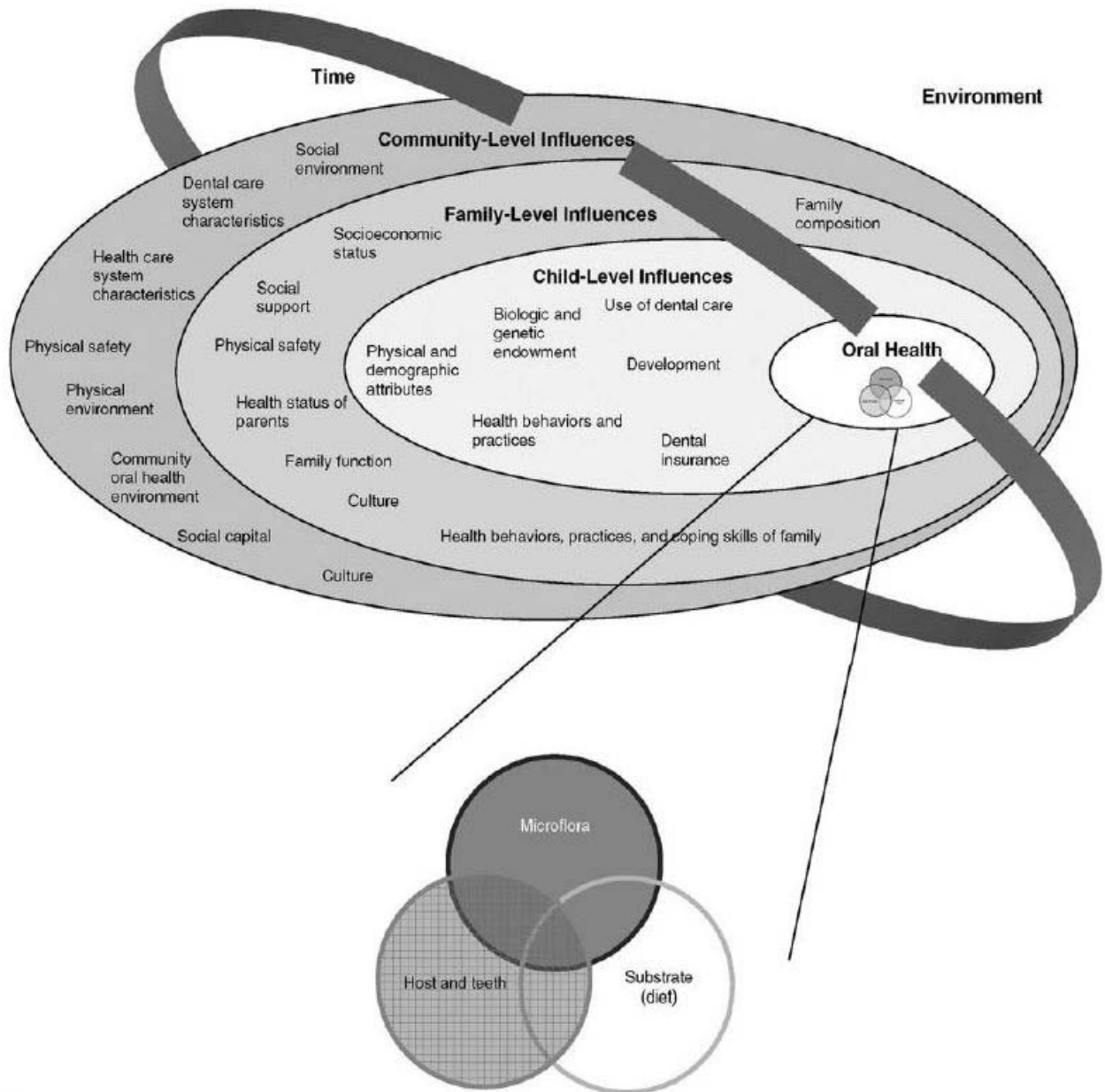
Appendix C: Literature Search Flowchart

Appendix D: Data Extraction Tables

Appendix E: Detailed Data Synthesis Table

Appendix F: Applicability & Transferability Worksheet

Appendix A: Concept Model



Source: Fisher-Owens et al., (2007). Influences on Children's Oral Health: A Conceptual Model. *Pediatrics*, 120 (3): e510-e520.

Appendix B: Search Strategy

Academic database searches

Database: Global Health <1973 to 2017 Week 23>, EBM Reviews - Cochrane Database of Systematic Reviews <2005 to June 20, 2017>, Ovid Healthstar <1966 to May 2017>, Ovid MEDLINE(R) <1946 to June Week 2 2017>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <June 19, 2017>, PsycINFO <2002 to June Week 2 2017>

Search Strategy:

-
- 1 exp child, preschool/ (1413219)
 - 2 preschool.ti. (25726)
 - 3 exp preschool students/ (6614)
 - 4 exp infant/ (1744931)
 - 5 infant.ti. (111617)
 - 6 infancy.ti. (27233)
 - 7 pregnancy.ti. (254244)
 - 8 1 or 2 or 3 or 4 or 5 or 6 or 7 (2652342)
 - 9 exp health education, dental/ (11453)
 - 10 educ*.ti. (320730)
 - 11 intervention*.ti. (268595)
 - 12 program*.ti. (373602)
 - 13 strategy.ti. (84974)
 - 14 policy.ti. (85740)
 - 15 policies.ti. (24930)
 - 16 framework*.ti. (58007)
 - 17 exp health promotion/ (172225)
 - 18 health promot*.ti. (23426)
 - 19 exp fluorides, topical/ (8498)
 - 20 fluoride*.ti. (34711)
 - 21 exp mass screening/ (229911)
 - 22 screen*.ti. (294725)
 - 23 exp dentists/ (34712)
 - 24 dentist*.ti. (59426)
 - 25 exp dental hygienists/ (9901)
 - 26 hygienist*.ti. (3544)
 - 27 strategies.ti. (137580)

28 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27
(1903576)

29 exp oral health/ (29509)

30 oral health.ti. (19732)

31 exp dental care/ (57249)

32 dental.ti. (200192)

33 exp oral hygiene/ (33192)

34 exp dental caries/ (81670)

35 dental caries.ti. (16230)

36 exp gingival diseases/ (39017)

37 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 (348967)

38 28 and 37 (62090)

39 9 or 38 (68950)

40 8 and 39 (6785)

41 review.ti,ab. (2561854)

42 meta analys*.ti,ab. (244112)

43 Synthes*.ti,ab. (1178577)

44 guideline*.ti,ab. (555650)

45 41 or 42 or 43 or 44 (4209452)

46 40 and 45 (504)

47 remove duplicates from 46 (247)

48 limit 47 to yr="2007 -Current" (122)

49 review.ti. (760367)

50 meta analys*.ti. (143767)

51 synthes*.ti. (347559)

52 guideline*.ti. (128705)

53 49 or 50 or 51 or 52 (1324935)

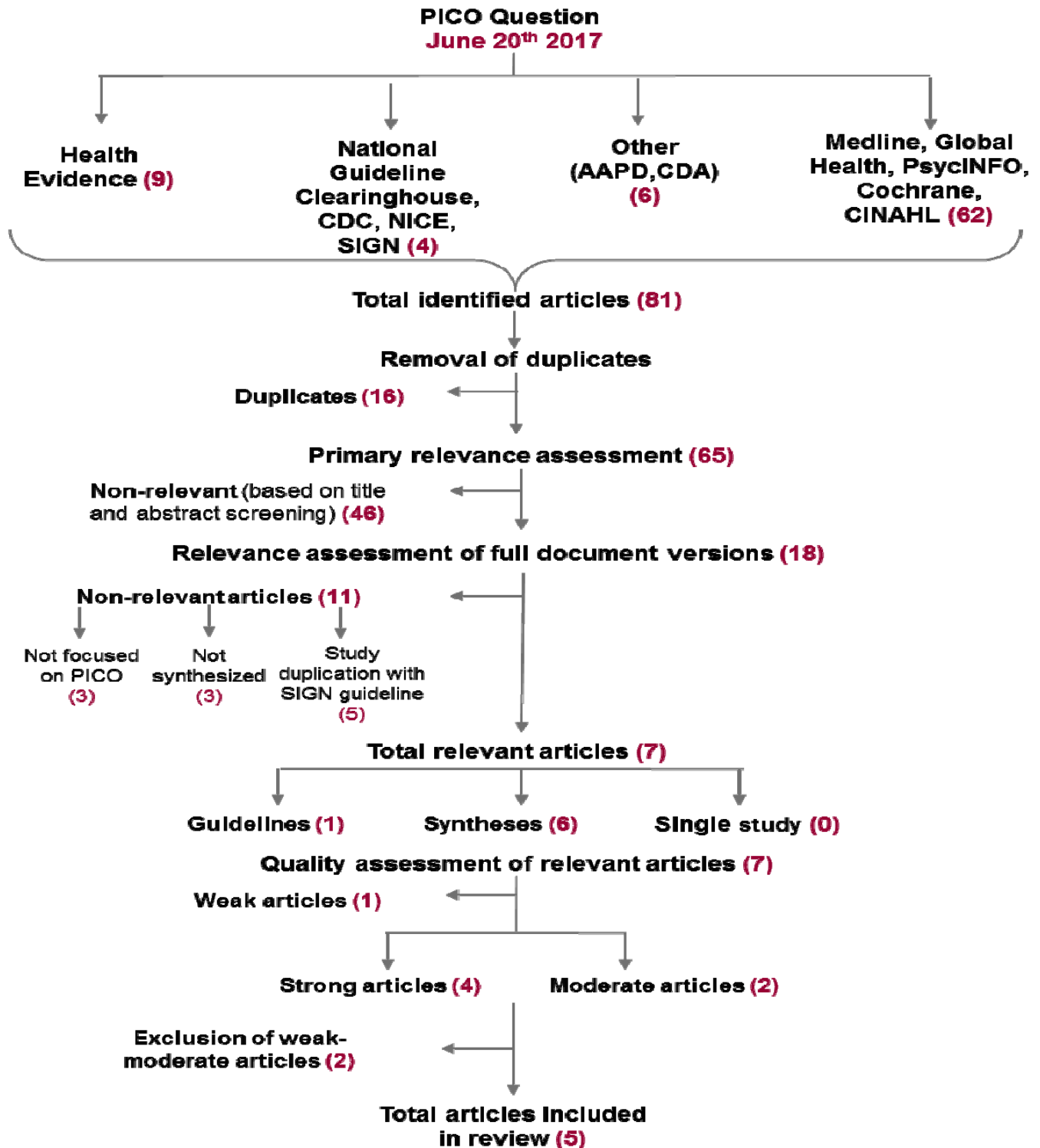
54 48 and 53 (51)

55 remove duplicates from 54 (51)

Grey Literature search

National Guideline Clearinghouse http://www.guideline.gov/index.aspx	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Registered Nurses Association of Ontario http://rnao.ca/bpg	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
World Health Organization (WHO) http://www.who.int/en/	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
National Institute for Health and Clinical Excellence (NICE) http://www.nice.org.uk/	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
CDC – The community Guide http://www.thecommunityguide.org/index.html	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
EPPI http://eppi.ioe.ac.uk/cms/Default.aspx?tabid=53	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
NCCMT (National Collaborating Centre for Methods and Tools) Public Health portal http://www.nccmt.ca/public_health_plus/all/1/list-eng.html	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
The Campbell Collaboration http://www.campbellcollaboration.org/	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Guideline Advisory Committee http://www.gacguidelines.ca/index.cfm?pagePath=GAC_Endorsed_Guidelines&id=21080	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
The TRIP database http://www.tripdatabase.com/	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Public Health Agency of Canada http://www.phac-aspc.gc.ca/index-eng.php	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Health Evidence http://www.healthevidence.org/	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Google – with limits (only the first 5 pages, limited to current year)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
DuckDuckGo http://duckduckgo.com/?t=&kl=ca-en (only the first 20 returns)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Appendix C: Literature Search Flowchart



Appendix D: Data Extraction Tables

Items Reviewed	Review #1: Systematic Review by de Silva et al., 2016
General Information & Quality Rating for Review	
1. Citation	de Silva, A. M., Hegde, S., Akudo Nwagbara, B., Calache, H., Gussy, M. G., Nasser, M., ... & Yousefi-Nooraie, R. (2016). Community-based population-level interventions for promoting child oral health. <i>Cochrane Database Syst Rev</i> , 9.
2. Country	Corresponding author from Australia <ul style="list-style-type: none"> • Study locations: Brazil (n=3), China (n=2), Australia (n=2), United States (n=2), Argentina (n=1), Thailand (n=1), Canada (n=1) Russia (n=1)
3. Quality Rating	9/10 (Strong): Appraised using the Health-Evidence Quality Assessment Tool
4. Objectives of Review	<u>Primary</u> :To identify the effectiveness of community-based population-level oral health promotion interventions in preventing dental caries and gingival and periodontal disease in children 0-18 years of age. <u>Secondary</u> : (1) To determine most effective intervention and guiding theoretical frameworks; (2) To identify interventions that reduce inequality in oral health outcomes; (3) examine the influence of context in the design, delivery and outcomes of interventions. Note: To match the PICO question data was extracted relevant to the primary objective
Details of Review	
5. Number and types of studies	13 primary studies specifically address the PICO question in this review: <ul style="list-style-type: none"> • RCT with low risk (n=6); unclear risk (n=1) of bias • Cluster-RCT with low risk of bias (n=2) • Quasi-experimental with unclear risk (n=2); high risk (n=1) of bias • Quasi-randomized trial with unclear-high risk of bias (n=1)
6. Search Period	1996-2014
7. Number/types of databases searched	<ul style="list-style-type: none"> • 16 databases: Cochrane Central Register of Controlled Trials, MEDLINE (Ovid), Embase, CINAHL, BIOSIS, ISI, DARE, PsycInfo, ProQuest Dissertations & Theses, Science Direct, Conference Proceedings Citation Index, Web of Science, Sociological Abstracts, SCOPUS • Additional articles were identified through reference lists, hand searching and a targeted grey literature search
8. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> • <u>Inclusion</u>: (1) Studies had to be randomised or quasi-RCT, cluster-RCT, controlled before-and-after studies and interrupted time series. (2) Eligible participants included are from birth up to and including 18 years of age; (3) Intervention settings included those external to clinics (home, childcare facilities, education or health care setting). There are no restriction on the delivery model of the interventions (4) Studies included had to target primary outcome of dental caries and report on baseline/post intervention results. • <u>Exclusion</u>: (1) Excluded studies that target specific groups in the community such as special needs or those with high rate of caries; (2) Studies that had individuals over the age of 18; (3) If the intervention focused only on chemical components such as fluoride varnish only in clinical setting or fluoridation (water, milk) (4) Any studies that focused solely on water fluoridation.
Details of Interventions	
9. Target groups	Healthy children ages 0-18 years without special needs <ul style="list-style-type: none"> • Studies targeting infants had the inclusion criteria of infants with first or second permanent molar or >1 surface exposed. • Studies targeting pregnant mothers ensured they were over the age of 18.

	<ul style="list-style-type: none"> • Studies indirectly targeted children through: only teachers (n=1); combination of teachers, parents and the child (n=2), parent and child (n=6); parents or new mothers only (n=2); children only (n=2). • The studies took place in a variety of countries resulting in multiple ethnicities such as Chinese, Australian, Russian, and American.
<p>10. Description of interventions (type, delivery method)</p>	<p>Note: The studies had single and multi-component interventions to make comparisons. These community-based interventions varied in delivery, frequency and setting.</p> <p>Education: (n=4)</p> <p>Diet and nutrition education: (n=2):</p> <ul style="list-style-type: none"> • 2/4 studies focused on the reduction of sugar intake but differed in methodology and delivery. <ul style="list-style-type: none"> • 1/2 studies provided education on nutrition through home visits to new mothers in “Ten Steps for Healthy Feeding” that included advice on exclusive breastfeeding up to 6 months, avoiding the use of bottles and pacifiers and against consumption of soft drinks and unhealthy food. There was no control reported. • 1/2 studies devised dietary guidelines according to a nutritionist in a nursery setting to reduce sugar intake and provided recommended menu’s to parents. The control was no implementation of the new guideline. <p>Oral health education: (n=2)</p> <ul style="list-style-type: none"> • 2/4 studies provided oral health education on various topics in different settings. <ul style="list-style-type: none"> • 1/2 trials provided oral health print education on oral health changes during pregnancy, use of pacifiers, oral hygiene during tooth eruption and feeding practices. The control group received no intervention. • 1/2 studies used different methods of delivering oral health education in their intervention and control. The intervention group received 15 minute oral health education video message that covered issues of tooth decay, oral hygiene practices, dietary habits that affect caries and checking the child’s teeth for early signs of caries whereas the control group only received a paper brochure on oral health education. <p>Oral health education + oral health materials: (n=2):</p> <ul style="list-style-type: none"> • 2 studies provided oral health education in the form of motivational interviewing but differed in delivery. <ul style="list-style-type: none"> • 1/2 of the studies offered the intervention group a pamphlet, video plus 45-minute counselling in the format of motivational interviewing. There were 2 follow-up phone calls within 6 weeks, 4 follow-up calls within 20 weeks and postcards. The control group was offered education pamphlet and video (specific topic of oral health education not specified). • 1/2 of the studies provided 15-minute educational video and motivational interview session along with 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. The control received only a 15-minute educational video. <p>Oral health education + supervised tooth brushing: (n=3)</p> <ul style="list-style-type: none"> • All 3 studies took place in a school setting where the teacher was trained to deliver the intervention to children. <ul style="list-style-type: none"> • 1/3 studies gave oral health education (topic not specified), and used the bucco-lingual toothbrushing technique with the children in the intervention group. The control received oral health presentation on plaque followed by brushing with fluoridated toothpaste 4

	<p>times a year and were supervised by a teacher.</p> <ul style="list-style-type: none"> • 2/3 trials provided oral health education (topic not specified) to teachers, parents and children along with supervised toothbrushing with fluoridated toothpaste. Both trials control groups received no intervention. <ul style="list-style-type: none"> • 1/2 of those studies had researchers check in with the school every 4 months and met with teachers to discuss the approach. <p>Oral health education + preventive treatment: (n=4)</p> <ul style="list-style-type: none"> • 2/4 studies provided oral health education and preventive oral care in non-clinical settings. <ul style="list-style-type: none"> • 1/2 of those studies had a multicomponent approach: (1) Fluoride varnish was applied to children’s teeth once every 6 months for 2 years. (2) Advice (on causes of decay, drinking water, sugary diet, and use of fluoride toothpaste) to parents about caries prevention was provided in 2 settings (clinical/preschools/community). (3) Community health promotion engaged parents and healthcare workers about oral health in their community. The control received no intervention. • 1/2 studies provided oral health education and services at health centres with: fluoride supplements, toothbrushes, and home visits to provide education to caregivers about early childhood caries. The control had provision of toothbrushes and routine oral care only. • 1/4 studies provided oral health counselling and preventive oral care in clinical setting. Intervention Group A (children 3 years old): parents received education (two 45-minute lectures) about caries, reducing sweets and brushing teeth 2X daily. Intervention Group B (children 6 years old): received same two 45-min lectures as Group A plus: training on supervised toothbrushing (parents instructed to brush child’s teeth 2X daily), professional tooth cleaning and application of 2% sodium fluoride and sealants. There was no control for Group A. Group B control received oral care by the local public health service. • 1/4 studies had a multicomponent approach. Education was provided to: parents about children’s dental health and supervision of daily oral health hygiene; teachers to develop skills to supervise oral hygiene of children, and lastly children to develop self-care behaviours. Application of acidulated sodium fluoride phosphate and daily supervised toothbrushing using fluoridated toothpaste (0.12%) also occurred. The control group received only the application of acidulated sodium fluoride phosphate and fluoridated toothpaste.
11. Intervention settings	Most studies were in nursery/school setting (n=7) Some studies were in a clinical setting (n=3) and few were in the home (n=3)
12. Theoretical frameworks	N/A
13. Primary Outcomes	<ul style="list-style-type: none"> • Caries experience; (DMFT score and/or gingival status and index/plaque index • New non-cavitated, new cavitated, new untreated lesions
Results of Review	
14. Meta-analysis?	<ul style="list-style-type: none"> • No. This systematic review focused on children 0-18 years of age, for the purpose of this review, studies focusing on children 0-6 years of age were extracted only. This resulted in not being able to use the meta-analysis reported by the authors. This is because the meta-analysis analyzed according to type of intervention rather than being stratified by age.
15. Main Results of Review	<p>Education: (n=4)</p> <p>Diet and nutrition education: (n=2)</p> <ul style="list-style-type: none"> • 1/2 measured the average dmft score and showed a significant impact 0.90 (95% CI -1.85 to 0.05). • 1/2 measured dmfs (mean difference in caries) and showed significant impact -1.48 (95% CI -2.51, -0.45).

	<p>Oral health education: (n=2)</p> <ul style="list-style-type: none"> • 1/2 studies reported an insignificant impact on severe early childhood caries (S-ECC) where intervention d3mfs of 1.46 vs. control 2.45. • 1/2 studies did not report post intervention data. <p>Oral health education + oral health materials: (n=2)</p> <ul style="list-style-type: none"> • 1/2 studies reported a significant impact on the rate of caries. Percentage of infants with new dfs after the intervention: 35.2% and Control: 52%. • 1/2 studies reported no impact on reduction in caries increment. Number of non-cavitated lesions (n) after the intervention: 4.0 vs. Control: 4.1. Number of cavitated lesions Intervention: 2.5 vs. Control: 2.3. <p>Oral health education + supervised toothbrushing: (n=3)</p> <ul style="list-style-type: none"> • 1/3 studies reported a significant impact on caries with a dmft > 0 intervention: 13.0 (9.4 to 16.5) vs. Control: 16.1 (11.9 to 20.2). • 1/3 studies reported a significant impact on dental caries with dmfs: mean (SD) Intervention: increment: 2.47 (4.09) vs. control: increment: 3.56 (5.30). Differences between groups = 1.09 (95% CI 0.27 to 1.91), P value = 0.009. • 1/3 studies reported a significant impact on the experience of caries with DMFS (mean difference) of -2.70 [95% CI -4.43, -0.97]. <p>Oral health education +preventive treatment: (n=4)</p> <ul style="list-style-type: none"> • 1/4 studies reported a significant impact with dmfs: mean difference (MD) - 3.00 (95% CI -4.91 to -1.09). The study also reported reduced caries increment by 2.3 to 3.5 surfaces per child. • 1/4 studies reported no impact on the effect of caries, caries increased in the intervention and control group dmfs: (mean difference) - 0.57 (95% CI -2.05 to 0.91). • 1/4 studies reported an insignificant effect of the intervention on caries. Group A: def-s mean (SE) intervention group: 4.91 vs. control 8.60. Group B: def-s mean in the intervention was 5.66 vs control 3.38. • 1/4 studies reported an insignificant impact with a mean difference of -0.45 (95% CI -2.60, 1.70). This study reported a significant decrease in gingival index after 6 months in the intervention group 0.4 (95% CI, 0.25 to 0.45). Secondary outcome of plaque index had a significant decrease in the intervention group after 6 months 0.75 (95% CI, 0.6-0.8).
16. Comments/Limitations	<p>Comments:</p> <ul style="list-style-type: none"> • Quality assessment of included studies in the article is completed with the Cochrane Handbook for Systematic Reviews of Interventions, and GRADE for the non-randomized studies • To focus on the PICO question in this review, only studies that targeted preschool children or those in ages 0 -6 years were extracted. <p>Major limitations reported by authors:</p> <ul style="list-style-type: none"> • 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.

	<p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> • Conflict resolution for quality assessments not stated
17. Conclusions	<ul style="list-style-type: none"> • Out of all the relevant interventions examined, oral health education was least effective way to prevent caries, only education will not make a difference. • Oral health promotion interventions that included supervised toothbrushing with fluoridated toothpaste or preventive oral care services were more effective in reducing caries in children. • Multi-component and multi-setting approaches to oral health also resulted in positive outcomes (oral health education, motivational interviewing, training non-dental professionals or fluoride varnish) • Interventions focused on diet or reduction in sugar intake may be able to reduce caries but further research is required.

Items Reviewed	Review #2: Systematic review by Chou et al., 2013
General Information & Quality Rating for Review	
1. Citation	Chou, R., Cantor, A., Zakher, B., Mitchell, J. P., & Pappas, M. (2013). Preventing dental caries in children < 5 years: Systematic review updating USPSTF recommendation. <i>Pediatrics</i> , peds-2013.
2. Country	Corresponding author from United States <ul style="list-style-type: none"> • Studies were from the United States (n=8) while others varied in location China (n=3), Canada (n=1), Japan (n=1), Sweden (n=1), Saudi Arabia (n=1), Finland (n=1)
3. Quality Rating	Appraised using the Health-Evidence Quality Assessment Tool- 9/10 (Strong)
4. Objectives of Review	<p>The review aimed to address the following questions:</p> <ol style="list-style-type: none"> 1) How effective is oral screening (including risk assessment) by the primary care clinician in preventing dental caries in children younger than 5 years of age? 2) How accurate is screening by the primary care clinician in identifying children younger than 5 years of age who: a. Have cavitated or non-cavitated caries lesions? b. Are at increased risk for future dental caries? 3) What are the harms of oral health screening by the primary care clinician? 4) How effective is parental or caregiver oral health education by the primary care clinician in preventing dental caries in children younger than 5 years of age? 5) How effective is referral by a primary care clinician to a dentist in preventing dental caries in children younger than 5 years of age? 6) How effective is preventive treatment (dietary fluoride supplementation, topical fluoride application, or xylitol) in preventing dental caries in children younger than 5 years of age? 7) What are the harms of specific oral health interventions for prevention of dental caries in children younger than 5 years of age (parental or caregiver oral health education, referral to a dentist, and preventive treatments)? <p>Note: Questions #1-3 were excluded as they did not meet the PICO.</p>

Details of Review	
5. Number/types of studies included with quality rating	<p>16 primary studies specifically address the PICO question in this review:</p> <ul style="list-style-type: none"> • RCT rated fair (n=8); poor (n=1) • Cluster RCT rated fair (n=1); rated good (n=2); poor (n=1) • Controlled clinical trial rated poor (n=1) • Cohort study rated fair (n=1) • SR rated good (n=1)
6. Search Period	1946-2013
7. Number/types of databases searched	<ul style="list-style-type: none"> • Three databases: Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews and Ovid MEDLINE • Additional articles were identified through reviewing reference lists
8. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> • <u>Inclusion:</u> (1) Healthy children less than 5 years of age (2) Interventions include: oral screening by primary care physicians; parent/caregiver oral health education or dentist referrals; preventive treatment (oral fluoride, supplements topical fluoride application or xylitol); (3) Outcomes of interest: reduced dental caries or dental fluorosis (4) Types of studies included are RCT, randomized controlled clinical trial and cohort studies and systematic reviews; (5) English articles. • <u>Exclusion:</u> (1) Animal studies, adults or children over the age of 5, unhealthy; (2) Community or school based interventions; interventions not in primary settings; treatments not available for preschool children or in the United States; (3) Excluded studies that had the outcome of cost-effectiveness; (4) Case-control, uncontrolled intervention studies or opinion/editorials/case reports are excluded; (5) Non-English articles.
Details of Interventions	
9. Target groups	<ul style="list-style-type: none"> • Asymptomatic children younger than the age of 5 years, including those who have existing dental caries who may need treatment
10. Description of interventions (type, delivery method)	<p>Note: None of the interventions used the same method of delivery making each trial unique.</p> <p>Oral health education: (n=1)</p> <ul style="list-style-type: none"> • 1 study had a community approach with a series of interventions by health visitors such as giving parents educational materials, counselling on oral hygiene and provision of toothbrush/toothpaste. The control group received no intervention. <p>Preventive treatment: (n=15)</p> <p>Topical fluoride: (n=6)</p> <ul style="list-style-type: none"> • 1/6 studies looked into the effect of applying fluoride varnish every 6 months by a dental professional to reduce caries. This study had no intervention for the control. • 2/6 studies evaluated topical fluoride where one study applied acidulated phosphate fluoride foam every 6 month, the control received placebo foam. The other study compared the application of silver diamine fluoride to fluoride varnish for 3 months. • 3/6 studies compared multiple fluoride varnish application in various frequencies. <ul style="list-style-type: none"> • 1/3 studies compared fluoride varnish application within 2 weeks from baseline vs 6 months. • 1/3 studies compared the difference between once vs. twice yearly application of fluoride varnish. • 1/3 studies compared fluoride applications of 2X per year vs 1 per year vs no fluoride.

	<p>Xylitol: (n=6)</p> <ul style="list-style-type: none"> • 4/6 studies examined the effect of xylitol but varied in doses and formulation (tablets or wipes) and the control group received no intervention. • 2/6 studies compared xylitol to fluoride where one study compared xylitol gum (3 times/day) to topical fluoride (tooth brushing with fluoride) and the other compared xylitol tablets to fluoride varnish once every 6 months. <p>Other: (n=3)</p> <ul style="list-style-type: none"> • 1/3 studies applied chlorhexidine acetate varnish to see an association in decreasing the rate of caries. The control group received placebo varnish. • 1/3 studies looked at the application of povidone-iodine solution every 2 months to see the effect on white spot lesions. The control group received placebo solution. • 1/3 studies reported on the association of fluoride supplements and risk of developing fluorosis.
11. Intervention settings	Majority of the studies took place in a clinical setting (n=8), community (n= 3), school/daycare setting (n=5)
12. Theoretical frameworks	N/A
13. Primary Outcomes	<ul style="list-style-type: none"> • Caries experience (e.g., rate of caries dmft/dmfs, caries lesions, new tooth decay, incidence of decay. • Any harms or complications (such as fluorosis).
Results of Review	
14. Meta-analysis?	No, due to methodology limitations within the included studies and heterogeneity in design
15. Main Results of Review	<p>Oral health education: (n=1)</p> <ul style="list-style-type: none"> • 1 study reported a positive effect and reported a lower prevalence of caries (54 vs. 64%; p=0.03) and dmft (2.2 vs. 3.7; p<0.001). <p>Preventive treatment: (n=15)</p> <p>Topical fluoride: (n=6)</p> <ul style="list-style-type: none"> • 1/6 studies reported an insignificant effect although a reduction in dmfs was found to be 18% with applying fluoride varnish every 6 months vs. no fluoride varnish. • 2/6 studies reported a positive effect that topical fluoride was more effective than the placebo. Acidulated phosphate fluoride foam vs. placebo foam had a net dmfs increment of 3.8 vs. 5.0; p=0.03; silver diamine fluoride vs. fluoride varnish had absolute reduction in caries increment: 1.32 vs. 0.88. • 2/6 studies reported insignificant effect with different frequencies of fluoride varnish application by comparing 2 weeks from baseline vs 6 months with clinical dmfs increment: 4.6 vs 3.2 vs 4.7 p=0.65; multiple fluoride applications every 6 months vs 3 treatments over 2 weeks that reduced dmfs by 24%. • 1/6 studies reported a positive effect with a 59% reduction in dmfs by applying fluoride varnish 2X a year vs 1 per year. <p>Xylitol: (n=6)</p> <ul style="list-style-type: none"> • 1/6 study showed a positive effect of using xylitol wipes vs. placebo wipes resulting in a 91% reduction of dmfs (p<0.05). • 1/6 studies found no effect in chewing xylitol gum 3X per day vs. brushing with fluoride. Caries increment: xylitol gum: 57% (177/310) vs.

	<p>toothbrushing 49% (213/434), RR 1.16 (95% CI 1.02 to 1.33). 11% Participants in the xylitol group experienced side effects of diarrhea.</p> <ul style="list-style-type: none"> • 1/6 studies that compared xylitol gum vs. no gum reported no effect. • 1/6 studies found a positive effect of xylitol chewable tablets (1.2g 3X daily) than fluoride varnish every 6 month with reduction in caries increment of 82%. • 1/6 studies that compared xylitol tablets vs. no tablets reported no effect. • 1/6 studies found a positive effect when comparing different doses of xylitol syrup (8g/day vs 2.67g) in reducing caries. Reduction in caries increment: (8g/day) 68% vs. (2.67g/day) 47%. 11% of participants in both groups experience loose stool or diarrhea. <p>Other: (n=3)</p> <ul style="list-style-type: none"> • 1/3 studies reported a positive effect of applying chlorhexidine varnish with 37% reduction in dmfs. • 1/3 studies reported an insignificant effect on the incidence of white spot lesions (8 vs. 32%; relative risk [RR], 0.24; 95% CI, 0.1 to 0.8). • 1/3 studies reported risk of fluorosis due to fluoride supplements (OR 10.8 95% CI, 1.9 to 62).
16. Comments/Limitations	<p>Comments:</p> <ul style="list-style-type: none"> • Quality assessment of included studies in the article is completed with the USPSTF criteria as “good, fair or poor”. <p>Major limitations reported by authors:</p> <ul style="list-style-type: none"> • The exclusion of non-English language articles may result in language bias. • There were limited randomized trials found to address the key research questions. This resulted in the use of nonrandomized and observational studies which are more susceptible to bias and confounding factors. <p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> • According to the quality appraisal through Health Evidence, the search strategy was considered not comprehensive enough as only health databases and reference lists were examined.
17. Conclusions	<p>The following recommendations are from USPSTF:</p> <ul style="list-style-type: none"> • Children from 0-5 years of age: primary care clinicians prescribe oral fluoride supplementation starting at age 6 months for children whose water supply is deficient in fluoride. Also, primary care clinicians apply fluoride varnish to the primary teeth of all infants and children starting at the age of primary tooth eruption. • The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of routine screening examinations for dental caries performed by primary care clinicians in children from birth to age 5 years.

Items Reviewed	Review #3: Meta-analysis by Santos et al., 2013
General Information & Quality Rating for Review	
1. Citation	Santos, A. P. P., Oliveira, B. H., & Nadanovsky, P. (2013). Effects of low and standard fluoride toothpastes on caries and fluorosis: systematic review and meta-analysis. <i>Caries research</i> , 47(5), 382-390.
2. Country	Corresponding author from Brazil <ul style="list-style-type: none"> • Most of the studies were from England (2) and others varied Sweden (1) Germany (1) Brazil (1)
3. Quality Rating	Appraised using the Health-Evidence Quality Assessment Tool-9/10 (Strong) <ul style="list-style-type: none"> • Quality assessment of included studies in the article is completed with the Cochrane Collaboration Tool
4. Objectives of Review	The review aimed to evaluate the effects of low and standard fluoride toothpaste on the prevention of caries in the primary dentition of preschoolers and moderate forms of fluorosis in permanent dentition.
Details of Review	
5. Number/types of primary studies Included with quality rating	Five primary studies are included in this review: <ul style="list-style-type: none"> • Controlled clinical trial with low risk of bias (n=2) • Controlled clinical trial with high risk of bias (n=2) • Cluster randomized trial with low risk of bias (n=1)
6. Search Period	Inception-2012
7. Number of databases searched	<ul style="list-style-type: none"> • 10 databases: Cochrane Central Register of Controlled Trials, MEDLINE via PubMed, EMBASE, Web of Science, LILACS, and Brazilian Library of Dentistry. Current clinical trials were searched through a Brazilian database of thesis and dissertations (Banco de Teses CAPES), a Brazilian register for projects involving human beings (SISNEP) and 2 international registers (Current Controlled Trials and ClinicalTrials.gov). • Additional articles were identified through grey literature by searching meeting abstracts of the International Association for Dental Research and the European Organisation for Caries Research. Hand search of 16 dental journals in the Cochrane Master List of Journals was also completed by two independent examiners. Specialists in the field were also approached.
8. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> • <u>Inclusion:</u> (1) Studies include individual or cluster-randomized/quasi randomized clinical trials with a follow-up period of at least 1 year (2) children under the age of 7 of when the outcome of caries is assessed (intervention should have taken place 0-6 years of age) (3) interventions that had low (<660 ppm) and standard (1,000-1,500 ppm) fluoride toothpastes regardless of formulation. • <u>Exclusion:</u> (1) Studies with participants over the age of 7 at the start of the study (2) Studies that had participants with special health or oral health conditions (3) any studies that looked at fluoride gel, fluoride mouth rinse, chlorhexidine, xylitol or dental sealants.
Details of Interventions	
9. Target groups	<ul style="list-style-type: none"> • Asymptomatic children younger than the age of 7 years at the time of assessment
10. Description of interventions (type, delivery method)	<p>Note: Although all studies (n=5) compared low to standard fluoride (F) toothpaste, each study had a unique formulation in the dose of fluoride:</p> <ul style="list-style-type: none"> • 1/5 studies compared 440 ppm F toothpaste in the test group and 1450 ppm F toothpaste in the control group. To compliment the intervention a leaflet was provided to parents with instructions. • 1/5 studies examined the difference between providing 250 ppm in the test group to 1000 ppm in the control group. • 1/5 studies provided 250 ppm F in the test group in comparison to 1450 ppm in the control group. This study had a school and home

	<p>setting whereas at home all children used 250 ppm F toothpaste.</p> <ul style="list-style-type: none"> • 2/5 studies compared 550 ppm F in the test group but differed in the control group where one study looked at to 1100 ppm F toothpaste using the “drop” technique and the other study provided 1055 ppm toothpaste as a pea sized amount in the control.
11. Intervention settings	<ul style="list-style-type: none"> • 4/5 studies occurred within the home setting where parents were provided with instructions of brushing the child’s teeth daily, and the amount. • 1/5 studies took place in the school setting where children were supervised by kindergarten teachers
12. Theoretical frameworks	N/A
13. Primary Outcomes	<ul style="list-style-type: none"> • Enamel and dentine caries in primary dentition • Moderate to severe fluorosis in permanent dentition (no age limit for the assessment of fluorosis)
Results of Review	
14. Meta-analysis?	<p>Yes, pooled relative risks [RR] and 95% confidence intervals were estimated for the development of caries and fluorosis in permanent teeth. Numbers needed to treat for additional harmful outcome (NNT) were found by applying the pooled RR of caries to three different scenarios: high (70%), medium (50%) and low (20%) 5 year caries incidence. No meta-analyses were done for the difference in means as data regarding caries incidence at tooth and surface level was highly skewed.</p> <p>NNT is the number of children that needed to use low F toothpaste as opposed to standard F toothpaste in order for 1 child to be harmed (i.e., to develop at least one caries lesion).</p>
15. Main Results of Review	<ul style="list-style-type: none"> • 3/5 studies reported a significant effect of caries developing in children where the pooled RR was 1.13 (1.07-1.20). NNTs were 11 (7-20), 15 (10-28) and 38 (25-71) for high, medium and low incidence of caries. • 2/5 studies reported a significant effect on the incidence of caries in primary teeth also reported on fluorosis with a pooled RR of 0.32 (0.03-2.97). However, the authors considered this RR to be imprecise.
16. Comments/Limitations	<p>Major limitations reported by authors:</p> <ul style="list-style-type: none"> • Majority of the studies had 20% loss to follow up. • Baseline data regarding caries level, age, gender, and socioeconomic status wasn’t possible to evaluate. • 2/5 trials lasted less than 2 years which is considered to be insufficient to determine a significant number of lesions. <p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> • In the conclusions of the review, the authors discussed findings from trials that were not included as a part of the review. This made it difficult to connect the authors’ findings to the evidence.
17. Conclusions	<ul style="list-style-type: none"> • Overall, the results showed that children who brushed their teeth with low fluoridated toothpaste had an increased risk of developing caries at dentine level in primary teeth and did not decrease the risk of fluorosis in upper permanent anterior teeth.

Items Reviewed	Review #4: Systematic review by El Fadl et al., 2016
General Information & Quality Rating for Review	
1. Citation	El Fadl, R. A., Blair, M., & Hassounah, S. (2016). Integrating Maternal and Children's Oral Health Promotion into Nursing and Midwifery Practice-A Systematic Review. <i>PloS one</i> , 11(11), e0166760.
2. Country	Corresponding author is from the U.K. <ul style="list-style-type: none"> Majority of the studies were from the United States (n=8). Other countries included: U.K. (n=3), Brazil (n=1), Iran (n=2), Belgium (n=1), Australia (n=1), India (n=1).
3. Quality Rating	Appraised using the Health-Evidence Quality Assessment Tool =8/10 (Strong). <ul style="list-style-type: none"> Quality assessment of included studies in the article is completed with the Cochrane Collaboration Tool for assessing risk of bias for RCT's and Downs and Blacks assessment tool for non-randomized trials.
4. Objectives of Review	The aim of this review was to gather evidence on the effectiveness of integrating oral health promotion into basic services delivered by nurses and midwives to childbearing women and very young children.
Details of Review	
5. Number/types of primary studies with quality rating	16 primary studies are in this review: <ul style="list-style-type: none"> Quasi-experimental with pre/post-test design had D&B score of good (n=1) Quasi-experimental with pre/post-test design had D&B score of poor (n=3) Quasi-experimental with equivalent comparison gps with D&B score of good (n=2); poor (n=1) Historically-controlled non-randomized study with a D&B score of good (n=1) Cluster RCT with low risk of bias (n=1) RCT with unclear risk of bias (n=1); low risk of bias (n=2); high risk of bias (n=4) <p>Note: The total Down & Black score (D&B) ranges from 0-27, with excellent (26-27); good (20-25); and poor (<14)</p>
6. Search Period	Inception-2015
7. Number/ types of databases searched	<ul style="list-style-type: none"> Seven databases: CENTRAL, EMABSE, MEDLINE, GLOBAL HEALTH, CINHAL, Scopus, Web of Science Additional articles were identified through a grey literature search consisting of conference proceedings/theses through PROQUEST. Reference lists of studies were also cross-referenced.
8. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> <u>Inclusion:</u> (1) Pregnant women and caregivers of children 0-5 years; (2) preventive oral health services such as education or screening by nurses or midwives; programs in clinical or household settings; (3) outcomes such as caries increment, change in oral health behaviour/knowledge or rate of dental visits; (4) types of study include RCT, cluster RCT, quasi-experimental or observational. <u>Exclusion:</u> (1) Caregivers of children more than 5 years of age or caregivers with special needs; (2) interventions where services are provided solely by other non-dental or dental providers, programs providing restorative or rehab care and programs in school or dental settings; (3) economic evaluation of interventions; (4) articles that are reviews, abstracts, editorials or expert opinions are excluded.
Details of Interventions	
9. Target groups	<ul style="list-style-type: none"> Healthy pregnant mothers or caregivers for children from ages 0-5 years.

10. Description of interventions (type, delivery method)	<p>Note: None of the interventions used the same method of delivery or frequency, making each trial unique.</p> <ul style="list-style-type: none"> All 16 studies had an educational component independently or in addition to preventive services. The delivery method and frequency were unique in each trial. None of the studies reported on what intervention the control group received. <p>Oral health education: (n=5)</p> <ul style="list-style-type: none"> 4/5 studies provided oral health education during home visits. <ul style="list-style-type: none"> 1/3 studies offered nutritional counselling; 3/5 studies provided oral health counselling over various periods of time. 1/2 studies had home visits with video sessions for 8-10 weeks. <p>Oral health education + oral health materials : (n=5)</p> <ul style="list-style-type: none"> 1/5 studies provided oral health counselling, oral health kit, dental registration vouchers and home visits at 7 weeks, 8 months and 18 months. 2/5 studies provided oral health education plus oral health materials (toothbrush, paste and feeding cups) and; <ul style="list-style-type: none"> 1/2 studies showed educational videos; 1/2 studies provided oral health counselling 2/5 studies gave print information (i.e., brochures) and; <ul style="list-style-type: none"> 1/2 studies had role play exercises; 1/2 studies had a counselling session with follow-up phone calls reminders for 6 months. <p>Oral health education + preventive treatment: (n=6)</p> <ul style="list-style-type: none"> 2/6 studies provided oral health education in home visit plus dental referral. 4/6 studies provided preventative service in addition to oral health counselling. <ul style="list-style-type: none"> 2/4 studies had dental screening, fluoride varnish and counselling but differed in frequency where one trial lasted for 14 months and another over 6 medical visits. 2/4 studies gave fluoride application and counselling as a onetime intervention.
11. Intervention settings	The studies took place in a variety of settings: home (n=6); community (n=4); clinic (n=5); both community centre and clinic (n=1)
12. Theoretical frameworks	N/A
13. Primary Outcomes	<ul style="list-style-type: none"> Parental oral health knowledge/ Adherence to oral hygiene measures Caries experience Rates of dental attendance
Results of Review	
14. Meta-analysis?	No, there was heterogeneity across studies due to differences in population characteristics therefore authors completed a narrative synthesis rather than meta-analysis.

<p>15. Main Results of Review</p>	<p>Note: the authors did not provide the magnitude of effect. Interventions were rated as (+): significant improvement (0), insignificant difference (-), no measurement reported. Outcomes measured: caries experience, oral health knowledge and utilization of dental care. Some studies measured more than 1 outcome.</p> <p>Oral health education only: (n=5) Caries experience: (n=3)</p> <ul style="list-style-type: none"> • 1/3 studies reported significant improvement. • 2/3 studies reported insignificant differences between intervention and control group. <p>Oral health knowledge: (n=4)</p> <ul style="list-style-type: none"> • 3/4 studies reported significant improvement. • 1/4 studies reported insignificant differences between intervention and control group. <p>Utilization of dental care: (n=2)</p> <ul style="list-style-type: none"> • 1/2 studies reported significant improvement. • 1/2 studies reported insignificant differences between intervention and control group.. <p>Oral health education + oral health materials: (n=5) Caries experience: (n=4)</p> <ul style="list-style-type: none"> • 3/4 studies reported significant improvement. • 1/4 studies reported insignificant differences between intervention and control group. <p>Oral health knowledge: (n=2)</p> <ul style="list-style-type: none"> • 1/2 studies reported significant improvement. • 1/2 studies reported insignificant differences between intervention and control group. <p>Utilization of dental care: (n=1)</p> <ul style="list-style-type: none"> • 1 study reported insignificant differences between intervention and control group. <p>Oral health education+ preventive services: (n=6) Caries experience: (n=2)</p> <ul style="list-style-type: none"> • 2/2 studies reported a significant improvement. <p>Oral health knowledge: (n=2)</p> <ul style="list-style-type: none"> • 2/2 studies reported a significant improvement.
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	<p>Utilization of dental care: (n=3)</p> <ul style="list-style-type: none"> • 3/3 reported a significant improvement. <p>Overall:</p> <ul style="list-style-type: none"> • 9/16 studies examined caries experience: 3/9 reported insignificant differences, 6/9 studies had a significant improvement on caries experience. • 8/16 studies evaluated oral health knowledge, 2/8 reported insignificant difference, 6/8 studies had an improvement in knowledge. • 8/16 trials measured the utilization of dental care, 2/8 reported no difference, 6/8 reported improvement in dental visits.
16. Comments/Limitations	<p>Major limitations reported by authors:</p> <ul style="list-style-type: none"> • Although RCT's are gold standard, it was difficult to find evidence from high quality low bias RCT. • This review completed a narrative synthesis rather than meta-analysis. • Qualitative studies were not taken into consideration. <p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> • According to the quality appraisal through Health Evidence, this review lacked transparency around the results of the review and did not weigh the studies adequately.
17. Conclusions	<ul style="list-style-type: none"> • There is moderate evidence that inter-professional collaboration and focus, especially when embedded into an existing child-care system results in improved child and to a lesser extent maternal oral health status and reduces oral health disparities within disadvantaged populations.

Items Reviewed	Review #5: SIGN 138-Dental Interventions to Prevent Caries in Children (2014)
General Information & Quality Rating for Review	
1. Citation	Scottish Intercollegiate Guidelines Network (SIGN). (2014). Dental interventions to prevent caries in children (<i>SIGN publication no.138</i>). Scotland: Author. Retrieved from http://www.sign.ac.uk/pdf/SIGN138.pdf
2. Organization & Country	Scottish Intercollegiate Guidelines Network (SIGN), Scotland
3. Quality Rating	Appraised using the Agree II tool 6-7/10 (moderate)
4. Objectives of Review	The guideline aims to provide recommendations for best practice in dental interventions at the individual level to prevent caries in children and youth from ages 0-18 years. Note: For the purpose of this review, interventions that target preschool children from 0-6 years of age were extracted
5. Target audience (for Guideline)	Any health care professionals that may provide oral health advice or service to children in a one-to-one context specifically those who belong to a dental care team. Parents or caregivers, primary care and public health professionals involved in children's health, social and education services may be interested.
Details of Review	
6. Number/types of primary studies included with quality rating	21 studies specifically addressed the PICO: <ul style="list-style-type: none"> • RCT very low risk of bias (n=1); low risk of bias (n=3); high risk of bias (n=1); • Controlled clinical trial low risk of bias (n=1) • High quality meta-analysis with very low risk of bias (n=2) • High quality systematic review of case control with very low risk bias (n=1); systematic reviews with very low risk of bias (n=7) • Expert Opinion (n=1) • Non-analytic studies (n=3) • Case control with high risk of confounding bias (n=1)
7. Search Period	2000-2011
8. Number/types of databases searched	<ul style="list-style-type: none"> • Seven databases: CENTRAL, EMABSE, MEDLINE, GLOBAL HEALTH, CINHAL, Scopus, Web of Science • Additional articles were identified through a grey literature search consisting of conference proceedings/theses through PROQUEST. Reference lists of studies were also cross-referenced.
9. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> • <u>Inclusion:</u> Studies looking at individual interventions for children 0-18 years of age to prevent caries; • <u>Exclusion:</u> (1) Studies looking at community level interventions to prevent caries; (2) non-English speaking articles
Details of interventions	
10. Target groups	<ul style="list-style-type: none"> • Children and youth aged 0-18 years old
11. Description of interventions (type, delivery method)	Note: The SIGN 138 guideline did not provide specific details on the description of the interventions and did not provide additional supplementary material. <ul style="list-style-type: none"> • Interventions were individual level rather than community. • The type of interventions varied: oral health promotion, supervised toothbrushing, toothbrushing with fluoride toothpaste, topical fluoride
12. Intervention setting	<ul style="list-style-type: none"> • Interventions were delivered in clinical (e.g., dental office) and non-clinical (e.g., within child's home, school, nursery).
13. Primary outcomes	<ul style="list-style-type: none"> • Prevention of dental caries • Fluorosis

Results of the Guideline

14. Relevant Recommendations

Recommendation 1: Oral health promotion interventions should facilitate daily toothbrushing with fluoride toothpaste

Related evidence (n= 2 studies):

- 1/2 studies provided new mothers with oral health information for infants resulting in a statistically significant decrease in the severity of caries. The intervention group was 1.7% lower whereas the control group was 9.6% ($p < 0.05$).
- 1/2 studies evaluated an oral health promotion program where parents were given oral health education, dietary guidance and support for daily toothbrushing in preventing caries in 2-3 year olds. The trial found that the interventional group had a lower dmft score than the control group after one year (3.0 v. 4.4, $p < 0.01$.)

Recommendation 2: Oral health promotion interventions should be based on recognised health behaviour theory and models such as motivational interviewing.

Related evidence: (n=2)

- 1/2 studies considered motivational interviewing be effective in changing oral health behaviours. One study found mothers to increase toothbrushing episodes (regardless of only four weeks of follow up).
- 1/2 studies reported a 45-minute motivational interviewing session to be most effective with a 46% reduction in dmfs compared to other groups after a 2 year follow-up (Hazard Ratio [HR]= 0.54, 95% CI: 0.35 to 0.84).

Recommendation 3: To reduce risk of mild fluorosis and reinforce good oral health the amount of toothpaste used by children up to the age of three years should be supervised.

Related evidence: (n=2)

- 1/2 studies was a meta-analysis that reported the standard concentration of fluoride toothpaste 1000-1500 ppmF reduced caries in primary teeth compared to placebo or no intervention (dmfs PF 31%, 95%CI 18 to 43%).
- 1/2 studies was another meta-analysis that reported statistically significant reduction in fluorosis if brushing a child's teeth fluoride toothpaste started after the age of 12 months (OR= 0.70, 95%CI: 0.57 to 0.88). This study did not find a consistent association between starting to use fluoridated toothpaste before or after 24 months and fluorosis. Frequency of toothbrushing (less than twice daily compared with twice daily or more) had no association (OR= 0.88, 95%CI: 0.71 to 1.08).

Recommendation 3.1: Following risk assessment, children up to the age of 10 years who are at increased risk of developing dental caries should be advised to use toothpastes at 1,500 ppmF.

Related evidence: (n=1)

- One study reported on harms related to certain concentrations of fluoride in toothpaste and the risk of developing fluorosis. Results from two RCT's within a systematic review were considered. One RCT compared 550 with 1,000 ppmF and the other compared 440 with 1,450 ppmF. Both studies found statistically significant differences (relative risk (RR) 0.75, 95%CI 0.57 to 0.99) and (RR 0.59, 95%CI 0.44 to 0.79)

indicating that a higher concentration of fluoride toothpaste was associated with increased risk of fluorosis. Meta-analysis of three cross-sectional surveys did not show a significant association between concentrations of fluoride and risk of fluorosis (OR = 0.79, 95%CI 0.61 to 1.02).

Recommendation 3.2: Supervision of toothbrushing with fluoride toothpaste is recommended as an effective caries prevention measure. Children who are unable to brush their teeth unaided should be assisted to do so.

Related evidence: (n=2)

- 1/2 studies measured caries increment following an intervention comparing daily teacher-supervised toothbrushing vs. no intervention and found a significantly lower overall caries increment in the group who had supervision of brushing (2.60 v 2.92; p<0.001).
- 1/2 studies was an expert opinion paper that confirmed that supervised brushing is important when regulating the quantity of toothpaste applied to the brush and the tendency of children swallowing the toothpaste therefore increasing risk of fluorosis.

Recommendation 3.3: Children should be assisted to brush their teeth as soon as they erupt.

Related evidence: (n=2)

- 1/2 studies was a national diet and nutrition survey report that found that the younger children are when they start toothbrushing, the lower the proportion developing tooth decay. 88% of children who started brushing before the age of 1 remained caries free, whereas 81% of those who started between the age of 1-2 years of age and 66% of those who started after the age of 2 years (p<0.01).
- 1/2 studies demonstrated 46% likelihood of remaining caries free if brushing commences before three years of age as opposed to 36% if older than three years of age at commencement of brushing. The earlier toothbrushing commences (particularly before the age of two) the larger the decrease in caries risk.

Recommendation 4: Fluoride varnish should be applied at least twice yearly in all children.

Related evidence: (n=4)

- All four studies reported that fluoride varnish substantially reduced caries increment in most of the studies but the size of effect did vary.
- 1/4 studies which is the most recent and updated systematic review reported a pooled DMFS prevented fraction of 43% (95% CI 30% to 57%) compared to placebo and control (no treatment). Specifically, the effect of fluoride varnish on primary teeth was also statistically significant with a pooled dmfs prevented fraction of 37% (95% CI 24% to 51%).
- 1/4 studies reported through meta-regression, and found no significant effect regarding the frequency of fluoride varnish application among primary teeth (slope estimates 5.09%, 95% CI -19.33% to 29.51%, p=0.64) suggesting that 4 applications per year did not make a difference in comparison to a twice-yearly application.
- 1/4 studies recommended twice-yearly application in those who are at high risk of caries.

	<p>Of the 21 primary studies, the following six studies had insufficient evidence to make a recommendation:</p> <p>Dental floss: (n=1)</p> <ul style="list-style-type: none"> One study looked at the application of chlorhexidine gluconate (CHX) gel which is related to flossing in primary children (ages 4-6). Results show that the number of children that did not have any caries lesions on the proximal tooth surfaces was significantly higher in the CHX group (49.2%) than the no flossing group (25.9%; $p < 0.01$). However outcome assessment was not fully blinded and reporting was incomplete resulting in insufficient quality and consistency of evidence to make a recommendation <p>Chlorhexidine varnish: (n=1)</p> <ul style="list-style-type: none"> One study looked at topical chlorhexidine varnish (CHX) for children and reported no significant difference between CHX varnish and placement or no treatment in caries increment. There were also conflicting results from “split mouth trials” with two studies. Therefore it is not possible to make a recommendation on the use of CHX varnish due to inconclusive results of relevant studies and their low methodological quality <p>Fluoride gel: (n=2)</p> <ul style="list-style-type: none"> 1/2 studies included one RCT that investigated topical fluoride concentrations in 3-4 year old children. The study concluded that increased frequency of application of low-fluoride solution (10 times per year) may provide caries protection in preschool children. 1/2 studies reported that the effect of fluoride gel varies according to the type of control used with DMFS prevented fraction on average being 19% (95% CI 5% to 33%; $p < 0.009$) higher in non-placebo-controlled trials. Overall, the high frequency of application to reduce caries is a barrier to its use and practicality in application. Fluoride gel has been used where there is a lack of daily use of fluoride such as no fluoridated toothpaste or community fluoridated water. No recommendation can be given as complete absence of fluoride toothpaste is unlikely. Providing children with fluoride toothpaste daily is a feasible intervention. <p>Fluoride drops or tablets: (n=2)</p> <ul style="list-style-type: none"> 1/2 studies included a trial for primary dentition that had a high level of bias (83% drop-out rate). The trial provided expecting mothers and children from birth-3 years of age with fluoride supplements. The study found that there is no difference between the intervention and control group in developing caries (RR 0.90, 95% CI 0.41 to 1.97). The study was conducted at the time where fluoride toothpaste was not widely available so the magnitude of the effect may be lower (in combination with fluoride toothpaste)
15. Comments/Limitations	<p>Comments:</p> <ul style="list-style-type: none"> Scotland has national Childsmile programme (www.child-smile.org) that provides free comprehensive public health access for disease prevention and care to all children and young people up to the age of 17 years. Guideline includes a caries assessment section to aid with identifying those at high caries risk <p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> Authors did not clearly state the inclusion and exclusion criteria Some recommendations are vague and require more detail

Appendix E: Detailed Data Synthesis table

Types of Interventions	Intervention components and comparator	Types of outcomes reported	Effect	Summary
Fluoridated toothpaste <i>Santos et al., 2013: (n=5)</i> <i>SIGN 138, 2014: (n=2)</i>	Combination of comparing standard fluoridated (1000-1500 ppmf) toothpaste vs. placebo or vs. low fluoridated toothpaste (250-550ppmf)	Caries experience	↑ (n=1)	Children experienced 31% (95% CI 18 to 43%) reduction in caries by using standard fluoridated toothpaste. If children used low fluoridated toothpaste it increased the risk of caries (RR of 1.13 (1.07-1.20) and did not decrease the risk of developing fluorosis (RR of 0.32 (0.03-2.97).
		Fluorosis	↔ (n=5) ↓ (n=1)	
	Compared using standard fluoridated toothpaste at 12 months vs. 24 months	Fluorosis	↓ (n=1)	Children who started to brush their teeth after the age of 12 months experienced significant reduction in mild fluorosis (OR= 0.70, 95% CI: 0.57 to 0.88).
Topical fluoride varnish applications <i>Chou et al., 2013: (n=6)</i> <i>SIGN 138., 2014: (n=4)</i>	Applying 2.26% fluoride varnish vs no varnish at different frequencies	Caries experience	↑ (n=5) ↔ (n=3)	In children 0-6 years of age, twice-yearly fluoride varnish application reduced caries by 37-59%.
	Various types of topical fluoride application: 38% silver diamine fluoride every 12 months vs 2.26% fluoride varnish every 3 months; 1.23% acidulated phosphate fluoride foam vs placebo foam every 6 months)		↑ (n=2)	Different types of fluoride application were more effect than the control as net caries increment ranged from 1.32-3.8 (p=0.03).
Other clinical intervention: Fluoride supplementation <i>Chou et al., 2013 (n=1)</i>	Dietary fluoride supplements	Fluorosis	↓ (n=1)	Fluoride supplements in children under the age of 5 are associated with increased risk of fluorosis (OR=10.8, 95% CI: 1.9 to 62).
Other clinical intervention: Xylitol <i>Chou et al., 2013 (n=6)</i>	Combination of: xylitol tablets, xylitol gum vs. no gum, different frequencies of xylitol syrup, xylitol wipes vs placebo	Caries experience	↑ (n=3) ↔ (n=3)	Mixed effects were reported among the trials (n=6), however xylitol wipes used three times per day for 1 year was more effective than placebo wipes with a reduction in caries increment by 91% (p<0.05).
		Adverse effect	↓ (n=2)	

Other unique clinical interventions <i>Chou et al., 2013: (n=2)</i>	40% w/w chlorhexidine acetate varnish every 6 months vs. placebo.	Caries experience	↑ (n=1)	Unique clinical applications were more effective than the control as they reduced caries increment by 24-37%.
	0.2 ml of 10% povidone iodine solution every 2 months vs placebo.		↑ (n=1)	
Policy change <i>de Silva et al., 2016 (n=1)</i>	Adapted an revised dietary guideline in a nursery setting to reduce sugar intake vs not adopting guideline.	Caries experience	↑ (n=1)	The revised guideline reduced dmfs by -1.48 (95% CI -2.51 to -0.45).
Oral health education + supervised toothbrushing <i>SIGN 138, 2014 (n=6)</i> <i>de Silva et al., 2016 (n=3)</i>	Combination of topics (nutrition, toothbrushing) in various settings (in-home, kindergarten, nursery), for different frequencies over time.	Caries experience	↑ (n=9)	Children supervised by teachers or parents for toothbrushing experienced a mean difference in caries ranging from -2.70 to 1.09 (95% CI -4.43, 1.91).
Oral health education + preventive services <i>El Fadl et al., 2016 (n=6)</i> <i>de Silva et al., 2016 (n=4)</i>	Studies varied in education topics, types of preventive services and duration. Parents were given education on: nutrition or toothbrushing. Preventive services consisted of fluoride varnish, fluoride supplements and sealants.	Caries experience	↑ (n=3) ↔ (n=3)	Providing oral health education in addition to fluoride varnish reduced dmfs by of -3.00 [-4.91, -1.09] and reduced caries increment by 2.3-3.5 surfaces per child.
		Dental utilization	↑ (n=3)	
		Oral health knowledge	↑ (n=2)	
Oral health education + oral health materials <i>El Fadl et al., 2016 (n=5)</i> <i>de Silva et al., 2016 (n=2)</i> <i>Chou et al., 2013 (n=1)</i>	Oral health education varied in method of delivery (pamphlet, video, counselling) in addition to oral health kit consisting of various items (toothbrushes, fluoridated toothpastes).	Caries experience	↑ (n=5) ↔ (n=2)	5 out of 8 trials reported a positive effect on caries experience. Effect size NR.
		Dental utilization	↔ (n=1)	
Oral health education only <i>El Fadl et al., 2016 (n=5)</i> <i>de Silva et al., 2016 (n=3)</i> <i>SIGN 138, 2014 (n=2)</i>	All studies varied in topics, method of delivery and duration. Education on nutritional, oral hygiene practices, exclusive breastfeeding up to 6 months, pacifier use provided through counselling, motivational interviewing, print information and video. Some studies provided weekly, monthly and yearly support.	Caries experience	↑ (n=4) ↔ (n=4)	Mixed results from the trials (n=4) providing oral health education only. Only 1 out of 4 trials reported effect size with a reduction in caries dmfs by 46%.
		Dental utilization	↑ (n=1) ↔ (n=1)	There was limited evidence. Effect size NR.
		Oral health knowledge	↑ (n=3) ↔ (n=1)	3 out of 4 trials reported a positive effect in oral health knowledge. Effect size NR.

Note: Number of studies in each cell represents the number of single studies in the systematic review.

↑= positive effect, ↓ negative effect, ↔ not significant.

Appendix F: Applicability & Transferability Worksheet

Factors	Questions	Notes
Applicability (feasibility)		
Political acceptability or leverage	<ul style="list-style-type: none"> • Will the intervention be allowed or supported in current political climate? • Will this program enhance the stature of the organization? <ul style="list-style-type: none"> ○ <i>For example, are there reasons to do the program that relate to increasing the profile and/or create a positive image of public health?</i> • Will the public and target groups accept and support the intervention in its current format? 	
Social acceptability	<ul style="list-style-type: none"> • Will the target population find the intervention socially acceptable? Is it ethical? <ul style="list-style-type: none"> ○ <i>Consider how the program would be perceived by the population.</i> ○ <i>Consider the language and tone of the key messages.</i> ○ <i>Consider any assumptions you might have made about the population. Are they supported by the literature?</i> ○ <i>Consider the impact of your program and key messages on non-target groups.</i> 	
Available essential resources (personnel and financial)	<ul style="list-style-type: none"> • Who/what is available/essential for the local implementation? • Are they adequately trained? If not, is training available and affordable? • What is needed to tailor the intervention locally? • What are the full costs? <ul style="list-style-type: none"> ○ <i>Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports.</i> • Are the incremental health benefits worth the costs of the intervention? <ul style="list-style-type: none"> ○ <i>Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention.</i> ○ <i>Consider the cost of the program relative to the number of</i> 	

	<i>people that benefit/receive the intervention.</i>	
Organizational expertise and capacity	<ul style="list-style-type: none"> • Is the intervention to be offered in line with Peel Public Health’s 10-Year Strategic Plan (i.e., 2009-2019, ‘Staying Ahead of the Curve’)? • Does the intervention conform to existing legislation or regulations (either local or provincial)? • Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)? • Does the intervention lend itself to cross-departmental/divisional collaboration? • Any organizational barriers/structural issues or approval processes to be addressed? • Is the organization motivated (learning organization)? <ul style="list-style-type: none"> ○ <i>Consider organizational capacity/readiness and internal supports for staff learning.</i> 	
Transferability (generalizability)		
Magnitude of health issue in local setting	<ul style="list-style-type: none"> • What is the baseline prevalence of the health issue locally? • What is the difference in prevalence of the health issue (risk status) between study and local settings? <ul style="list-style-type: none"> ○ <i>Consider the Comprehensive Health Status Report, and related epidemiological reports.</i> 	
Magnitude of the “reach” and cost effectiveness of the intervention above	<ul style="list-style-type: none"> • Will the intervention appropriately reach the priority population(s)? <ul style="list-style-type: none"> ○ What will be the coverage of the priority population(s)? 	
Target population characteristics	<ul style="list-style-type: none"> • Are they comparable to the study population? • Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally? <ul style="list-style-type: none"> ○ <i>Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).</i> 	
Proposed Direction (after considering the above factors):		

