JDR CLINICAL & TRANSLATIONAL RESEARCH

Systematic review of evidence pertaining to factors that modify risk of early childhood caries

Journal:	*JDR Clinical & Translational Research*
Manuscript ID	CTR-18-RE-0094.R1
Manuscript Type:	Reviews
Date Submitted by the Author:	29-Nov-2018
Complete List of Authors:	Moynihan, Paula; Newcastle University, Centre for Oral Health Research Tanner, Louise; Newcastle University, Institute of Health and Society Holmes, Richard; Newcastle University, School of Dental Sciences Hillier-Brown, Frances; University of Durham, Faculty of Social Science and Health Mashayekhi , Atefeh ; Newcastle University, Institute of Health and Society Craig, Dawn; Newcastle University, Institute of Health & Society
Keywords:	infant feeding, breastfeeding, sugars, Fluoride(s)
Abstract:	INTRODUCTION: A systematic review of evidence on the impact of modifiable risk factors on early childhood caries (ECC) was conducted to inform recommendations in a WHO Manual on ECC prevention. OBJECTIVES: To systematically review published evidence pertaining to the effect on ECC of modifiable risk factors. METHODS: Twelve questions, prioritized by a WHO Expert Panel, relating to infant feeding, diet, oral hygiene and fluoride were addressed. Due to proven efficacy, questions pertaining to use of fluoride toothpaste were excluded. The target population was children aged <72 months. Data sources included MEDLINE, EMBASE, CINAHL, and PubMed. Included were all human epidemiological studies. The highest-level of evidence was used for evidence synthesis and where possible, meta-analysis. The review was conducted in accordance with the PRISMA statement. Evidence was assessed using the GRADE method. RESULTS: 627 of the 13,831 papers identified were screened in duplicate; of these 139 were included. The highest-level evidence indicated breastfeeding ≤ 24 months does not increase ECC risk, but suggested longer duration breastfeeding increases risk (low quality evidence). Low quality evidence indicated increased risk associated with consumption of sugars in bottles. Only one study had data on the impact of sugars in complementary foods; which increased risk. Moderate quality evidence showed a benefit of oral health education for care-givers (OR (95% CI) 0.39 (0.19, 0.80) P=0.009). Meta-analysis of data on the impact on ECC of living in a fluoridated area showed a significant effect (mean difference (95% CI) -1.25 (-1.24,-0.36) P=0.006). Limited, moderate and low quality data indicated a benefit of fluoride exposure from salt and milk respectively. CONCLUSION: The best available evidence indicates breastfeeding up to

	2 years of age does not increase ECC risk. Providing access to fluoridated water and educating care-givers are justified approaches to ECC prevention. Limiting sugars in bottles and complementary foods should

Date submitted: 9/10/2018

Date last revised: 11/29/2018

Date accepted: 12/18/2018

Systematic review of evidence pertaining to factors that modify risk of early childhood caries

Moynihan P [1,2,3], Tanner LM [3], Holmes R.D. [1,2], Hillier-Brown F [4], Mashayekhi A [3], Kelly SAM [5], Craig D [3].

School of Dental Sciences [1], Centre for Oral Health Research [2] Institute of Health & Society [3], Newcastle University.
Faculty of Social Sciences and Health, Durham University [4]
Cambridge Institute of Public Health, University of Cambridge, UK[5]

Abstract word count 299
Word count abstract to acknowledgements 5273
Number of figures 3
Number of tables 2
Number of references 49

Keywords: breastfeeding, sugars, fluoride, infant feeding

Knowledge Transfer Statement:

This research is being used by the WHO in developing a toolkit on the prevention and management of ECC. The information will guide governments in developing national oral health plans, and clinicians when providing preventive advice, including advice regarding infant feeding practices. It will help ensure advice is in line with current WHO guidelines and the best available evidence.

Abstract

INTRODUCTION: A systematic review of evidence on the impact of modifiable risk factors on early childhood caries (ECC) was conducted to inform recommendations in a WHO Manual on ECC prevention.

OBJECTIVES: To systematically review published evidence pertaining to the effect on ECC of modifiable risk factors.

METHODS: Twelve questions, prioritized by a WHO Expert Panel, relating to infant feeding, diet, oral hygiene and fluoride were addressed. Due to proven efficacy, questions pertaining to use of fluoride toothpaste were excluded. The target population was children aged <72 months. Data sources included MEDLINE, EMBASE, CINAHL, and PubMed. Included were all human epidemiological studies. The highest-level of evidence was used for evidence synthesis and where possible, meta-analysis. The review was conducted in accordance with the PRISMA statement. Evidence was assessed using the GRADE method.

RESULTS: 627 of the 13,831 papers identified were screened in duplicate; of these 139 were included. The highest-level evidence indicated breastfeeding ≤ 24 months does not increase ECC risk, but suggested longer duration breastfeeding increases risk (low quality evidence). Low quality evidence indicated increased risk associated with consumption of sugars in bottles. Only one study had data on the impact of sugars in complementary foods; which increased risk. Moderate quality evidence showed a benefit of oral health education for care-givers (OR (95% CI) 0.39 (0.19, 0.80) P=0.009). Meta-analysis of data on the impact on ECC of living in a fluoridated area showed a significant effect (mean difference (95% CI) -1.25 (-1.24,-0.36) P=0.006). Limited, moderate and low quality data indicated a benefit of fluoride exposure from salt and milk respectively.

CONCLUSION: The best available evidence indicates breastfeeding up to 2 years of age does not increase ECC risk. Providing access to fluoridated water and educating care-givers are justified approaches to ECC prevention. Limiting sugars in bottles and complementary foods should be part of this education.

Introduction

Early childhood caries (ECC) is a worldwide pandemic and is increasing rapidly in low and middle income countries where exposure to sugars has increased following nutrition transition. ECC may be defined as the presence of one or more non-cavitated or cavitated lesions, missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger (American Academy of Pediatric Dentistry 2015).

The highest prevalence of ECC is in Asia and Africa where the disease affects 36-85% and 38-45% of children aged under 6 years respectively. Prevalence is also higher in lower socioeconomic groups (Phantumvanit et al. 2018). The highest reported levels are in Cambodia and Indonesia where 90% of 3-5 year olds have a dmft >6.0. In many countries, especially in lower socioeconomic populations, ECC is untreated and, if severe, impacts on health and wellbeing, causing pain and potentially leading to life threatening infections requiring hospitalization. It is beyond the capacity of healthcare resources of most low and middle income countries to treat ECC as prevalence is high and treatment is expensive, especially if general anesthesia is required. An effective means of prevention is therefore of paramount importance.

ECC is caused by exposure to sugars through the diet (Moynihan and Kelly 2014); but a child is exposed to many factors that modify ultimate risk. There are factors that will modify exposure to sugars such as dietary patterns and drinking habits. There are also factors that potentially mitigate ECC and the effect of sugars, including oral hygiene practices and exposure to fluoride through a variety of means. WHO recommends exclusive breastfeeding for the first 6 months of life, followed by

continued breastfeeding with appropriate complementary feeding (foods and drinks other than breastmilk and infant formula) for up to 2 years or beyond (WHO 2018), although concerns over the impact on risk of ECC of breast feeding after 12 months of age have been raised (Tham et al. 2015). However, to date, no systematic review has specifically compared the impact of breastfeeding up to 12 months with breastfeeding up to two years, or the impact of breastfeeding up to 2 years with breastfeeding beyond 2 years. Moreover, most research has focused on comparing bottle versus breastfeeding and not on comparisons of breast versus cow's milk. Knowledge of which modifiable risk factors have most impact on risk of ECC is essential to inform programs of prevention.

In view of the global problem of ECC, a WHO Expert Consultation on Public Health Intervention against Early Childhood Caries was held in January 2016. The aim was to agree on a set of recommendations for a future action plan. The Consultation included narrative review of evidence for factors that impact on risk of ECC (WHO 2016). However, recommendations need to be based on systematic review of the best available evidence (WHO 2014) and be in line with WHOs common risk factor approach to prevention. Based on the evidence presented at the Expert Consultation, research questions pertaining to the prevention of ECC that required systematic review were prioritised by the panel. Questions pertaining to the use of fluoride toothpaste were excluded as the panel concluded its efficacy as a mitigating factor against ECC was already proven through systematic review (dos Santos et al 2013a; 2013b; Wright et al 2014). Nonetheless it was recognised that accessibility of affordable fluoride toothpaste was not universal, especially in less affluent countries and that other means of prevention and mitigation were essential. This systematic

review was commissioned by WHO and the aim of this paper is to report the outputs. The objective was to systematically identify and review all available published evidence pertaining to the effect on ECC of modifiable risk and protective factors. The overall question underpinning the review was 'which is the best way to maintain health of the primary dentition? The specific questions addressed are presented in Table 1.

Methods

Guided by the WHO Guideline Development Process (WHO 2014) a systematic review was conducted and reported according to the PRISMA statement. The review methods were established prior to the conduct of the review. The protocol is published on PROSPERO (Hillier-Brown et al. 2017) and is described, in brief, below.

Eligibility criteria

All relevant randomized controlled trials (RCTs), other intervention studies and observational studies (including cohort, case-control, ecological and cross-sectional studies), were included. Participants were apparently healthy (without acute illness, but may be overweight or have chronic illness such as diabetes) infants and children aged <72 months, and caregivers, in countries that are low, middle or high income. For RCTs an intervention period of at least one year for dental caries was required. The American Academy of Pediatric Dentistry (American Academy of Pediatric Dentistry 2016) definition of ECC was adopted for this review. The intervention/exposures and the comparator/controls according to each research question are presented in Table 1. Excluded were studies with participants of different age groups, studies specifically targeting children with medical conditions, and articles not peer-reviewed and published. Non-English articles were included if they contained an English language abstract. No date restrictions were used. The questions were limited to risk and protective factors that can be described as 'modifiable' (i.e. could lead to a recommendation or policy for a change in practice). Therefore, genetics and acquisitions of mutans streptococci, salivary protein profile and

antioxidant capacity were all excluded.

Dental caries outcomes included the primary dentition only, including caries increment, incidence and/or severity, measured as decayed, missing/exfoliated and filled teeth (dmft, dmfs, deft, dft ECC and S-ECC (Severe Early Childhood Caries)); and/or comparisons of higher or lower levels of dental caries.

Search Strategy

Four electronic databases were searched in August 2017. The databases included MEDLINE, EMBASE, CINAHL, PubMed. Moreover, registers of the ongoing systematic reviews (SRs) were searched using the Cochrane Library (Dentistry and Oral Health) and PROSPERO (Centre for Reviews and Dissemination). Clinical trials were also identified by accessing and searching the U.S. National Library of Medicine and the WHO International Clinical Trials Registry Platform. Abstracts and unpublished studies were not included. The search strategy is presented in the Appendix.

Study selection

An initial screen of titles and abstracts of all records identified in the electronic search was conducted by a single reviewer (LT, RH, BA, AM, PK). A random 5% sample of titles and abstracts were screened by all reviewers and inter-rater reliability was assessed qualitatively. Studies that apparently met the inclusion criteria or where there was not enough information in the abstract to inform a decision, underwent independent duplicate screening of the full article. Differences between reviewers

were resolved by discussion and by a third reviewer where consensus could not be reached. Data extraction was undertaken by one reviewer and checked by a second reviewer. Evidence was grouped according to the 12 review questions and each organised by study type, according to the hierarchy: systematic review; RCT; cohort, case-control, other interventions (e.g. quasi-experimental studies); cross-sectional, ecological, to enable a pragmatic data synthesis of the 'best available evidence' (Petticrew and Roberts 2006). For each research question the highest level of evidence retrieved was used for evidence synthesis and where appropriate meta-analysis. Meta-analysis and forest plots of data that could be pooled, were created using RevMan software. Evidence was also reported narratively. When data from the highest level of evidence were scant, the next level of evidence was referred to narratively.

Quality assessment

Risk of bias for individual studies was assessed using the Cochrane 'Risk of Bias' tool for RCTs (Cochrane Collaboration) and the ROBINS-I for non-randomised trials and all other studies (Cochrane Collaboration). The Grading of Recommendations Assessment Development and Evaluation (GRADE) (Atkins et al. GRADE Working Group, 2004) was used to assess the quality of the overall body of evidence in relation to each review question, based on the WHO Handbook for Guideline Development (WHO 2014). The quality of the evidence was categorised as high, moderate, low or very low. The GRADE assessment was conducted by using GRADEpro software. The GRADE method classifies observational studies as 'low quality' and upgrading to a higher level requires evidence of a large effect size or a dose response. RCTs are classified as 'high quality' but in some instances, the GRADE method requires

downgrading of evidence if there is serious risk of bias, imprecision, inconsistency of results, indirectness, or if publication bias is likely.

Results

Figure 1 presents the PRISMA flow chart. In total 13,831 papers were retrieved, reducing to 9,449 following de-duplication. Of those, 627 papers full papers were retrieved and screen. Following this screening, 137 papers (133 studies) were eligible for inclusion and 493 papers were excluded. The reasons for exclusions are provided in Figure 1 and the Appendix (Appendix Table 1). A breakdown of the number of studies for each main research question is presented in Appendix Table 2. Information from the data extraction, for each paper identified as the highest level of evidence retrieved for each question, is presented in the Appendix (Appendix Table 3). The results, by research question, are considered below and a summary of the highest-level evidence pertaining to each question is provided in Table 2. The GRADE evidence profiles are presented in the Appendix (Appendix Tables 4-13).

Question 1. Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?

Twenty one studies had data that enabled comparison of dental caries in children breast fed beyond one year with up to one year of age. Of these, one was a case control study and 19 were cross sectional studies. The highest level of evidence came from one prospective cohort study (Peres et al. 2017). This study showed no significant difference in severity of caries at 5 years between children breastfed up to 23 months with those breastfed up to one year. Overall risk of bias rating for this study was moderate. In relation to confounding, all participants entered the study at

the same time. Additionally, fluoridated area and sugars intake was controlled for. A GRADE evidence profile analysis of these data, that showed no increased risk of ECC with breastfeeding up to 23 months, classified the evidence as 'low quality'. This finding was supported by the next level of evidence: a case control study in which multivariate analysis indicated that breastfeeding >13 months compared with <12 months, was not predictive of high dmft. Moreover, of the 19 cross sectional studies, 9 included multivariate analysis to explore an independent effect of breastfeeding up to 2 years compared with up to one year. Six of 9 studies showed breastfeeding up to 24 months of age was not a primary risk factor for ECC (Appendix Table 14).

QUESTION 2. Does breastfeeding beyond one year increase the risk of early childhood caries compared with cow's (or similar) milk consumption as main milk source from one year of age?

No studies were identified that had data to enable risk of ECC to be compared between children breast fed beyond one year compared with children who consumed cow's milk as the main source of milk.

QUESTION 3. Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?

Eight studies provided data that enabled levels of ECC to be compared when breast feeding extended beyond 2 years of age compared with when it ceased by age 2. Included were: 2 cohort studies; 1 case control study and 5 cross sectional studies. The highest-level evidence was the cohort studies (Chaffee et al. 2014; Peres et al. 2017). The aforementioned study by Peres et al, which showed breastfeeding beyond 2 years of age increased caries risk, demonstrated a large effect size. However, the

study by Chaffee found a non-significant trend towards increased prevalence of ECC with breastfeeding at 24 months and beyond compared with breastfeeding between 6 and 23 months (adjusted Prevalence Ratio (95% CI) 1.17 (0.85, 1.78). This evidence was classified as 'low quality' using the GRADE process.

QUESTION 4. Does breastfeeding beyond two years increase the risk of early childhood caries compared with cow's (or similar) milk consumption as main milk source from two years of age?

No studies were identified that had data to enable risk of ECC to be compared between children breast fed beyond two years of age compared with children who consumed cow's milk as the main source of milk from two years of age.

QUESTION 5. Does consumption of liquids that contain free sugars from an infant feeding bottle, increase the risk of early childhood caries?

Thirty one studies provided data relating to the risk of ECC from consumption of liquids containing free sugars from an infant feeding bottle. These included: 3 cohort studies, 2 case control studies and 25 cross sectional studies. The highest level evidence came from the cohort studies, all of which showed a positive relationship between consumption of sugars as liquids in feeder bottles, however, two of these were rated as being at critical risk of bias (in relation to confounding) (Tanaka et al. 2013; Wendt and Birkhed 1995; Wendt et al. 1996) and were therefore excluded from the GRADE evidence profile as recommended (Guyatt et al. 2013). The remaining cohort study was rated as having a low risk of bias (Feldens et al. 2010). This study showed a significant increased risk of severe ECC with use of bottles containing fruit juices or soft drinks at 12 months of age (Relative Risk 1.41 (95% CI 1.08, 1.86). A

GRADE evidence profile classified this evidence as 'low quality'. This finding is supported by the data from the next level of evidence; two case control studies, both of which showed sugars in bottles to be independently associated with ECC (Appendix Table 14).

QUESTION 6. Does consumption of complementary drinks that contain free sugars increase the risk of early childhood caries?

Data pertaining to the risk of ECC from consumption of drinks containing free sugars were found in 8 studies: 6 cohort studies and 2 cross sectional studies. The highest level evidence came from the 6 cohort studies for which analysis of risk of bias classified risk as very serious primarily due to risk of confounding and weaknesses in experimental design. Five of the 6 studies showed significantly higher ECC in children that consumed a higher compared with lower/no drinks containing free sugars

(Warren et al. 2009; Watanabe et al. 2014; Wendt and Birkhed 1995; Wendt et al. 1996; Wigen and Wang 2014) and one study found no significant difference (Yonezu et al. 2006). However, this study compared ECC between those consuming 3 vs. 2 drinks/week and not with non-consumers. The GRADE profile analysis of these data, suggesting increased risk of ECC from consumption of sugars containing drinks, classified the evidence as 'very low quality'.

QUESTION 7. Does consumption of complementary foods to which free sugars have been added increase the risk of early childhood caries?

One cohort study (Feldens et al. 2010) provided data that enabled the comparison of levels of ECC according to consumption of complementary foods (foods consumed in addition to breast or bottle feeding up to the age of 2 years) containing free sugars.

This study showed a relative risk of severe ECC of 1.43 (95% CI 1.08, 1.89) P=0.003) with consumption of items with a high density of added sugars compared with no consumption of items of high added sugars density. A GRADE profile analysis of these data, showing increased risk of ECC with consumption of foods high in free sugars, classified the evidence as 'low quality'

QUESTION 8. Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries?

Twenty one studies had data on the impact on ECC of oral hygiene provided by a care giver. These included: 2 cohort studies, 1 quasi experimental study and 17 cross sectional studies. The highest level of evidence came from the cohort studies (Leroy et al. 2012; Okuno et al. 1994) both studies had serious risk of bias due to lack of control for confounding. Neither study showed a significant independent effect. In the study by Leroy, multivariate analysis showed that oral hygiene provided by parent or care-giver was not an independent factor for risk of ECC. Okuno et al. (1994) found that oral hygiene conditions and eating habits between meals were stronger determinants of ECC than oral hygiene provided by parent. The evidence therefore suggests little effect of oral hygiene provided by parent or care-giver on ECC risk. The quality of the data were also classified as 'very low' quality by the GRADE profile analysis.

QUESTION 9. Is oral health education for care-givers' effective for preventing early childhood caries?

Fourteen studies had data pertaining to the impact of oral health education for care-givers on children's risk of ECC. These included: 6 RCTs, 2 cohort and 6 quasi-

experimental studies. The highest level of evidence was provided by the RCTs, 4 showed lower levels of ECC in children, resulting from oral health education programmes for care givers (Feldens et al. 2007; Harrison et al. 2007; Mohebbi et al. 2009; Plutzer and Spencer 2008), and two showed no significant effect (Jiang et al. 2014; Vachirarojpisan et al. 2005). It was not possible to conduct a meta-analysis on all 6 RCTs due to differences in outcomes reported. A random effect meta-analysis of 3 RCTs reporting data as odds ratio showed children of caregivers who received oral health education had a reduced risk of ECC compared with those of caregivers who had never received oral health education (OR (95% CI) 0.39(0.19,0.79 P=0.009; with moderate heterogeneity between studies (I^2=52%; p=0.12). A random effect meta-analysis of three studies reporting outcomes as mean (SD) dmft, showed a non-significant trend (Standardized mean difference (95% CI) -0.15 (-0.34, 0.05) P=0.140 (Harrison et al. 2007; Jiang et al. 2014; Vachirarojpisan et al. 2005); with low to moderate heterogeneity between studies (I^2 = 43%; p=0.17). Forest plots are presented in Figure 2. A GRADE evidence profile classified the evidence as 'moderate quality' as data were downgraded for inconsistency of findings.

QUESTION 10. Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?

Thirty two studies had data relating to the above question; 13 cohort studies; 15 cross sectional studies and 4 ecological studies. The highest level of evidence came from the cohort studies that reported ECC in children that had resided in fluoridated areas from birth compared with those residing in non-fluoridated areas (Blinkhorn et al. 1981; Booth et al. 1992; Evans et al. 1996; French et al. 1984; Jackson et al. 1980; Jackson et al. 1975a; Jackson et al. 1985; Jackson et al. 1975b; O'Mullane 1997;

Rugg-Gunn et al. 1988; Rugg-Gunn et al. 1981; Tank 1964; Thomas 1995). All studies showed lower development of ECC in children exposed to fluoridated water and there was evidence of a large effect size in individual studies. Only 2 studies (Booth et al. 1992; Jackson et al. 1975a) reported data comparing levels of fluorosis between groups; none showed a difference between fluoridated and non-fluoridated populations. Four studies had a serious risk of bias due to failure to measure and account for any socioeconomic difference between groups and these were excluded from the analyses (Jackson et al. 1980; Jackson et al. 1975a; Jackson et al. 1985; Jackson et al. 1975b). It was possible to pool data for dmft from 4 studies for meta-analysis (Figure 3) which showed evidence of significant protective moderate size effect of exposure to fluoridated water (mean difference between fluoridated and non-fluoridated -1.25, 95% CI -2.14, -0.36), P=0.006). There were high levels of heterogeneity between studies I^2 = 92%; p<0.00001). Most studies were rated as having a moderate risk of bias. A GRADE evidence profile of these data classified the evidence as 'moderate quality'

Question 11. Does consumption of fluoridated milk reduce the risk of early childhood caries?

Three studies with data pertaining to the impact of drinking fluoridated milk on risk of ECC were identified. These included: 1 quasi-experimental and 2 cross sectional studies. The highest level of evidence was the quasi-experimental study (Bian et al. 2003), which showed a strong protective effect on ECC of consumption of fluoridated milk. However, risk of bias was assessed as serious, as socioeconomic status of control and intervention groups was not controlled for. There was also a lack of control for dietary factors (e.g. sugars intake). The findings of the cross sectional

studies supported the findings of a protective effect of fluoridated milk (Appendix Table 14). The GRADE evidence profile classified the evidence as 'low quality'.

Question 12. Does salt fluoridation reduce the risk of early childhood caries?

Four studies had data pertaining to the impact on risk of ECC of consumption of fluoridated salt. These included: 1 RCT, 1 cohort and 2 quasi-experimental studies. The highest level of evidence was provided by the RCT (Jordan et al. 2017). This study received a high risk of bias rating due to lack of blinding of the outcome assessors and was therefore downgraded for risk of bias. This study showed a lower level of cavitation in the test population. Data for pre-cavitated lesions showed higher mean lesions in the test compared with control group (i.e. opposite effect as observed for caries into dentine measured by dmft), however 95% CI suggest this difference was not significant. A GRADE evidence profile of this study rated the quality as 'moderate'. The next level of evidence was provided by one cohort study that indicated a significant protective effect of the use of fluoride salt on caries experience (dmft) (Appendix Table 14).

Discussion

The best available evidence indicates that breastfeeding up to 2 years of age does not increase risk of ECC, compared with breastfeeding up to one year of age. The findings show consistent albeit low quality evidence that consumption of liquids containing free sugars, including from a feeding bottle, increases the risk of ECC. Limited data indicate that adding free sugars to complementary foods also increases risk. This systematic review has identified moderate quality evidence that provision of oral health education to carers, exposure to optimally fluoridated water and salt fluoridation (limited data), decrease risk of ECC. Evidence, albeit low quality, also shows a protective effect of fluoridated milk. There was limited opportunity for meta-analysis. However where these analysis were undertaken the findings support the conclusion of a protective effect. All three meta-analysis showed heterogeneity between studies; although only one was considered high.

This systematic review has largely identified low/very low quality evidence pertaining modifiable factors for risk of ECC, which reflects the observational nature of most of the data and the serious risk of bias in many studies. There is a need for better quality research including where appropriate, trials and well-designed cohort studies that collect data on, and control for, relevant confounders and that also adopt robust and objective measures of risk exposure.

This review focused on factors known to be modifiable, but excluded factors if pre-existing evidence from systematic review was sufficient (e.g. amount of sugars consumed, use of fluoride toothpaste). It is acknowledged that socioeconomic factors (i.e. low level of general education, low income, family dynamics) may increase the likelihood of being exposed to risk factors for ECC (Phantumvanit et al. 2018),

however, it is unlikely such factors are independent risk factors and questions specific to these factors were therefore not included.

The current review indicated that breastfeeding up to 2 years did not increase risk of ECC compared with breastfeeding up to one year. A previous systematic review (Tham et al. 2015) suggested that breastfeeding beyond one year of age increased the risk of ECC, but cautioned that until the confounding effects of dietary habits and oral hygiene are adequately controlled for it cannot be certain if prolonged breastfeeding can be principally associated with ECC. Moreover, the meta-analysis included studies of breastfeeding beyond 12 months, with no upper limit on duration, whereas the current review focused on breastfeeding up to 2 years of age. The current review also included more recent longitudinal data (Peres et al. 2017). The review by Tham et al. (2015) included only one cohort study (Tanaka et al. 2013) and one cross sectional study (Nobile et al. 2014) that enabled comparison of breastfeeding up to 2 years with up to one year. Tanaka et al. (2013) found a non-significant trend towards a lesser protective effect against S-ECC of breastfeeding 12-17 months (OR 0.81 (95% CI 0.16, 4.01)) compared with breastfeeding for 6-11 months (OR 0.4 (0.07-2.01) p=0.09. Nobile et al.(2014) showed that prevalence of ECC increased with increased breastfeeding duration and those breastfed 11-19 months had a higher dmft (0.44 (SD 1.07) compared with infants breastfed for 5-10 months duration (dmft = 0.22 (SD 0.62). Neither study adequately controlled for important confounders.

An aim of the review was to determine if weaning from breast milk to cow's milk from one year of age effected ECC risk; however, no data were identified to address this. Human breast milk contains approximately 7% sugars compared with cow's

milk which contains <5% sugars (primarily lactose). Cow's milk is also high in calcium and phosphorus which protect against demineralisation and therefore it is reasonable to suggest that weaning to cow's milk would lower caries risk. However, studies have reported only on duration of breastfeeding and not on the alternative source of milk on its cessation – which could be formula or cow's milk. Moreover, cessation of breastfeeding might lead to the introduction of sugars-sweetened beverages. There are therefore many factors to consider when investigating the impact of breastfeeding duration on risk of ECC (Peres et al. 2017) and future research should pay more careful attention to controlling for confounding form complementary foods and drinks. The impact on ECC risk of weaning onto cow's milk also warrants further exploration in well conducted studies that consider and control for the intake of all drinks. It is unknown if there are benefits to oral health of weaning a child onto cow's milk at one year and from a general health perspective, for both child and mother, breastfeeding to age 2 years and beyond has considerable benefits (WHO 2018).

A previous systematic review has shown moderate quality evidence for an increased risk of dental caries, including ECC, from increasing the amount of free sugars consumed (Moynihan and Kelly 2014). The current review has indicated that data pertaining to specific dietary practices and risk of ECC are more limited. Notwithstanding the importance of limiting intake of free sugars per se, the current systematic review found only one study that had examined specifically the effect of consuming complementary foods containing free sugars. This study did however, clearly show an independent effect indicating that complementary foods should not contain added free sugars. The data also support the avoidance of sugars-containing

drinks including from a feeding bottle. Studies on the impact on ECC risk of interventions promoting the avoidance of adding sugars in complementary foods and drinks are needed.

A larger volume of data pertaining to the impact of providing oral health education to care givers on ECC risk, including that from RCTs were available. Information on the difference approaches used is given in Table 2. Meta-analysis of studies reporting risk as odds ration indicated a reduced risk of 39% but there was inconsistency between studies. Nonetheless, overall the evidence supports oral health education for care-givers as a means of ECC prevention.

Unsurprisingly there was a larger body of moderate quality evidence to support water fluoridation as a means of ECC prevention, thus indicating the importance of promoting exposure to optimally fluoridated water wherever possible. The findings suggest that for areas without access to public water supplies to fluoridate, that exposure to fluoride via alternative means such as kindergarten/school milk fluoridation programmes or salt fluoridation programmes is effective. However, the results of the one RCT on salt fluoridation showed lower cavitation lesions and a trend towards higher pre-cavitation lesions in the test group, suggesting an arresting effect of salt fluoridation on existing dental caries. Moreover, salt *per se* is detrimental to health and therefore fluoridation must be achieved within the WHO recommended limits for sodium intake (WHO 2018b).

Conclusion

Based on the best available, albeit limited, evidence, breastfeeding up to 24 months is not associated with an increased risk of ECC. The evidence indicates that breastfeeding beyond 24 months carries an increased risk of ECC; this risk should be balanced against the nutritional and health benefits of breastfeeding children beyond 2 years of age.

Based on the best available evidence, providing access to fluoridated water and delivering oral health education to care givers are justified approaches to ECC prevention. The evidence suggests that limiting sugars in feeder bottles and avoiding addition of sugars to complementary foods and drinks should be part of this education. Evidence that pre-existed this review indisputably proves the efficacy of fluoride toothpastes which should be made accessible and affordable to all. Evidence from this review shows efforts to increase access to fluoridated water should also be given priority. In populations without access to a fluoridated public water supply, the evidence shows that exposure to fluoride through milk schemes, and to a lesser extent salt, are justifiable as a means of prevention.

Acknowledgements

The work was funded in part by the Borrow Foundation and Newcastle University WHO Collaborating Centre for Nutrition and Oral Health.

The authors gratefully acknowledge the contribution of Patience Kunonga who assisted with screening titles and abstracts, and Yuka Makino, Andrew Rugg-Gunn, Bana Abdulmohsen, and the WHO Expert Panel on ECC who assisted in prioritizing the review questions and comments on the protocol. Paula Moynihan attended a WHO expert workshop on the management and prevention of ECC, funded by The Borrow Foundation, in Bangkok Thailand January 2016 and her travel expenses were reimbursed. The other authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

References

American Academy of Pediatric Dentistry. 2016. Policy on early childhood caries (ECC): Classifications, consequences, and preventive strategies. Oral Health Policies Reference Manual 39(6):17-18.

Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, Guyatt GH, Harbour RT, Haugh MC, Henry D, et al; GRADE Working Group, 2004. Grading quality of evidence and strength of recommendations. BMJ. 328(7454):1490.

Bian JY, Wang WH, Wang WJ, Rong WS, Lo EC. 2003. Effect of fluoridated milk on caries in primary teeth: 21-month results. Community Dentistry & Oral Epidemiology. 31(4):241-245.

Blinkhorn AS, Brown MD, Attwood D, Downer MC. 1981. The effect of fluoridation on the dental health of urban Scottish schoolchildren. Journal of Epidemiology & Community Health. 35(2):98-101.

Booth JM, Mitropoulos CM, Worthington HV. 1992. A comparison between the dental health of 3-year-old children living in fluoridated Huddersfield and non-fluoridated Dewsbury in 1989. Community Dental Health. 9(2):151-157.

Chaffee BW, Feldens CA, Vítolo MR. 2014. Association of long-duration breastfeeding and dental caries estimated with marginal structural models. Annals of Epidemiology. 24(6):448-454.

dos Santos AP, Nadanovsky P, de Oliveira BH. 2013. A systematic review and meta-analysis of the effects of fluoride toothpastes on the prevention of dental caries in the primary dentition of preschool children. Community Dentistry and Oral Epidemiology.41(1):1-12..

dos Santos AP, Oliveira BH, Nadanovsky P. 2013. Effects of low and standard fluoride toothpastes on caries and fluorosis: systematic review and meta-analysis. Caries Research. 47(5): 382-390

Evans DJ, Rugg-Gunn AJ, Tabari ED, Butler T. 1996. The effect of fluoridation and social class on caries experience in 5-year-old Newcastle children in 1994 compared with results over the previous 18 years. Community Dental Health. 13(1):5-10.

Feldens CA, Giugliani ER, Vigo Á, Vitolo MR. 2010. Early feeding practices and severe early childhood caries in four-year-old children from southern Brazil: A birth cohort study. Caries research. 44(5):445-452.

Feldens CA, Vitolo MR, Drachler Mde L. 2007. A randomized trial of the effectiveness of home visits in preventing early childhood caries. Community Dentistry & Oral Epidemiology. 35(3):215-223.

Frances Hillier-Brown, Paula Moynihan, Dawn Craig, Bana Abdulmohsen, Richard Holmes, Louise Tanner, Atefeh Mashayekhi, Patience Kunonga, Sarah Kelly. 2017. Systematic review of early childhood caries: which is the best way to maintain the health of the primary dentition? PROSPERO CRD42017074616 . Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017074616

French AD, Carmichael CL, Rugg-Gunn AJ, Furness JA. 1984. Fluoridation and dental caries experience in 5-year-old children in Newcastle and Northumberland in 1981. British Dental Journal. 156(2):54-57.

Guyatt GH, Oxman AD, Schunemann HJ. 2013. Grade guidelines-an introduction to the 10th-13th articles in the series. Journal of clinical epidemiology. 66(2):121-123.

Harrison R, Benton T, Everson-Stewart S, Weinstein P. 2007. Effect of motivational interviewing on rates of early childhood caries: A randomized trial. Pediatric Dentistry. 29(1):16-22.

Jackson D, Goward PE, Morrell GV. 1980. Fluoridation in Leeds. A clinical survey of 5-year-old children. British Dental Journal. 149(8):231-234.

Jackson D, Gravely JF, Pinkham IO. 1975a. Fluoridation in Cumbria. A clinical study. British Dental Journal. 139(8):319-322.

Jackson D, James PM, Thomas FD. 1985. Fluoridation in Anglesey 1983: A clinical study of dental caries. British Dental Journal. 158(2):45-49.

Jackson D, James PM, Wolfe WB. 1975b. Fluoridation in Anglesey. A clinical study. British Dental Journal. 138(5):165-171.

Jiang EM, Lo EC, Chu CH, Wong MC. 2014. Prevention of early childhood caries (ECC) through parental toothbrushing training and fluoride varnish application: A 24-month randomized controlled trial. Journal of Dentistry. 42(12):1543-1550.

Jordan RA, Schulte A, Bockelbrink AC, Puetz S, Naumova E, Warn LG, Zimmer S. 2017. Caries-preventive effect of salt fluoridation in preschool children in the Gambia: A prospective, controlled, interventional study. Caries Res. 51(6):596-604.

Leroy R, Bogaerts K, Martens L, Declerck D. 2012. Risk factors for caries incidence in a cohort of Flemish preschool children. Clinical Oral Investigations. 16(3):805-812.

Mohebbi SZ, Virtanen JI, Vahid-Golpayegani M, Vehkalahti MM. 2009. A cluster randomised trial of effectiveness of educational intervention in primary health care on early childhood caries. Caries research. 43(2):110-118.

Moynihan PJ, Kelly SA. 2014. Effect on caries of restricting sugars intake: Systematic review to inform who guidelines. J Dent Res. 93(1):8-18.

Nobile CG, Fortunato L, Bianco A, Pileggi C, Pavia M. 2014. Pattern and severity of early childhood caries in southern Italy: A preschool-based cross-sectional study. BMC Public Health. 14:206.

Okuno M, Kani T, Shimizu H. 1994. A cohort study on dental caries in infants. Japanese journal of public health. 41(7):625-628.

O'Mullane D, Whelton H. (1997). Efficacy of fluoride against dental caries; fluoride in water. Fogorvosi szemle. 90 Spec No:7-12.

Peres KG, Nascimento GG, Peres MA, Mittinty MN, Demarco FF, Santos IS, Matijasevich A, Barros AJD. 2017. Impact of prolonged breastfeeding on dental caries: A population-based birth cohort study. Pediatrics. 140(1). pii: e20162943.

Petticrew M, Roberts H. 2006. Systematic reviews in the social sciences: A practical guide. John Wiley & Sons.

Phantumvanit P, Makino Y, Ogawa H, Rugg-Gunn A, Moynihan P, Peterson PE, Evans W, Feldens CA, Lo E, Khoshnevisan MH et al. 2018. WHO global consultation on public health intervention against early childhood caries. Community Dentistry & Oral Epidemiology 46(3):280-287.

Plutzer K, Spencer AJ. 2008. Efficacy of an oral health promotion intervention in the prevention of early childhood caries. Community Dentistry & Oral Epidemiology. 36(4):335-346.

Rugg-Gunn AJ, Carmichael CL, Ferrell RS. 1988. Effect of fluoridation and secular trend in caries in 5-year-old children living in Newcastle and Northumberland. British Dental Journal. 165(10):359-364.

Rugg-Gunn AJ, Nicholas KE, Potts A, Cranage JD, Carmichael CL, French AD. 1981. Caries experience of 5-year-old children living in four communities in N.E. England receiving differing water fluoride levels. British Dental Journal. 150(1):9-12.

Tanaka K, Miyake Y, Sasaki S, Hirota Y. 2013. Infant feeding practices and risk of dental caries in japan: The Osaka maternal and child health study. Pediatric Dentistry. 35(3):267-271.

Tank G, Storvick CA.1965. Caries experience of children one to six years old in two Oregon communities (Corvallis and Albany). The Journal of the American Dental Association. 70(2):394-403.

Tham R, Bowatte G, Dharmage SC, Tan DJ, Lau MX, Dai X, Allen KJ, Lodge CJ. 2015. Breastfeeding and the risk of dental caries: A systematic review and meta-analysis. Acta Paediatrica. 104(467):62-84.

Thomas FD, Kassab JY, Jones BM. 1995. Fluoridation in Anglesey 1993: a clinical study of dental caries in 5-year-old children who had experienced sub-optimal fluoridation. British Dental Journal. 178(2):55-9.

Vachirarojpisan T, Shinada K, Kawaguchi Y. 2005. The process and outcome of a programme for preventing early childhood caries in Thailand. Community Dental Health. 22(4):253-259.

Warren JJ, Weber-Gasparoni K, Marshall TA, Drake DR, Dehkordi-Vakil F, Dawson DV, Tharp KM. 2009. A longitudinal study of dental caries risk among very young low SES children. Community Dentistry & Oral Epidemiology. 37(2):116-122.

Watanabe M, Wang DH, Ijichi A, Shirai C, Zou Y, Kubo M, Takemoto K, Masatomi C, Ogino K. 2014. The influence of lifestyle on the incidence of dental caries among 3-year-old Japanese children. International Journal of Environmental Research and Public Health. 11(12):12611-12622.

Wendt L, Hallonsten AL, Koch G, Birkhed D. 1996. Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odontologica Scandinavica. 54(2):131-7.

Wendt LK, Birkhed D. 1995. Dietary habits related to caries development and immigrant status in infants and toddlers living in Sweden. Acta Odontol Scand. 53(6):339-344.

WHO 2014. WHO handbook for guideline development. World Health Organization. http://apps.who.int/iris/handle/10665/145714

WHO 2016. Expert consultation on public health intervention against early childhood caries: Report of a meeting, Bangkok, Thailand, 26-28 January 2016. World Health Organization; [accessed 2018 July 02]. http://www.who.int/iris/handle/10665/255627

WHO 2018. Maternal, newborn, child and adolescent health: Breastfeeding. World Health Organization; [accessed 2018 July 02]. http://www.who.int/maternal_child_adolescent/topics/newborn/nutrition/breastfeeding/en/.

WHO 2018b. Guideline: Sodium intake for adults and children. World Health Organization; [accessed 2018 02 July]. http://www.who.int/nutrition/publications/guidelines/sodium_intake/en/.

Wigen TI, Wang NJ. 2014. Health behaviors and family characteristics in early childhood influence caries development. A longitudinal study based on data from moba. Norsk Epidemiologi. 24(1):91-95.

Wright JT, Hanson N, Ristic H, Whall CW, Estrich CG et al. Fluoride toothpaste efficacy and safety in children younger than 6 years: a systematic review. Journal of the American Dental Association 2014; 145(2): 182-189.

Yeung CA, Chong LY, Glenny AM. 2015. Fluoridated milk for preventing dental caries. Cochrane Database Systematic Review. (9):CD003876.

Yonezu T, Yotsuya K, Yakushiji M. 2006. Characteristics of breast-fed children with nursing caries. Bull Tokyo Dent Coll. 47(4):161-165.

Table 1. Review questions with related definitions of intervention and control (intervention studies) and exposure and comparator (observational studies)

Question	Intervention/control*. Exposure/comparator **	
Q1.Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?	Exposure	Breastfeeding beyond one year.
	Comparator	Breastfeeding less than one year.
Q2. Does breastfeeding beyond one year increase the risk of early childhood caries compared with cow's (or similar) milk consumption as main milk source from one year of age?	Exposure	Breastfeeding beyond one year.
	Comparator	Cow's (or similar) milk consumption as main milk source from one year of age.
Q3. Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?	Exposure	Breastfeeding beyond two years.
	Comparator	Breastfeeding less than two years.
Q4. Does breastfeeding beyond two years increase the risk of early childhood caries compared with cow's (or similar) milk consumption as main milk source from two years of age?	Exposure	Breastfeeding beyond two year.
	Comparator	Cow's (or similar) milk consumption as main milk source from two years of age.
Q5. Does consumption of liquids that contain free sugars from an infant feeding bottle, increase risk of early childhood caries?	Intervention	Any intervention intended to reduce the consumption of liquids that contain free sugars from an infant feeding bottle in one arm of the study, compared to consumption of such liquids in another arm of the study. To be included a trial must report this feeding practice status in both arms.
	Control	Consumption of liquids that contain free sugars from an infant feeding bottle.

	Exposure	Consumption of liquids that contain free sugars from a bottle. When assessing the quality of the evidence, the separation or controlling for the effects of other lifestyle or medical interventions (for example, use of bottle per se, prolonged breast feeding, exposure to fluoride, sugars intake from other dietary sources, feeding practices, oral hygiene behaviour) will be considered.
	Comparator	No or lower free sugars containing drinks consumed from an infant feeding bottle.
Q6. Does consumption of complementary drinks[$] that contain free sugars increase the risk of early childhood caries?	Intervention	Any intervention intended to reduce the consumption of complementary drinks that contain free sugars in one arm of the study, compared to consumption of such complementary in another arm of the study. To be included a trial must report this feeding practice status in both arms.
	Control	Consumption of complementary drinks that contain free sugars.
	Exposure	Consumption of complementary drinks that contain free sugars.
	Comparator	No or lower free sugars containing complementary drinks consumed.
Q7. Does consumption of complementary foods[$] to which free sugars have been added increase risk of early childhood caries?	Intervention	Any intervention intended to reduce the consumption of free sugars in complementary foods in one arm of the study, compared with no intervention in the other arm. To be included a trial must report this feeding practice status in both arms.
	Control	Consumption free sugars in the complementary diet.
	Exposure	Consumption free sugars in the complementary diet.
	Comparator	No or lower consumption of free sugars in complementary diet.
Q8. Does oral hygiene	Exposure	Good oral hygiene as indicated by

provided by a parent/carer reduce the risk of early childhood caries?		the absence of a high plaque volume and or daily tooth brushing by carer.
	Comparator	Poor oral hygiene (as defined above).
Q9. Is oral health education for care givers' effective for preventing early childhood caries?	Intervention	Any intervention where care givers receive oral health education in one arm of the study, compared with no intervention in the other arm.
	Control	No or lower oral health education to caregivers.
	Exposure	Caregiver exposure to oral health education.
	Comparator	No or less caregiver exposure to oral health education.
Q10. Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?	Intervention	Any intervention where participants are exposed to fluoridated water or water naturally containing fluoride (at a concentration of >0.6 PPM (mg/L)) in one arm of the study, compared with non-fluoridated water or water that is naturally low in fluoride (<0.3PPM) in the other arm.
	Control	No exposure to fluoridated water or water naturally containing fluoride at a level of >0.6 PPM.
	Exposure	Participants living in areas where water is fluoridated or naturally contains fluoride (at a concentration of >0.6 PPM).
	Comparator	Participants living in areas where water is not fluoridated nor naturally high in fluoride (i.e. the concentration of fluoride in water is <0.3 PPM).
Q11. Does consumption of fluoridated milk reduce the risk of early childhood caries?	Intervention	Any intervention intending to increase the consumption of fluoridated milk in one arm of the study, compared with no intervention, or no consumption of fluoridated milk, in the other arm.
	Control	No consumption of fluoridated milk.

	Exposure	Consumption of fluoridated milk.
	Comparator	No consumption of fluoridated milk.
Q12. Does salt fluoridation reduce the risk of early childhood caries?	Intervention	Any intervention intending to encourage the exposure to/consumption of fluoridated salt in one arm of the study, compared with no intervention, or no consumption of fluoridated salt, in the other arm.
	Control	No exposure/consumption of fluoridated salt.
	Exposure	Consumption of/exposure to fluoridated salt.
	Comparator	No consumption of fluoridated salt/exposure to salt fluoridation.

* for intervention studies
** for observational studies
$ all foods and drinks consumed in addition to breastmilk and infant formula are referred to as 'complementary foods and drinks' and sometimes commonly referred to as 'weaning foods and drinks'

Table 2. Summary of studies contributing to the top level of evidence for review questions.

Q1. Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?	
Reference	**Evidence**
Peres et al 2017	Cohort study to investigate if there is a controlled direct effect of breastfeeding on dental caries in Brazilian children aged 5 years. Risk of dental caries amongst children who were breastfed for 13-23 was not significantly different to those breastfed to up to 12 months. Multi-source method for caries amongst children who were breastfed for 13-23 months compared to up to 12 months showed the mean ratio (95% CI) = 0.9 (0.6, 1.3). For severe dental caries -relative risk (95% CI) = 1.0 (0.6, 1.6).
Q2. Does breastfeeding beyond one year increase the risk of early childhood caries compared with cows (or similar) milk consumption as main milk source from one year of age?	
N/A	No evidence
Q3. Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?	
Peres et al 2017	Cohort study investigating risk of dental caries amongst children who were breastfed for ≥24 months was significantly increased. Multi-source method for caries amongst children who were breastfed ≥ 24 months compared to up to 24 months showed the mean ratio (95% CI) = 1.9 (1.5, 2.4). For severe dental caries -relative risk (95% CI) = 2.4 (1.7, 3.3).
Chaffee et al 2014	Cohort study investigating the risk of severe ECC in children from a low income population in Brazil who were breastfed for 24 months compared with lesser durations. Severe early childhood caries (S-ECC) was assessed at aged 38 months. Breastfeeding ≥24 months was associated with a higher adjusted population-average severe-ECC prevalence (0.45, 95% CI: 0.36, 0.54) compared with 12–23 months (0.39, 95% CI: 0.20, 0.56). The Prevalence Ratio for ECC (95% CI) with breastfeeding for 24 or months was 1.17 (0.85, 1.78) which failed to reach statistical significance.
Q4. Does breastfeeding beyond two years increase the risk of early childhood caries compared with cows (or similar) milk consumption as main milk source from two years of age?	
N/A	No evidence
Q5. Does consumption of liquids that contain free sugars from an infant feeding bottle, increase the risk of early childhood caries?	
Feldens et al 2010	Cohort study that compared S-ECC at 4 years of age in Brazilian children exposed to bottle use for fruit juices / soft drinks at 12 months compared with no use of bottle for juices/soft drinks. Relative risk for S-ECC (95% CI) = 1.41 (1.08, 1.86), (P=0.025).
Wendt and	Cohort study of caries free Swedish children at age one

Birkhed 1995; Wendt et al 1996	year, examining the factors associated with the development of ECC at age 2 years. Compared with children remaining caries free at age 3 years , a higher proportion of children with caries at age 3 consumed soft drinks more than once a day (12% vs 23% respectively) p<0.04).
Tanaka et al 2013	Cohort study of children followed from age 2 to 50 months in Japan. Of 1002 recruited 315 completed all aspects of the study. Logistic regression indicated that consuming sweetened liquids from a bottle compared with never consuming these drinks from a bottle, significantly increased risk of ECC. Adjusted OR 2.17 (95% CI 1.23, 5.05).
Q6. Does consumption of complementary drinks that contain free sugars increase the risk of early childhood caries?	
Warren et al 2009	A cohort study to assess the effect of sugar-sweetened beverage consumption on 18-month caries prevalence (as part of a longitudinal study) of high-risk children in the USA. The odds ratio (95% CI) for development of dental caries in those consuming sugars drinks was 3.04 (1.07, 8.64).
Watanbe et al 2014	Cohort study that examined how lifestyle, household environment, and caries activity test score of Japanese children at age 1.5 years, affected their dental caries incidence at age 3. The odds ratio (95%CI) for ECC with daily sugar-sweetened beverage consumption was 1.56 (1.46, 1.65) p= <0.001.
Wendt et al 1995;1996	Cohort study of caries-free Swedish children at age on years examining the factors associated with the development of ECC at age 2 and 3 years. Not drinking sugars sweetened drinks to quench thirst at age one was an independent significant factor determining being free of dental caries at age 3 (OR 2.26 (95% CI 1.07, 4.77) p=0.033. No comparative data were provided on the proportion of children with caries and caries-free at 3 years of age who got milk or water when thirsty.
Wigen & Wang 2014	Cohort study in which exposure to sugars in drinks in Norwegian children aged 1.5 years of age was related to caries experience at 5 years. Risk (OR, 95% CI) of ECC with consumption of sugars-containing drinks at night was 1.5 (0.8–2.8) for consumption sometimes, and 2.2 (1.1–4.5) for nightly consumption, compared with never.
Yonezu et al 2006	Cohort study that compared ECC between Japanese children that consumed sweetened beverages 2/week versus 3/week at age 18 months. Logistic regression analysis of effect on ECC experience at 24 months of age showed sweet beverages intake was no significant OR(95%CI): 0.99 (0.25, 4.01).
Q7. Does consumption of complementary foods to which free sugars have been added increase the risk of early childhood caries?	
Feldens et al	Cohort study investigating feeding practices in the first year

2010	of life associated with S-ECC at the age of 4 years. 47.3% of children who consumed foods with a high density of added sugars had ECC compared with 32% in non-consumers. Multivariate analysis showed consumption of foods with a high density of added sugars increased risk of ECC. Relative risk 1.43 (1.08, 1.89) P =0.003.
Q8. Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries?	
Leroy et al 2012	Cohort study that examined risk factors for the incidence of visible caries experience in pre-school children in Belgium. Help with brushing >1/day compared with <daily was associated with reduced risk of ECC between 3 and 5 years of age in univariate analysis. However, help with brushing was not an independent factor in multivariate analysis.
Okuno 1994	Cohort study of children aged 18 months in Japan. Exposure to risk factors at 18 months was related to ECC at age 3 years. Logistic regression analysis showed that oral hygiene conditions and eating habits between meals were more important than mother-aided daily tooth brushing.
Q9. Is oral health education for care givers' effective for preventing early childhood caries?	
Feldens et al 2007	RCT to investigate the impact of home visits for advising mothers about breast feeding and weaning on ECC in Brazil. The intervention was initially delivered from 10 days – 14 months; dental examination took place between 12 and 14 months. 10.2% of the intervention group had ECC and the mean dmft was 0.37 compared with 18.3% in the control group with a mean dmft of 0.63 (p=0.03). Odds Ratio for the intervention group 0.52 (95% CI 0.27, 0.97) (p = 0.03).
Harrison et al 2007	RCT to investigate the effect of an oral health intervention employing motivational interviewing (MI) to prevent ECC in S. Asian immigrants in Canada. The dmft in the intervention group was 3.35 (SD 7.8) versus 7.59 (SD 14.2) in the control (p=0.001). Poisson regression showed protective effect of MI relative to the control condition on the rate of dmfs after 2 years (hazard ratio = 0.54 (95% CI 0.35, 0.84).
Plutzer et al 2008	RCT to investigate the efficacy of an oral health promotion programme during pregnancy and when the child was 6 and 12 months of age, on S-ECC at 18 months of age in offspring (in Australia). For the intervention group the adjusted OR for S-ECC (95.0% CI) was 6.8 (2.1, 21.9), P<0.001. The cumulative incidence of S-ECC in the test group was 1.7% and in the control group 9.6% (P < 0.01).
Mohebbi et al 2009	RCT to evaluated the impact of a 6-month educational intervention (educational pamphlet with or without 5 minutes of oral health instructions, plus two recall phone

	calls of the oral health instructions at 2-month intervals) on ECC in children in Iran. The mean age of the children was 12.3 months (SD= 0.4) at baseline and 18.3 months (SD 0.6) at outcome. No new decayed/exfoliated (de) teeth appeared in intensive intervention group. With pamphlet only, the mean de increment was 0.2 (SD 0.6), and in the controls 0.4 (SD = 0.7) (p =0.05).
Vachirarojpisan et al. 2005	RCT of the effectiveness of a one year participatory dental health education programme aimed at care givers to increase tooth brushing and use of fluoride toothpaste in children initially aged 6-19 months in Thailand. Caries increment (cavitated) was 3.46 (SD 3.36) in the test compared with 3.24 (3.53) in the control group. There were no statistically significant differences in oral health outcomes at 1 year follow up.
Jiang et al 2014	RCT of the effectiveness oral health education talk and parental tooth brushing training, reinforced every 6 months, in preventing ECC in children in Hong Kong, China aged 15 months at baseline, followed up for 24 months. Mean dmft (including non cavitated lesions) was 0.2 (SD 0.6) in the test compared with 0.3 (sd 1.2) in the control group. Caries incidence was 11.8 vs 11.9%.
Q10. Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?	
Tank et al 1965	Cohort study of the effect of exposure to fluoridated water on ECC in children in Canada aged 1-6 years. For children aged 5, mean dmft was 3.29 in fluoridated group compared with 6.0 in non-fluoridated. Only 4% of those in non-fluoridated community were caries free compared with 39% in those exposed to fluoride in drinking water since birth (significant differences at $p<0.05$).
Jackson et al 1975a	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of Cumbria England since birth. Mean dmft was 2.38 (SE 0.3) vs 4.40 (SE 0.35) for fluoridated and non- fluoridated groups respectively.
Jackson et al 1975b	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of Wales since birth. Mean dmft was 2.83 (SE 0.26) vs 4.58 (SE 0.34) for fluoridated and non- fluoridated groups respectively.
Jackson et al 1980	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of Leeds England since birth. Mean dmft was 1.23 (SE 0.15) vs 3.38 (SE 0.25) for fluoridated and non- fluoridated groups respectively.
Rugg-Gunn et al 1981	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of North East England since birth. Mean deft was 2.5 (SD 2.79) for fluoridated and 6.1 (4.03) for non-fluoridated groups respectively. There was a higher proportion of lower SES in the non-fluoridated group.
Blinkhorn et al	Compared ECC at age 4-5 years in children residing in

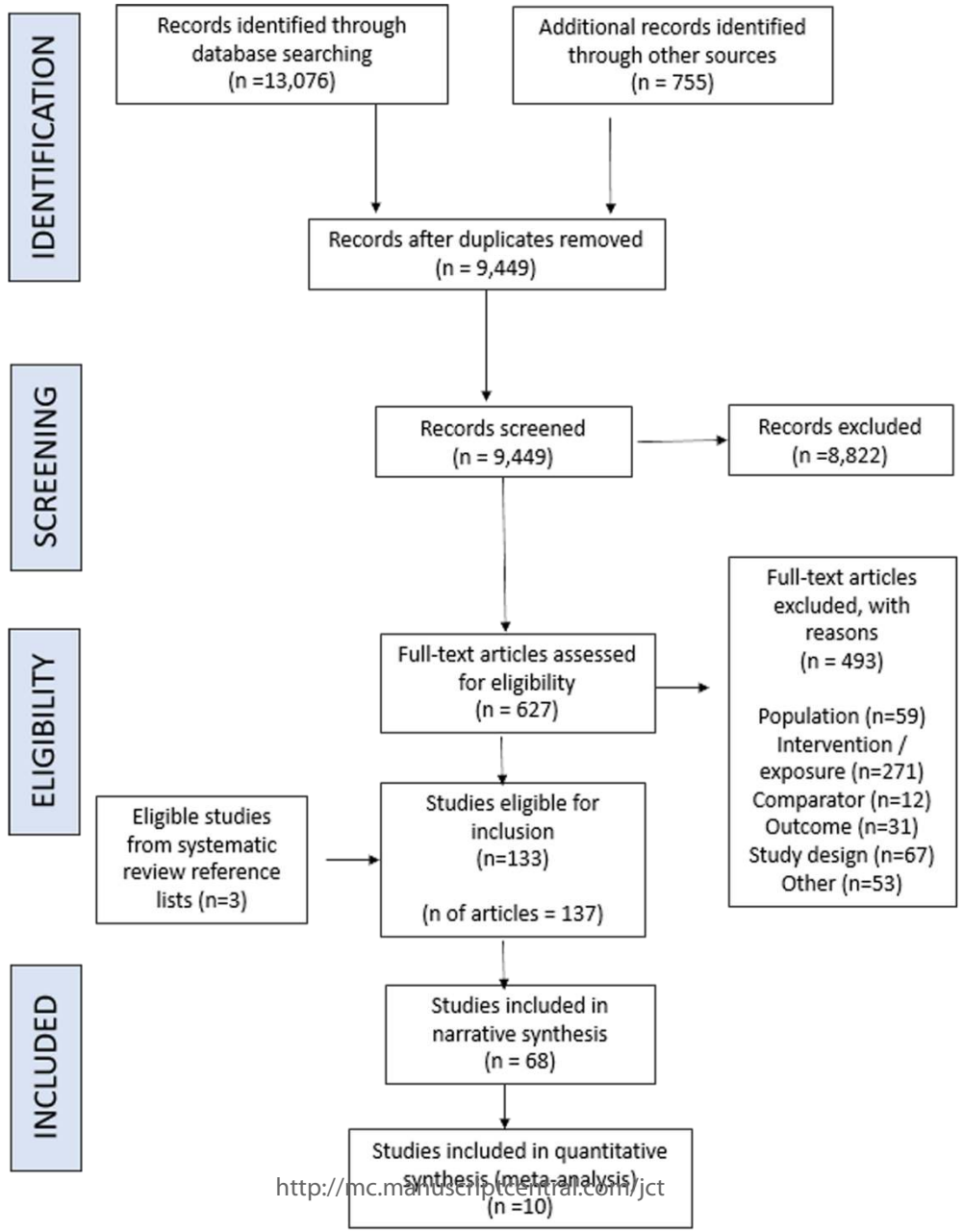
1981	fluoridated compared with non-fluoridated areas of Scotland since birth. Mean dmft was 2.48 (SD 3.16) vs 4.34 (SD 4.04) in the fluoridated and non-fluoridated groups respectively. Those residing in a fluoridated area had a 65% reduction in ECC.
French et al 1984	Compared ECC at age 5 in children living in fluoridated and non-fluoridated areas in North East England. In children from social class III mean dmft was 1.51 (SD 2.28) vs 3.55 (3.69) for children from fluoridated vs non-fluoridated area respectively ($p<0.001$).
Jackson et al 1985	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of Wales since birth Mean dmft was 1.58 (SE0.17) vs 3.55 SE 0.33) for fluoridated and non- fluoridated groups respectively.
Rugg-Gunn et al 1988	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of North East England since birth. In children from social class III, mean deft was 1.70 (SD 2.53) for fluoridated and 3.71 (SD 4.05) for non-fluoridated groups respectively. Overall there was a 54% reduction in caries in children residing in the fluoridated area.
Booth et al 1992	Compared ECC at age 3 in children residing in fluoridated compared with non-fluoridated areas of England since birth. Mean dmft was 0.3 (SD 1.0) for fluoridated and 0.74 (SD 2.0) for non-fluoridated groups respectively ($p<0.03$).
Thomas et al 1995	Retrospective cohort study investigating ECC in 5 year old children who had resided in a fluoridated area for at least 35% of their life compared with those who had resided in a fluoridated area for <10% of life: dmft were 1.81 (SD 2.86) vs 2.28 (SD 3.48) respectively.
Evans et al 1996	Retrospective cohort study investigating ECC in 5 year old children who had resided in fluoridated or non fluoridated areas of Northumberland England since birth. Mean dmft was significantly lower for children from fluoridated areas for all social classes. For high social class dmft was 0.59 (SD 1.37) vs 1.46 (SD2.62), and for low social classes mean dmft was 1.19 (2.73) vs 2.74 (SD 3.05) for children residing in fluoridated and non-fluoridated areas respectively.
O'Mullane & Whelton 1997	Compared ECC at age 5 in children residing in fluoridated compared with non-fluoridated areas of the Republic of Ireland, since birth. Mean dmft was 1.8 for fluoridated and 3.0 for non-fluoridated groups respectively.
Q11. Does consumption of fluoridated milk reduce the risk of early childhood caries?	
Bian 2003	Quasi-experimental study to investigate the effect of fluoridated milk on ECC in children from Beijing China, aged 54 (SD 4.0) month at baseline followed up for 21 months. Test group received approximately 200ml of milk fluoridated at 2.5mg F\L each day. Caries increment was 0.4 (SD 1.9) dmft for test group compared with 1.3 (SD 1.2) dmft for control group, $P<0.001$.

Q12. Does salt fluoridation reduce the risk of early childhood caries?	
Jordon et al 2017	RCT of children aged 3-5 years in Gambia that investigated the effect of fluoridated salt in a communal feeding program for pre-school children. At 12 month follow up the mean (95% CI) for dmft for test and control groups were 4.64 (4.04, 5.23) vs 6.57 (5.52, 7.61) respectively. The percentage of children free of caries into dentine was 25.0 vs 16.8 for test and control groups respectively but this was not significant with relative risk RR 0.88 (0.79, 1.01). For pre-cavitated lesions, the test group had higher values compared with control group: 8.14 (7.45, 8.83) vs 7.70 (6.56, 8.83) respectively). There was high bias in measurement of the outcome.

Figure 1: PRISMA Flow Diagram

Figure 2. Meta-analysis of randomised controlled trials pertaining to question 9: Is oral health education for care-givers' effective for preventing early childhood caries?

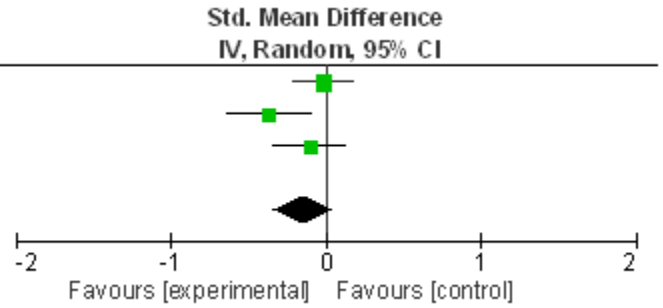
Figure 3. Meta-analysis of data from cohort studies pertaining to question 10: Does an optimum concentration of fluoride in water reduce the risk of early childhood caries? Mean difference (Random effect)



a

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Vachirarojpisan 2005	3.98	3.08	213	4.04	2.99	191	38.9%	-0.02 [-0.22, 0.18]	2005
Harrison 2007	3.35	7.8	105	7.59	14.2	100	28.0%	-0.37 [-0.65, -0.09]	2007
Jiang 2014	0.2	0.6	144	0.3	1.2	134	33.1%	-0.11 [-0.34, 0.13]	2014
Total (95% CI)			**462**			**425**	**100.0%**	**-0.15 [-0.34, 0.05]**	

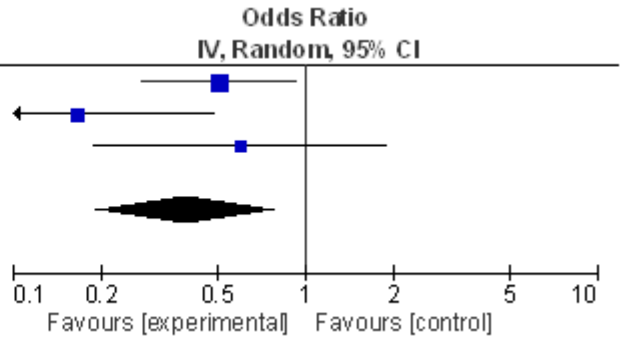
Heterogeneity: Tau² = 0.02; Chi² = 4.19, df = 2 (P = 0.12); I² = 52%
Test for overall effect: Z = 1.47 (P = 0.14)



b

Study or Subgroup	Experimental Events	Total	Control Events	Total	Weight	Odds Ratio IV, Random, 95% CI	Year
Feldens 2007	16	157	40	219	47.8%	0.51 [0.27, 0.94]	2007
Plutzer 2008	4	232	20	209	27.1%	0.17 [0.06, 0.49]	2008
Mohebbi 2009	5	55	9	63	25.0%	0.60 [0.19, 1.91]	2009
Total (95% CI)		**444**		**491**	**100.0%**	**0.39 [0.19, 0.79]**	
Total events	25		69				

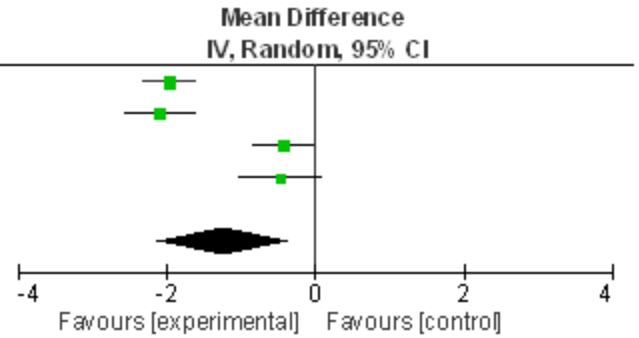
Heterogeneity: Tau² = 0.17; Chi² = 3.51, df = 2 (P = 0.17); I² = 43%
Test for overall effect: Z = 2.59 (P = 0.009)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Year
French 1981	1.41	2.21	533	3.37	3.65	536	25.7%	-1.96 [-2.32, -1.60]	1981
Rugg-Gunn 1988	1.81	2.56	457	3.9	4.22	370	24.8%	-2.09 [-2.58, -1.60]	1988
Booth 1992	0.3	1	121	0.74	2	107	25.3%	-0.44 [-0.86, -0.02]	1992
Thomas 1995	1.81	2.86	230	2.28	3.48	268	24.3%	-0.47 [-1.03, 0.09]	1995
Total (95% CI)			**1341**			**1281**	**100.0%**	**-1.25 [-2.14, -0.36]**	

Heterogeneity: Tau² = 0.77; Chi² = 47.42, df = 3 (P < 0.00001); I² = 94%

Test for overall effect: Z = 2.74 (P = 0.006)



Appendix

Medline search strategy

1 Infant Formula/
2 Beverages/
3 Bottle Feeding/
4 exp Breast Feeding/
5 Milk, Human/
6 Cariogenic Agents/
7 Diet, Cariogenic/
8 exp Cariostatic Agents/
9 complementary food*.mp.
10 Infant Food/
11 exp Feeding Behavior/
12 Fluoridation/
13 Milk/
14 follow on formula.mp.
15 follow-on formula.mp.
16 free sugar*.mp.
17 Oral Health/
18 Health Education, Dental/
19 Oral hygiene/
20 Dietary Sucrose/
21 Toothbrushing/
22 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23 exp Dental Caries/
24 carious dentine.mp.
25 carious lesion*.mp.
26 carious lesion*.mp.
27 cavit*.mp.
28 tooth decay.mp.
29 dental decay.mp.
30 deft.mp.
31 dft.mp.
32 dmf index/
33 exp dental materials/ or dental amalgam/
34 Dental Restoration, Permanent/
35 Tooth Demineralization/
36 Tooth Remineralization/
37 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36
38 Infant/
39 Child, Preschool/
40 Infant, Newborn/
41 38 or 39 or 40
42 22 and 37 and 41
43 limit 42 to ‘humans’

Appendix Table 1. Excluded studies

Reason for exclusion
Article not peer-reviewed
1. Aeck MA. 1995. The prevalence of nursing caries among head start early childhood education and assistance program for children by ethnicity, age, gender, and nursing practices. Gonzaga University.
Full text not available
1. Bordoni N, Bellagamba H, Dono R, Marcantoni M, Sabelli C, Macchi R, Squassi A. 1985. Dental condition in a preventive program for school children. Acta odontologica latinoamericana: AOL. 2(2-3):91-96. 2. Government funding body Oral Health Program LBA, Metro South Health Service District. 2009. A controlled longitudinal study of caries prevention in children aged 2 to 4 years. 3. University Menzies School of Health Research. 2009. Improved dental health for remote aboriginal children: A cluster randomised trial. 4. University of Michigan, National Institute of Dental and Craniofacial Research (NIDCR). 2012. Predicting caries risk in underserved toddlers in primary healthcare settings. https://ClinicalTrials.gov/show/NCT01707797.
Comparator did not meet the inclusion criteria
1. Birungi N, Fadnes LT, Okullo I, Kasangaki A, Nankabirwa V, Ndeezi G, Tumwine JK, Tylleskar T, Lie SA, Astrom AN. 2015. Effect of breastfeeding promotion on early childhood caries and breastfeeding duration among 5 year old children in eastern Uganda: A cluster randomized trial. PLoS ONE. 10(5):e0125352. 2. Dini EL, Holt RD, Bedi R. 1998. Comparison of two indices of caries patterns in 3-6 year old Brazilian children from areas with different fluoridation histories. Int Dent J. 48(4):378-385. 3. Forsman B, Ericsson Y. 1974. Breastfeeding, formula feeding and dental health in low-fluoride districts in Sweden. Community Dent Oral Epidemiol. 2(1):1-6. 4. Hallonsten AL, Wendt LK, Mejare I, Birkhed D, Hakansson C, Lindvall AM, Edwardsson S, Koch G. 1995. Dental caries and prolonged breast-feeding in 18-month-old Swedish children. Int J Paediatr Dent. 5(3):149-155. 5. Hong L, Levy SM, Warren J, Broffitt B. 2006. Dental caries and fluorosis in relation to water fluoride levels. Canadian Journal of Dental Hygiene. 40(3):140-140. 6. Marino RJ, Onetto JE. 1995. Caries experience in urban and rural Chilean 3-year-olds. Community Dent Oral Epidemiol. 23(1):60-61. 7. Scavuzzi AI, De Franca Caldas Junior A, Couto GB, De Vasconcelos MM, De Freitas Soares RP, Valenca PA. 2007. Longitudinal study of dental caries in Brazilian children aged from 12 to 30 months. Int J Paediatr Dent. 17(2):123-128. 8. Shizukuishi S, Tsunemitsu A, Sobue S, Nakagawa H, Morisaki I, Usui M, Ohmae H, Pal V. 1986. Epidemiologic survey on oral diseases in Fiji. Ii. Survey on dental caries, mottled teeth, missing teeth and frequency of daily toothbrushing. J Osaka Univ Dent Sch. 26:219-229. 9. Tiano AV, Moimaz SA, Saliba O, Saliba NA. 2009. Dental caries prevalence in children up to 36 months of age attending daycare centers in municipalities with different water fluoride content. Journal of Applied Oral Science. 17(1):39-44.

10. Timmis JC. 1971. Caries experience of 5-year-old children living in fluoride and non-fluoride areas of Essex. Br Dent J. 130(7):278-283.
11. Tsubouchi J, Tsubouchi M, Maynard RJ, Domoto PK, Weinstein P. 1995. A study of dental caries and risk factors among native american infants. ASDC Journal of Dentistry for Children. 62(4):283-287.
12. Wendt LK, Hallonsten AL, Koch G, Birkhed D. 1996. Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odontol Scand. 54(2):131-137.

Population did not meet the inclusion criteria

1. Alm A, Wendt LK, Koch G, Birkhed D, Nilsson M. 2012. Caries in adolescence - influence from early childhood. Community Dent Oral Epidemiol. 40(2):125-133.
2. Beal JF, James PM, Bradnock G, Anderson RJ. 1979. The relationship between dental cleanliness, dental caries incidence and gingival health. A longitudinal study. Br Dent J. 146(4):111-114.
3. Binder K. 1973. Comparison of the effects of fluoride drinking water on caries frequency and mottled enamel in three similar regions of Austria over a 10-year period. Caries Res. 7(2):179-183.
4. Burt BA, Keels MA, Heller KE. 2000. The effects of a break in water fluoridation on the development of dental caries and fluorosis. J Dent Res. 79(2):761-769.
5. Camrass R. 1974. An oral health survey of manono-tai, Western Samoa. The New Zealand Dental Journal. 70(320):126-137.
6. Correa-Faria P, Paixao-Goncalves S, Paiva SM, Pordeus IA. 2016. Incidence of dental caries in primary dentition and risk factors: A longitudinal study. Pesqui Odontol Bras. 30(1):20.
7. Craig EW, Suckling GW, Pearce EI. 1981. The effect of a preventive programme on dental plaque and caries in school children. The New Zealand Dental Journal. 77(349):89-93.
8. Curnow MM, Pine CM, Burnside G, Nicholson JA, Chesters RK, Huntington E. 2002. A randomised controlled trial of the efficacy of supervised toothbrushing in high-caries-risk children. Caries Res. 36(4):294-300.
9. Duany LF, Zinner DD, Jablon JM. 1972. Epidemiologic studies of caries-free and caries-active students. II. Diet, dental plaque, and oral hygiene. J Dent Res. 51(3):727-733.
10. Dunning JM, Hodge AT. 1971. Influence of cocoa and sugar in milk on dental caries incidence. J Dent Res. 50(4):854-859.
11. Frencken JE, Truin GJ, Van't Hof MA, Konig KG, Kahabuka FK, Mulder J, Kalsbeek H. 1991. Fluoride in drinking water and caries progression in a Tanzanian child population. Community Dent Oral Epidemiol. 19(3):180-181.
12. Gillcrist JA, Brumley DE, Blackford JU. 2001. Community fluoridation status and caries experience in children. J Public Health Dent. 61(3):168-171.
13. Gopal S, Chandrappa V, Kadidal U, Rayala C, Vegesna M. 2016. Prevalence and predictors of early childhood caries in 3- to 6-year-old south Indian children--a cross-sectional descriptive study. Oral health prev. 14(3):267-273.
14. Graves RC, Disney JA, Beck JD, Abernathy JR, Stamm JW, Bohannan HM. 1992.

The university of North Carolina caries risk assessment study: Caries increments of misclassified children. Community Dentistry and Oral Epidemiology. 20(4):169-174.
15. Grow TE. 1979. Nutrition and oral health. J Fla Med Assoc. 66(4):408-413.
16. Guido JA, Martinez Mier EA, Soto A, Eggertsson H, Sanders BJ, Jones JE, Weddell JA, Villanueva Cruz I, Anton de la Concha JL. 2011. Caries prevalence and its association with brushing habits, water availability, and the intake of sugared beverages. Int J Paediatr Dent. 21(6):432-440.
17. Hallett KB, O'Rourke PK. 2002. Early childhood caries and infant feeding practice. Community Dent Health. 19(4):237-242.
18. Harris R, Nicoll AD, Adair PM, Pine CM. 2004. Risk factors for dental caries in young children: A systematic review of the literature. Community Dent Health. 21(1 Suppl):71-85.
19. Hashim R, Williams S, Thomson WM. 2011. Severe early childhood caries and behavioural risk indicators among young children in Ajman, United Arab Emirates. Eur Arch Paediatr Dent. 12(4):205-210.
20. Heifetz SB, Driscoll WS, Horowitz HS, Kingman A. 1988. Prevalence of dental caries and dental fluorosis in areas with optimal and above-optimal water-fluoride concentrations: A 5-year follow-up survey. JADA (1939). 116(4):490-495.
21. Heifetz SB, Horowitz HS, Brunelle JA. 1983. Effect of school water fluoridation on dental caries: Results in Seagrove, N C, after 12 years. Journal of the American Dental Association (1939). 106(3):334-337.
22. Heloe LA, Konig KG. 1978. Oral hygiene and educational programs for caries prevention. Caries Res. 12 Suppl 1:83-93.
23. Hill IN, Blayney JR, Wolf W. 1951. The Evanston dental caries study. Vii. The effect of artificially fluoridated water on dental caries experience of 12-, 13-, and 14-year-old school children. J Dent Res. 30(5):670-675.
24. Hollis MJ, Knowsley PC. 1970. Ten years of fluoridation in Lower Hutt. N Z Dent J. 66(305):235-238.
25. 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 of the literature. J Dent. 40(11):873-885.
26. Iftikhar A, Zafar M, Kalar MU. 2012. The relationship between snacking habits and dental caries in school children. International Journal of Collaborative Research on Internal Medicine and Public Health. 4(12):1943-1951.
27. Iheozor-Ejiofor Z, Worthington HV, Walsh T, O'Malley L, Clarkson JE, Macey R, Alam R, Tugwell P, Welch V, Glenny A-M. 2015. Water fluoridation for the prevention of dental caries. Cochrane Database Syst Rev. (6)http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010856.pub2/abstract. doi:10.1002/14651858.CD010856.pub2.
28. Jackson RJ, Newman HN, Smart GJ, Stokes E, Hogan JI, Brown C, Seres J. 2005. The effects of a supervised toothbrushing programme on the caries increment of primary school children, initially aged 5-6 years. Caries Res. 39(2):108-115.
29. Jessri M, Rashidkhani B, Kimiagar SM. 2011. Oral health behaviors in relation to dental caries and gingivitis. Clinical Nutrition, Supplement. 6 (1):161-162.
30. Johnsen DC, Bhat M, Kim MT, Hagman FT, Allee LM, Creedon RL, Easley MW. 1986. Caries levels and patterns in head start children in fluoridated and non-

fluoridated, urban and non-urban sites in Ohio, USA. Community Dentistry & Oral Epidemiol. 14(4):206-210.
31. Kramer N, Kunzelmann KH, Hickel R. 1990. Middle course between group and individual preventive programs. [German]. Dtsch Zahnarztl Z. 45(11):706-709.
32. Lee JG, Messer LB. 2010. Intake of sweet drinks and sweet treats versus reported and observed caries experience. Eur Arch Paediatr Dent. 11(1):5-17.
33. Lin YC, Chen PH, Lin PL, Lee CH, Huang HL. 2013. Oral health disparities of children among Southeast Asian immigrant women in arranged transnational marriages in Taiwan. Am J Epidemiol. 177:S33.
34. Lin YT, Tsai CL. 1999. Caries prevalence and bottle-feeding practices in 2-year-old children with cleft lip, cleft palate, or both in Taiwan. Cleft Palate Craniofac J. 36(6):522-526.
35. Marquette University. 2015. Dietary analysis for caries prevention in children using a computer software. https://ClinicalTrials.gov/show/NCT02375763.
36. Marshall TA, Eichenberger-Gilmore JM, Larson MA, Warren JJ, Levy SM. 2007. Comparison of the intakes of sugars by young children with and without dental caries experience. J Am Dent Assoc. 138(1):39-46.
37. Marshall TA, Levy SM, Broffitt B, Warren JJ, Eichenberger-Gilmore JM, Burns TL, Stumbo PJ. 2003. Dental caries and beverage consumption in young children. Pediatrics. 112(3 Pt 1):e184-191.
38. Maslak E, Afonina I, Kchmizova T, Litovkina L, Luneva N. 2004. The effect of a milk fluoridation project in Volgograd. Caries Res. 38(4):377.
39. Maupome G, Clark DC, Levy SM, Berkowitz J. 2001. Patterns of dental caries following the cessation of water fluoridation. Community dentistry and oral epidemiology. 29(1):37-47.
40. McDonagh MS, Kleijnen J, Whiting PF, Wilson PM, Sutton AJ, Chestnutt I, Cooper J, Misso K, Bradley M, Treasure E. 2000. Systematic review of water fluoridation. Br Med J. 321(7265):855-859.
41. McIntyre J, Wight C, Blinkhorn AS. 1985. A reassessment of lothian health board's dental health education programme for primary school children. Community Dent Health. 2(2):99-108.
42. McLaren L, Patterson S, Thawer S, Faris P, McNeil D, Potestio M, Shwart L. 2016. Measuring the short-term impact of fluoridation cessation on dental caries in grade 2 children using tooth surface indices. Community dentistry and oral epidemiology. 44(3):274-282.
43. Noah MO. 1984. Caries experience and oral cleanliness in the deciduous dentitions of Ibadan children from different social groups. J Int Assoc Dent Child. 15(1):43-49.
44. Palin-Palokas T. 1987. Relative importance of dental health habits and some other factors in association with the occurrence of caries in mentally retarded Finnish children. Proc Finn Dent Soc. Suomen Hammaslaakariseuran toimituksia. 83(5-6):241-248.
45. Petersen PE, Kwan S, Ogawa H. 2015. Long-term evaluation of the clinical effectiveness of community milk fluoridation in Bulgaria. Community Dent Health. 32(4):199-203.
46. Petrescu CI, Croitor CA, Suciu OI, Olariu TO. 2010. Gender distribution affects eating behavior in patients with dental decay. Timisoara Medical Journal. 60(4):284-

288.

47. Pieper K, Dressler S, Heinzel-Gutenbrunner M, Neuhauser A, Krecker M, Wunderlich K, Jablonski-Momeni A. 2012. The influence of social status on pre-school children's eating habits, caries experience and caries prevention behavior. Int J Public Health. 57(1):207-215.
48. Pilot T. 1988. Trends in oral health: A global perspective. N Z Dent J. 84(376):40-45.
49. Pine CM, Curnow MM, Burnside G, Nicholson JA, Roberts AJ. 2007. Caries prevalence four years after the end of a randomised controlled trial. Caries Res. 41(6):431-436.
50. Potgieter M, Morse EH, Relenbach FM, Dall R. 1956. The food habits and dental status of some Connecticut children. J Dent Res. 35(4):638-644.
51. Reinhardt CH, Lopker N, Noack MJ, Rosen E, Klein K. 2009. Peer teaching pilot programme for caries prevention in underprivileged and migrant populations. Int J Paediatr Dent. 19(5):354-359.
52. Rodrigues AP, Matias F, Ferreira MM. 2016. Tooth brushing at school and reduction on dental plaque: Evaluation of the effectiveness of an oral health project. Revista Portuguesa de Saude Publica. 34(3):244-249.
53. Sahgal J, Sood PB, Raju OS. 2002. A comparison of oral hygiene status and dental caries in children on long term liquid oral medications to those not administered with such medications. J Indian Soc Pedod Prev Dent. 20(4):144-151.
54. Selwitz RH, Nowjack-Raymer RE, Kingman A, Driscoll WS. 1995. Prevalence of dental caries and dental fluorosis in areas with optimal and above-optimal water fluoride concentrations: A 10-year follow-up survey. J Public Health Dent. 55(2):85-93.
55. Stephen KW, Boyle IT, Campbell D, McNee S, Boyle P. 1984. Five-year double-blind fluoridated milk study in Scotland. Community Dent Oral Epidemiol. 12(4):223-229.
56. Warren JJ, Levy SM, Hand JS, Maurer WC, Beltran ED. 1996. Results of the 1994 Iowa oral health survey. Iowa Dent J. 82(1):55-61.
57. Whittle JG, Downer MC. 1979. Dental health and treatment needs of Birmingham and Salford school children. A comparison in a fluoridated and a non-fluoridated area. Br Dent J. 147(3):67-71.
58. Yen CE, Huang YC, Hu SW. 2010. Relationship between dietary intake and dental caries in preschool children. Int J Vitam Nutr Res. 80(3):205-215.
59. Zahlaka M, Mitri O, Munder H, Mann J, Kaldavi A, Galon H, Gedalia I. 1987. The effect of fluoridated milk on caries in Arab children. Results after 3 years. Clin Prev Dent. 9(4):23-25.

Study design did not meet inclusion criteria

1. Anonymous. 1994. Fluorides and oral health. Report of a WHO expert committee on oral health status and fluoride use. World Health Organ Tech Rep Ser. 846:1-37.
2. Arora A, Foster JP, Gillies D, Moxey AJ, Moody G, Curtis B. 2013. Breastfeeding for oral health in preschool children. Cochrane Database Syst Rev. (3)http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010416/abstract.

doi:10.1002/14651858.CD010416.
3. Arora A, Scott JA, Bhole S, Do L, Schwarz E, Blinkhorn AS. 2011. Early childhood feeding practices and dental caries in preschool children: A multi-centre birth cohort study. BMC Public Health. 11:28.
4. Arrow P, Raheb J, Miller M. 2013. Brief oral health promotion intervention among parents of young children to reduce early childhood dental decay. BMC Public Health. 13:245.
5. Bach K, Manton DJ. 2014. Early childhood caries: A New Zealand perspective. J Prim Health Care. 6(2):169-174.
6. Batliner T, Fehringer KA, Tiwari T, Henderson WG, Wilson A, Brega AG, Albino J. 2014. Motivational interviewing with American Indian mothers to prevent early childhood caries: Study design and methodology of a randomized control trial. Trials. 15:125.
7. Bedi R, Blinkhorn A, Holloway P, Carnell H, Copestake P, Farmelo C, Harvey S, Larsen L. 2005. A futures study of dental decay in 5 and 15 year olds in England. Health Education Journal. 64(4):1-111.
8. de Silva-Sanigorski AM, Calache H, Gussy M, Dashper S, Gibson J, Waters E. 2010. The vicgeneration study--a birth cohort to examine the environmental, behavioural and biological predictors of early childhood caries: Background, aims and methods. BMC Public Health. 10:97.
9. de Silva-Sanigorski AM, Waters E, Calache H, Smith M, Gold L, Gussy M, Scott A, Lacy K, Virgo-Milton M. 2011. Splash!: A prospective birth cohort study of the impact of environmental, social and family-level influences on child oral health and obesity related risk factors and outcomes. BMC Public Health. 11:505.
10. Dunbar JB, Moller P, Wolff AE. 1968. A survey of dental caries in Iceland. Arch Oral Biol. 13(5):571-581.
11. Ericsson Y, Wei SH. 1979. Fluoride supply and effects in infants and young children. Pediatr Dent. 1(1):44-54.
12. Eronat N, Eden E. 1992. A comparative study of some influencing factors of rampant or nursing caries in preschool children. J Clin Pediatr Dent. 16(4):275-279.
13. Gao X, Lo EC, McGrath C, Ho SM. 2013. Innovative interventions to promote positive dental health behaviors and prevent dental caries in preschool children: Study protocol for a randomized controlled trial. Trials. 14:118.
14. Gao XL, Hsu CY, Loh T, Koh D, Hwamg HB, Xu Y. 2009. Dental caries prevalence and distribution among preschoolers in Singapore. Community Dent Health. 26(1):12-17.
15. Gray M, Morris AJ, Davies J. 2000. The oral health of south Asian five-year-old children in deprived areas of dudley compared with white children of equal deprivation and fluoridation status. Community Dent Health. 17(4):243-245.
16. Gussy MG, Waters EG, Walsh O, Kilpatrick NM. 2006. Early childhood caries: Current evidence for aetiology and prevention. J Paediatr Child Health. 42(1-2):37-43.
17. Hackett AF, Rugg-Gunn AJ. 1982. Sweets, snacks, and dental caries: South African interracial patterns. Am J Clin Nutr. 35(6):1503-1505.
18. Han DH, Kim DH, Kim MJ, Kim JB, Jung-Choi K, Bae KH. 2014. Regular dental checkup and snack-soda drink consumption of preschool children are associated with

early childhood caries in Korean caregiver/preschool children dyads. Community Dent Oral Epidemiol. 42(1):70-78.

19. Hann HJ, Gray AS, Yeo DJ, Philion JJ. 1984. A dental health survey of British Columbia children. J Can Dent Assoc. 50(10):754-759.
20. Hardison JD, Cecil JC, White JA, Manz M, Mullins MR, Ferretti GA. 2003. The 2001 Kentucky childrens oral health survey: Findings for children ages 24 to 59 months and their caregivers. Pediatr Dent. 25(4):365-372.
21. Hargreaves JA, Thompson GW, Wagg BJ. 1983. Changes in caries prevalence of isle of lewis children between 1971 and 1981. Caries Res. 17(6):554-559.
22. Hargreaves JA, Titley KC. 1973. The dental health of Indian children in the Sioux lookout zone of northwestern ontario. Journal of the Canadian Dental Association. 39(10):709-714.
23. Hattab FN, Al-Omari MA, Angmar-Mansson B, Daoud N. 1999. The prevalence of nursing caries in one-to-four-year-old children in Jordan. J Dent Child. 66(1):53-58.
24. Ivancevic V, Tusek I, Tusek J, Knezevic M, Elheshk S, Lukovic I. 2015. Using association rule mining to identify risk factors for early childhood caries. Comput Methods Programs Biomed. 122(2):175-181.
25. Jessri M, Rashidkhani B, Kimiagar S, Mobley C. 2011a. Prevalence of dental caries and its association with cariogenic foods and beverages. Annals of Nutrition and Metabolism. 58:345.
26. Jessri M, Rashidkhani B, Kimiagar SM, Mobley C. 2011b. Prevalence of dental caries in relation to cariogenic food intakes. Clinical Nutrition, Supplement. 6 (1):162.
27. Johnsen DC, Gerstenmaier JH, Schwartz E, Michal BC, Parrish S. 1984. Background comparisons of pre-$3^{1}/_{2}$-year-old children with nursing caries in four practice settings. Pediatr Dent. 6(1):50-54.
28. Johnston DW, Grainger RM, Ryan RK. 1986. The decline of dental caries in Ontario school children. J Can Dent Assoc. 52(5):411-417.
29. Jose B, King NM. 2003. Early childhood caries lesions in preschool children in Kerala, India. Pediatr Dent. 25(6):594-600.
30. Kallestal C, Norlund A, Soder B, Nordenram G, Dahlgren H, Petersson LG, Lagerlof F, Axelsson S, Lingstrom P, Mejare I et al. 2003. Economic evaluation of dental caries prevention: A systematic review. Acta Odontol Scand. 61(6):341-346.
31. King NM, Wu, II, Tsai JS. 2003. Caries prevalence and distribution, and oral health habits of zero- to four-year-old children in Macau, China. J Dent Child (Chic). 70(3):243-249.
32. Knychalska-Karwan Z, Laskowska L, Pelcowa M, Szafraniec I, Wedler A. 1972. Juvenile caries activity and dietary regime. Caries Res. 6(1):70-71.
33. Lawrence HP, Binguis D, Douglas J, McKeown L, Switzer B, Figueiredo R, Reade M. 2009. Oral health inequalities between young aboriginal and non-aboriginal children living in Ontario, Canada. Community Dentistry and Oral Epidemiology. 37(6):495-508.
34. Leatherwood EC, Burnett GW, Chandravejjsmarn R, Sirikaya P. 1965. Dental caries and dental fluorosis in Thailand. Am J Public Health Nations Health. 55(11):1792-1799.
35. MacKeown JM, Cleaton-Jones PE, Edwards AW. 2000. Energy and macronutrient intake in relation to dental caries incidence in urban black South African preschool

children in 1991 and 1995: The birth-to-ten study. Public Health Nutr. 3(3):313-319.
36. Manji F, Fejerskov O. 1990. Dental caries in developing countries in relation to the appropriate use of fluoride. J Dent Res. 69(SPEC. ISS. FEB.):733-741.
37. Marrs JA, Trumbley S, Malik G. 2011. Early childhood caries: Determining the risk factors and assessing the prevention strategies for nursing intervention. Pediatr Nurs. 37(1):9-15; quiz 16.
38. Marthaler TM. 1994. Fluoridation at community level. World Health. 47(1):7-9.
39. O'Keefe E. 2013. Early childhood caries. Evid Based Dent. 14(2):40-41.
40. Onetto JE. 2014. Early oral health promotion program for new mothers may have impact on child dental caries after 5 years. Journal of Evidence-Based Dental Practice. 14(4):188-189.
41. Peltzer K, Mongkolchati A, Satchaiyan G, Rajchagool S, Pimpak T. 2014. Sociobehavioral factors associated with caries increment: A longitudinal study from 24 to 36 months old children in Thailand. International Journal of Environmental Research and Public Health. 11(10):10838-10850.
42. Phantumvanit P. 2014. How to use fluoride effectively for dental caries prevention? Indian J Dent Res. 25(1):1-2.
43. Phillips MG, Stubbs PE. 1987. Head start combats baby bottle tooth decay. Child Today. 15(5):25-28.
44. Richards D. 2016. Breastfeeding up to 12 months of age not associated with increased risk of caries. Evid Based Dent. 17(3):75-76.
45. Richardson BD, Cleaton-Jones PE. 1977. Nursing bottle caries. Pediatrics. 60(5):748-749.
46. Richardson BD, Cleaton-Jones PE. 1986. Sugar, snacks, fluoride and dental caries in rsa preschool children: An overview. J Dent Assoc S Afr. 41(9):611-613.
47. Richardson BD, Rantsho JM. 1976. Caries and dental hygiene. SAMJ. 50(40):1536.
48. Salford Royal NHS Foundation Trust (UK). 2013. Dental Recur Trial.
49. Scheer B. 1985. Caries in children--the dietary factor. Middle East Dent Oral Health. (3):20-22.
50. Schiffner U. 1989. [Influence of caries preventive measures on prevalence and incidence of caries in Hamburg preschool children]. Dtsch Zahnarztl Z. 44(7):531-535.
51. Schneider HG, Hierse P, Hierse H, Deichsel E. 1989. The influence of parents on the oral health condition of children. [German]. Z Gesamte Hyg. 35(9):523-526.
52. Shannon IL. 1977. Sucrose-the tooth's mortal enemy; fluoride-the tooth's best friend. ASDC Journal of Dentistry for Children. 44(6):429-437.
53. Shearer TR, Howard HE, DeSart DJ. 1978. Breast-feeding and nursing caries. J Oreg Dent Assoc. 47(3):17.
54. Singh G, Singh T. 1985. Dental caries. Indian Pediatr. 22(11):849-852.
55. Tickle M. 2006. Improving the oral health of young children through an evidence-based approach. Community Dent Health. 23(1):2-4.
56. Tinanoff N. 2005. Association of diet with dental caries in preschool children. Dent Clin North Am. 49(4):725-737, v.
57. Uribe S. 2009. Early childhood caries risk factors. Evid Based Dent. 10(2):37-38.
58. Victora CG, Bahl R, Barros AJ, Franca GV, Horton S, Krasevec J, Murch S, Sankar MJ, Walker N, Rollins NC et al. 2016. Breastfeeding in the 21st century:

Epidemiology, mechanisms, and lifelong effect. Lancet. 387(10017):475-490.
59. Wainwright WW. 1987. The Borrow Dental Milk Foundation program to reduce dental caries in children. Odontostomatol Trop. 10(2):85-96.
60. Walker AR, Cleaton-Jones PE. 1977. Dental caries reduction from dietary changes. AJCN. 30(12):1938-1939.
61. Wendt LK. 1995. On oral health in infants and toddlers. Swed Dent J Suppl. 106:1-62.
62. Wetzel WE. 1988. ["Nursing bottle syndrome" in young children. Dental findings, incidence and family environment]. Monatsschr Kinderheilkd. 136(10):673-679.
63. White V. 2008. Breastfeeding and the risk of early childhood caries. Evid. 9(3):86-88.
64. Wong D. 2000. Fluoride levels best in tap water, study finds. Dent Today. 19(8):30, 36.
65. Wyne AH. 1996. Early childhood caries. A review. Indian J Dent Res. 7(1):7-15.
66. Yadav RK, Das S, Kumar PR. 2001. Dental caries and dietary habits in school going children. Indian J Physiol Pharmacol. 45(2):258-260.
67. Yaghi MM. 2001. Soda pop and caries. JADA (1939). 132(5):578, 580.

Publication withdrawn

1. de Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, Morrice HR, Riggs E, Leong PM, Meyenn LK et al. 2016. Community-based population-level interventions for promoting child oral health. Cochrane Database Syst Rev. 2016 (9) (no pagination)(CD009837).

No English language abstract

1. Kalsbeek H. 1982. [The effect of dental health education projects on the prevention of dental caries. A summary observation of a study on the incidence of caries in preschool children, carried out between 1965-1980]. Ned Tijdschr Tandheelkd. 89(3):106-117.
2. Lazzati M, Nidoli G, Preda EG, Tommasin B. 1987. [Epidemiological study of dental caries in nursery schools in the city of Varese]. Mondo Odontostomatol. 29(2):13-17.
3. Meskov M. 1968. Current results of water supply fluoridation applied in caries prevention and the possibility of its introduction in titov veles. [Serbian]. Stomatoloski vjesnik. Stomatological review. 2(1-6):169-172.
4. Ohhashi K. 1986. The quantification of nursery environment to caries prevalence in children. [Japanese]. The Japanese journal of pedodontics. 24(4):704-724.
5. Rokytova K, Hoskova M, Thorova J, Mrklas L. 1979. [Fluorine and dental caries]. Cesk Pediatr. 34(1):39-41.
6. Sakakibara Y, Fukada H, Ochiai S, Samejima T. 1976. [Sugar-added drinks and their relationship to dental caries of deciduous teeth]. Nippon Shika Ishikai Zasshi. 28(11):1174-1184.
7. Saxer UP, Steiner M. 1983. [Early education and motivation for oral prophylaxis]. SSO Schweiz Monatsschr Zahnheilkd. 93(1):27-36.
8. Schmidt HF. 1968. [Current knowledge about the tropical application of a long-acting fluoride preparation for the prevention of dental caries]. Dtsch Zahnarztl Z.

23(2):148-151.
9. Shen YM. 1985. Analysis of the 18th year of the fluoridation of the water supply to prevent dental caries in fangcun in Guangzhou. [Chinese]. Chinese journal of stomatology. 20(6):337-340.
10. Shiokawa H. 1979. Our experience with mothers' classes for caries prevention--follow-up studies. [Japanese]. Dental outlook. 53(6):1022-1031.
11. Sigrist H. 1969. 3 years of caries prevention. [German]. Das Offentliche Gesundheitswesen. 31(7):373-378.
12. Streliukhina TF, Belova TA, Beliaevskaia LA, Gromova EM. 1976. Effect of water fluoridation in Leningrad on dental caries susceptibility in childhood. [Russian]. Stomatologiia (Mosk). 55(4):66-69.
13. Tonello G. 1962. [Dentition and dental caries in relation to the type of nursing. (clinico-statistical research on elementary school pupils of sacile)]. Friuli Med. 17:739-747.
14. Valente AP, Varveri RL, Polak N, Abeles G, Dono R, Kwiatkosvky I, Preliasco A. 1982. Epidemiology of caries in preschoolers, relation to preventive habits and demand for care. [Spanish]. Salud bucal / Confederacion Odontologica de la Republica Argentina. 9(55):29-42.
15. Viegas Y, Viegas AR. 1988. Prevalence of dental caries in Barretos, Brazil, after 16 years of water supply fluoridation. [Portuguese]. Rev Saude Publica. 22(1):25-35.
16. Vines JJ, Clavero J. 1968. Relation between the occurrence of dental caries and the amount of fluorine in the water supply. [Spanish]. Rev Sanid Hig Publica (Madr). 42(7):401-431.
17. Wakabayashi Y, Tsuchiya T, Korosu K. 1982. A trace-back survey of dental attitudes of caries-free children examined in a 3-year period. Questionnaires for the parents. [Japanese]. Aichi Gakuin Daigaku Shigakkai Shi. 20(1):29-39.
18. Wang BK. 1980. [A survey of drinking water floride content in tong county, Beijing (author's transl)]. Chung Hua Kou Chiang Ko Tsa Chih. 15(3):171-174.
19. Wang XS. 1984. Caries incidence among 3,000 primary school pupils in Li County, Aba District. [Chinese]. Chinese Journal of Stomatology. 19(1):56-58.
20. Warrer E. 1974. Caries development in a public school dental service through a 20 year period with 10 years of local administration of fluoride. [Danish]. Tandlaegebladet. 78(7):271-278.
21. Wei SH, Kuriyama S. 1981. Fluoride and dental caries prevention (author's transl). [Japanese]. Dental outlook. 58(6):1079-1091.
22. Weiss K. 1990. [Success, what is it? Four years prevention in Hamburg kindergarten (1)]. Quintessenz J. 20(8):727-733.
23. Wetzel WE. 1982. [Dental caries caused by excessive consumption of sweetened tea from nursing bottles]. Monatsschr Kinderheilkd. 130(9):726-730.
24. Wetzel WE. 1989. Nursing bottle syndrome in small children. [German]. Zahnarztl. 79(3):249-257.
25. Weyers H. 1983. Findings in "nursing-bottle caries". [German]. Dtsch Zahnarztl Z. 38(7):722-726.
26. Widstrom E. 1983. Dental health and dental care habits in a group of Turkish immigrant children. [Swedish]. Tandlakartidningen. 75(4):152-156.
27. Wigdorowicz-Makowerowa N. 1972. The development of dental caries in school

children and its prevention by fluoridation. [Polish]. Czas Stomatol. 25(9):879-883.
28. Wigdorowicz-Makowerowa N. 1980. Value and effectiveness of the use of fluoride in preventing dental caries. [Polish]. Postpy higieny i medycyny doswiadczalnej. 34(5):353-366.
29. Wigdorowicz-Makowerowa N. 1982. Effect of 13 years of water fluoridation in Wroclaw on the course of caries in school children. [Polish]. Czas Stomatol. 35(9):577-582.
30. Wigdorowicz-Makowerowa N, Dadun-Sek A, Plonka B. 1978. Comparison of the effectiveness of water fluoridation during 5 and 8 years in Wroclaw. [Polish]. Czas Stomatol. 31(9):817-823.
31. Wigdorowicz-Makowerowa N, Plonka B, Dadun-Sek A. 1975. [Evaluation of water fluoridation effectiveness in children in Wroclaw in the course of 5 years]. Czas Stomatol. 28(3):253-259.
32. Wikner S. 1974. Prevention of dental caries at the pedodontic clinic. Ii. Reduction in caries after giving standardized, optimum information. [Swedish]. Tandlakartidningen. 66(20):1134-1140.
33. Wikner S. 1975a. Caries prevention at the pedodontic clinic. [Swedish]. Tandlakartidningen. 67(13-14):798-802.
34. Wikner S. 1975b. Dental caries prevention at the pedodontic clinic. Iii. Analysis of background factors in development of dental caries in preschool children. [Swedish]. Tandlakartidningen. 67(3):146-164.
35. Winter K. 1979. Successes of juvenile dental hygiene; improvement in the health response of young children after 4 years of individual early prophylaxis. [German]. Zahnarztl. 69(21):1331-1332, 1334-1337, 1339.
36. Woltgens JH, Bervoets TJ, de Blieck-Hogervorst JM, Vingerling PA. 1984. Relation between caries, oral hygiene and caries susceptibility tests in children. [Dutch]. Ned Tijdschr Tandheelkd. 91(12):545-548.
37. Yamane T. 1973. [A study on conditions of caries, tooth surface deposits, and paradental diseases, and those correlations in infants]. Shigaku. 60(6):812-838.
38. Yanagawa K, Shibayama K. 1969. Report on oral health survey at Chichijima, Ogasawara, Tokyo. The 1st dental clinic group in ogasawara supported by Tokyo-to. [Japanese]. Shika gakuho. Dental science reports. 69(6):976-988.
39. Yonezu T, Sugiyama M, Mikami K, Machida Y. 1988. [Dental caries prevalence in infants under a dental health care program]. Shikwa Gakuho. 88(3):557-564.
40. Yoshida S. 1978a. Dental caries control in children. [Japanese]. Dental outlook. 51(5):822-829.
41. Yoshida S. 1978b. [Dental caries control in children]. Shikai Tenbo. 51(5):822-829.
42. Zamorano WM, Ribeiro JC, Linhares RM, Parreira ML. 1987. Correlation of the dmf-s index with the age of the child. [Portuguese]. Rgo. 35(6):481-484.

Intervention or exposure did not meet the inclusion criteria

1. Agouropoulos A, Twetman S, P, is N, Kavvadia K, Papagiannoulis L. 2014. Caries-preventive effectiveness of fluoride varnish as adjunct to oral health promotion and supervised tooth brushing in preschool children: A double-blind randomized controlled trial. J Dent. 42(10):1277-1283.

2. Akizawa Y, Sakurai Y, Hara N, Fujita Y, Nagai M, Nakamura Y, Sakata K, Yanagawa H. 1990. An epidemiological study of the influence of sweets intake and toothbrushing on dental caries among children in japan. Asia-Pacific Journal of Public Health. 4(4):242-250.
3. Al Mughery AS, Attwood D, Blinkhorn A. 1991. Dental health of 5-year-old children in Abu Dhabi, United Arab Emirates. Community Dent Oral Epidemiol. 19(5):308-309.
4. Al-Dashti AA, Williams SA, Curzon ME. 1995. Breast feeding, bottle feeding and dental caries in Kuwait, a country with low-fluoride levels in the water supply. Community Dental Health. 12(1):42-47.
5. Aldy D, Siregar Z, Siregar H, Liwijaya SG, Tanyati S. 1979. A comparative study of caries formation in breast-fed and bottle-fed children. Paediatrica Indonesiana. 19(11):308-312.
6. Alkhtib A, Ghanim A, Temple-Smith M, Messer LB, Pirotta M, Morgan M. 2016. Prevalence of early childhood caries and enamel defects in four and five-year old Qatari preschool children. BMC Oral Health. 16(1):73.
7. Ammari JB, Baqain ZH, Ashley PF. 2007. Effects of programs for prevention of early childhood caries. A systematic review. Medical Principles & Practice. 16(6):437-442.
8. Anonymous. 2001. Children's snacking habits can predict caries. Journal of the American Dental Association. 132(5):594, 598.
9. Attwood D, Blinkhorn AS. 1991. Dental health in schoolchildren 5 years after water fluoridation ceased in south-west Scotland. Int Dent J. 41(1):43-48.
10. Avila WM, Pordeus IA, Paiva SM, Martins CC. 2015. Breast and bottle feeding as risk factors for dental caries: A systematic review and meta-analysis. PLoS ONE [Electronic Resource]. 10(11):e0142922.
11. Babeely K, Kaste LM, Husain J, Behbehani J, al-Za'abi F, Maher TC, Tavares M, Soparkar P, DePaola P. 1989. Severity of nursing-bottle syndrome and feeding patterns in Kuwait. Community Dent Oral Epidemiol. 17(5):237-239.
12. Bang G, Kristoffersen T. 1972. Dental caries and diet in an Alaskan Eskimo population. Scandinavian Journal of Dental Research. 80(5):440-444.
13. Bankel M, Robertson A, Kohler B. 2011. Carious lesions and caries risk predictors in a group of Swedish children 2 to 3 years of age. One year observation. European Journal of Paediatric Dentistry. 12(4):215-219.
14. Bao XL, Jibek O, Yu Q, Zhao J. 2014. Prevalence and risk factors for severe early childhood caries for Uyghur and Han children in Kashi city: A cross-sectional study. [Chinese]. Chinese Journal of Evidence-Based Medicine. 14(3):260-264.
15. Barnes GP, Parker WA, Lyon Jr TC, Drum MA, Coleman GC. 1992. Ethnicity, location, age, and fluoridation factors in baby bottle tooth decay and caries prevalence of head start children. Public Health Reports. 107(2):167-173.
16. Beal JF, Clayton M. 1981. Fluoridation. A clinical survey in Corby and Scunthorpe. Public Health. 95(3):152-160.
17. Beal JF. 1973. The dental health of five-year-old children of different ethnic origins resident in an inner Birmingham area and a nearby borough. Arch Oral Biol. 18(3):305-312.
18. Begzati A, Berisha M, Meqa K. 2010. Early childhood caries in preschool children of kosovo - a serious public health problem. BMC Public Health. 10:788.

19. Behrendt A, Sziegoleit F, Muler-Lessmann V, Ipek-Ozdemir G, Wetzel WE. 2001. Nursing-bottle syndrome caused by prolonged drinking from vessels with bill-shaped extensions. Journal of Dentistry for Children. 68(1):47-50, 12.
20. Bernabe E, MacRitchie H, Longbottom C, Pitts NB, Sabbah W. 2017. Birth weight, breastfeeding, maternal smoking and caries trajectories. J Dent Res. 96(2):171-178.
21. Bhayade SS, Mittal R, C, Ak S, Bhondey A. 2016. Assessment of social, demographic determinants and oral hygiene practices in relation to dental caries among the children attending anganwadis of Hingna, Nagpur. Journal of the Indian Society of Pedodontics & Preventive Dentistry. 34(2):124-127.
22. Bjarnason S, Care R, Berzina S, Brinkmane A, Rence I, Mackevica I, Paeglite I, Senakola E. 1995. Caries experience in Latvian nursery school children. Community Dent Oral Epidemiol. 23(3):138-141.
23. Blair Y, Macpherson L, McCall D, McMahon A. 2006. Dental health of 5-year-olds following community-based oral health promotion in Glasgow, UK. Int Journal Paed Dent. 16(6):388-398.
24. Blair Y, Macpherson LMD, McCall DR, McMahon AD, Stephen KW. 2004. Glasgow nursery-based caries experience, before and after a community development-based oral health programme's implementation. Community Dent Health. 21(4):291-298.
25. Blinkhorn AS. 1982. The caries experience and dietary habits of Edinburgh nursery school children. Brit Dent J. 152(7):227-230.
26. Bourgeois DM, Llodra JC. 2014. Global burden of dental condition among children in nine countries participating in an international oral health promotion programme, 2012-2013. Int Dent J. 64:27-34.
27. Brega AG, Thomas JF, Henderson WG, Batliner TS, Quissell DO, Braun PA, Wilson A, Bryant LL, Nadeau KJ, Albino J. 2016. Association of parental health literacy with oral health of Navajo nation preschoolers. Health Education Research. 31(1):70-81.
28. Brignardello-Petersen R. 2017. Breast-feeding up to 11 months associated with lower decayed, missing, and filled surfaces index and lower caries prevalence up to 4 years of age. JADA. 148(5):e44-e44.
29. Broderick E, Mabry J, Robertson D, Thompson J. 1989. Baby bottle tooth decay in Native American children in head start centers. Public Health Reports. 104(1):50-54.
30. Cageorge SM, Ryding WH, Leake JL. 1980. Dental health status survey of Manitoba children. J Cand Dent Assoc. 46(2):108-116.
31. Campus G, Lumbau A, Sanna AM, Solinas G, Luglie P, Castiglia P. 2004. Oral health condition in an Italian preschool population. European Journal of Paediatric Dentistry. 5(2):86-91.
32. Campus G, Solinas G, Sanna A, Maida C, Castiglia P. 2007. Determinants of ECC in Sardinian preschool children. Community Dent Health. 24(4):253-256.
33. Campus G, Solinas G, Strohmenger L, Cagetti MG, Senna A, Minelli L, Majori S, Montagna MT, Reali D, Castiglia P. 2009. National pathfinder survey on children's oral health in Italy: Pattern and severity of caries disease in 4-year-olds and the collaborating study group. Caries Res. 43(2):155-162.
34. Caplan LS, Erwin K, Lense E, Hicks J, Jr. 2008. The potential role of breast-feeding and other factors in helping to reduce early childhood caries. J Public Health Dent. 68(4):238-241.
35. Carino KM, Shinada K, Kawaguchi Y. 2003. Early childhood caries in northern

Philippines. Community Dent Epidemiol. 31(2):81-89.
36. Chaffee BW, Cheng A. 2014. Global research trends on early-life feeding practices and early childhood caries: A systematic review. J Oral Dis. 2014:675658.
37. Chaffee BW, Feldens CA, Rodrigues PH, Vítolo MR. 2015. Feeding practices in infancy associated with caries incidence in early childhood. Community Dent Oral Epidemiol. 43(4):338-348.
38. Chaffee BW, Feldens CA, Vitolo MR. 2013. Cluster-randomized trial of infant nutrition training for caries prevention. J Dent Res. 92(7):29S-36S.
39. Chaffee BW, Feldens CA, Vítolo MR. 2014. Association of long-duration breastfeeding and dental caries estimated with marginal structural models. Annals of Epidemiology. 24(6):448-454.
40. Chankanka O, Levy SM, Marshall TA, Cavanaugh JE, Warren JJ, Broffitt B, Kolker JL. 2015. The associations between dietary intakes from 36 to 60 months of age and primary dentition non-cavitated caries and cavitated caries. J Public Health Dent. 75(4):265-273.
41. Chu CH, Ho PL, Lo EC. 2012. Oral health status and behaviours of preschool children in Hong Kong. BMC Public Health. 12:767.
42. Cleaton-Jones P, Richardson BD, Rantsho JM, Pieters L, McInnes PM. 1979. Patterns of oral hygiene and dental caries in urban and rural South African preschool children. Odonto-Stomatologie Tropicale. 11(8):27-33.
43. Clifford H, Johnson NW, Brown C, Battistutta D. 2012. When can oral health education begin? Relative effectiveness of three oral health education strategies starting pre-partum. Community Dent Health. 29(2):162-167.
44. Colquhoun J. 1988. Decline in primary tooth decay in New Zealand. Community Health Studies. 12(2):187-191.
45. Congiu G, Campus G, Sale S, Spano G, Cagetti MG, Luglie PF. 2013. Early childhood caries and associated determinants: A cross-sectional study on Italian preschool children. J Public Health Dent. 74(2):147-152.
46. Creedon MI, O'Mullane DM. 2001. Factors affecting caries levels amongst 5-year-old children in county Kerry, Ireland. Community Dent Health. 18(2):72-78.
47. Currier GF, Glinka MP. 1977. The prevalence of nursing bottle caries or baby bottle syndrome in an inner city fluoridated community. Virginia Dental Journal. 54(5):9-19.
48. Cypriano S, Pecharki GD, de Sousa Mda L, Wada RS. 2003. [Oral health of schoolchildren residing in areas with or without water fluoridation in Sorocaba, Sao Paulo State, Brazil]. Cadernos de Saude Publica. 19(4):1063-1071.
49. Dabawala S, Suprabha BS, Shenoy R, Rao A, Shah N. 2017. Parenting style and oral health practices in early childhood caries: A case-control study. Int J Paediatr Dent.
50. Dantas Cabral de Melo MM, Vieira de Souza W, Tavares MC, Carvalho de Lima ML, Jamelli S, Lindoso Couto GB. 2015. Social conditions and high levels of dental caries in five-year-old children in Brazil. Journal of Dentistry for Children. 82(1):29-35.
51. Darmawikarta D, Chen Y, Carsley S, Birken CS, Parkin PC, Schroth RJ, Maguire JL, Collaboration TAK. 2014. Factors associated with dental care utilization in early childhood. Pediatrics. 133(6):e1594-1600.
52. Davenport ES, Litenas C, Barbayiannis P, Williams CE. 2004. The effects of diet, breast-feeding and weaning on caries risk for pre-term and low birth weight children.

International journal of paediatric dentistry. 2004 Jul; 14(4):251-9.

53. Davies GM, Duxbury JT, Boothman NJ, Davies RM, Blinkhorn AS. 2005. A staged intervention dental health promotion programme to reduce early childhood caries. Community Dent Health. 22(2):118-122.
54. Davies GM, Duxbury JT, Boothman NJ, Davies RM. 2007. Challenges associated with the evaluation of a dental health promotion programme in a deprived urban area. Community Dent Health. 24(2):117-121.
55. de Melo MMDC, de Souza WV, de Lima MLC, Braga C. 2011. Factors associated with dental caries in preschoolers in Recife, Pernambuco state, Brazil. [Portuguese]. Cadernos de Saude Publica. 27(3):471-485.
56. Deichsel M, Rojas G, Ludecke K, Heinrich-Weltzien R. 2012. [Early childhood caries and associated risk factors among infants in the German federal state of Brandenburg]. Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz. 55(11):1504-1511.
57. Del Valle LL, Velazquez-Quintana Y, Weinstein P, Domoto P, Leroux B. 1998. Early childhood caries and risk factors in rural Puerto Rican children. ASDC Journal of Dentistry for Children. 65(2):132-135.
58. Demers M, Brodeur JM, Mouton C, Simard PL, Trahan L, Veilleux G. 1992. A multivariate model to predict caries increment in Montreal children aged 5 years. Community Dent Health. 9(3):273-281.
59. Derkson GD, Ponti P. 1982. Nursing bottle syndrome; prevalence and etiology in a non-fluoridated city. J Can Dent Assoc. 48(6):389-393.
60. Dimitrova M, Kukleva M. 2008. Model for early childhood caries risks. [Russian]. Stomatologiia. 87(4):29-32.
61. Dimitrova MM, Kukleva MP, Kondeva VK. 2002. Prevalence of early childhood caries and risk factors in children from 1 to 3 years of age in Plovdiv, Bulgaria. Folia Medica (Plovdiv). 44(1):60-63.
62. Dirks OB. 1967. The relation between the fluoridation of water and dental caries experience. Int Dent J. 17(3):582-605.
63. Dogar F, Kruger E, Dyson K, Tennant M. 2011. Oral health of pre-school children in rural and remote Western Australia. Rural & Remote Health. 11(4):1869.
64. Douglass JM, Tinanoff N, Tang JMW, Altman DS. 2001. Dental caries patterns and oral health behaviors in Arizona infants and toddlers. Community Dent Oral Epidemiol. 29(1):14-22.
65. Du M, Bian Z, Guo L, Holt R, Champion J, Bedi R. 2000. Caries patterns and their relationship to infant feeding and socio-economic status in 2-4-year-old Chinese children. Int Dent J. 50(6):385-389.
66. Du M, Luo Y, Zeng X, Alkhatib N, Bedi R. 2007. Caries in preschool children and its risk factors in 2 provinces in china. Quintessence International. 38(2):143-151.
67. Dye BA, Shenkin JD, Ogden CL, Marshall TA, Levy SM, Kanellis MJ. 2004. The relationship between healthful eating practices and dental caries in children aged 2-5 years in the United States, 1988-1994. JADA. 135(1):55-66.
68. Ekman A, Holm AK, Schelin B, Gustafsson L. 1981. Dental health and parental attitudes in Finnish immigrant preschoolchildren in the north of Sweden. Community Dent Oral Epidemiol. 9(5):224-229.
69. El Fadl RA, Blair M, Hassounah S. 2016. Integrating maternal and children's oral

health promotion into nursing and midwifery practice - a systematic review. PLoS ONE. 11.
70. Erickson PR, Mazhari E. 1999. Investigation of the role of human breast milk in caries development. Pediatric Dentistry. 21(2):86-90.
71. Evans RW, Beck DJ, Brown RH. 1980. Dental health of 5-year-old children: A report from the Dunedin multidisciplinary child development study. N Z Dent J. 76(346):179-186.
72. Farsi N, Merdad L, Mirdad S. 2013. Caries risk assessment in preschool children in Saudi Arabia. Oral Health & Preventive Dentistry. 11(3):271-280.
73. Faye M, Ba AA, Yam AA, Ba I. 2006. [Caries patterns and diet in early childhood caries]. Dakar Medical. 51(2):72-77.
74. Feldens CA, Giugliani ERJ, Duncan BB, Drachler ML, Vítolo MR. 2010. Long-term effectiveness of a nutritional program in reducing early childhood caries: A randomized trial. Community Dent Oral Epidemiol. 38(4):324-332.
75. Feldens CA, Giugliani ERJ, Vigo A, Vitolo MR. 2010. Early feeding practices and severe early childhood caries in four-year-old children from southern Brazil: A birth cohort study. Caries Res. 44(5):445-452.
76. Feldens CA, Rodrigues PH, Rauber F, Chaffee BW, Vitolo MR. 2013. Food expenditures, cariogenic dietary practices and childhood dental caries in southern Brazil. Caries Res. 47(5):373-381.
77. Ferrazzano GF, Sangianantoni G, Cantile T, Ingenito A. 2016. Relationship between social and behavioural factors and caries experience in schoolchildren in Italy. Oral Health & Preventive Dentistry. 14(1):55-61.
78. Figueiredo MC, Guarienti CA, Michel JA, Sampaio MS. 2008. Comprehensive attention to oral health in early childhood: A longitudinal evaluation of the infant clinic program of the Federal University of Rio Grande do Sul, Brazil. Acta Odontologica Latinoamericana. 21(2):181-187.
79. Fraiz FC, Walter LR. 2001. Study of the factors associated with dental caries in children who receive early dental care. Brazilian Oral Research. 15(3):201-207.
80. Frazao P. 2011. Effectiveness of the bucco-lingual technique within a school-based supervised toothbrushing program on preventing caries: A randomized controlled trial. BMC Oral Health. 11:11.
81. Freeman L, Martin S, Rutenberg G, Shirejian P, Skarie M. 1989. Relationships between def, demographic and behavioral variables among multiracial preschool children. Journal of Dentistry for Children. 56(3):205-210.
82. Freeman R, Breistein B, McQueen A, Stewart M. 1997. The dental health status of five-year-old children in north and west Belfast. Community Dent Health. 14(4):253-257.
83. Frostell G, Birkhed D, Edwardsson S, Goldberg P, Petersson LG, Priwe C, Winholt AS. 1991. Effect of partial substitution of invert sugar for sucrose in combination with duraphat treatment on caries development in preschool children: The Malmo study. Caries Res. 25(4):304-310.
84. Ge X, Zhang B, Li B, Zhao L, Zhao B, Ren X, Sun K. 2004. The effects of feeding methods on deciduous caries. [Chinese]. Shanghai Journal of Stomatology. 13(5):365-366.
85. Ghazal T, Levy SM, Childers NK, Broffitt B, Cutter G, Wiener HW, Kempf M,

Warren J, Cavanaugh J. 2015a. Prevalence and incidence of early childhood caries among African-American children in Alabama. J Public Health Dent. 75(1):42-48.

86. Ghazal T, Levy SM, Childers NK, Broffitt B, Cutter GR, Wiener HW, Kempf MC, Warren J, Cavanaugh JE. 2015b. Factors associated with early childhood caries incidence among high caries-risk children. Community Dent Oral Epidemiol. 43(4):366-374.
87. Gibbs L, de Silva AM, Christian B, L G, Gussy M, Moore L, Calache H, Young D, Riggs E, Tadic M. 2016. Child oral health in migrant families: A cross-sectional study of caries in 1-4 year old children from migrant backgrounds residing in Melbourne, Australia. Community Dent Health. 33(2):100-106.
88. Gibson S, Williams S. 1999. Dental caries in pre-school children: Associations with social class, toothbrushing habit and consumption of sugars and sugar-containing foods. Further analysis of data from the National Diet and Nutrition Survey of children aged 1.5-4.5 years. Caries Res. 33(2):101-113.
89. Goose DH, Gittus E. 1968. Infant feeding methods and dental caries. Public Health. 82(2):72-76.
90. Gordon Y, Reddy J. 1985. Prevalence of dental caries, patterns of sugar consumption and oral hygiene practices in infancy in S. Africa. Community Dent Oral Epidemiol. 13(6):310-314.
91. Harrison R, Wong T, Ewan C, Contreras B, Phung Y. 1997. Feeding practices and dental caries in an urban Canadian population of Vietnamese preschool children. Journal of Dentistry for Children. 64(2):112-117.
92. Harrison RL, Wong T. 2003. An oral health promotion program for an urban minority population of preschool children. Community Dent Oral Epidemiol. 31(5):392-399.
93. Hashim R, Williams SM, Murray Thomson W. 2009. Diet and caries experience among preschool children in Ajman, United Arab Emirates. Eur J Oral Sci. 117(6):734-740.
94. Holm AK, Blomquist HK, Crossner CG, Grahnen H, Samuelson G. 1975. A comparative study of oral health as related to general health, food habits and socioeconomic conditions of 4-year-old Swedish children. Community Dent Oral Epidemiol. 3(1):34-39.
95. Holt RD. 1991. Foods and drinks at four daily time intervals in a group of young children. Brit Dent J. 170(4):137-143.
96. Hong L, Levy SM, Warren JJ, Broffitt B. 2014. Infant breast-feeding and childhood caries: A nine-year study. Pediatric Dentistry. 36(4):342-347.
97. Horowitz HS, Heifetz SB, Law FE, Driscoll WS. 1968. School fluoridation studies in Elk Lake, Pennsylvania, and Pike County, Kentucky-results after eight years. American Journal of Public Health and the Nation's Health. 58(12):2240-2250.
98. Huntington NL, Kim IJ, Hughes CV. 2002. Caries-risk factors for Hispanic children affected by early childhood caries. Pediatric Dentistry. 24(6):536-542.
99. Huong DM, Hang LTT, Nhu Ngoc VT, Anh LQ, Son LH, Chu DT, Le DH. 2017. Prevalence of early childhood caries and its related risk factors in preschoolers: Result from a cross sectional study in Vietnam. Pediatric Dental Journal. 27(2):79-84.
100. Iida H, Auinger P, Billings RJ, Weitzman M. 2007. Association between infant breastfeeding and early childhood caries in the United States. Pediatrics. 120(4):e944-952.

101. Ismail AI, Lim S, Sohn W, Willem JM. 2008. Determinants of early childhood caries in low-income African American young children. Pediatric Dentistry. 30(4):289-296.
102. Ismail AI, Ondersma S, Jedele JM, Little RJ, Lepkowski JM. 2011. Evaluation of a brief tailored motivational intervention to prevent early childhood caries. Community Dent Oral Epidemiol. 39(5):433-448.
103. Ismail AI, Sohn W, Lim S, Willem JM. 2009. Predictors of dental caries progression in primary teeth. J Dent Res. 88(3):270-275.
104. Kailis DG, Taylor SR, Davis GB, Bartlett LG, Fitzgerald DJ, Grose IJ, Newton PD. 1968. Fluoride and caries: Observations on the effects of prenatal and postnatal fluoride on some Perth pre-school children. Med J Aust. 2(23):1037-1040.
105. Kalyvas DI, Taylor CM, Michas V, Lygidakis NA. 2006. Dental health of 5-year-old children and parents' perceptions for oral health in the prefectures of Athens and Piraeus in the Attica county of Greece. Int J Paed Dent. 16(5):352-357.
106. Kaminska A, Szalewski L, Batkowska J, Wallner J, Wallner E, Szabelska A, Borowicz J. 2016. The dependence of dental caries on oral hygiene habits in preschool children from urban and rural areas in Poland. Annals of Agricultural & Environmental Medicine. 23(4):660-665.
107. Kang BH, Park SN, Sohng KY, Moon JS. 2005. [Effect of a tooth-brushing education program on oral health of preschool children]. Journal of Korean Academy of Nursing. 38(6):914-922.
108. Kanou N, Koseki A, Yamada K, Sakurai S, Ohnishi N, Mayanagi H, Kamiyama K. 1989. [Investigation into the actual condition of outpatients. II. Correlation between the daily habits of eating and toothbrushing and the prevalence of dental caries incidence]. Japanese Journal of Pedodontics. 27(2):467-474.
109. Karjalainen S, Soderling E, Sewon L, Lapinleimu H, Simell O. 2001. A prospective study on sucrose consumption, visible plaque and caries in children from 3 to 6 years of age. Community Dent Oral Epidemiol. 29(2):136-142.
110. Kato T, Yorifuji T, Yamakawa M, Inoue S, Saito K, Doi H, Kawachi I. 2014. Association of breast feeding with early childhood dental caries: Japanese population-based study. BMJ Open. 5(3):e006982.
111. Kawashita Y, Fukuda H, Kawasaki K, Kitamura M, Hayashida H, Furugen R, Fukumoto E, Iijima Y, Saito T. 2011. Pediatrician-recommended use of sports drinks and dental caries in 3-year-old children. Community Dent Health. 28(1):29-33.
112. Kerosuo H, Ngassapa D, Kerosuo E, Ranta K. 1988. Caries experience in the primary dentition of nursery school children in Dar Es Salaam, Tanzania. Caries Res. 22(1):50-54.
113. Khadka N, Roy S, Athavale P, Bhatia A, Barkan H, Sokal-Gutierrez K. 2016. A community-based intervention to reduce tooth decay and malnutrition in Mumbai, India. Annals of Global Health. 82(3):392.
114. Kolker JL, Yuan Y, Burt BA, S, retto AM, Sohn W, Lang SW, Ismail AI. 2007. Dental caries and dietary patterns in low-income African American children. Pediatric Dentistry. 29(6):457-464.
115. Kowash MB. 2015. Severity of early childhood caries in preschool children attending al-ain dental centre, United Arab Emirates. European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry. 16(4):319-324.

116. Kuriakose S, Prasannan M, Remya KC, Kurian J, Sreejith KR. 2015. Prevalence of early childhood caries among preschool children in Trivandrum and its association with various risk factors. Contemp Clin Dent. 6(1):69-73.
117. Lalloo R, Jamieson LM, Ha D, Ellershaw A, Luzzi L. 2015. Does fluoride in the water close the dental caries gap between indigenous and non-indigenous children? Aust Dent J. 60(3):390-396.
118. Lemos LV, Myaki SI, Walter LR, Zuanon AC. 2014. Oral health promotion in early childhood: Age of joining preventive program and behavioral aspects. Einstein. 12(1):6-10.
119. Leroy R, Jara A, Martens L, Declerck D. 2009. Oral hygiene and gingival health in Flemish pre-school children. Community Dent Health. 28(1):75-81.
120. Li Y, Zhang Y, Yang R, Zhang Q, Zou J, Kang D. 2011. Associations of social and behavioural factors with early childhood caries in Xiamen City in China. Int J Paed Dent. 21(2):103-111.
121. Lim S, Sohn W, Burt BA, S, Retto AM, Kolker JL, Marshall TA, Ismail AI. 2008. Cariogenicity of soft drinks, milk and fruit juice in low-income African-American children: A longitudinal study. JADA. 139(7):959-967.
122. Lim S, Tellez M, Ismail AI. 2015. Dental caries development among African American children: Results from a 4-year longitudinal study. Community Dent Oral Epidemiol. 43(3):200-207.
123. Ludwig TG. 1965. The Hastings fluoridation project v. Dental effects between 1954 and 1964. N Z Dent J. 61(285):175-179.
124. Marshall TA, Broffitt B, Eichenberger-Gilmore J, Warren JJ, Cunningham MA, Levy SM. 2005. The roles of meal, snack, and daily total food and beverage exposures on caries experience in young children. J Public Health Dent. 65(3):166-173.
125. Masumo R, Bardsen A, Mashoto K, Astrom AN. 2013. Feeding practice among 6-36 months old in Tanzania and Uganda: Reliability and relationship with early childhood caries, ECC. Acta Odont Scand. 71(5):1309-1318.
126. Mathur A, Mathur A, Jain M, B, ari S, Choudhary S, Prabu D, Kulkarni S. 2011. Influence of feeding habits on early childhood caries (ECC) within primary dentition in India. Pediatric Dental Journal. 21(2):101-106.
127. Maupome G, Karanja N, Ritenbaugh C, Lutz T, Aickin M, Becker T. 2010. Dental caries in American Indian toddlers after a community-based beverage intervention. Ethnicity & Disease. 20(4):444-450.
128. McMahon J, Parnell WR, Spears GFS. 1993. Diet and dental caries in preschool children. Eur J Clin Nutr. 47(11):794-802.
129. Meurman P, Pienihakkinen K, Eriksson AL, Alanen P. 2009. Oral health programme for preschool children: A prospective, controlled study. Int J Paediat Dent. 19(4):263-273.
130. Milgrom P, Riedy CA, Weinstein P, Tanner AC, Manibusan L, Bruss J. 2000. Dental caries and its relationship to bacterial infection, hypoplasia, diet, and oral hygiene in 6- to 36-month-old children. Community Dent Oral Epidemiol. 28(4):295-306.
131. Mohebbi SZ, Virtanen JI, Vahid-Golpayegani M, Vehkalahti MM. 2008. Feeding habits as determinants of early childhood caries in a population where prolonged breastfeeding is the norm. Community Dent Oral Epidemiol. 36(4):363-369.
132. Mothupi KA, Nqcobo CB, Yengopal V. 2016. Prevalence of early childhood caries

among preschool children in Johannesburg, South Africa. J Dent Child (Chic). 83(2):83-87.
133. Murray J. 1969. Caries experience of five-year-old children from fluoride and non-fluoride communities. Brit Dent J. 126(8):352-354.
134. Naidu R, Nunn J, Kelly A. 2013. Socio-behavioural factors and early childhood caries: A cross-sectional study of preschool children in central Trinidad. BMC Oral Health. 13:30.
135. Nainar SM, Mohummed S. 2004. Role of infant feeding practices on the dental health of children. Clinical Pediatrics. 43(2):129-133.
136. Nair R, Weber-Gasparoni K, Marshall TA, Warren JJ, Levy SM. 2010. Factors affecting early childhood caries among wic-enrolled children in Linn County, Iowa. Journal of Dentistry for Children (Chicago, Ill). 77(3):158-165.
137. Nazar H, Al-Mutawa S, Ariga J, Soparkar P, Mascarenhas AK. 2014. Caries prevalence, oral hygiene, and oral health habits of Kuwaiti infants and toddlers. Medical Principles & Practice. 23(2):125-128.
138. Neumann AS, Lee KJ, Gussy MG, Waters EB, Carlin JB, Riggs E, Kilpatrick NM. 2011. Impact of an oral health intervention on pre-school children < 3 years of age in a rural setting in Australia. Journal of Paediatrics & Child Health. 47(6):367-372.
139. Nirunsittirat A, Pitiphat W, McKinney CM, DeRouen TA, Chansamak N, Angwaravong O, Patcharanuchat P, Pimpak T. 2016. Breastfeeding duration and childhood caries: A cohort study. Caries Res. 50(5):498-507.
140. Nishimura M, Oda T, Kariya N, Matsumura S, Shimono T. 2008. Using a caries activity test to predict caries risk in early childhood. JADA. 139(1):63-71.
141. Nizel AE. 1973. Nutrition and oral problems. World Rev Nutr Diet. 16:226-252.
142. Nizel AE. 1977. Preventing dental caries: The nutritional factors. Pediatric Clinics of North America. 24(1):141-155.
143. Nunn ME, Braunstein NS, Krall Kaye EA, Dietrich T, Garcia RI, Henshaw MM. 2009a. Healthy eating index is a predictor of early childhood caries. J Dent Res. 88(4):361-366.
144. Nunn ME, Dietrich T, Singh HK, Henshaw MM, Kressin NR. 2009b. Prevalence of early childhood caries among very young urban Boston children compared with US children. J Public Health Dent. 69(3):156-162.
145. Nurbiye M, Zhao J, M, Niu QL. 2011. An epidemiological investigation of early child caries and the correlative factors' analysis of Uyghur and Chinese children in Urumqi. Chinese Journal of Evidence-Based Medicine. 11(2):143-146.
146. University of Otago. 2011. Prevention of early decay in children's teeth.
147. Olivieri-Munroe C. 1968. A study of the oral health of Maltese school children. Brit Dent J. 124(4):177-182.
148. Olmez S, Uzamis M. 2002. Risk factors of early childhood caries in Turkish children. Turkish Journal of Pediatrics. 44(3):230-236.
149. O'Mullane D, Whelton H. 1997. Efficacy of fluoride against dental caries; fluoride in water. Fogorvosi Szemle. 90:7-12.
150. O'Mullane DM, Clarkson J, H, T, O'Hickey S, Whelton H. 1988. Effectiveness of water fluoridation in the prevention of dental caries in Irish children. Community Dent Health. 5(4):331-344.
151. Ozen B, Van Strijp AJ, Ozer L, Olmus H, Genc A, Cehreli SB. 2016. Evaluation of

possible associated factors for early childhood caries and severe early childhood caries: A multicenter cross-sectional survey. Journal of Clinical Pediatric Dentistry. 40(2):118-123.

152. Ozer S, Sen Tunc E, Bayrak S, Egilmez T. 2011. Evaluation of certain risk factors for early childhood caries in Samsun, Turkey. European Journal of Paediatric Dentistry. 12(2):103-106.
153. Pacey L. 2012. Research trial to improve oral health of children in Northern Ireland. Brit Dent J. 212(10):468.
154. Palmer JD. 1971. Dietary habits at bedtime in relation to dental caries in children. Brit Dent J. 130(7):288-293.
155. Parker WA, Fultz RP. 1986. Dentistry's commitment to head start: An evaluation of selected programs. JADA. 113(4):658-664.
156. Paul TR. 2003. Dental health status and caries pattern of preschool children in Al-Kharj, Saudi Arabia. Saudi Medical Journal. 24(12):1347-1351.
157. Peltzer K, Mongkolchati A. 2015. Severe early childhood caries and social determinants in three-year-old children from northern Thailand: A birth cohort study. BMC Oral Health. 15:108.
158. Perera PJ, Fernando MP, Warnakulasooriya TD, Ranathunga N. 2014. Effect of feeding practices on dental caries among preschool children: A hospital based analytical cross sectional study. Asia Pac J Clin Nutr. 23(2):272-277.
159. Persson LA, Stecksen-Blicks C, Holm AK. 1984. Nutrition and health in childhood: Causal and quantitative interpretations of dental caries. Community Dent Oral Epidemiol. 12(6):390-397.
160. Picton DC, Wiltshear PJ. 1970. A comparison of the effects of early feeding habits on the caries prevalence of deciduous teeth. Dental Practitioner & Dental Record. 20(5):170-172.
161. Pine CM, McGoldrick PM, Burnside G, Curnow MM, Chesters RK, Nicholson J, Huntington E. 2000. An intervention programme to establish regular toothbrushing: Understanding parents' beliefs and motivating children. Int Dent J.312-323.
162. Prakash P, Subramaniam P, Durgesh BH, Konde S. 2012. Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A cross-sectional study. Eur J Dent. 6(2):141-152.
163. Provart SJ, Carmichael CL. 1995. The relationship between caries, fluoridation and material deprivation in five-year-old children in Country Durham. Community Dent Health. 12(4):200-203.
164. Qadri G, Nourallah A, Splieth CH. 2012. Early childhood caries and feeding practices in kindergarten children. Quintessence International. 43(6):503-510.
165. Qin M, Li J, Zhang S, Ma W. 2008. Risk factors for severe early childhood caries in children younger than 4 years old in Beijing, China. Pediatric Dentistry. 30(2):122-128.
166. Qiu RM, Lo EC, Zhi QH, Zhou Y, Tao Y, Lin HC. 2014. Factors related to children's caries: A structural equation modeling approach. BMC Public Health. 14:1071.
167. Quinonez R, Santos RG, Wilson S, Cross H. 2001. The relationship between child temperament and early childhood caries. Pediatric Dentistry. 23(1):5-10.
168. Quissell DO, Bryant LL, Braun PA, Cudeii D, Johs N, Smith VL, George C, Henderson WG, Albino J. 2014. Preventing caries in preschoolers: Successful

initiation of an innovative community-based clinical trial in navajo nation head start.[erratum appears in contemp clin trials. 2014 may;38(1):155]. Contemporary Clinical Trials. 37(2):242-251.
169. Rajshekar SA, Laxminarayan N. 2011. Comparison of primary dentition caries experience in pre-term low birth-weight and full-term normal birth-weight children aged one to six years. Journal of the Indian Society of Pedodontics & Preventive Dentistry. 29(2):128-134.
170. Ramezani GH, Norozi A, Valael N. 2003. The prevalence of nursing caries in 18 to 60 months old children in Qazvin. Journal of the Indian Society of Pedodontics & Preventive Dentistry. 21(1):19-26.
171. Ramos-Gomez FJ, Tomar SL, Ellison J, Artiga N, Sintes J, Vicuna G. 1999. Assessment of early childhood caries and dietary habits in a population of migrant Hispanic children in Stockton, California. Journal of Dentistry for Children. 66(6):395-403, 366.
172. Razmiene J, Vanagas G, Bendoraitiene E, Vysniauskaite A. 2011. The relation between oral hygiene skills and the prevalence of dental caries among 4 - 6-year-old children. Stomatologija. 13(2):62-67.
173. Reisine ST, Psoter W. 2001. Socioeconomic status and selected behavioral determinants as risk factors for dental caries. J Dent Edu. 65(10):1009-1016.
174. Richardson BD, Cleaton-Jones PE, Sinwel RE, Rantsho JM. 1984. Trends in sugar intake: Do these parallel changes in caries prevalence among S. African preschoolchildren? Community Dent Oral Epidemiol. 12(2):140-144.
175. Ripa L, Levinson A, Leske G. 1980. Epidemiological survey of caries-related behavior in caries-free children. The New York State Dental Journal. 46(2):78-80.
176. Roberts CR, Warren JJ, Weber-Gasparoni K. 2009. Relationships between caregivers' responses to oral health screening questions and early childhood caries. J Public Health Dent. 69(4):290-293.
177. Roberts GJ, Cleaton-Jones PE, Fatti LP, Richardson BD, Sinwel RE, Hargreaves JA, Williams S. 1993. Patterns of breast and bottle feeding and their association with dental caries in 1- to 4-year-old South African children. 1. Dental caries prevalence and experience. Community Dent Health. 10(4):405-413.
178. Roberts GJ, Cleaton-Jones PE, Fatti LP, Richardson BD, Sinwel RE, Hargreaves JA, Williams S, Lucas VS. 1994. Patterns of breast and bottle feeding and their association with dental caries in 1- to 4-year-old South African children. 2. A case control study of children with nursing caries. Community Dent Health. 11(1):38-41.
179. Roeters J, Burgersdijk R, Truin GJ, van 't Hof M. 1995. Dental caries and its determinants in 2-to-5-year-old children. Journal of Dentistry for Children. 62(6):401-408.
180. Rong WS, Bian JY, Wang WJ, De Wang J. 2003. Effectiveness of an oral health education and caries prevention program in kindergartens in china. Community Dent Oral Epidemiol. 31(6):412-416.
181. Rosenblatt A, Zarzar P. 2002. The prevalence of early childhood caries in 12- to 36-month-old children in Recife, Brazil. Journal of Dentistry for Children. 69(3):319-324, 236.
182. Rosenblatt A, Zarzar P. 2004. Breast-feeding and early childhood caries: An assessment among Brazilian infants. Int J Paediat Dent. 14(6):439-445.

183. Rugg-Gunn AJ, Carmichael CL, French AD, Furness JA. 1977. Fluoridation in Newcastle and northumberland. A clinical study of 5-year-old children. Brit Dent J. 142(12):395-402.
184. Rugg-Gunn AJ, Hackett AF, Appleton DR. 1987. Relative cariogenicity of starch and sugars in a 2-year longitudinal study of 405 English schoolchildren. Caries Res. 21(5):464-473.
185. Sacic L, Markovic N, Arslanagic Muratbegovic A, Zukanovic A, Kobaslija S. 2016. The prevalence and severity of early childhood caries in preschool children in the federation of Bosnia and Herzegovina. Acta Medica Academica. 45(1):19-25.
186. Saito E, Wakizaka H, Niwa M, Miura H, Watanabe S, Igarashi S, Ueda I, Ito N. 1989. [Dental caries of primary teeth and life habits in Shinshinotsu nursery school: Three years of observations]. Higashi Nippon Shigaku Zasshi. 8(2):125-138.
187. Sälzer S, Alkilzy M, Slot DE, Dörfer CE, Schmoeckel J, Splieth CH. 2017. Socio-behavioural aspects in the prevention and control of dental caries and periodontal diseases at an individual and population level. J Clin Periodontol. 44:S106-S115.
188. Samuelson G, Blomquist HK, Crossner CG, Holm AK, Grahnen H. 1975. An epidemiological study of child health and nutrition in a northern Swedish county. Vii. A comparative study of general and dental health, food habits and socio-economic conditions in 4-year-old children. Acta Paediatrica Scandinavica. 64(2):241-247.
189. Sankeshwari RM, Ankola AV, Tangade PS, Hebbal MI. 2013. Association of socio-economic status and dietary habits with early childhood caries among 3- to 5-year-old children of Belgaum City. European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry. 14(3):147-153.
190. Savara BS, Suher T. 2015. Dental caries in children one to six years of age as related to socioeconomic level, food habits, and toothbrushing. J Dent Res. 34(6):870-875.
191. Schou L, Uitenbroek D. 1995. Social and behavioural indicators of caries experience in 5-year-old children. Community Dent Oral Epidemiol. 23(5):276-281.
192. Schroder U, Granath L. 1983. Dietary habits and oral hygiene as predictors of caries in 3-year-old children. Community Dent Oral Epidemiol. 11(5):308-311.
193. Schroth RJ, Edwards JM, Brothwell DJ, Yakiwchuk CA, Bertone MF, Mellon B, Ward J, Ellis M, Hai-Santiago K, Lawrence HP et al. 2015. Evaluating the impact of a community developed collaborative project for the prevention of early childhood caries: The healthy smile happy child project. Rural & Remote Health. 15(4):3566.
194. Schroth RJ, Halchuk S, Star L. 2013. Prevalence and risk factors of caregiver reported severe early childhood caries in Manitoba first nations children: Results from the RHS phase 2 (2008-2010). International Journal of Circumpolar Health. 72.
195. Schroth RJ, Moffatt ME. 2005. Determinants of early childhood caries (ECC) in a rural Manitoba community: A pilot study. Pediatric Dentistry. 27(2):114-120.
196. Schroth RJ, Smith PJ, Whalen JC, Lekic C, Moffatt ME. 2005. Prevalence of caries among preschool-aged children in a northern Manitoba community. JCDA. 71(1):27.
197. Seki M, Karakama F, Yamashita Y. 2003. Does a clinical evaluation of oral cleanliness correlate with caries incidence in preschool children? Findings from a cohort study. Journal of Oral Science. 45(2):93-98.
198. Sellman S, Syrrist A. 1968. The Norrkoping fluoridation study. Odontologisk revy. 19(1):23-29.
199. Seow K. 2012. Environmental, maternal, and child factors which contribute to early

childhood caries: A unifying conceptual model. Int J Paediat Dent. 22(3):157-168.
200. Seow WK, Amaratunge A, Sim R, Wan A. 1999. Prevalence of caries in urban Australian Aborigines aged 1-3.5 years. Pediatric Dentistry. 21(2):91-96.
201. Si Y, Guo Y, Yuan C, Xu T, Zheng SG. 2016. Comprehensive oral health care to reduce the incidence of severe early childhood caries (S-ECC) in urban China. Chinese Journal of Dental Research. 19(1):55-63.
202. Singh A, Purohit B, Sequeira P, Acharya S. 2011. Oral health status of 5-year-old aborigine children compared with similar aged marginalised group in south western India. Int Dent J. 61(3):157-162.
203. Skeie MS, Espelid I, Riordan PJ, Klock KS. 2008. Caries increment in children aged 3-5 years in relation to parents' dental attitudes: Oslo, Norway 2002 to 2004. Community Dent Oral Epidemiol. 36(5):441-450.
204. Skeie MS, Riordan PJ, Klock KS, Espelid I. 2006. Parental risk attitudes and caries-related behaviours among immigrant and western native children in Oslo. Community Dent Oral Epidemiol. 34(2):103-113.
205. Slack-Smith L, Colvin L, Leonard H, Kilpatrick N, Bower C, Brearley Messer L. 2009. Factors associated with dental admissions for children aged under 5 years in Western Australia. Arch Dis Child. 94(7):517-523.
206. Songo BF, Declerck D, Vinckier F, Mbuyi MD, Pilipili CM, Kayembe KP. 2013. Caries experience and related factors in 4-6 year-olds attending dental clinics in Kinshasa, district of Congo. Community Dent Health. 30(4):257-262.
207. Sowole A, Sote E, Folayan M. 2007. Dental caries pattern and predisposing oral hygiene related factors in Nigerian preschool children. European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry. 8(4):206-210.
208. Stacey MA, Wright FA. 1991. Diet and feeding patterns in high risk pre-school children. Aust Dent J. 36(6):421-427.
209. Staskiewicz T. 2012. [Analysis of the influence of some factors on the intensity of early childhood caries]. Annales Academiae Medicae Stetinensis. 58(2):36-39.
210. Stecksen-Blicks C, Hasslof P, Kieri C, Widman K. 2014. Caries and background factors in Swedish 4-year-old children with special reference to immigrant status. Acta Odontol Scand. 72(8):852-858.
211. Stecksen-Blicks C, Holgerson PL, Twetman S. 2007. Caries risk profiles in two-year-old children from northern Sweden. Oral Health & Preventive Dentistry. 5(3):215-221.
212. Stecksen-Blicks C, Sjostrom I, Twetman S. 2009. Effect of long-term consumption of milk supplemented with probiotic lactobacilli and fluoride on dental caries and general health in preschool children: A cluster-randomized study. Caries Res. 43(5):374-381.
213. Stecksén-Blicks C, Sjöström I, Twetman S. 2009. Effect of long-term consumption of milk supplemented with probiotic lactobacilli and fluoride on dental caries and general health in preschool children: A cluster-randomized study. Caries Res. 43(5):374-381.
214. Stevens A, Hamel C, Singh K, Ansari MT, Myers E, Ziegler P, Hutton B, Sharma A, Bjerre LM, Fenton S et al. 2014. Do sugar-sweetened beverages cause adverse health outcomes in children? A systematic review protocol. Systematic Reviews. 3:96.

215. Subramaniam P, Prashanth P. 2012. Prevalence of early childhood caries in 8 - 48 month old preschool children of Bangalore City, South India. Contemp Clin Dent. 3(1):15-21.
216. Sujlana A, Pannu PK. 2015. Family related factors associated with caries prevalence in the primary dentition of five-year-old children. Journal of the Indian Society of Pedodontics & Preventive Dentistry. 33(2):83-87.
217. Szatko F, Wierzbicka M, Dybizbanska E, Struzycka I, Iwanicka-Frankowska E. 2004. Oral health of polish three-year-olds and mothers' oral health-related knowledge. Community Dent Health. 21(2):175-180.
218. Tanaka K, Miyake Y, Sasaki S, Hirota Y. 2013. Infant feeding practices and risk of dental caries in japan: The Osaka maternal and child health study. Pediatric Dentistry. 35(3):267-271.
219. Tank G, Storvick CA. 1964. Caries experience of children one to six years old in two Oregon communities (Corvallis and Albany). I. Effect of fluoride on caries experience and eruption of teeth. JADA. 69:749-757.
220. Tank G, Storvick CA. 1965. Caries experience of children one to six years old in two Oregon communities (Corvallis and Albany). 3. Relation of diet to variation of dental caries. JADA. 70:394-403.
221. Thomas FD, Kassab JY, Jones BM. 1995. Fluoridation in Anglesey 1993: A clinical study of dental caries in 5-year-old children who had experienced sub-optimal fluoridation. Brit Dent J. 178(2):55-59.
222. Tiberia MJ, Milnes AR, Feigal RJ, Morley KR, Richardson DS, Croft WG, Cheung WS. 2007. Risk factors for early childhood caries in Canadian preschool children seeking care. Pediatric Dentistry. 29(3):201-208.
223. Tickle M, O'Neill C, Donaldson M, Birch S, Noble S, Killough S, Murphy L, Greer M, Brodison J, Verghis R et al. 2016. A randomised controlled trial to measure the effects and costs of a dental caries prevention regime for young children attending primary care dental services: The Northern Ireland caries prevention in practice (nic-pip) trial. Health Technology Assessment. 20(71): vii-96.
224. Tsai AI, Chen C, Li L, Hsiang C, Hsu K. 2006. Risk indicators for early childhood caries in Taiwan. Community Dent Oral Epidemiol. 34(6):437-445.
225. Tsai AI, Johnsen DC, Lin YH, Hsu KH. 2001. A study of risk factors associated with nursing caries in Taiwanese children aged 24-48 months. Int J Paediat Dent. 11(2):147-149.
226. Tubert-Jeannin S, Leger S, Manevy R. 2012. Addressing children's oral health inequalities: Caries experience before and after the implementation of an oral health promotion program. Acta Odontol Scand. 70(3):255-264.
227. Ulvestad H, Gilinsky A. 1977. Effect on caries prevalence in three year old children of a preventive program given at child health centre. Swedish Dental Journal. 1(4):159-162.
228. Universitätsklinikum Jena Zentrum für Zahn- M-uKPfPZuK. 2012. Evaluation of a dental preventive program for 0- to 3 year old Thuringian children, Germany.
229. Trial registered on ANZCTR. 2015. Canberra (Aus): Australian and New Zealand Clinical Trials Registry; [accessed 2018 Sep 05]. https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?ACTRN=12615000693527

230. Prevention Management Model for Early Childhood Caries (MAYA Project). 2014. San Francisco (USA): Clinicaltrials.gov; [accessed 2018 Sep 05]. https://clinicaltrials.gov/ct2/show/NCT00066950
231. Effectiveness of supervised toothbrushing on prevention of childish dental caries. 2011. Santos (Bra): International Standard Registered Clinical/soCial sTudy Number Registry; [accessed 2018 Sep 05]. http://www.isrctn.com/ISRCTN18548869
232. Vachirarojpisan T, Shinada K, Kawaguchi Y. 2005. The process and outcome of a programme for preventing early childhood caries in Thailand. Community Dent Health. 22(4):253-259.
233. Valaitis R, Hesch R, Passarelli C, Sheehan D, Sinton J. 2000. A systematic review of the relationship between breastfeeding and early childhood caries. Canadian Journal of Public Health Revue Canadienne de Sante Publique. 91(6):411-417.
234. van Palenstein Helderman WH, Soe W, van 't Hof MA. 2006. Risk factors of early childhood caries in a Southeast Asian population. J Dent Res. 85(1):85-88.
235. Vargas CM, Dye BA, Kolasny CR, Buckman DW, McNeel TS, Tinanoff N, Marshall TA, Levy SM. 2014a. Early childhood caries and intake of 100 percent fruit juice. JADA. 145(12):1254-1261.
236. Vargas CM, Dye BA, Kolasny CR, Buckman DW, McNeel TS, Tinanoff N, Marshall TA, Levy SM. 2014b. Early childhood caries and intake of 100 percent fruit juice: Data from NHANES, 1999-2004. JADA. 145(12):1254-1261.
237. Wakaguri S, Aida J, Osaka K, Morita M, Ando Y. 2011. Association between caregiver behaviours to prevent vertical transmission and dental caries in their 3-year-old children. Caries Res. 45(3):281-286.
238. Walker JD, Beck JD, Jakobsen J. 1984. Parental attitudes and dental disease in preschool children in Iowa. Journal of Dentistry for Children. 51(2):141-145.
239. Wallace DC, Gillooly CJ. 1966. San Francisco's "operation headstart"; the impact of fluoridation. J Public Health Dent. 26(4):365-367.
240. Wallenstein S, Fleiss JL, Chilton NW. 1982. Confidence intervals for percentage reduction in caries increments. J Dent Res. 61(6):828-830.
241. Walton JL, Messer LB. 1981. Dental caries and fluorosis in breast-fed and bottle-fed children. Caries Res. 15(2):124-137.
242. Wang WH, Wang WJ. 2008. [Caries-related factors for preschool children]. [Chinese]. Chinese Journal of Stomatology. 43(2):105-106.
243. Watson MR, Horowitz AM, Garcia I, Canto MT. 1999. Caries conditions among 2-5-year-old immigrant Latino children related to parents' oral health knowledge, opinions and practices. Community Dent Oral Epidemiol. 27(1):8-15.
244. Weber-Gasparoni K, Kanellis MJ, Levy SM, Stock J. 2007. Caries prior to age 3 and breastfeeding: A survey of la leche league members. Journal of Dentistry for Children (Chicago, Ill). 74(1):52-61.
245. Wei SH, Holm AK, Tong LS, Yuen SW. 1993. Dental caries prevalence and related factors in 5-year-old children in Hong Kong. Pediatric Dentistry. 15(2):116-119.
246. Weinstein P, Harrison R, Benton T. 2004. Motivating parents to prevent caries in their young children: One-year findings. JADA. 135(6):731-738.
247. Weiss RL, Trithart AH. 1960. Between-meal eating habits and dental caries experience in preschool children. American Journal of Public Health & the Nation's Health. 50:1097-1104.

248. Wendt LK, Carlsson E, Hallonsten AL, Birkhed D. 2001. Early dental caries risk assessment and prevention in pre-school children: Evaluation of a new strategy for dental care in a field study. Acta Odont Scand. 59(5):261-266.
249. Wennhall I, Martensson EM, Sjunnesson I, Matsson L, Schroder U, Twetman S. 2005. Caries-preventive effect of an oral health program for preschool children in a low socio-economic, multicultural area in Sweden: Results after one year. Acta Odont Scand. 63(3):163-167.
250. Wennhall I, Matsson L, Schroder U, Twetman S. 2002. Caries prevalence in 3-year-old children living in a low socio-economic multicultural urban area in southern Sweden. Swed Dent J. 26(4):167-172.
251. Whittle JG, Whitehead HF, Bishop CM. 2008. A randomised control trial of oral health education provided by a health visitor to parents of pre-school children. Community Dent Health. 25(1):28-32.
252. Whittle JG, Whittle KW. 1995. Five-year-old children: Changes in their decay experience and dental health related behaviours over four years. Community Dent Health. 12(4):204-207.
253. Winter GB, Rule DC, Mailer GP, James PM, Gordon PH. 1971. The prevalence of dental caries in pre-school children aged 1 to 4 years. Brit Dent J. 130(10):434-436.
254. Winter J, Glaser M, Heinzel-Gutenbrunner M, Pieper K. 2015. Association of caries increment in preschool children with nutritional and preventive variables. Clinical Oral Investigations. 19(8):1913-1919.
255. Wong MC, Lu HX, Lo EC. 2012. Caries increment over 2 years in preschool children: A life course approach. Int Journal Paediat Dent. 22(2):77-84.
256. Wyne AH, Al-Ghannam NA, Al-Shammery AR, Khan NB. 2002. Caries prevalence, severity and pattern in pre-school children. Saudi Medical Journal. 23(5):580-584.
257. Wyne AH, Chohan AN, Jastaniyah N, Al-Khalil R. 2008. Bilateral occurrence of dental caries and oral hygiene in preschool children of Riyadh, Saudi Arabia. Odonto-Stomatologie Tropicale. 31(124):19-25.
258. Yam AA, Ba M, Faye M, Sane DD. 2000. [Caries and gingivitis study among preschool children (2-5 years) of the region of ziguinchor in senegal. Strategies of prevention]. Dakar Medical. 45(2):180-184.
259. Yasin-Harnekar S. 1988. Nursing caries. A review. Clinical Preventive Dentistry. 10(2):3-8.
260. Yokota K, Shiina Y, Harada M, Wakabayashi Y, Inagawa M, Oshima M, Toriumi S, Hirose K, Ikehara S, Yamagishi K et al. 2010. [Implementation and evaluation of a childhood dental health program in a community: Twenty-year observational data]. Japanese Journal of Public Health. 57(8):624-632.
261. Yonemitsu M, Kawaguchi Y, Ohara S, Hirayama Y, Sasaki Y, H, a K, Ueno M, Takashima T, Okada S. 1992. Evaluation of school dental health activities in hiraizumi primary school, iwate prefecture. [Japanese]. Kokubyo Gakkai zasshi. (3):562-570.
262. Yonezu T, Ushida N, Yakushiji M. 2006. Longitudinal study of prolonged breast- or bottle-feeding on dental caries in Japanese children. Bull Tokyo Dent Coll. 47(4):157-160.
263. Yu Lin T, Smith MD. 1958. Diet and dental health in Newfoundland children. Can J Public Health. 49(12):516-519.

264. Zaki NA, Dowidar KM, Abdelaziz WE. 2015. Assessment of the healthy eating index-2005 as a predictor of early childhood caries. Int J Paediat Dent. 25(6):436-443.
265. Zero D, Fontana M, Lennon AM. 2001. Clinical applications and outcomes of using indicators of risk in caries management. J Dent Edu. 65(10):1126-1132.
266. Zhang R, Lin HC, Zhi QH, Yang JY, Tu JZ. 2007. [A study on oral health behavior and other related factors between children with high dmft and no caries. Chinese Journal of Stomatol. 42(5):298-299.
267. Zhang S, Liu J, Lo EC, Chu CH. 2013. Dental caries status of Dai preschool children in Yunnan province, China. BMC Oral Health. 13:68.
268. Zhang S, Liu J, Lo EC, Chu CH. 2014. Dental caries status of bulang preschool children in southwest China. BMC Oral Health. 14:16.
269. Zhang Y, Cheng R, Cheng M, Li Y. 2007. The prevalence of dental caries in primary dentition and the risk factors of 5-year-old children in northeast of China. [Chinese]. Shanghai J Stomatol. 16(6):570-573.
270. Zhang Y, Liu L, Cheng R, Lu Z. 2008. Difference between dental caries and oral health behavior of family in primary dentition. [Chinese]. West China J Stomatol. 26(1):67-69.
271. Zhou Y, Yang JY, Lo EC, Lin HC. 2012. The contribution of life course determinants to early childhood caries: A 2-year cohort study. Caries Res. 46(2):87-94.

Systematic reviews that did not answer questions being addressed in the review

1. Chou R, Cantor A, Zakher B, Mitchell JP, Pappas M. 2013. Preventing dental caries in children <5 years: Systematic review updating USPSTF recommendation. Pediatrics. 132(2):332-350.
2. Cui LL, Li X, Tian YL, Bao JT, Wang L, Xu DM, Zhao B, Li WJ. 2016. Breastfeeding and early childhood caries in children: an update meta-analysis of observational studies. Asia Pac J Clin Nutr.Pre-publication article: 1-20.
3. Sinton J, Valaitis R, Passarelli C, Sheehan D, Hesch R. 1998. A systematic overview of the relationship between infant feeding caries and breast-feeding. Ont Dent. 75(9):23-27.
4. Tham R, Bowatte G, Dharmage SC, Tan DJ, Lau MX, Dai X, Allen KJ, Lodge CJ. 2015. Breastfeeding and the risk of dental caries: A systematic review and meta-analysis. Acta Paediatr. 104(467):62-84.
5. Yeung CA, Hitchings JL, Macfarlane TV, Threlfall AG, Tickle M, Glenny AM. 2005. Fluoridated milk for preventing dental caries. Cochrane Database of Systematic Reviews.

Outcomes did not meet the inclusion criteria

1. Anonymous. 1985. Leads from the mmwr. Dental caries and community water fluoridation trends-United States. JAMA. 253(10):1377, 1383.
2. Anonymous. 2000. Baby food linked to teeth damage, warns watchdog. Community Practitioner. 73(6):627-627.
3. Ast DB, Cons NC, Pollard ST, Garfinkel J. 1970. Time and cost factors to provide regular, periodic dental care for children in a fluoridated and nonfluoridated area: Final report. JADA. 80(4):770-776.

4. Beck AL, Patel A, Madsen K. 2013. Trends in sugar-sweetened beverage and 100% fruit juice consumption among California children. Academic Pediatrics. 13(4):364-370.
5. Chan SC, Tsai JS, King NM. 2002. Feeding and oral hygiene habits of preschool children in Hong Kong and their caregivers' dental knowledge and attitudes. Int J Paediat Dent. 12(5):322-331.
6. Freudenthal JJ, Bowen DM. 2010. Motivational interviewing to decrease parental risk-related behaviors for early childhood caries. Journal of Dental Hygiene. 84(1):29-34.
7. Gibbs L, Waters E, Christian B, Gold L, Young D, de Silva A, Calache H, Gussy M, Watt R, Riggs E et al. 2015. Teeth tales: A community-based child oral health promotion trial with migrant families in Australia. BMJ Open. 5(6):e007321.
8. Habibian M, Roberts G, Lawson M, Stevenson R, Harris S. 2001. Dietary habits and dental health over the first 18 months of life. Community Dent Oral Epidemiol. 29(4):239-246.
9. Preventing Early Childhood Obesity, Part 1: Family Spirit Nurture, 3-9 Months. 2017. Baltimore (USA): Clinicaltrials.gov; [accessed 2018 Sep 05]. https://clinicaltrials.gov/ct2/show/NCT03101943
10. Hsieh HJ, Huang ST, Tsai CC, Hsiao SY. 2014. Toothbrushing habits and risk indicators of severe early childhood caries among Aboriginal Taiwanese. Asia-Pac J Public Health. 26(3):238-247.
11. Keith KD, Wentz FM, Wood RM. 1977. A practical, behavior-based oral hygiene program for elementary school children. JADA. 94(6):1183-1186.
12. Kramer MS, Vanilovich I, Matush L, Bogdanovich N, Zhang X, Shishko G, Muller-Bolla M, Platt RW. 2007. The effect of prolonged and exclusive breast-feeding on dental caries in rarly school-age children: New evidence from a large randomized trial. Caries Res. 41(6):484-488.
13. Leong PM, Gussy MG, Barrow SY, de Silva-Sanigorski A, Waters E. 2013. A systematic review of risk factors during first year of life for early childhood caries. International J Paediat Dent. 23(4):235-250.
14. MacKeown JM, Faber M. 2002. Urbanisation and cariogenic food habits among 4-24-month-old black South African children in rural and urban areas. Public Health Nutr. 5(6):719-726.
15. Martignon S, Gonzalez MC, Santamaria RM, Jacome-Lievano S, Munoz Y, Moreno P. 2006. Oral-health workshop targeted at 0-5-yr. Old deprived children's parents and caregivers: Effect on knowledge and practices. Journal of Clinical Pediatric Dentistry. 31(2):104-108.
16. Naidu R, Nunn J, Irwin JD. 2015. The effect of motivational interviewing on oral healthcare knowledge, attitudes and behaviour of parents and caregivers of preschool children: An exploratory cluster randomised controlled study. BMC Oral Health. 15:101.
17. Nomura Y, Tsuge S, Hayashi M, Sasaki M, Yamauchi T, Ueda N, Hanada N. 2004. A survey on the risk factors for the prevalence of dental caries among preschool children in japan. Pediatric Dental Journal. 14(1):79-85.
18. Paunio P, Rautava P, Helenius H, Alanen P, Sillanpaa M. 1993. The Finnish family competence study: The relationship between caries, dental health habits and general

health in 3-year-old Finnish children. Caries Res. 27(2):154-160.
19. Pereira MB, do Carmo Matias Freire M. 2004. An infant oral health programme in Goiania-Go, Brazil: Results after 3 years of establishment. Pesquisa Odontologica Brasileira [Brazilian Oral Research]. 18(1):12-17.
20. Persson LA, Holm AK, Arvidsson S, Samuelson G. 1985. Infant feeding and dental caries--a longitudinal study of Swedish children. Swed Dent J. 9(5):201-206.
21. Petersen PE, Ogawa H. 2016. Prevention of dental caries through the use of fluoride--the WHO approach. Community Dent Health. 33(2):66-68.
22. Rubinson L, Tappe M. 1987. An evaluation of a preschool dental health program. Journal of Dentistry for Children. 54(3):186-192.
23. Santos AP, Soviero VM. 2002. Caries prevalence and risk factors among children aged 0 to 36 months. Pesquisa Odontologica Brasileira [Brazilian Oral Research]. 16(3):203-208.
24. Sarumathi T, Saravana Kumar B, Datta M, Hemalatha VT, Aarthi Nisha V. 2013. Prevalence, severity and associated factors of dental caries in 3-6 year old children. Journal of Clinical and Diagnostic Research. 7(8):1789-1792.
25. Scheiwe A, Hardy R, Watt RG. 2010. Four-year follow-up of a randomized controlled trial of a social support intervention on infant feeding practices. Maternal and Child Nutrition. 6(4):328-337.
26. Stecksen-Blicks C, Borssen E. 1999. Dental caries, sugar-eating habits and toothbrushing in groups of 4-year-old children 1967-1997 in the city of Umea, Wweden. Caries Res. 33(6):409-414.
27. Vichayanrat T, Steckler A, Tanasugarn C, Lexomboon D. 2012. The evaluation of a multi-level oral health intervention to improve oral health practices among caregivers of preschool children. Southeast Asian Journal of Tropical Medicine & Public Health. 43(2):526-539.
28. Wagner Y, Heinrich-Weltzien R. 2016. Evaluation of an interdisciplinary preventive programme for early childhood caries: Findings of a regional german birth cohort study. Clin Oral Investig. 20(8):1943-1952.
29. Whelton H, O'Mullane D. 2012. Monitoring the effectiveness of water fluoridation in the Republic of Ireland. Journal of the Irish Dental Association. 58(3):S6-8.
30. Wyne AH, Adenubi JO, Shalan T, Khan N. 1995. Feeding and socioeconomic characteristics of nursing caries children in a Saudi population. Pediatric Dentistry. 17(7):451-454.
31. Wyne AH, Khan N. 1995. Use of sweet snacks, soft drinks and fruit juices, tooth brushing and first dental visit in high dmft 4-6 year olds of Riyadh region. Indian J Dent Res. 6(1):21-24.

Appendix Table 2. Total number and type of studies by review question

Review question	Study type	Number of studies identified
Q1. Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?	All	28
	Cohort	1
	Cross sectional	27
Q2. Does breastfeeding beyond one year increase the risk of early childhood caries compared with cows (or similar) milk consumption as main milk source from one year of age?	All	0
Q3. Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?	All	8
	Cohort	2
	Case control	1
	Cross sectional	5
Q4. Does breastfeeding beyond two years increase the risk of early childhood caries compared with cows (or similar) milk consumption as main milk source from two years of age?	All	0
Q5. Does consumption of liquids that contain free sugars from an infant feeding bottle, increase the risk of early childhood caries?	All	31
	Cohort	4
	Case control	2
	Cross sectional	25
Q6. Does consumption of complementary drinks that contain free sugars increase the risk of early childhood caries?	All	8
	Cohort	5
	Cross sectional	3
Q7. Does consumption of complementary foods to which free sugars have been added increase the risk of early childhood caries?	All	1
	Cohort	1
Q8. Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries?	All	21
	Cohort	2
	Case control	1
	Cross sectional	17
	Quasi experimental	1
Q9. Is oral health education for care givers' effective for preventing early childhood caries?	All	14
	RCTs	6
	Cohort	2
	Quasi-experimental	6
Q10. Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?	All	32
	Cohort	13
	Cross sectional	15
	Ecological	4
Q11. Does consumption of fluoridated milk reduce the risk of early childhood caries?	All	3
	Quasi-experimental	1
	Cross sectional	2
Q 12. Does salt fluoridation reduce the risk of early childhood caries?	All	4
	RCTs	1
	Cohort	1
	Quasi-experimental	2

Appendix Table 3. Details of data extraction for the top level of evidence pertaining to each review question

Research question 1: Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?

Citation	Peres, K. G., et al. (2017). Impact of prolonged breastfeeding on dental caries: A population-based birth cohort study. Pediatrics, **140**,(1):e20162943		
Study design (including statistical analysis):	Prospective Cohort (marginal structural modelling)		
Aims/objectives:	RQ – is there a controlled direct effect of prolonged breastfeeding on dental caries at age 5 years?		
Participants	Total sample size at baseline:	1303	
	Country:	Brazil	
	Region (urban (city)/rural):	Not stated	
	Ethnicity:	Not stated (native)	
	Socioeconomic status:	Not stated	
	Gender:	Mixed	
	Age (including adults/children):	5 years (final data collection)	
	Health background/status:	Not stated	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Models (table 2) adjusted for family income, maternal schooling, maternal age, sugar consumption, and bottle feeding at 5 years	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposure: Breast feeding 13-23 months N= 129	Comparator: Breast feeding up to 12 months N= 741
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Participants were followed from birth; breastfeeding data were collected at birth and when participants were 3, 12 and 24 months. Outcome data were collected when the children were aged 5 years.	
	Oral outcomes measured:	WHO criteria – dmfs S-ECC = dmfs ≥6	
	Scale/measure:		
	Means and SD or events for	Mean dmfs (95% CI)	Mean dmfs (95% CI)

	each group at post-treatment or follow-up	amongst children breastfed 13-23 months: 3.1 (2.2 – 4.0) 1.0	amongst children breastfed 0-12 months: 3.4 (2.9-3.9)
	Other relevant statistical results	Table 1 data (crude, not adjusted): Crude rate ratio for dmfs (95% CI) amongst children breastfed 13-23 months: 0.9 (0.6-1.3) S-ECC for dmfs amongst children breastfed 13-23 months: 20.1 (13.1-27.2) Crude risk ratio for dmfs (95% CI) amongst children breastfed 13-23 months: 1.0 (0.6-1.6) Table 2 data (adjusted): Dental caries amongst children who were breastfed for 13-23 months compared to up to 12 months MSM: Mean ratio (95% CI) = 0.9 (0.6 to 1.3) Severe Dental Caries MSM: Relative risk (95% CI) = 1.0 (0.6 to 1.6)	Table 1 data (crude, not adjusted): Crude rate ratio for dmfs amongst children breastfed 0-12 months (ref): 1.0 S-ECC for dmfs amongst children breastfed 0-12 months: 19.8 (16.9-22.7) Crude risk ratio for dmfs amongst children breastfed 0-12 months: 1.0 (ref) Ref for both = 1.0

Research question 3: Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?

Citation	Chaffee, Benjamin W., Carlos Alberto Feldens, and Márcia Regina Vítolo. "Association of long-duration breastfeeding and dental caries estimated with marginal structural models." Annals of Epidemiology 24.6 (2014): 448-454.
Study design (including statistical analysis):	Prospective cohort
Aims/objectives:	Estimate the association between breastfeeding ≥24 months and severe early childhood caries.

Participants	Total sample size at baseline:	715	
	Country:	Brazil	
	Region (urban (city)/rural):	Porto Alegre	
	Ethnicity:	395 (55.2%) of participants self-identified as maternal white race	
	Socioeconomic status:	Data were from low income families	
	Gender:	Male and female	
	Age (including adults/children):	38 months	
	Health background/status:	Not specified	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Data were from low income families (household income ≤1500 Brazilian Reais monthly; approximately 900 US dollars in 2008) Participants were from the same city (Porto Alegre), presumably with similar exposure to water fluoride Analysis adjusted for: Clinic allocation (intervention); Maternal age (years); Maternal education (≤8 years);Maternal smoking (current); Parity (has previous child); Social class (C or lower);Pre-pregnancy BMI; Child age at dental assessment (years); Child sex (male); Length-for-age Zscore at 11–15 months (per SD) ; First-year feeding index (per unit);Daily bottles at 5–9 months (1–3;Daily bottles at 5–9 months (≥ 4);Added sugar in bottle at 5–9 months; Ever formula fed; Frequency of fruits at 11–15 months; Frequency of vegetables at 11–15 months; Frequency of beans at 11–15 months; Frequency of meat at 11–15 months; Frequency of organ meat at 11-15 months.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposure: Breastfeeding ≥24 months	Comparator: Breastfeeding <6 months (reference) Breastfeeding 6-11 months Breastfeeding 12-23 months
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	Outcome data were collected when participants were aged 38 months	
	Oral outcomes measured:	Population-average severe-ECC prevalence	
	Scale/measure:	severe-ECC was defined as ≥4 affected tooth surfaces or ≥1 affected maxillary anterior teeth	
	Means and SD or events for each group at post-treatment		

	or follow-up		
	Other relevant statistical results	Breastfeeding ≥24 months was associated with the highest adjusted population-average severe-ECC prevalence (0.45, 95% CI: 0.36, 0.54) compared with breastfeeding <6 months (0.22, 95% CI: 0.15, 0.28), 6–11 months (0.38, 95% CI: 0.25, 0.53), or 12–23 months (0.39, 95% CI: 0.20, 0.56).	

Citation	Peres, K. G., et al. (2017). Impact of prolonged breastfeeding on dental caries: A population-based birth cohort study. Pediatrics, **140** (1):e20162943.		
Study design (including statistical analysis):	Prospective Cohort (marginal structural modelling).		
Aims/objectives:	Research question – is there a controlled direct effect of prolonged breastfeeding on dental caries at age 5 years?		
Participants	Total sample size at baseline:	1303	
	Country:	Brazil	
	Region (urban (city)/rural):	Not stated	
	Ethnicity:	Not stated (native)	
	Socioeconomic status:	Not stated	
	Gender:	Mixed	
	Age (including adults/children):	5 years (final data collection)	
	Health background/status:	Not stated	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Models (table 2) adjusted for family income, maternal schooling, maternal age, sugar consumption, and bottle feeding at 5 years	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposure: Breast feeding ≥24 months N= 258	Comparator: Breast feeding <24 months N= 870
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Participants were followed from birth; breastfeeding data were collected at birth and when participants were 3, 12 and 24 months. Outcome data were collected when the children were aged 5 years.	
	Oral outcomes measured:	WHO criteria – dmfs S-ECC = dmfs ≥6	
	Scale/measure:		

	Means and SD or events for each group at post-treatment or follow-up		

Research question 5: Does consumption of liquids that contain free sugars from an infant feeding bottle, increase the risk of early childhood caries?

Citation	Feldens et al. (2010). Early Feeding Practices and Severe Early Childhood Caries in Four-Year-Old Children from Southern Brazil: A Birth Cohort Study. Caries Res. 44(5),445-52		
Study design (including statistical analysis):	Prospective cohort study (univariable poisson regression, multivariable modelling)		
Aims/objectives:	To investigate the relationship between feeding practices in the first year of life and the occurrence of severe early childhood caries (S-ECC) at 4 years of age.		
Participants	Total sample size at baseline:	500	
	Country:	Brazil	
	Region (urban (city)/rural):	São Leopoldo	
	Ethnicity:	-	
	Socioeconomic status:	71.2% of the mothers having ≤8 years of schooling, and the family income was low for most families, of which 82% had an income per capita below 1 national monthly minimum wage (R$ 180.00; approximately USD 80.00)	
	Gender:	Both male and female	
	Age (including adults/children):	48–50 months: N=171 51–53 months: N=169 48 to 53 months (mean = 50.5; SD = 1.7)	
	Health background/status:	Mothers were included in the study if they gave birth to apparently normal, single, full-term (≥ 37 weeks) baby with normal birth weight (≤ 2,500 g) were invited to take part in the study. The exclusion criteria were: impediment to breastfeeding (HIV/AIDS) or congenital malformation	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Relative risk estimate of the exposure of interest was adjusted for other variables in the multivariable model (maternal schooling, daily breastfeeding frequency at 12 months, daily meals and snacks at 12 months, high density of sugar at 12 months, teeth at 12 months). Fluoride level of the water supply in the area was 0.7 ppm.	
	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es	Exposure: bottle use for fruit juices / soft drinks at 12 months (n children assessed for caries at 4	Comparison: bottle not used for fruit juices / soft drinks at 12 months (n children assessed for caries

	used):	years= 129)	at 4 years= 205)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Exposure data were collected from mothers when the children were aged 12 months; clinical examinations took place at 4 years of age.	
	Oral outcomes measured:	severe early childhood caries (S-ECC) incidence	
	Scale/measure:	Defined as ≥1 cavitated, missing or filled smooth surfaces in primary maxillary anterior teeth or d 1+ mfs ≥ 5	
	Means and SD or events for each group at post-treatment or follow-up	**Univariable regression:** **S-ECC (N; %) among children aged 4 years** Bottle use for fruit juices/soft drinks at 12 months: Yes: 57; 44.2% No: 67; 32.7% **RR (95% CI)** Bottle use for fruit juices/soft drinks at 12 months (P=0.032): Yes: 1.35 (1.03–1.78) No: 1 **Multivariable regression:** **RR (95% CI)** Bottle use for fruit juices/soft drinks at 12 months (P=0.025): Yes: 1.41 (1.08–1.86) No: 1	
	Other relevant statistical results		

Citation	Tanaka et al. (2013). Infant feeding practices and risk of dental caries in Japan: The Osaka Maternal and Health Study. Pediatric Dentistry, 35(3), 267-71.	
Study design (including statistical analysis):	Prospective cohort (multiple logistic regression)	
Aims/objectives:	To investigate the relationship between feeding practice and the risk of ECC	
Participants	Total sample size at baseline:	1,002 children
	Country:	Japan
	Region (urban (city)/rural):	Osaka
	Ethnicity:	-
	Socioeconomic status:	-
	Gender:	Both male and female
	Age (including adults/children):	41-50 months old
	Health background/status:	-
	Any information on confounders (e.g. water, milk	The association between the exposure and outcome of interest was presented as crude ORs and ORs adjusted for

	or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	the following variables: Breastfeeding duration, bottle-feeding while falling asleep, age of introduction of foods, maternal age at baseline survey, maternal smoking during pregnancy, family income, paternal and maternal education levels, child's sex, birth weight, age at first tooth eruption, tooth-brushing frequency at fourth and fifth surveys, use of fluoride.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Bottle use for sweetened liquids other than milk Sometimes or usually (n = 148)	Bottle use for sweetened liquids other than milk Never (n = 167)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Study duration: November 2001 to March 2003 Information about the variables under study and potentially confounding factors were collected at: pregnancy, 2-9, 16-24, 29-39 and 41-49 months old; Outcome data were collected at 41-50 months	
	Oral outcomes measured:	ECC	
	Scale/measure:	Presence of one or more caries teeth (decayed or filled)	
	Means and SD or events for each group at post-treatment or follow-up	Odds ratio for early childhood caries according to bottle use for sweetened liquids other than milk: **Never:** N: 167 Prevalence (%): 19 Crude OR ratio (95% CI): 1.00 Adjusted OR (95% CI): 1.00 **Sometimes or usually:** N: 148 Prevalence (%): 28 Crude OR ratio (95% CI): 1.67 (0.99-2.84) Adjusted OR (95% CI): 2.47 (1.23-5.05) Odds ratio for moderate and severe early childhood caries according to bottle use for sweetened liquids other than milk: **Never:** Adjusted OR for moderate ECC vs caries free (95% CI): 1.00 Adjusted OR for severe ECC vs caries free (95% CI): 1.00 **Sometimes or usually:** Adjusted OR for moderate ECC vs caries free (95% CI): 2.63 (1.17-6.08)	

		Adjusted OR for severe ECC vs caries free (95% CI): 2.58 (0.74-9.57) The time point during the study when exposure data were collected was not specified
	Other relevant statistical results	Bottle use for sweetened liquids other than milk (n; %): Never: 167; 53% Sometimes or usually : 148; 47%

Citation	Wendt et al. (2009). Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odontol Scand. 54(2)131-7.		
Study design (including statistical analysis):	Prospective cohort (logistic regression analysis, chi-square test and Fisher's exact test w).		
Aims/objectives:	Oral hygiene and dietary factors (in percentage) at 2 years of age in children who got sugar-containing liquid in a feeding bottle at 1 year of age (n = 48)		
Participants	Total sample size at baseline:	671	
	Country:	Sweden	
	Region (urban (city)/rural):	community of Jonkoping	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Both male and female	
	Age (including adults/children):	One year old at baseline, re-examinations were undertaken when the children were 2 and 3 years of age	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children with carious lesions at baseline were excluded	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposures: Consumption of sugar sweetened liquid from an infant feeding bottle at 1 and 2 years of age.	Comparator Consumption of milk or water from an infant feeding bottle at 1 and 2 years of age.
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Between 1988 and 1990 clinical examinations took place at 1, 2 and 3 years of age; data on independent variables were collected at 1 and 2 years of age.	

	Oral outcomes measured:	Caries incidence
	Scale/measure:	Percentage
	Means and SD or events for each group at post-treatment or follow-up	Oral hygiene and dietary factors (in percentage) at 2 years of age in children who got sugar-containing liquid in a feeding bottle at 1 year of age (n = 51):
	Other relevant statistical results	children caries-free at 3 years of age (n = 28): 32% children with caries at 3 years of age (n = 23): 44% NS, p> 0.05 Lack of data on the comparator (i.e. the N / proportion of children with caries and caries free at 3 years of age who got milk or water. Oral hygiene and dietary factors (in percentage) at 2 years of age in children who got sugar-containing liquid when thirsty at 1 year of age (n = 48):

Citation	Wendt et al. (2009). Dietary habits related to caries development and Immigrant status in infants and toddlers living in Sweden. Acta Odont Scand, 53(6), 339-344.	
Study design (including statistical analysis):	Prospective cohort (chi-square test and Fisher's exact test w)	
Aims/objectives:	To describe the dietary habits of infants and toddlers living% Sweden with special reference to caries prevalence at 2 and 3 years of age and to immigrant status.	
Participants	Total sample size at baseline:	Children invited into the study, n= 671
	Country:	Sweden
	Region (urban (city)/rural):	community of Jonkoping; the areas included town, suburb, and countryside
	Ethnicity:	Caries-free at one year children with at least one parent born in Sweden (n = 532) Caries free at one year children with both parents born outside Sweden (n=61) Nineteen percent of the children were immigrants
	Socioeconomic status:	The areas were chosen to reflect the socioeconomic levels of the population living in the community of Jonkoping.
	Gender:	Both male and female
	Age (including adults/children):	One year old
	Health background/status:	-
	Any information on confounders (e.g. water, milk	The results were stratified according to whether children were immigrants or not

	or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):		
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposure: daily intake of a feeding bottle with sugar-containing liquid	Comparator no daily intake of a feeding bottle with sugar-containing liquid
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Between 1988 and 1990 Children were recruited into the study at 1 year; follow up took place at the ages of 2 and 3 years	
	Oral outcomes measured:	Caries incidence	
	Scale/measure:	No scale was defined.	
	Means and SD or events for each group at post-treatment or follow-up	**Sugar-containing liquid in feeding bottle in 8 groups (%):**	
	Other relevant statistical results	**Non-Caries I-** Children caries-free at one and three years (n=434): 13% **Caries I-** Children caries-free at one year but with caries at three years (n=159): 22% P-value <0.01 **Non-Caries II-** Children caries-free at one and two years (n=276): 16% **Caries II-** Children caries-free at one year but with caries at two years (n=22): 50% P-value <0.001 **Non-Caries III-** Children caries-free at one, two and three years (n=210): 6% **Caries III-** Children caries-free at one and two year but with caries at three years (n=60): 12% P>0.05 **Non-immigrant children-** Children with at least one parent born in Sweden (n=532): 14% **Immigrant children-** Children with both parents born outside Sweden (n=61): 31% P-value <0.001	

Research question 6: Does consumption of complementary drinks that contain free sugars increase the risk of early childhood caries?

Citation	Wendt et al. (2009). Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odontol Scand.54 (2)131-7.		
Study design (including statistical analysis):	Prospective cohort (logistic regression analysis, chi-square test and Fisher's exact test w)		
Aims/objectives:	Oral hygiene and dietary factors (in percentage) at 2 years of age in children who got sugar-containing liquid in a feeding bottle at 1 year of age (n = 48)		
Participants	Total sample size at baseline:	671	
	Country:	Sweden	
	Region (urban (city)/rural):	community of Jonkoping	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Both male and female	
	Age (including adults/children):	One year old at baseline, re-examinations were undertaken when the children were 2 and 3 years of age; exposure data were collected at 1 and 2 years of age	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children with carious lesions at baseline were excluded	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Exposures: Consumption of sugar sweetened liquid when thirsty at 1 and 2 years of age	Comparator Consumption of milk or water when thirsty at 1 and 2 years of age
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	between 1988 and 1990 clinical examinations took place at 1, 2 and 3 years of age; data on independent variables were collected at 1 and 2 years of age	
	Oral outcomes measured:	Caries incidence	
	Scale/measure:	Percentage	
	Means and SD or events for each group at post-treatment or follow-up	Dietary factors (in percentage) at 2 years of age in children who got sugar-containing liquid when thirsty at 1 year of age (n = 48): **Sugar-containing liquid when thirsty at 2 years of age:**	

	Other relevant statistical results	children caries-free at 3 years of age (n = 23): 52% children with caries at 3 years of age (n = 25): 60% NS, p> 0.05 Lack of data on the comparator (i.e. the N / proportion) of children with caries and caries free at 3 years of age who got milk or water when thirsty at 2 years of age.

Citation	Warren et al. (2009). A Longitudinal Study of Dental Caries Risk among Very Young low SES children. Community Dent Oral Epidemiol. 37(2), 116–122.		
Study design (including statistical analysis):	Cohort study (Logistic regression models for baseline predictors of d2-3f caries at the 18-month follow-up).		
Aims/objectives:	To assess the effect of Sugar-Sweetened Beverage Consumption for 18-month caries prevalence as part of a longitudinal study of high-risk children.		
Participants	Total sample size at baseline:	212	
	Country:	USA	
	Region (urban (city)/rural):	southeast Iowa community	
	Ethnicity:	Among those who remained in the study at follow-up, there were higher proportions who were Caucasian children	
	Socioeconomic status:	low-income and minority families	
	Gender:	Both male and female	
	Age (including adults/children):	6 to 24 months	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Logistic regression models were adjusted for age	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	**Exposure of interest: sugar-Sweetened Beverage Consumption** N=44 (Sugar Sweetened Beverages included regular soda pop, sugared beverages made from powder, sports drinks, juice drinks and other sugared beverages)	**Comparator: no Sugar-Sweetened Beverage Consumption** N=81
	Other relevant baseline	**Sugar-Sweetened Beverage Consumption**	

	statistics for each group (for the analysis/es used):	**Yes:** ID/ month=0.019 **No:** ID/ month=0.006 IDR=3.44 (P-value=0.001) OR (95%CI)=5.2 (2.0-13.3) *ID: Incidence dentistry *IDR: Incidence dentistry ratio - Incidence density of caries was estimated as the number of new caries developed during 18 months divided by the total person time at risk during the follow-up period
	Duration:	Risk factor data were collected at 6, 12 and 18 months, dental examinations were undertaken at baseline and at 18 months
	Oral outcomes measured:	Caries prevalence
	Scale/measure:	No. w/frank decay (d2-3 or filled surfaces)
	Means and SD or events for each group at post-treatment or follow-up	**Sugar-Sweetened Beverage Consumption** **Yes:** n=25 **No:** n=103 OR (95%CI)=3.04 (1.07-8.64) p-value=0.04
	Other relevant statistical results	

Citation	Watanbe et al. (2014). The Influence of Lifestyle on the Incidence of Dental Caries Among 3-Year-Old Japanese Children. Int J Environ Res Public Health, 11(12), 12611-22.	
Study design (including statistical analysis):	Cohort (multivariate logistic regression analysis)	
Aims/objectives:	To examine how lifestyle, household environment, and caries activity test score of Japanese children at age 1.5 years affected their dental caries incidence at age 3.	
Participants	Total sample size at baseline:	33, 655
	Country:	Japan
	Region (urban (city)/rural):	Kobe City Public Health Centre
	Ethnicity:	-
	Socioeconomic status:	-
	Gender:	Both male and female
	Age (including adults/children):	1.5 years of age
	Health background/status:	-
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The OR was adjusted for nationality, gender, birth order, and Cariostat score.

Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	**Exposure:** **Daily sugar-sweetened beverage consumption answer "Yes"**	**Comparator** **Daily sugar-sweetened beverage consumption answer "No"**
	Other relevant baseline statistics for each group (for the analysis/es used):	Children were caries free at 1.5 years	
	Duration:	June 2006 and August 2009 Follow-up duration: 21 months	
	Oral outcomes measured:	Incidence of dental caries in 3-years old subjects	
	Scale/measure:	No scale was defined	
	Means and SD or events for each group at post-treatment or follow-up	**Daily Sugar-Sweetened Beverage Consumption All (n = 31,202) (n; %)** **Yes:** 2782 (20.4) **No:** 2324 (13.2) P-value= <0.001 **Daily Sugar-Sweetened Beverage Consumption Boy (n = 16,052) (n; %)** **Yes:** 1532 (21.5) **No:** 1254 (14.0) P-value= <0.001 **Daily Sugar-Sweetened Beverage Consumption Girl (n = 15,150) (n; %)** **Yes:** 1259 (19.2) **No:** 1070 (12.5) P-value= <0.001 **Daily Sugar-Sweetened Beverage Consumption All OR (95%CI)** **Yes:** 1.56 (1.46, 1.65) **No:** 1 P-value= <0.001 **Daily Sugar-Sweetened Beverage Consumption Boy OR (95%CI)** **Yes:** 1.55 (1.42, 1.69) **No:** 1 P-value= <0.001 **Daily Sugar-Sweetened Beverage Consumption Girl OR (95%CI)** **Yes:** 1.55 (1.41, 1.70) **No:** 1 P-value= <0.001
	Other relevant statistical results		

Citation	Wigen and Wang (2014). Health behaviours and family characteristics in early childhood influence caries development. A longitudinal study based on data from MoBa. Norsk Epidemiologi, **24** (1-2), 91-95.
Study design	Cohort study (multivariable logistic regression).

(including statistical analysis):			
Aims/objectives:	To study how family characteristics and health behaviour in pregnancy and early childhood influence caries development in preschool children.		
Participants	Total sample size at baseline:	1607	
	Country:	Norway	
	Region (urban (city)/rural):	Akershus	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Both male and female	
	Age (including adults/children):	1.5 years of age	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Multivariable models included the exposure of interest (see below) in addition to the following variables: • Tooth brushing frequency • Sugary drink consumption level • Maternal health and lifestyle variables (dietary sugar, dietary fat, BMI) • Family characteristics (maternal education, parental origin (western or non-western), family status from pregnancy to age 5 (change from two to one parent family)	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Consumption of sugary drinks at night a) sometimes or b) each night Consumption of sugary drinks at least once per week Age = 1.5 years	Consumption of sugary drinks at night: never Consumption of sugary drinks less than once per week Age = 1.5 years
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Exposure data at 1.5 years of age in relation to caries experience at 5 years	
	Oral outcomes measured:	Caries prevalence	
	Scale/measure:	No scale was defined	
	Means and SD or events for each group at post-treatment or follow-up	Sugary drinks at night (OR, (95%CI)) Never (ref) Sometimes: 1.5 (0.8–2.8) Each night: 2.2 (1.1–4.5)	
	Other relevant statistical results	Sugary drinks less than once a week (reference) Sugary drinks at least once a week 1.7 (1.1-2.08)	

Citation	Yonezu et al. (2006). Characteristics of Breast-fed Children with Nursing Caries. Bull Tokyo Dent Coll. 47(4)161-5.		
Study design (including statistical analysis):	Cohort (logistic regression)		
Aims/objectives:	To investigate the characteristics and risk factors of prolonged breast feeding in children.		
Participants	Total sample size at baseline:	105	
	Country:	Japan	
	Region (urban (city)/rural):	-	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Both male and female	
	Age (including adults/children):	18 months	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Logistic regression analysis included the following variables: • Bedtime breast-feeding • Sweets intake • Tooth brushing frequency • Oral hygiene at 18 months exam • Sweet beverage intake (exposure of interest)	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Sweet beverages intake 3 times-/ week at 18 months	Sweet beverages intake - 2 times/ week at 18 months
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Study duration: 2003-2005 Exposure data were collected at 18 months Follow up (caries experience examined) 6 months later, at 24 months	
	Oral outcomes measured:	Initial and manifest caries	
	Scale/measure:		
	Means and SD or events for each group at post-treatment or follow-up	**Results of logistic regression analysis of effect of variables for caries (Experience at 24 months of age):** Sweet beverages intake (OR (95%CI)): 0.99 (0.25– 4.01) (not significant).	
	Other relevant statistical results		

Research question 7: Does consumption of complementary foods to which free sugars have been added increase the risk of early childhood caries?

Citation	Feldens et al. (2010). Early Feeding Practices and Severe Early Childhood Caries in Four-Year-Old Children from Southern Brazil: A Birth Cohort Study. Caries Res. 44(5),445-52		
Study design (including statistical analysis):	Prospective cohort study (Poisson regression models)		
Aims/objectives:	Investigate feeding practices in the first year of life associated with S-ECC at the age of 4 years.		
Participants	Total sample size at baseline:	500 (Final = 340)	
	Country:	Brazil	
	Region (urban (city)/rural):	Unclear	
	Ethnicity:	-	
	Socioeconomic status:	Low-income	
	Gender:	Mixed	
	Age (including adults/children):	4 years	
	Health background/status:	Apparently healthy at birth	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Adjusted models incorporated (and therefore controlled for the effects of). Maternal schooling, daily breastfeeding frequency at 12 months, daily meals and snacks at 12 months, bottle use for fruit juices / soft drinks at 12 months, number of teeth at 12 months.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	No high density of sugar at 12 months (n=240) Proportion of >50% simple carbohydrates in 100g food (but proportion not reported)	High density of sugar at 12 months (n=91)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Feeding practices were assessed using standardized methods at 6 and 12 months of age, severe early childhood caries (S-ECC) was assessed at 4 years	
	Oral outcomes measured:	S-ECC	
	Scale/measure:	≥1 cavitated, missing or filled smooth surfaces in primary maxillary anterior teeth or dmfs ≥5	
	Means and SD or events for each group at post-treatment or follow-up	S-ECC prevalence N=78 (32.5%) Univariate Poisson regression analysis RR (95% CI) 1.0 (ref)	S-ECC prevalence N=43 (47.3%) Univariate Poisson regression analysis RR (95% CI) 1.45 (1.10-1.93) p=0.010

		Adjusted multivariable model RR (95% CI) 1.00 (ref)	Adjusted multivariate model RR (95% CI) 1.43 (1.08-1.89) p=0.003

Research question 8: Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries?

Citation	Leroy et al. (2012). Risk factors for caries incidence in a cohort of Flemish preschool children. Clin Oral Invest. 16: 805-812.		
Study design (including statistical analysis):	Prospective cohort (multivariable logistic regression models).		
Aims/objectives:	To identify the risk factors for the incidence of visible caries experience in a cohort of preschool children living in Flanders.		
Participants	Total sample size at baseline:	1, 057 children	
	Country:	Belgium	
	Region (urban (city)/rural):	Flanders	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Male and female	
	Age (including adults/children):	3 & 5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The following variables were included in multivariable regression models: age, gender, ranking of the child, watching television at age 3 and 5, family smoking status at birth, family smoking status at age 3 and 5 years**,** educational level of mother, parental brushing frequency at birth and at ages 3 and 5, interdental cleaning aids at birth, interdental cleaning aids at 3 and 5 years, help with brushing at 3, help with brushing at 5, brushing frequency at age, plaque accumulation at ages 3 and 5, baby feeding at birth, in between meals sugar containing drinks, in between meals sugar containing snacks, drinks at night at ages 3 and 5, snacks at night at ages 3 and 5, fruit juice consumption at age 5, soda consumption at age 5.* These variables were include in multivariable regression models, for which data concerning the association between plaque and caries was presented.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	**<u>Intervention:</u>** Indicators of oral hygiene provided by parent or caregiver, measured in relation to plaque* and supervised daily tooth	**<u>Comparator</u>** Indicators of poor oral hygiene provided by parent or caregiver:

		brushing: No plaque accumulation at age 3 years No plaque accumulation at age 5 years Help with brushing at age 3 (daily) Help with brushing at age 5 (daily day)	 Plaque accumulation at age 3 years Plaque accumulation at age 5 years Help with brushing at age 3 (<1/day) Help with brushing at age 5 (<1/day)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Children were recruited at birth; parents completed questionnaires which yielded data on sociodemographic variables and on children's and parental oral health behaviour at birth (2003-4) and when the children were 3 (2007) and 5 (2009). Clinical examinations took place at 3 and 5 years	
	Oral outcomes measured:	Caries increment between ages 3 and 5	
	Scale/measure:	Dental caries lesions at the d1 level (cavitated and non-cavitated)	
	Means and SD or events for each group at post-treatment or follow-up	--	-
	Other relevant statistical results	**<u>*Multivariable models:</u>** OR (95% CI) for the association between increment in caries experience between age 3 and 5 and caries experience at age 3: 2.79 (1.82-4.29) OR (95% CI) for the association between increment in caries experience between age 3 and 5 and plaque accumulation at age 5: 2.20 (1.50-3.23) Data were available concerning the association between daily help with	

		tooth brushing >1/day versus <1 / day at age 3 and 5 and caries at 3 and 5 OR (95% CI), however, these data were from univariable models.	

Citation	Okuno, M. (1994). A Cohort Study on Dental Caries in Infants. Nihon Koshu Eisei Zasshi. 41(7), 625-8.		
Study design (including statistical analysis):	Cohort Study (Chi-square, Logistic regression analysis)		
Aims/objectives:	To determine what techniques are effective in dental caries prevention in infants.		
Participants	Total sample size at baseline:	878 (18 months children without dental caries)	
	Country:	Japan	
	Region (urban (city)/rural):	Gifu city, Gifu Prefecture	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	N/A (The author described that there were almost no difference by gender with regards to prevalence of dental caries and other indicators. Therefore, all statistical analysis was conducted by combing both gender information.)	
	Age (including adults/children):	Baseline 18 months children Follow up 3 yrs children	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The baseline information on; oral hygiene situation including plaque score, tooth brushing habit, and snack intakes	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Baseline information at 18 months – 1) Plaque score b) low 2) Toothbrushing behaviour by a) brushing teeth more than one time by parents or b) not brushing teeth by parents	Baseline information at 18 months – 1) Plaque score high 2) Toothbrushing behaviour not brushing teeth by parents
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-

	Duration:	Dental caries prevalence was assessed at 3 yrs in relation to oral health behaviour measured at the baseline (18 months)	
	Oral outcomes measured:	Prevalence of dental caries at 3 yrs	
	Scale/measure:	Percent	
	Means and SD or events for each group at post-treatment or follow-up	Results from Chi-square test 1) Plaque score at 18 months (baseline) a) low or b) high 2) Toothbrushing behaviour at 18 months a) brushing teeth more than one time per day by parents or b) not brushing teeth by parents.	1) Dental Caries Prevalence at 3 yrs among a) 31.5% (n=192) b) 43.3% (n=116) (p=0.001) 2) Dental Caries Prevalence at 3 yrs among a) 30.9% (n=121) b) 38.5% (n=187) (p=0.019)
	Other relevant statistical results	Results from Logistic regression analysis (a is reference) 1) Plaque score at 18 months (baseline) a) low or b) high 2) Toothbrushing behaviour at 18 months a) brushing teeth more than one time by parents or b) not brushing teeth by parents.	X^2 score (P-value) 1) 7.9763 (0.0047) 2) 1.8712 (0.1713)

Research question 9. Is oral health education for care givers' effective for preventing early childhood caries?

Citation	Feldens, C., Vítolo, M., & Drachler, M. (2007). A randomized trial of the effectiveness of home visits in preventing early childhood caries. Community Dent Oral Epidemiol, 35(3), 215-223.
Study design (including statistical	RCT. Mann-Whitney U test and Logistic regression.

analysis):			
Aims/objectives:	Assess the effectiveness of home visits for advising mothers about breast feeding and weaning on early childhood caries (ECC) at the age of 12 months.		
Participants	Total sample size at baseline:	500 (intervention group: 200 and control group: 300)	
	Country:	Brazil	
	Region (urban (city)/rural):	The city of San Leopoldo	
	Ethnicity:	-	
	Socioeconomic status:	Mother-child pairs were recruited from a publicly funded hospital that mainly serves the low-income population The income was low for most of the families, with 10.7% (17/159) of the families of the intervention group and 11.1% (25/225) of the controls living with an income below one minimum wage of the national salary; the income was between 1 and 3 minimum wages for 63.5% (101/ 159) of the intervention group and 58.7% (132/225) of the controls, and it was more than three minimum wages only for 25.8% (41/159) of the intervention group and 30.2% (68/225) of the controls. (v2 for differences in proportions between the two groups ¼ 0.600).	
	Gender:	Both male and female	
	Age (including adults/children):	Intervention delivered when babies were 10 days, 1-6 months, 8, 10 and 12 months; caries assessment for both groups at 12-14 months	
	Health background/status:	Apparently normal, single, full term babies with birth weight equal to or greater than 2500g and who did not have an impediment to breastfeeding (HIV/AIDS)	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	There were no evidence of imbalance between the intervention and control groups in the distribution of family income, maternal education and age at the child's birth. No significant differences were reported between groups in relation to other socioeconomic variables. Adjustment for: the confounding effect of number of teeth.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention: received home visits for advising mothers about breastfeeding and weaning at 10 days, monthly up to 6 months, and at 8, 10 and 12 months following their child's birth Almost all households in the city have access to public water supply with fluoride level of 0.7ppm	Control: routine assistance by their paediatricians in the health service, research assessment usually within 1 month following the child's 6-12 month anniversary and dietary advice by a fieldworker after the 12 month research assessment
	Other relevant baseline statistics for each group (for		

	the analysis/es used):	
	Duration:	Intervention was initially delivered from 10 days – 4 months; dental examination took place between 12 and 14 months
	Oral outcomes measured:	ECC incidence
	Scale/measure:	Caries status number of decayed surfaces
	Means and SD or events for each group at post-treatment or follow-up	Mean number of decayed surfaces (SD): Control group: 0.63 (1.62) Intervention group: 0.37 (1.37) (Mann Whitney U, P = 0.03)
	Other relevant statistical results	The proportion of children with ECC (defined as at least one decayed surface) was 10.2% (16/157) among the intervention group and 18.3% (40/219) among the controls and significantly higher in the control group relative to the intervention group: OR (adjusted for number of teeth) for the control group 1.0, OR for the intervention group 0.52 (95% CI 0.27-0.97) (p = 0.03)

Citation	Mohebbi, S. Z., et al. "A cluster randomised trial of effectiveness of educational intervention in primary health care on early childhood caries." Caries Res 43.2 (2009): 110-118.	
Study design (including statistical analysis):	Cluster RCT (Logistic regression, Kruskal-Wallis, Mann-Whitney U test and x2)	
Aims/objectives:	To evaluate the impact of a 6-month educational intervention on ECC	
Participants	Total sample size at baseline:	Total= 242 (group A = 77, group B = 85, group C = 80) 18 public health centres
	Country:	Iran
	Region (urban (city)/rural):	Tehran
	Ethnicity:	-
	Socioeconomic status:	The parents' level of education was low for 14%, moderate for 49% and high for 37%. The parents' level of education was low for 12% in group A, 12% in group B and 16% in group C. Family income was low for 10% of families; moderate for 50% and high for 40% of families. The family income was low for 7% in group A, for 12% in group B, and for 11% in group C. The parents' level of education and family income showed no differences between the groups.
	Gender:	Of the children who received outcome examinations, 50% were boys: 40% in group A, 59% in group B and 54% in group C (p = 0.11).
	Age (including	The mean age of the children was 12.3 months (SD = 0.4)

	adults/children):	(12 to 15 months old) at baseline and 18.3 months (SD = 0.6) at outcome. The groups showed no differences regarding children's age or dental findings at baseline	
	Health background/status:	Children suffering from any severe disease that could pose a barrier to the practice of oral health were excluded	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Child's age, Child's gender, Parent's level of education, Family income.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Group A = educational pamphlet, 5 min of oral health instructions, 2 recall phone calls of the oral health instructions at 2-month intervals. (n = 55) Group B = pamphlet only (n = 59)	C = control (n = 63)
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	6 month interval between intervention and follow-up	
	Oral outcomes measured:	Increments in the number of teeth with new dt or de, as percentages of children developing new dt or de, and as the number needed to treat (NNT).	
	Scale/measure:	Number and percentages of new de or dt dt = Number of teeth with dentinal caries; de = number of upper central incisors with enamel caries	
	Means and SD or events for each group at post-treatment or follow-up	Factors related to development of any new caries, either enamel caries (de) on upper central incisors or new decayed teeth (dt) during the 6-month intervention (n = 177). Intervention groups (control = 0) Pamphlet only (group B) = 1 Estimate of strength= –0.893 Standard error= 0.441 OR= 0.4 95%CI= 0.2–1.0 P= 0.043 Pamphlet + reminder (group A) = 2	

		Estimate of strength= –2.249 Standard error= 0.662 OR= 0.1 95%CI= 0.0–0.4 P= 0.001
	Other relevant statistical results	<u>Number of children at risk of developing new decayed enamel (de) on upper central incisors:</u> A: 48 B: 56 C: 61 <u>Increment in the new 'de' during the 6-month intervention:</u> A: 0 (SD=0) B: 0.2 (SD= 0.6) C: 0.4 (SD = 0.7) P (A vs C) < 0.001 P (B vs C) 0.066 <u>All children with de at the outcome examination:</u> A: 4 (7%), C: 18 (29%) (p<0.01) B: 10 (17%), C: 18 (29%) (p = 0.14) <u>Increment in percentages of children developing new de:</u> A: 0 B: 14 C: 26 P (A vs C) < 0.001 P (B vs C) 0.208 <u>No significant differences regarding the number or percentage of children developing new dt during the 6 month intervention were found between groups</u> <u>NNT, children with new de:</u> A: 4 B: 9 <u>Increment in the new dt during the 6-month intervention:</u> A: 0 .1 (SD=0.6) B: 0.1 (SD= 0.1) C: 0.2 (SD = 0.7)

		P (A vs C) 0.188 P (B vs C) 0.265 <u>Increment in percentages of children developing new dt:</u> A: 5 B: 7 C: 13 P (A vs C) 0.177 P (B vs C) 0.276 <u>NNT, children with new dt:</u> A: 13 B: 17

Citation	Plutzer, Kamila, and A. John Spencer. "Efficacy of an oral health promotion intervention in the prevention of early childhood caries." Community Dent Oral Epidemiol 36.4 (2008): 335-346.		
Study design (including statistical analysis):	RCT; Fisher's Exact test		
Aims/objectives:	The purpose of this study was to test the efficacy of an oral health promotion programme targeting nulliparous women starting during the pregnancy to reduce S-ECC at 18 months of age.		
Participants	Total sample size at baseline:	649 (Nulliparous pregnant women in the test group=327 and control group=322)	
	Country:	Australia	
	Region (urban (city)/rural):	South Australia	
	Ethnicity:	No information	
	Socioeconomic status:	No information	
	Gender:	Female (no data on this variable with respect to the children)	
	Age (including adults/children):	Intervention delivered during pregnancy and when the child and 12 months of age. In a test sub-group, a structured telephone consultation was given when the child was 6-12 months of age. Children's teeth were assessed at the age of 20 ± 2.5 months	
	Health background/status:	Mothers with high risk pregnancies were excluded	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Mother's age, examination-age, number of parent family, mother's employment, country of born, education	
Intervention	Comparison/exposure	Intervention group (n	Comparison (n

	(including n, age and gender (if different from above) for each group for the analysis/es used):	randomized =327): Oral health promotion information during pregnancy, and later when the child reached 6 and 12 months of age. After the second round of information the test group mothers were randomized again. The information was reinforced in one of the test subgroups (n randomized= 165; n analysed = 123) through a telephone consultation. In the second test subgroup (n randomized= 156; n analysed = 109) no telephone conversation was received.	randomized = 322; n analysed = 209): There was no contact with mothers in the control group after enrolment
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	Intervention delivered during pregnancy and when the child was 6 and 12 months of age	
	Oral outcomes measured:	S-ECC incidence %	
	Scale/measure:	A case of S-ECC was defined when one or more upper incisor teeth labial surfaces were carious, either non-cavitated or cavitated. Diagnosis was based on visual criteria only	
	Means and SD or events for each group at post-treatment or follow-up	Bivariate and multivariate logistic regression analyses of severe early childhood caries (S-ECC) with unadjusted and adjusted odds ratios:	
	Other relevant statistical results	Control group***(ref. test group): Un-adjusted odds ratio (95.0% CI): 6.1 (2.0-18.1) adjusted odds ratio (95.0% CI): 6.8 (2.1-21.9) *** P < 0.001 Cumulative incidence of S-ECC in the test and control groups, including test A and test B groups (Fisher's exact test): Test group (A+B) = 1.7%; Control group 9.6% (P < 0.01)	

		Tests group A = 1.6%; test group B = 1.8% (P = 0.903) Test group A = 1.6%; control group = 9.6% (P < 0.01) Test group B = 1.8%; control group = 9.6% (P < 0.01) (test B and control group). Number of children with S-ECC: A+B=4 (from total n=232) A=2 (from total n=123) B=2 (from total n=109) Control=20 (from total n=209)

Citation	Vachirarojpisan, Thongchai, Kayoko Shinada, and Yoko Kawaguchi. "The process and outcome of a programme for preventing early childhood caries in Thailand." Community Dent Health 22.4 (2005): 253-259.	
Study design (including statistical analysis):	Cluster- RCT (two-sample t-test to compare the differences in cavitated carious increment between the two groups).	
Aims/objectives:	To investigate the effectiveness of a participatory DHE approach to increase tooth brushing and fluoride toothpaste behaviour for preventing ECC.	
Participants	Total sample size at baseline:	520 mothers/caregivers of 6-19 month old children
	Country:	Thailand
	Region (urban (city)/rural):	One rural district of Suphanburi Province
	Ethnicity:	-
	Socioeconomic status:	Family income per month above Thai average: • Intervention group: 46% • Control group: 44% Family income per month below Thai average: • Intervention group: 54% • Control group: 56%
	Gender:	Both male and female
	Age (including adults/children):	6-19 month old children Children's average age at baseline Inter group: 12.9 (3.66%) Cont group: 12.24 (3.78%) Mother's/caregiver's average age at baseline: Inter group: 30.28 (9.65%) Cont group: 29.70 (9.35%)
	Health background/status:	-
	Any information on confounders (e.g. water, milk	No significant differences were reported concerning consumption of sweet food between meals between

	or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	intervention and control groups at baseline or in relation to measures of oral hygiene (tooth brushing habits).	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention: Small group discussion with 6-8 mothers/caregivers on their children's oral health, the cause and prevention of ECC three times (40-60 minutes/time), at 3-months interval +providing free toothbrushes and fluoride toothpaste (500 ppm F) N randomized (initial clinical examination and questionnaire interview Nov 2001): 11 health centres; 270 mothers / caregivers At the clinical examination and questionnaire interview (follow-up stage – Nov 2002), n= 213 mothers / caregivers participated	Control: Didactic teaching about the ECC prevention method + providing free toothbrushes conducted at the same time as vaccination program. N randomized (initial clinical examination and questionnaire interview Nov 2001): 10 health centres; 250 mothers / caregivers At the clinical examination and questionnaire interview (follow-up stage – Nov 2002), n= 191 mothers / caregivers participated
	Other relevant baseline statistics for each group (for the analysis/es used):	Intervention group: n=270	Control group: n=250
	Duration:	One-year intervention program	
	Oral outcomes measured:	Non-cavitated carious lesions, cavitated carious lesions, ECC (non-cavitated and cavitated carious lesions), Mean cavitated carious increment	
	Scale/measure:	Mean and SD	
	Means and SD or events for each group at post-treatment or follow-up	**Intervention group (Mean (SD))** Non-cavitated carious lesions: Baseline=1.38 (2.12) 1 year=3.98 (3.08) cavitated carious lesions: Baseline=0.36 (1.06) 1 year=3.82 (3.65) ECC (non-cavitated and	**Control group (Mean (SD))** Non-cavitated carious lesions: Baseline=1.47 (2.14) 1 year=4.04 (2.99) cavitated carious lesions: Baseline=0.51 (1.38) 1 year=3.74 (3.93) ECC (non-cavitated and

		cavitated carious lesions): Baseline=1.73 (2.60) 1 year=7.80 (4.99) There is no statistical differences in all above variables between 2 groups at the base line and 1-year follow-up. Mean cavitated carious increment=3.46 (3.36)	cavitated carious lesions): Baseline=1.97 (2.76) 1 year=7.78 (5.22) Mean cavitated carious increment= 3.24 (3.53)
	Other relevant statistical results	Intervention group: n=213 Male: 120 (56.3) Female: 93 (43.7)	Control group: n=191 Male: 96 (50.3) Female: 95 (49.7)

Citation	*Harrison, R. et al. Effect of motivational interviewing on rates of early childhood caries: a randomized trial.'Pediatric Dentistry 29.1 (2007): 16-22.*		
Study design (including statistical analysis):	RCT (Poisson regression)		
Aims/objectives:	To investigate the effect of motivational interviewing to prevent early childhood caries.		
Participants	Total sample size at baseline:	240	
	Country:	Canada	
	Region (urban (city)/rural):	Surrey, British Columbia	
	Ethnicity:	South Asian immigrant	
	Socioeconomic status:	Proportion of children with a household income of $31,000 / y: (control group: 51%, intervention group: 50%)	
	Gender:	Both male and female	
	Age (including adults/children):	6 to 18 months	
	Health background/status:	Proportion of children in 'fair or poor health': 24% in the intervention and control groups. Proportion of children with a major illness: 13% (control group), 8% (intervention group)	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	No significant differences between groups in relation to baseline characteristics presented in relation to: caries prevalence at baseline, age, recruitment age, socioeconomic factors, health status, whether mother pre-chews food, antibiotic and vitamin use and the child's mood disposition	
Intervention	Comparison/exposure	Intervention group (N=122)	Control group (N=118)

	(including n, age and gender (if different from above) for each group for the analysis/es used):	Boys (n, %): 69 (57%) Recruitment age (mean (SD)): 10.8 (5.3) The intervention (MI) group received the following: 1. The pamphlet and video 2. One 45-minute counselling session, in which a 'menu of options' for infant oral care were discussed 3. Two brief follow-up telephone calls up to 6 months after the initial contact 4. 2 postcard reminders	Boys (n, %): 61 (52%) Recruitment age (mean (SD)): 12.1 (5.3) The control group received 'traditional information' consisting of: a pamphlet on infant oral health; mother's also watched an 11-minute video 'preventing tooth decay for infants and toddlers'.
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Follow up period: 2 years	
	Oral outcomes measured:	Number of decayed surfaces, white spot surfaces, Missing surfaces, Filled surfaces, Dmfs, Dmfs plus white spots at 2 years post-intervention	
	Scale/measure:	Number of decayed surfaces, white spot surfaces, Missing surfaces, Filled surfaces, Dmfs, Dmfs plus white spots	
	Means and SD or events for each group at post-treatment or follow-up	Intervention group (n=105): mean (SD) Decayed surfaces: 2.03 (4.9) White spot surfaces: 0.17 (0.6) Missing surfaces:0.33 (2.5) Filled surfaces:0.99 (5.1) Dmfs: 3.35 (7.8) Dmfs plus white spots: 3.52 (8.0)	Control group (n=105): mean (SD) Decayed surfaces: 2.91 (5.6) White spot surfaces: 0.32 (1.1) Missing surfaces: 1.25 (5.8) Filled surfaces: 3.43 (9.7) Dmfs:7.59 (14.2) Dmfs plus white spots:7.91 (14.2)
	Other relevant statistical results	Significant ($p \leq 0.05$) differences were found between intervention and control groups in relation to the following:	

		Filled surfaces (p = 0.03) Dmfs: 3.35 (p = 0.001) Dmfs plus white spots: (p = 0.1) Poisson regression results support a protective effect of MI relative to the control condition on the rate of dmfs after 2 years (hazard ratio = 0.54 (95% CI 0.35-0.84).

Citation	Jiang, Emily Ming, et al. "Prevention of early childhood caries (ECC) through parental tooth brushing training and fluoride varnish application: a 24-month randomized controlled trial." J Dent 42.12 (2014): 1543-1550.		
Study design (including statistical analysis):	RCT (independent samples Kruskal-Wallis test)		
Aims/objectives:	To investigate the effectiveness of hands-on training in parental tooth brushing in preventing ECC.		
Participants	Total sample size at baseline:	Intervention group=152 Control group=149	
	Country:	China	
	Region (urban (city)/rural):	Hong Kong	
	Ethnicity:	-	
	Socioeconomic status:	Monthly household income: Intervention group (n=144): <15,000: 24 (17%) 15,000-25,000: 35 (24%) >25,000: 85 (59%) Control group (n=134): <15,000: 20 (15%) 15,000-25,000: 23 (17%) >25,000: 91 (68%)	
	Gender:	Both male and female	
	Age (including adults/children):	8-23 Months	
	Health background/status:	Good general health and not on long term medication	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	There are no statistically significant difference (at $p \leq 0.05$ level) between the two groups in terms of the children's age, gender, monthly household income, parents' education level, parental tooth brushing and child self-tooth brushing at baseline.	
Intervention	Comparison/exposure (including n, age and gender	Intervention group (G2): Mean age at base line: 15.6	Control group (G1): Mean age at base line:

	(if different from above) for each group for the analysis/es used):	(3.8) Boys: 62 (43%) Girls: 82 (57%) The intervention group received oral health education talk and parental tooth brushing training, reinforced every 6 months.	15.5 (3.9) Boys: 58 (43%) Girls: 76 (57%) The control group received one-off oral health education talk to parents and printed materials information on children's tooth eruption, suggested method for cleaning baby's mouth, parental tooth brushing methods, healthy oral health-related dietary practice, need for regular dental visits, and a brief introduction to early childhood caries. There was no reinforcement of the oral health education messages by the investigators during the study period.
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	Follow up: 24 months (every 6 months)	
	Oral outcomes measured:	ECC incidence	
	Scale/measure:	Dmft	
	Means and SD or events for each group at post-treatment or follow-up	Mean dmtf increment at 24 month follow up: Intervention group: (n=144) Mean (included non-cavitated and cavitated lesions)=0.2 (SD=0.6) Mean (included cavitated lesions)=0.1 (SD=0.5)	Mean dmft increment at 24 month follow up: Control group: (n=134) Mean((non-cavitated and cavitated)=0.3 (SD=1.2) Mean (cavitated)=0.2 (SD=1.0)
	Other relevant statistical results	Incidence of ECC in the intervention group (non-cavitated+cavitated) (n-144) = 17 (11.8%) (cavitated)=10 (6.9%)	Incidence of ECC in the control group (non-cavitated+cavitated) (n=134) =16 (11.9%) (cavitated)=11 (8.2%)

Research question 10: Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?

Citation	Blinkhorn, A., Brown, M., Attwood, D., & Downer, M. (1981). The effect of fluoridation on the dental health of urban Scottish Schoolchildren. Journal of Epidemiology and Community Health, 35(2), 98-101.		
Study design (including statistical analysis):	Retrospective cohort (two way ANOVA)		
Aims/objectives:	To demonstrate the likely benefits of introducing fluoridation to urban areas of Scotland by comparing the dental health of children from Stranraer, a fluoridated area, with similar children from Anan, a non-fluoridated area.		
Participants	Total sample size at baseline:	262 eligible children; 230 examined and lifetime residents	
	Country:	Scotland	
	Region (urban (city)/rural):	Annan and Stranraer; seaport towns with a mixture of rural activities and light industry	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	-	
	Age (including adults/children):	4-5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The number of dentists serving the two towns was also comparable, five in Stranraer and four in Annan. Only children who were lifetime residents were included in the analysis	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Stranraer received water with an optimally adjusted 1mg /l fluoride N=129	Annan did not have fluoridated drinking water (the concentrate of naturally occurring fluoride was not specified) N=101
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Exposure (or not) to fluoridated water from birth. Data collected at 4-5 years	
	Oral outcomes measured:	Number of decayed deciduous teeth Number of decayed, missing and filled deciduous teeth	
	Scale/measure:	Mean (SD)	
	Means and SD or events for each group at post-treatment or follow-up	Stranraer (fluoridated) : Adjusted* mean dt score:	Annan (non-fluoridated) : Adjusted* mean dt score:

		1.34 Adjusted mean dmft score: 2.47 *adjusted for differences between two examiners	3.34 Adjusted mean dmft score: 4.41 *adjusted for differences between two examiners
	Other relevant statistical results	Mean difference in adjusted mean dt scores in 4-5 year olds between Stranraer (Fluoridated) and Annan (Non-fluoridated): 2.0, F(31.5), p<0.01 Mean difference in adjusted mean dmft scores in 4-5 year olds between Stranraer (Fluoridated) and Annan (Non-fluoridated): 1.94, F(17.0), p<0.01 (Results specific to anterior teeth also reported (as fluoridation shows particular benefit to these) – but I wouldn't have extracted these data either as overall results is our main interest)	

Citation	Booth et al. (1992). A comparison between the dental health of 3-year-old children living in fluoridated Huddersfield and non-fluoridated Dewsbury in 1989. Community Dent Health, 9(2):151-7.	
Study design (including statistical analysis):	Retrospective cohort	
Aims/objectives:	To compare the prevalence if dental caries and developmental defects of enamel between 3 year old children who were lifelong residents of fluoridated areas of Huddersfield and non-fluoridated Dewsbury.	
Participants	Total sample size at baseline:	480 (240 from Huddersfield and 240 from Dewsbury)
	Country:	England, UK
	Region (urban (city)/rural):	Huddersfield and Dewsbury
	Ethnicity:	White children
	Socioeconomic status:	A representative cross-section of all social classes was obtained from each location
	Gender:	Male and female
	Age (including adults/children):	3 years
	Health background/status:	-
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration,	Included children had never taken fluoride tablets Areas were matched according to socio-economic data Participants were randomly selected All participants had to be lifelong residents of the area to which they were grouped in this study There was no significant difference regarding response

	frequency) and oral hygiene behaviour):	rate between areas No significant difference between social class or mean ages of the two samples No significant differences were found with respect to demarcated developmental defects of enamel between intervention and control areas Significant differences were found between groups with respect to diffuse defects of the upper and lower first molars	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention: (n = 240 randomly sampled, 225 contacted, 126 attended the first appointment, 22 attended the second appointment, 121 children were included in the analysis) Fluoridated water supply (1 ppm F)	Control: (n = 240 randomly samples, 206 contacted, 206 were contacted, 101 attended the first appointment, 21 the second, of theses 122 children, 107 were included in the analysis) Non-fluoridated water supply (<0.3ppm)
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	The intervention area received fluoridated water (1 ppm F) from 1970 – 31st Oct 1989. In the fluoridated area, dental examinations took place in September and October 1989; in the non-fluoridates area, dental examinations took place in October and November 1989	
	Oral outcomes measured:	Number of DMFT	
	Scale/measure:	Mean	
	Means and SD or events for each group at post-treatment or follow-up	Mean (SD) values in Fluoridated Huddersfield: dt: 0.24 (0.84) mt: 0.03(0.29) ft: 0.03(0.20) dmft: 0.30 (1.00)* *denotes a significant effect p =0.03	Mean (SD) values in non-Fluoridated Dewsbury: dt: 0.60 (1.87) mt: 0.10(0.53) ft: 0.04 (0.23) dmft: 0.74 (2.00)*
	Other relevant statistical results	1) Caries free (dmft = 0) 87% 2) Carious teeth (dt>0)	1) Caries free (dmft = 0) 75%, p = 0.03 2) Carious teeth

		11% 3) Teeth extracted (mt>0) 2%	(dt>0) 11%, p = 0.04 3) Teeth extracted (mt>0) 5%, p = 0.35

Citation	Evans, D.J., Rugg-Gunn, A.J., Tabari, E.D. and Butler, T. (1996) The effect of fluoridation and social class on caries experience in 5-year-old. Community Dent Health, 13(1), 5-10.		
Study design (including statistical analysis):	Historical cohort; Chi-square and Mann-Whitney U tests		
Aims/objectives:	To compare the dental health of children who had lived in continuously fluoridated compared to non-fluoridated areas of Northumberland.		
Participants	Total sample size at baseline:	662	
	Country:	England, UK	
	Region (urban (city)/rural):	North-East	
	Ethnicity:	-	
	Socioeconomic status:	Children in social groups from I-V from intervention and control areas were included in the analyses	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	There was a statistically significant difference in the distribution of subjects in three social class groups between the two areas – in Northumberland (NF) a higher proportion of social class III (manual) were included whereas in Newcastle (F) a higher proportion of social group 1 were included. This was not controlled for in overall analysis but results were presented by social group.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Newcastle was continuously fluoridated (at 0.1 mg/lF) n = 327 children	South-East Northumberland was non-Fluoridated (0.1 mg/lF) n = 335
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Children lived in areas since birth and examinations tool place when they were 5 years old	
	Oral outcomes measured:	Caries prevalence	
	Scale/measure:	Number / Percentage	
	Means and SD or events for each group at post-treatment	-	-

	or follow-up	
	Other relevant statistical results	

	Fluoridated area	Non-Fluoridated area	Difference	%
No of sound teeth	18.37	17.19**	1.18	6
dt	0.79	1.63**	0.84	52
mt	0.19	0.42**	0.23	55
ft	0.22	0.24 NS	0.02	8
dmft	1.20	2.29**	1.09	48
dmfs	2.52	5.49**	2.97	54
dfs	1.59	3.41**	1.82	53
%dmft>0	36%	52%	16%	
%dmft>4	12%	26%	14%	

NS = Non significant
*P = <0.05
** P<0.001

Social class	F	NF	Difference
dmft			
I + II	0.59 (1.37)	1.46 (2.61)	0.87 (60%)*
III	1.21 (2.36)	2.04 (3.42)	0.83 (41%) NS
IV + V	1.17 (2.73)	2.74 (3.05)	1.57 (57%)**
dfs			
I + II	0.85 (2.28)	2.18 (4.46)	1.33 (61%)*
III	1.25 (2.84)	3.13 (6.94)	1.88 (60%)*
IV + V	1.17 (2.65)	3.65 (4.51)	2.48 (68%)

Mean (SD)
*P= <0.05, **P= <0.001

Citation	French, A. D., et al. Fluoridation and dental caries experience in 5-year-old children in Newcastle and Northumberland in 1981." Brit Dent J 156.2 (1984): 54.	
Study design (including statistical analysis):	Retrospective cohort (Chi-squared test and Mann-Whitney U test)	
Aims/objectives:		
Participants	Total sample size at baseline:	1069
	Country:	UK
	Region (urban (city)/rural):	North East
	Ethnicity:	-

	Socioeconomic status:	All social classes	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Social class: In the fluoridated Newcastle locality slightly more social class I, II and III children were obtained in the sample, while in low fluoride Northumberland more social class IV and V were found to be present.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Children were continuous residents of a fluoridated area (Newcastle), n = 533 children	Children were continuous residents of a low-fluoride area (Northumberland), n = children 536
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	5 years	
	Oral outcomes measured:	Caries experience	
	Scale/measure:	dmft, dmfs, dfs	
	Means and SD or events for each group at post-treatment or follow-up	See tables 1 and 2 (below)	See tables 1 and 2 (below)
	Other relevant statistical results	See tables 1 and 2 (below)	

Table I: Caries experience (dmft and dmfs) of 5-year old children in each area for all subjects and for social class III children only

				dmft		*dmfs*	
	N	*Percent caries free (dmft=0)*	*Difference*	*Mean (SD)*	*Difference (%)*	*Mean (SD)*	*Difference (%)*
All subjects							
Newcastle (Fluoridated)	533	55	24~	1.41 (2.21)	1.96*(58)	2.14 (4.13)	3.56 (62)
Northumberland (Fluoride low)	536	31		3.37 (3.65)		5.70 (7.19)	
Class III only							
Newcastle (Fluoridated)	295	52	21~	1.54 (2.28)	2.01* (57)	2.32 (4.13)	3.61* (61)
Northumberland (Fluoride low)	253	31		3.55 (3.69)		5.93 (7.08)	
P<0.001 (Mann-Whitney U test)							
~P<0.001 (Chi-squared)							

Table 2 dfs experience for each surface type separately for all subjects and for social class III children only						
	Fissure		Free smooth surface		Approximal	
	Mean (SD)	Difference (per cent)	Mean (SD)	Difference (per cent)	Mean (SD)	Difference (per cent)
All subjects						
Newcastle (Fluoridated)	0.98 (1.65)	0.74* (43%)	0.14 (0.64)	0.37* (73%)	0.30 (1.0)	1.22*(76%)
Northumberland (Fluoride low)	1.72 (1.99)		0.51(1.29)		1.60 (2.51)	
Class III only						
Newcastle (Fluoridated)	1.04 (1.62)	0.75* (42%)	0.18 (0.79)	0.42* (70%)	0.43 (1.03)	1.32* (75%)
Northumberland (Fluoride low)	1.79 (2.06)		0.60(1.49)		1.75(2.56)	
P<0.001 (Mann-Whitney U test)						

Citation	Jackson et al (1975). Fluoridation in Anglesey A Clinical Study. Brit Dent J, 138 (5), 165-71.		
Linked studies	Jackson et al. (1980). Fluoridation in Leeds. Brit Dent J, 149, 231-4. Jackson D, James PM, Thomas FD. 1985. Fluoridation in Anglesey 1983: a clinical study of dental caries. Brit Dent J. 158(2):45. Jackson et al. (1975). Fluoridation in Cumbria A Clinical Study. Brit Dent J , 139, 319-322.		
Study design (including statistical analysis):	Historical cohort		
Aims/objectives:	To find out the possible benefits of water fluoridation		
Participants	Total sample size at baseline:	600	
	Country:	Wales, UK	
	Region (urban (city)/rural):	-	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children were excluded from the study for the reasons including the following: - The child had left the area - The child did not have continuity of residence - The home of the child did not have a piped water supply for his/her whole life No information on similarity of the two areas although close geographically	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention area: Anglesey Intervention: drinking water had contained 0.9ppm fluoride for the whole lives of participants	Control area: Bangor / Caernarvon Intervention: drinking water contained <0.01 ppm fluoride

		N of children examined: 153 (50% of baseline)	N of children examined: 145 (49% of baseline)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Drinking water contained 0.9ppm fluoride in Anglesey from 1955; clinical examinations for this study took place in 1974	
	Oral outcomes measured:	D,m,f, dmf	
	Scale/measure:	Number, mean	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Accompanying data

Table IV: Caries experience (dmf or DMF) of children aged 5 years in Anglesey and in non-fluoridated Bangor / Caernarvon (NF<0.1PPM)

Area	N	d	m	f	dmf	SE
Anglesey	Total	306	48	79	433	-
	Mean per person	2.00	0.31	0.52	2.83	0.261
Bangor / Caernarvon	Total	412	91	161	664	-
	Mean per person	2.84	0.63	1.11	4.58	0.338

Citation	Jackson et al. (1980). Fluoridation in Leeds. Brit Dent J. 149, 231-4.	
Linked studies	Jackson et al (1975). Fluoridation in Anglesey A Clinical Study. Brit Dent J. 138 (5), 165-71. Jackson D, James PM, Thomas FD. 1985. Fluoridation in Anglesey 1983: a clinical study of dental caries. Brit Dent J. 158(2):45. Jackson, D. et al. (1975). Fluoridation in Cumbria A Clinical Study. Brit Dent J. 139, 319-322.	
Study design (including statistical analysis):	Historical cohort	
Aims/objectives:	To find out the possible benefits of water fluoridation	
Participants	Total sample size at baseline:	910
	Country:	England, UK
	Region (urban (city)/rural):	Leeds (urban)
	Ethnicity:	-
	Socioeconomic status:	-

	Gender:	-	
	Age (including adults/children):	5-year-old	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children were excluded if their parents reported that they in receipt of fluoride - topical or supplements, or if they were in receipt of mixed water supplies Children who were continuous residents were included in the analysis	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention: 4 districts of Leeds that had been fluoridated continuously at an average level of 0.9 ppm fluoride since 1968 n =470 children examined and n = 349 questionnaires returned in 1979; n = 190 acceptable for the study after disqualifications	Control: Low fluoride districts of Leeds where the water supply is about 0.1ppm F n =440 children examined and n = 317 questionnaires returned in 1979; n = 198 acceptable for the study after disqualifications
	Other relevant baseline statistics for each group (for the analysis/es used):	All included participants were continuous residents of the districts they were assigned to in the study	
	Duration:	Intervention implemented in 1968, clinical examination took place in 1979	
	Oral outcomes measured:	Dmf, d,m,f,df	
	Scale/measure:	Mean, percentage	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Table 1: Caries experience (mean dmf ±SE) in 5-year old children

	Total caries experience. Mean values			
	d	**m**	**f**	**dmf±SE**
Fluoridated districts (n= 190)	0.71	0.11	0.41	1.23 ±0.1462
Low fluoride districts (n= 198)	2.30	0.43	0.54	3.38 ±0.2543

Table 2: Caries experience of approximal sites in 5-year old children

	Total no approximal sites	Total no df approximal sites	Percentage df
Fluoridated districts (n=190)	7,432	73	0.98
Low fluoride districts (n= 198)	7,590	302	3.98

Table 3: Caries experience of occlusional and approximal sites on deciduous molars in 5-year old children

	Occlusional sites					Approximal sites				
	no	df	Df percent	f	f/f+d percent	no	df	Df percent	f	f/f+d percent
Fluoridated districts (n=190)	1,503	115	7.65	52	45	3,006	46	1.53	16	35
Low-fluoride districts (n=198)	1,488	209	14.05	62	30	2,976	194	6.52	34	18

Citation	Jackson, D., P. M. James, and F. D. Thomas. "Fluoridation in Anglesey 1983: a clinical study of dental caries." Brit Dent J 158.2 (1985): 45. (A follow-up study from Jackson 1975. Fluoridation in Anglesey A Clinical Study)	
Linked studies	Jackson et al (1975). Fluoridation in Anglesey A Clinical Study. *British Dental Journal*, 138 (5), 165-71. Jackson et al. (1980). Fluoridation in Leeds. *British Dental Journal*, 149, 231-4. Jackson, D. et al. (1975). Fluoridation in Cumbria A Clinical Study. *British Dental Journal*, 139, 319-322.	
Study design (including statistical analysis):	Historical cohort	
Aims/objectives:	It has recently been noticed that caries experience has fallen in English children from both fluoridated and non-fluoridated communities. It was important to know whether a similar phenomenon had occurred in fluoridated Anglesey and in the non-fluoridated adjacent mainland part of Gwynedd.	
Participants	Total sample size at baseline:	600

	Country:	Wales, UK	
	Region (urban (city)/rural):	Anglesey and Gwynedd	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children who were discontinuous residents, had fluoride supplements or who received water from a well or from a well and the mains water supply were excluded*	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention group (5 year old children from Anglesey) had received a mains water supply containing F=0.9 PPM fluoride for all of their lives (since 1964, the study including clinical examinations were undertaken in 1983). N children examined = 314 Number of children in the final sample following exclusions due to the presence of confounders* = 219	Control group (5 year old children from Gwynedd) received un-fluoridated water containing F=0.1 PPM fluoride. N children examined = 172 Number of children in the final sample following exclusions due to the presence of confounders* = 128
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Water fluoridation to 0.9 ppm fluoride was implemented in Anglesey in 1964; clinical examinations were conducted of children in the intervention and control areas in 1983.	
	Oral outcomes measured:	D, m, f, dmf	
	Scale/measure:	Mean, difference	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Table IV: Caries experience (dmf or DMF) of children aged 5 years in Anglesey and in non-fluoridated

Gwynedd (NF<0.1PPM)

Age 5 years	N	d	m	f	*dmf±SE
Anglesey	219	1.03	0.10	0.46	1.58±0.174
Gwynedd	128	2.24	0.45	0.86	3.55±0.328

Table V. Caries experience in children aged 5 years in fluoridated (F) Anglesey and non-fluoridated Gwynedd 1974-83 data compared

	Anglesey (F=0.9 PPM) Mean dmf	Gwynedd (F=0.1 PPM) Mean dmf
1974	2.83	4.58
1983	1.38	3.55
Diff. 1974-83	44%	22%

Citation	Jackson, D. et al. (1975). Fluoridation in Cumbria A Clinical Study. Brit Dent J. 139, 319-322.	
Linked studies	Jackson et al (1975). Fluoridation in Anglesey A Clinical Study. *British Dental Journal*, 138 (5), 165-71. Jackson et al. (1980). Fluoridation in Leeds. Brit Dent J. 149, 231-4. Jackson et al. 1985. Fluoridation in Anglesey 1983: a clinical study of dental caries.	
Study design (including statistical analysis):	Historical cohort	
Aims/objectives:	-	
Participants	Total sample size at baseline:	830
	Country:	England, UK
	Region (urban (city)/rural):	Cumbria (rural)
	Ethnicity:	-
	Socioeconomic status:	-
	Gender:	-
	Age (including adults/children):	5 years
	Health background/status:	-
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration,	Children were excluded from the study for reasons including the following: - Non continued residence in their community - Non continuous receipt of mains water supply - Receipt of one of the following preventative

	frequency) and oral hygiene behaviour):	measures against caries: fluoride tablets, topical fluoride, fissure sealant or other No information given on how the areas were comparable	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention area: Cockermouth / Workington Intervention: water supply fluoridated to 1ppm N of children examined: 106 (26% of baseline)	Control area 1: Carlisle / Penrith Intervention: drinking water contained <0.01 ppm fluoride N of children examined: 130 (31% of baseline)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Drinking water contained 0.9ppm fluoride in Anglesey from 1955; clinical examinations for this study took place in 1974	
	Oral outcomes measured:	D, m, f, d+m+f teeth	
	Scale/measure:	Number, mean	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Table II: Caries experience of 5-year-old children in fluoridated and in non-fluoridated communities of Cumbria

	Cockermouth and Workington F = 1ppm N = 106		Carlisle and Penrith F = <0.1ppm N = 130		Decoys N= 143	
	Total	Mean	Total	Mean	Total	Mean
d teeth	194	1.83	426	3.28	431	3.01
m teeth	40	0.38	105	0.81	95	0.66
f teeth	18	0.17	41	0.32	81	0.57
d+m+f teeth	252	2.38±0.304 (SE)	572	4.40 ±0.349 (SE)	607	4.24 ±0.365 (SE)

Citation	O'Mullane D, Whelton H. Efficacy of fluoride against dental caries; fluoride in water. Fogorvosi szemle. 1997 Apr; 90:7.		
Study design (including statistical analysis):	Retrospective cohort		
Aims/objectives:	To consider the effectiveness of fluoridated water		
Participants	Total sample size at baseline:	1995	
	Country:	Republic of Ireland	
	Region (urban (city)/rural):	All	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	Males and females	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Subjects in the intervention (Full FI) group may have had exposure to school fluoridation, fluoride tablets or fluoride mouth rinses Subjects in the control ("Non FI") group never had fluoride tablets or mouth rinses.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention ("Full FI") group: Home water supply fluoridated continuously (0.8-1.0mg'l fluoride) since birth.	Control ("Non FI") group Home water supply never fluoridated. Present school water supply is not fluoridated. Subject never had fluoride tablets or mouth rinses.
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	Home water supply of the "Full FL" fluoridated continuously since birth.	
	Oral outcomes measured:	Number of decayed, missing and filled teeth	
	Scale/measure:	Mean	
	Means and SD or events for each group at post-treatment or follow-up	See table 1, below	See table 1, below
	Other relevant statistical results	-	

Table 1: Mean number of decayed missing and filled teeth in 5-year-old children (dmft) in 1984

	Group	
Health board	Full FL	Non-FL
Eastern	1.3	2.9
Midland	1.9	3.0
M-western	2.3	4.0
N-Eastern	1.0	2.1
N-Western	1.7	3.0
S-Eastern	1.9	2.8
Southern	2.5	4.0
Western	1.5	2.2
All health boards	1.8	3.0

Citation	Rugg-Gunn et al. (1981). Caries Experience of 5-year-old children living in four communities in N.E. England Receiving Differing Water Fluoride Levels. Brit. Dent. J. 150, 9-12.		
Linked studies	Rugg-Gunn, A.J., Carmichael, C.L. and Ferrell, R.S. (1988) Effect of fluoridation and secular trend in caries in 5-year-old children living in Newcastle and Northumberland. Brit Dent J. 19;165(10):359-64.)		
Study design (including statistical analysis):	Historical cohort (T test)		
Aims/objectives:	To assess the relationship between water fluoride levels and caries experience.		
Participants	Total sample size at baseline:	N= 2,023 consent forms issued N=1,038 subjects studied (following exclusion of participants who failed to return their consent form and of children who failed to meet the inclusion criteria*)	
	Country:	England, UK	
	Region (urban (city)/rural):	North-East (urban)	
	Ethnicity:	Caucasian	
	Socioeconomic status:	Children from social classes I –V	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	* • Non-caucasian children were excluded • All consenting children had lived in the area throughout their lives were examined • Proportion of individuals from each social class I-V were well balanced between groups, except for a significantly higher proportion of social class IV&V children from Ashington (ppm<0.1)	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es	Intervention: Residence in Newcastle , which had ppm 1.0 F for	Comparators: Residence in Ashington, and Houghton, which had

	used):	the last seven years N = 438 subjects studied	ppm <0.1 and 0.2 F, respectively N = 132 subjects studied (Ashington) N= 112 subjects studied (Houghton)
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Fluoride levels had remained constant for the past seven years; participants' teeth were examined at 5 years of age	
	Oral outcomes measured:	Caries experience (deft and DMFS)	
	Scale/measure:	Mean (SD), %	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Table III – caries experience (deft and defs) of 5-year-old children in each of the 4 areas. Data also given for social class III children only

			Ashington (<0.1ppm)	Sig. [1]	Houghton (0.2 ppm)	Newcastle (1.0 ppm)
deft (all subjects)		Mean (sd)	6.1 (4.03)		4.9 (4.42)	2.5 (2.79)
deft (social class III)		Mean (sd)	5.9 (3.92)	n.s.	4.9 (4.10)	2.4 (2.73)
defs (all subjects)		Mean (sd)	11.6 (9.54)	[1]	8.9 (9.86)	4.1 (5.76)
defs (social class III only)		Mean (sd)	11.5 (9.64)	[1]	8.2 (8.34)	4.0 (5.67)

Sig. = significance between adjacent pairs (Welsh or t test); [1] P<0.05

Table IV – Percentage of children caries-free or with gross caries

	Ashington (<0.1ppm)	Houghton (0.2 ppm)	Newcastle (1.0 ppm)
Caries free	11	24	33
Deft 5+	65	47	20
Defs 15 +	36	29	8

Citation	Rugg-Gunn, A.J., Carmichael, C.L. and Ferrell, R.S. (1988**)** Effect of fluoridation and secular trend in caries in 5-year-old children living in Newcastle and Northumberland. Brit Dent J. 19;165(10):359-64.		
Linked studies	Rugg-Gunn et al. (1981). Caries Experience of 5-year-old children living in four communities in N.E. England Receiving Differing Water Fluoride Levels. Brit Dent J. 150, 9-12.		
Study design (including statistical analysis):	Historical cohort (Chi-square and Mann-Whitney U)		
Aims/objectives:	This study compared the dental health of 457 5-year-old children who had lived in continuously fluoridated (at 1.0 mg F/litre) Newcastle with the dental health of 370 5-year old children of the same age in non-fluoridated (less than 0,1 mg F/litre) south Northumberland.		
Participants	Total sample size at baseline:	827	
	Country:	England, UK	
	Region (urban (city)/rural):	Newcastle (urban) and Northumberland (rural)	
	Ethnicity:	Caucasian	
	Socioeconomic status:	-	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Only Caucasian participants were included in the study, as the study authors reported that ethnicity influences caries experience in young children and the control area contained very few non-Caucasians Children had to have lived in their locality since birth to be included in the study Data from the analyses were presented for all subjects and for children from social class III only	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention: Residence since birth in Newcastle-upon-Tyne, the water supply of this city had been fluoridated since 1967; the level of fluoridated was between 0.9 and 1 mg F/ litre since 1981 N = 457 participants included in the analysis	Control: Residence since birth in south Northumberland, a non-fluoridated area (<0.1 mg F / litre) N = 370 participants included in the analysis
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-

	Duration:	The water in Newcastle-upon-Tyne had been fluoridated to 0.9 and 1 mg F/ litre since 1981; caries was examined in 5-year-old children in 1987	
	Oral outcomes measured:	Caries experience (dmft, dmfs)	
	Scale/measure:	Mean, mean difference, %	
	Means and SD or events for each group at post-treatment or follow-up	See accompanying data (below)	See accompanying data (below)
	Other relevant statistical results	See accompanying data (below)	See accompanying data (below)

Table III Caries experience (dmft and dmfs) of 5-year-old children in each area, for all subjects and for social class III children only

	dmft		dmfs	
All subjects	**Mean (SD)**	**Difference (%)**	**Mean (SD)**	**Difference (%)**
F (n = 457)	1.81 (2.56)	2.09[a] (54%)	2.81 (4.77)	4.19[a] (60%)
NF (n = 370)	3.90 (4.22)		7.00 (9.28)	
Social class III only				
F (n = 170)	1.70 (2.53)	2.01[a] (54%)	2.49 (4.24)	3.72[a] (60%)
NF (n = 146)	3.71 (4.05)		6.21 (8.15)	

P<0.001 (Mann-Whitney test)

Table IV Percentage of children caries-free or with gross caries in each area, for all subjects and for social class III

	% caries free	% dmft 5+	% dmfs 15+
All subjects			
F	50[a]	16[a]	4[a]
NF	32	37	17
Social class III only			
F	54[a]	15[a]	4[b]
NF	33	33	14

[a] P<0.001

[b] P <0.01 (chi-squared test)

Citation	Tank, Gertrude, and Clara A. Storvick. "Caries experience of children one to six years old in two Oregon communities (Corvallis and Albany)." JADA 70.2 (1965): 394-403.	
Study design (including statistical analysis):	Prospective cohort	
Aims/objectives:	To investigate the effect of pre- and post-natal exposure to a fluoridated water supply on the teeth of children from one to six years old	
Participants	Total sample size at baseline:	246 (aged 1- 5 years)
	Country:	Canada
	Region (urban (city)/rural):	Ontorio

	Ethnicity:	All included children were white	
	Socioeconomic status:	-	
	Gender:	Male and female	
	Age (including adults/children):	1- 6 years (data were presented for individual years, therefore data on 1-5 year old children were extracted for this review)	
	Health background/status:	Healthy children	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The authors indicated that Corvallis and Albany were comparable in climate, topography and population. Mother had used the municipal water during pregnancy. All children in the study had consumed the municipal water since birth and had not been absent from their respective areas for more than two months in any year. Children who had received topical applications of fluoride or who were taking fluoride by prescription were excluded, as were those children whose parents refused to allow roentgenograms to be taken.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention group (Corvallis residents) Pre- and post-natal exposure to water adjusted to 1.0 ppm of fluoride	Control group (Albany residents) Lack of pre- or post-natal exposure to artificially fluoridated water
	Other relevant baseline statistics for each group (for the analysis/es used):		
	Duration:	Annual assessments of caries took place annually for 5 years	
	Oral outcomes measured:	Mean dmft; N decayed teeth; N missing teeth; N filled teeth; N decayed surfaces (all per child) Percent difference (between Corvallis and Albany) in the above measures; percent of children caries-free (without dmft) Percent of teeth caries free (no dmft).	
	Scale/measure:	Mean values Percentages	
	Means and SD or events for each group at post-treatment or follow-up	See table 3 (below)	
	Other relevant statistical results	See table 3 (below)	

Table 3: Decayed, missing and filled deciduous teeth of children with a fluoride-free water supply (Albany) and a fluoridated water supply (Corvallis)

		Age on last birthday				
	Community	**1**	**2**	**3**	**4**	**5**
Mean no. of dmft per child	Albany	0.14	1.26	4.25	5.51	6.0
	Corvallis	0.08	0.59	1.44	2.31	3.29
Percent difference	Corvallis	-43	-53*	-66*	-58*	-45*
Mean no. of decayed teeth per child	Albany	0.14	1.26	3.89	4.95	4.96
	Corvallis	0.08	0.59	1.30	2.0	2.0
Percent difference	Corvallis	-43	-53*	-67*	-60*	-60*
Mean no. of missing teeth per child	Albany	0	0	0.09	0.06	0.17
	Corvallis	0	0	0	0	0
Percent difference	Corvallis	-	-	-100	-100	-100
Mean no. of filled teeth per child	Albany	0	0	0.32	0.68	1.0
	Corvallis	0	0	0.11	0.41	1.32
Percent difference	Corvallis	-	-	-66	-40	+32
Mean no. of decayed surfaces per child	Albany	0.14	1.34	5.08	7.28	8.83
	Corvallis	0.09	0.56	1.45	2.66	2.89
Percent difference	Corvallis	-36	-58*	-71*	-63*	-67*
Percent of children caries-free (without dmft)	Albany	89	54	11	8	4
	Corvallis	97	79*	55*	38*	39*
Percent of teeth caries-free	Albany	99	93	79	72	69
	Corvallis	99	97	93*	88	83

(no dmft)						

- = reduction. + = increase. Calculated as follows: Corvallis-Albany/ Albany (100)
*Difference significant at the 5 percent level

Citation	Thomas, F.D., Kassab, J.Y. and Jo, B.M. Fluoridation in Anglesey: a clinical study of dental caries in in 5-year-old children who had experienced sub-optimal fluoridation. Br Dent J. 1995 Jan 21; 178(2):55-9.		
Study design (including statistical analysis):	Retrospective cohort		
Aims/objectives:	1. To ascertain and compare dental caries experience amongst Anglesey 5-year-old children residing in zones which had experienced different periods of fluoridation, and 2. To compare dental caries experience amongst Anglesey 5-year-old children who experienced sub-optimal fluoridation in the earlier part of their lives only, with previous caries experience related to whole life fluoridation and to that of contemporaries with low or negligible experience of fluoridation.		
Participants	Total sample size at baseline:	725 (all children examined in the survey) 498 children examined had continually resided in specific water district zones (the cohort of interest)	
	Country:	Wales	
	Region (urban (city)/rural):	Anglesey	
	Ethnicity:	-	
	Socioeconomic status:	-	
	Gender:	-	
	Age (including adults/children):	5 years	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	Children whose parents indicated in the questionnaire that they had received fluoride supplements were eliminated from the inter-zone comparisons. Children whose parents indicated in the questionnaire that the child had consumed non-mains water from well, spring or bottle were also eliminated from the inter-zone comparison.	
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	<u>Intervention group:</u> Child had resided in an area (Alaw zone) of optimal fluoridation during approximately 35% of their lives (n=230)	<u>Comparison group:</u> Child had resided in an area (Cefni and Penmynydd zones) of optimal fluoridation for less than 10% of their lives (n=268)
	Other relevant baseline statistics for each group (for the analysis/es used):		

	Duration:	Outcome data were collected when the children were aged 5 years.	
	Oral outcomes measured:	dmft and components (d,m,f)	
	Scale/measure:	mean	
	Means and SD or events for each group at post-treatment or follow-up	<u>Intervention group:</u> Mean dmft (SD): 1.81 (2.86) Mean d: 1.13 Mean m: 0.38 Mean f: 0.31	<u>Control group:</u> Mean dmft (SD): 2.28 (3.48) Mean d: 1.36 Mean m: 0.45 Mean f: 0.47
	Other relevant statistical results		

Research question 11: Does consumption of fluoridated milk reduce the risk of early childhood caries?

Citation	Bian et al. 2003. Effect of fluoridated milk on caries in primary teeth: 21-month results. Community Dent Oral Epidemiol. 31(4), 241-5.	
Study design (including statistical analysis):	Quasi experimental (t-tests)	
Aims/objectives:	To investigate the effect of fluoridated milk on caries in primary teeth	
Participants	Total sample size at baseline:	534 (intervention group)-305 (control group)
	Country:	China
	Region (urban (city)/rural):	Beijing
	Ethnicity:	-
	Socioeconomic status:	-
	Gender:	Both male and female
	Age (including adults/children):	3-5 years old
	Health background/status:	-
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):	The fluoride concentration in the drinking water in all kindergartens was determined before starting the program and every 3 months after the program was implemented. Results showed that it was less than 0.3mg/l. The fluoride content in the local fresh cow milk was found to be below 0.02mg/l No oral health education program was implemented in any of the kindergartens There was no statistically significant difference in the baseline mean dmft scores between the two groups (3.2 vs. 3.5, p = 0.312)

Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention group: Each participant consumed 200 ml of fluoridated milk (concentration 2.5mgF per litre) per day from Monday to Friday in the kindergarten, and was given two packs of fluoridated milk (250ml) for consumption at home on Saturday and Sunday every week. Parents of the children were asked to ensure that the children drank the fluoridated milk. There were 534 children (mean age 54±4 months) in the test group at baseline and 417 at the 21 month follow up	control group: Fresh milk without addition of sugar or fluoride There were 305 children (mean age 53±4 months) in the control group at baseline and 247 at the 21 month follow up
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Follow up duration: 21 months	
	Oral outcomes measured:	caries experience, new caries, reversals, and net caries increment	
	Scale/measure:	dmft	
	Means and SD or events for each group at post-treatment or follow-up	Baseline caries experience, new caries, reversals, and net caries increment of test and control children **Test group (n=417)- Control group (n=247)- P-value** Mean baseline dmft (SD): 3.2 (3.7)-3.5 (1.4)- 0.312 % dmft>0 at baseline: 66- 68- 0.723 % dmft>0 at 21 months: 72- 82- 0.003 Mean new caries (SD)(dmft): 1.2 (1.5)- 1.8 (1.6)- <0.001 % with new caries: 51- 73- <0.001 Mean reversal (SD)(dmft) Mean arrested caries: 0.3 (0.9)- 0.1 (0.5)- <0.001 Mean examiner reversal: 0.5 (0.9)- 0.4 (0.9)- 0.578 Mean net increment (SD)(dmft): 0.4 (1.9)- 1.3 (1.2)- <0.001	
	Other relevant statistical results		

Research question 12: Does salt fluoridation reduce the risk of early childhood caries?

Citation	Jordan et al. (2017). Caries preventive effect of salt fluoridation in preschool children in the Gambia: A prospective, controlled, interventional study. Caries Res. 15;51 (6):596-604.		
Study design (including statistical analysis):	RCT (Wilcoxon rank-sum test)		
Aims/objectives:	To investigate the effect of fluoridated salt in a communal feeding program for pre-school children.		
Participants	Total sample size at baseline:	700 assessed for eligibility; 441 randomized 304 (intervention group)-137 (control group)	
	Country:	Gambia	
	Region (urban (city)/rural):	Brikama	
	Ethnicity:	-	
	Socioeconomic status:		
	Gender:	Both male and female	
	Age (including adults/children):	3-5 years old	
	Health background/status:	-	
	Any information on confounders (e.g. water, milk or salt fluoridation, sugars intake from diet, feeding practices (e.g. breastfeeding, bottle feeding – duration, frequency) and oral hygiene behaviour):		
Intervention	Comparison/exposure (including n, age and gender (if different from above) for each group for the analysis/es used):	Intervention group: Meals were prepared with fluoridated (250mg F^-/kg) salt Mean age=4.7 years Female=184 (60.5%) Male=120 (39.5%) N analyzed = 304	control group: Meals were not prepared with fluoridated table salt Mean age=4.9 years Female=90 (65.7%) Male=47 (34.3%) N analyzed = 137
	Other relevant baseline statistics for each group (for the analysis/es used):	-	-
	Duration:	Follow up duration: 12 months	
	Oral outcomes measured:	Caries incidence	
	Scale/measure:	$D_{3/4}$mft; $G_{2\text{-}4}$; TCT $D_{3/4}$: decayed with cavitation into dentine. M: missing	

		F: filled T: teeth $G_{2\text{-}4}$: teeth with white lesions from slight white spot formation to white spot formation with cavitation into enamel TCT: weighted sum score according to the following weights
	Means and SD or events for each group at post-treatment or follow-up	**Caries experience at t_0: (Baseline)** **Test group:** $D_{3/4}$mft: 3.35 (2.83-3.86) $G_{2\text{-}4}$: 4.65 (4.17-5.14) TCT: 23.95 (21.51-26.39) **Control group:** $D_{3/4}$mft: 2.74 (1.76-3.72) $G_{2\text{-}4}$: 5.41 (4.33-6.49) TCT: 23.26 (18.14-28.39) **Caries experience at t_1: (After 12-month)** **Test group:** $D_{3/4}$mft: 4.63 (4.04-5.23) $G_{2\text{-}4}$: 8.14 (7.45-8.83) TCT: 36.80 (34.10-39.50) **Control group:** $D_{3/4}$mft: 6.57 (5.52-7.61) $G_{2\text{-}4}$: 7.70 (6.56-8.83) TCT: 47.74 (42.78-52.70) **Proportion (%) of dentine caries-free individuals in the test and control groups at t_0 and t_1** **Test group:** $D_{3/4}(t_0)$: 33.0% $D_{3/4}(t_1)$: 26.7% **Control group:** $D_{3/4}(t_0)$: 25.9% $D_{3/4}(t_1)$: 16.8% **RR (95%CI):** $D_{3/4}(t_0)$: 0.90 (0.80-1.04) $D_{3/4}(t_1)$: 0.88 (0.79-1.01)

Appendix: GRADE Evidence Profiles

Appendix Table 4. Question 1: Does breastfeeding beyond one year increase the risk of early childhood caries compared with breastfeeding until less than one year of age?

Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Breastfeeding until less than one year	Breastfeeding beyond one year	Relative (95% CI)	Absolute (95% CI)		
ECC												
1	observational studies	not serious [a]	not serious	not serious	not serious	none	741	129	-	**0** (0 to 0)	⨁⨁◯◯ LOW	CRITICAL

Explanations

a. Overall risk of bias rating for this study was moderate, as determined by the ROBINS-I tool. In relation to confounding, all participants entered the study at the same time. Additionally, fluoridated area and sugars intake was controlled for. All participants fell within our specified time frame (<1 year versus >=24 months).

Reference:
Peres KG, Nascimento GG, Peres MA, Mittinty MN, Demarco FF, Santos IS, Matijasevich A, Barros AJD. 2017. Impact of prolonged breastfeeding on dental caries: A population-based birth cohort study. Pediatrics. 140 (1): e20162943.

Appendix Table 5. Question 3: Does breastfeeding beyond two years increase the risk of early childhood caries compared with breastfeeding until less than two years of age?

Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Breastfeeding for 24 months or longer	Breastfeeding for less than 24 months	Relative (95% CI)	Absolute (95% CI)		
ECC												
2	observational studies	not serious	not serious	not serious	not serious	none	414	1251	-	**0** (0 to 0)	⨁⨁◯◯ LOW	CRITICAL

References:

1. Chaffee BW, Feldens CA, Vítolo MR. 2014. Association of long-duration breastfeeding and dental caries estimated with marginal structural models. Annals of Epidemiology. 24(6):448-454.
2. Peres KG, Nascimento GG, Peres MA, Mittinty MN, Demarco FF, Santos IS, Matijasevich A, Barros AJD. 2017. Impact of prolonged breastfeeding on dental caries: A population-based birth cohort study. Pediatrics. 140 (1): e20162943.

Appendix Table 6. Question 5: Does consumption of liquids that contain free sugars from an infant feeding bottle, increase the risk of early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	No free sugars from an infant feeding bottle	Free sugars from an infant feeding bottle	Relative (95% CI)	Absolute (95% CI)		
ECC												
1	observational studies	not serious [a]	not serious	not serious	not serious	none	205	129	-	**0** (0 to 0)	⨁⨁◯◯ LOW	

Explanations

a. One of the articles (Feldens et al. 2010) was rated as having a low risk of bias; two* were rated as being at critical risk of bias (in relation to confounding)

Reference

Feldens CA, Giugliani ERJ, Vigo A, Vitolo MR. 2010. Early feeding practices and severe early childhood caries in four-year-old children from Southern Brazil: A birth cohort study. Caries Res. 44(5):445-452.

Two additional cohort studies were identified but were excluded from the GRADE analysis due to serious risk of bias (based on information from Gordon et al. J Clinical Epidemiol. 2011, 64:407). The excluded references were:

*Tanaka K, Miyake Y, Sasaki S, Hirota Y. 2013. Infant feeding practices and risk of dental caries in Japan: The Osaka maternal and child health study. Pediatric Dentistry. 35(3):267-271.

* Wendt LK, Hallonsten AL, Koch G, Birkhed D. 1996. Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odont Scanda. 54(2):131-137.

Appendix Table 7. Question 6: Does consumption of complementary drinks that contain free sugars increase the risk of early childhood caries?
Setting: population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	No/ lower intake of free sugars from complementary drinks	Intake /higher intake of free sugars from complementary drinks	Relative (95% CI)	Absolute (95% CI)		
ECC												
6	observational studies	very serious [a]	not serious	not serious	not serious	strong association	36250		-	**0** (0 to 0)	⨁◯◯◯ VERY LOW	

Explanations

a. Assigned based on ROBINS-I overall risk of bias scores.

Total sample size for all studies at baseline is specified in the table

References:

1. Warren JJ, Blanchette D, Dawson DV, Marshall TA, Phipps KR, Starr D, Drake DR. 2016. Factors associated with dental caries in a group of American Indian children at age 36 months. Community Dent Oral Epidemiol. 44(2):154-161.
2. Warren JJ, Weber-Gasparoni K, Marshall TA, Drake DR, Dehkordi-Vakil F, Dawson DV, Tharp KM. 2009. A longitudinal study of dental caries risk among very young low ses children. Community Dent Oral Epidemiol. 37(2):116-122.
3. Watanabe M, Wang DH, Ijichi A, Shirai C, Zou Y, Kubo M, Takemoto K, Masatomi C, Ogino K. 2014. The influence of lifestyle on the incidence of dental caries among 3-year-old Japanese children. Int J Environ Res Public Health. 11(12):12611-12622.
4. Wendt LK, Hallonsten AL, Koch G, Birkhed D. 1996. Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odont Scand. 54(2):131-137.
5. Wigen TI, Wang NJ. 2014. Health behaviors and family characteristics in early childhood influence caries development. A longitudinal study based on data from Moba. Norsk Epidemiologi. 24(1):91-95.
6. Yonezu T, Yotsuya K, Yakushiji M. 2006. Characteristics of breast-fed children with nursing caries. Bull Tokyo Dent Coll. 47(4):161-165.

Appendix Table 8. Question 7: Does consumption of complementary foods to which free sugars have been added increase the risk of early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Free sugars not added to complementary food	Free sugars added to complementary food	Relative (95% CI)	Absolute (95% CI)		
ECC												
1	observational studies	not serious	not serious	not serious	not serious	none	240	91	-	**0** (0 to 0)	⨁⨁◯◯ LOW	

Reference:
Feldens CA, Giugliani ERJ, Vigo A, Vitolo MR. 2010. Early feeding practices and severe early childhood caries in four-year-old children from Southern Brazil: A birth cohort study. Caries Res. 44(5):445-452.

Appendix Table 8. Question 9: Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Oral hygiene provided by parent / carer	No oral hygiene provided by parent / carer	Relative (95% CI)	Absolute (95% CI)		
ECC												
2	observational studies	serious [a]	not serious	not serious	not serious	none	-/1935 [b]		not estimable		⨁◯◯◯ VERY LOW	IMPORTANT

Explanations

a. Serious risk of bias due to lack of information on water fluoride

b. Overall number of participants from both studies is specified in the GRADE table. In Okuno et al. (1994), the number of participants analysed in the intervention and control groups were 121 and 187, respectively. The number of participants in intervention and control groups were not provide for Leroy et al. (2012)

References:

1. Leroy R, Bogaerts K, Martens L, Declerck D. 2012. Risk factors for caries incidence in a cohort of Flemish preschool children. Clinical Oral Investigations. 16(3):805-812.
2. Okuno M, Kani T, Shimizu H. 1994. A cohort study on dental caries in infants. Japanese Journal of Public Health. 41(7):625-628.

Appendix Table 9. Question 10: Is oral health education for care givers' effective for preventing early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Oral health education for care givers	No or lower exposure to oral health education for caregivers	Relative (95% CI)	Absolute (95% CI)		
ECC												
6	randomised trials	not serious	serious [a]	not serious	not serious	none	1185	1202	-	**0** (0 to 0)	⨁⨁⨁◯ MODERATE	CRITICAL

a. Four out of six studies indicated a significant protective effect of oral health education for caregivers, whereas two studies, with sufficient power, indicated a non-significant effect. Meta-analysis of studies reporting odds ratio reported significant effect.

References:

1. Feldens CA, Vitolo MR, Drachler Mde L. 2007. A randomized trial of the effectiveness of home visits in preventing early childhood caries. Community Dent Oral Epidemiol. 35(3):215-223.
2. Harrison R, Benton T, Everson-Stewart S, Weinstein P. 2007. Effect of motivational interviewing on rates of early childhood caries: A randomized trial. Pediatric Dentistry. 29(1):16-22.
3. Jiang EM, Lo EC, Chu CH, Wong MC. 2014. Prevention of early childhood caries (ecc) through parental toothbrushing training and fluoride varnish application: A 24-month randomized controlled trial. J. Dent. 42(12):1543-1550.
4. Mohebbi SZ, Virtanen JI, Vahid-Golpayegani M, Vehkalahti MM. 2009. A cluster randomised trial of effectiveness of educational intervention in primary health care on early childhood caries. Caries Res. 43(2):110-118.
5. Plutzer K, Spencer AJ. 2008. Efficacy of an oral health promotion intervention in the prevention of early childhood caries. Community Dent Oral Epidemiol. 36(4):335-346.
6. Vachirarojpisan T, Shinada K, Kawaguchi Y. 2005. The process and outcome of a programme for preventing early childhood caries in Thailand. Community Dent Health. 22(4):253-259.

Appendix Table 11. Question 10: Does an optimum concentration of fluoride in water reduce the risk of early childhood caries? (Fluoridated water compared with non-fluoridated water / water with a low fluoride concentration for children)

Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Fluoridated water	Non-fluoridated water/ water with lower concentration of fluoride	Relative (95% CI)	Absolute (95% CI)		
ECC												
9	observational studies	not serious	not serious	not serious	not serious		2367	2075 [a]	-	0 (0 to 0)	MODERATE-	CRITICAL

a. No of patients in intervention and control groups were unavailable from the study: O'Mullane, D., and H. Whelton. "Efficacy of fluoride against dental caries; fluoride in water." Fogorvosi szemle 90 (1997): 7.

References:

Blinkhorn AS, Brown MD, Attwood D, Downer MC. 1981. The effect of fluoridation on the dental health of urban Scottish schoolchildren. Journal of Epidemiology & Community Health. 35(2):98-101.

Booth JM, Mitropoulos CM, Worthington HV. 1992. A comparison between the dental health of 3-year-old children living in fluoridated Huddersfield and non-fluoridated Dewsbury in 1989. Community Dent Health. 9(2):151-157.

Evans DJ, Rugg-Gunn AJ, Tabari ED, Butler T. 1996. The effect of fluoridation and social class on caries experience in 5-year-old Newcastle children in 1994 compared with results over the previous 18 years. Community Dent Health. 13(1):5-10.

French AD, Carmichael CL, Rugg-Gunn AJ, Furness JA. 1984. Fluoridation and dental caries experience in 5-year-old children in Newcastle and northumberland in 1981. Brit Dent J. 156(2):54-57.

O'Mullane D, Whelton H. 1997. Efficacy of fluoride against dental caries; fluoride in water. Fogorvosi szemle. 90 Spec No: 7-12.

Rugg-Gunn AJ, Carmichael CL, Ferrell RS. 1988. Effect of fluoridation and secular trend in caries in 5-year-old children living in Newcastle and Northumberland. Brit Dent J. 165(10):359-364.

Tank G, Storvick CA. 1964. Caries experience of children one to six years old in two Oregon communities (Corvallis and Albany). I. Effect of fluoride on caries experience and eruption of teeth. JADA (1939). 69:749-757.

Studies with serious risk of bias, excluded from GRADE Profile analysis:

Jackson D, Goward PE, Morrell GV. 1980. Fluoridation in Leeds. A clinical survey of 5-year-old children. Brit Dent J. 149(8):231-234.
Jackson D, Gravely JF, Pinkham IO. 1975a. Fluoridation in Cumbria. A clinical study. Brit Dent J.l. 139(8):319-322.
Jackson D, James PM, Thomas FD. 1985. Fluoridation in Anglesey 1983: A clinical study of dental caries. Brit Dent J. 158(2):45-49.
Jackson D, James PM, Wolfe WB. 1975b. Fluoridation in Anglesey. A clinical study. Brit Dent J.l. 138(5):165-171.

Appendix Table 12. Question 11: Does consumption of fluoridated milk reduce the risk of early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Fluoridated milk	Unfluoridated milk	Relative (95% CI)	Absolute (95% CI)		
ECC												
1	observational studies	serious [a]	not serious	not serious	not serious	strong association	417	247	-	**0** (0 to 0)	⨁⨁◯◯ LOW	CRITICAL
New outcome												
									not estimable		-	

Explanations

a. Socioeconomic status of control and intervention groups was not controlled for. There was also a lack of lack of control for dietary factors (e.g. sugar intake).

Reference:

Bian JY, Wang WH, Wang WJ, Rong WS, Lo EC. 2003. Effect of fluoridated milk on caries in primary teeth: 21-month results. Community Dent Oral Epidemiol. 31(4):241-245.

Appendix Table 13. Question 12: Does salt fluoridation reduce the risk of early childhood caries?
Setting: Population

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Salt fluoridation	unfluoridated salt	Relative (95% CI)	Absolute (95% CI)		
ECC												
1	randomised trials	serious [a]	not serious	not serious	not serious	none	304/-	137/-	not estimable		⨁⨁⨁◯ MODERATE	
New outcome												
									not estimable		-	

Explanations

a. This study received a high risk of bias rating due to lack of blinding of the outcome assessors.

- Regarding other considerations: follow-up period was relatively short. Data for pre-cavitated lesions shows higher mean lesions in test compared with control group (i.e. opposite effect as observed for caries into dentine measured by dmft).
- A cohort study* was identified that fulfilled the inclusion criteria for research question 12 but was not included in the narrative synthesis or GRADE process as it provided lower quality evidence compared to the RCT for addressing this intervention evaluation research question due to its study design. The cohort study indicated a significant protective effect of the use of fluoride salt on caries experience (dmft).

Study reference:

Jordan RA, Schulte A, Bockelbrink AC, Puetz S, Naumova E, Warn LG, Zimmer S. 2017. Caries-preventive effect of salt fluoridation in preschool children in the Gambia: A prospective, controlled, interventional study. Caries Res. 51(6):596-604.

Appendix Table 14. Summary of lower level evidence

Q1: Does breastfeeding beyond one year increase the risk of ECC compared with breastfeeding until less than one year of age?

Case control			
Reference	**Country**	**+, 0, - ***	**Summary of study and findings**
Al-Ghanim et al 1998	Saudi Arabia	0	445 children aged 4.13 years, comparing practices in cases with dmft ≥ 8 those with dmft 0. A higher % of children in the ECC group were breastfed for longer duration, but breastfeeding duration was not predictive of ECC in the multivariate logistic regression model.
Cross sectional			
Lida et al 2017	USA	0	1576 children aged 2-5 years. Using data from NHANES, the association of breastfeeding and its duration was examined in bivariate analyses and by multivariable logistic and Poisson regression analyses. After adjusting for potential confounders significant in bivariate analyses, breastfeeding and its duration were not associated with the risk for ECC.
Folayan et al 2015	Nigeria	0	497 children aged 6 – 71 months. Duration of breastfeeding (up to 12 months compared with over 12 months duration) was not associated with ECC in multivariate analysis.
Correa-Faria et al 2015	Brazil	0	381 children aged 1-5 years. In bivariate chi square analysis, a greater proportion of children breastfed beyond 12 months had ECC. However, duration of breastfeeding was not identified as an independent risk factor in multivariate analysis.
Nobile et al 2014	Italy	+	515 children aged 36-71 months. Prevalence of ECC was 12.2% in those breastfed 5-10 months compared with 20.1% in those breastfed 11-19 months. Multivariate analysis showed prevalence of ECC increased with breastfeeding duration OR 1.26, 96% CI 1.01-1.57) P=0.039.
Bissar et al 2014	Germany	+	1007 children aged 3-5 years. Breastfeeding >12 months was a significant risk factor for S-ECC in multivariate analysis OR 3.27 (1.63, 6.59) p=0.0009.
Olatoshi 2014	Nigeria	+	302 children aged 6-70 months. Odds ratio for ECC with breastfeeding 7-12 months compared with >12 months was 0.12 (0.05, 0.27) in multivariate analysis – however, it is unclear which confounders were controlled for (e.g. age, sugars intake).

Nunes et al 2012; 2014	Brazil	0	Measured ECC in 260 children aged 18-42 months and compared those still being breastfed with those who ceased breastfeeding by 12 months in a low-income population. Analysis adjusted for some known confounders, using a hierarchical approach. Prolonged breast-feeding was not associated with ECC (IDR 1.15; 95%CI 0.84–1.59; P = 0.363).
Al Malik et al 2003	Saudi Arabia	0	Children aged 2-5 years, n= 987. ECC was more prevalent with longer breastfeeding (but confounded by education level). However this association was not found in multivariate analysis
Mattee et al 1994	Tanzania	0	2912 children aged 1 to 4 years. Duration of breastfeeding was non-significant in multivariate analysis but a wide variability in effect was observed OR 2.4 95% CI 0.7, 9.1
Q3: Does breastfeeding beyond two years increase the risk of ECC compared with breastfeeding until less than two years of age?			
Case control			
Ayhan H 1996		+	161 children aged 2-5 years with ECC compared with 181 children aged 2-5 years without caries. Breastfeeding beyond 2 years was more common in cases (43%) compared with controls (1%). However this observation does not control for confounding.
Q5: Does consumption of liquids that containing free sugars from an infant feeding bottle increase the risk of ECC?			
Case control			
Ye et al 1999	China	+	Study of 2094 children aged 2-5 years, 404 cases or 'rampant' caries compared with 1690 controls stratified by age. Odds ratio for ECC when sweet liquids were consumed from a bottle 1.71, P=0.002.
Wang et al 2008	China	+	Study of 204 children aged 4 and 5 years, with dmft >6 compared with 237 children that were caries free. Odds ratio for ECC when sweet liquids were consumed in a bottle was 2.25 (logistic Regression), P<0.05.
Q6: Does consumption of complementary drinks that contain free sugars increase the risk of ECC			
Cross sectional			
Detsomboonrat and Pisarnturakit 2015	Thailand	+	Children aged 9-18 months, N=151. Hierarchial multiple regression was used to determine factors predictive of dental caries. Frequency of drinking sweeting milk was a significant predictor, β= -.17-0.18, P<0.005.

Warran et al 2016	USA	+	American Indian Children (n=232) aged 36 months followed from birth. The relationship between dental caries (dmft) at 36 months and intake of sugars-containing drinks at 36 months was explored in logistic regression. Analysis identified higher added sugar beverage consumption as a significant risk factor for dmft ($p<0.05$).
Hoffmeister et al 2016	Chile	+	Children aged 2-4 years in southern Chile. Zero inflated negative binomial regression model was used to determine the factors associated with dental caries. In the 4 year old age group, a high frequency of consuming sugar containing drinks at bedtime was associated with increased ECC (OR 1.30) 1.06, 1.59).
Q8: **Does oral hygiene provided by a parent/carer reduce the risk of early childhood caries**			
Quasi-experimental			
Manowiec 2003	Poland	-	A study of 4-6 year old children. Two models of supervised tooth brushing: brushing supervised by teachers and parents and brushing supervised by teacher only with a control group not supervised. The dft values differed between groups at baseline and were 6.53, 4.5 and 5.4 for control, teachers and parent supervision and teacher only. The increases in dft were 1.27 for the control group and 0.95, 0.13 for the parent/teacher and teacher only intervention groups respectively. Difference between groups at baseline, or other confounders, did not appear to be accounted for in analysis.
Q9: **Is oral health education for care-givers' effective for preventing early childhood caries?**			
Cohort			
Wagner et al 2012	Austria	-	A case-cohort study of 5 year old children whose mothers had (intervention) or had not (control) participated in a one off oral health education programme following the child's birth. At 5 years 33.2% of the intervention group had caries ($d_{3\ 4}$mfs 7.4) compared with 42.6% of the control group ($d_{3\ 4}$mfs 6.4).
Da Silva et al 2013	Brazil	-	Mothers with babies aged 0-8 months at baseline, n=112. Followed up for one year following educational lectures (oral hygiene dietary practices). The educational intervention resulted in a decrease in the percent of caries in dental surfaces. Initally 5.6% of surfaces had white spot or

				cavities. This decreased to 0.4% after one year (NB the number of surfaces increased as teeth erupted).
Q10: **Does an optimum concentration of fluoride in water reduce the risk of early childhood caries?**				
Cross sectional				
	Beal and James 1971	England	-	Caries levels of 5 year olds residing in fluoridated areas compared with non-fluoridated area, 5.5 years after the introduction of water fluoridation,.n=2280. Before water fluoridation the % of children who were caries free (and % with def >10) were 8.9 (30.4) and 28.6 (18.1) for two areas to receive fluoridation and 16.1 (12.0) for a control area. Following 5.5 years of water fluoridation these values changed to: 47.0 (def >10, 1.5%) and 41.2 (def >10 4.9%) and for the control area, 24.1 (def >10 20.1).
	McInnes et al 1982	S. Africa	-	331 children aged 1-5 years living in areas with water fluoride at 2.2-4.0 mg/l had on average dmft 0.8 +/- 2.1 and 82% were caries free (51% had enamel opacities). 177 children aged 1-5 years living in non-fluoridated areas had an average dmft of 5.4 9+/_ 5.8) and 28% were caries free, none had opacities.
	Gu et al 1989	China	-	Measured dental caries in children aged 3-6 years, 31 and 52 months after stopping water fluoridation. Caries significantly increased in the 3 year old group but not in the 4-6 year old children who were born during the water fluoridation period.
	Seaman et al 1989	UK (Wales)	-	5 year old children attending schools in fluoridated and non-fluoridated areas of Wales, UK. For fluoridated areas mean dmft was 0.8 (+/- 1.43) for non-fluoridated it was 2.26 (+/- 1.46).
	Treasure and Dever 1991	New Zealand	-	345 5 year old children. Significantly lower dmft in those residing in fluoridated compared with non-fluoridated communities. The average dmft for fluoridated areas were 1.08 (=/- 1.64) and 1.03 (+/- 1.86) and for non-fluoridated communities the average dmft were 2.0 (+/- 2.93) and 2.91 (=/- 2.82). In non-fluoridated communities there was a clear social gradient in caries levels that was not observed for fluoridated communities.
	Vignarajan and Williams 1992	Antigua	-	3-4 year old children attending nursery schools, 146 from a low water fluoride concentration area (0.1-0.3 ppm) and 66 from an optimum fluoride area (0.6-1.0 ppm). Caries

			experience in the low fluoride area was 29% higher than in optimum area. Average dmft values were 0.9 (=/- 2.29) and 0.64 (+/- 1.65) for children from low and optimally fluoridated areas respectively.
Serwint et al 1993	USA	-	Convenience sample of 110 sequential children aged 18-36 months attending a general paediatric clinic. 27% of those with caries drank fluoridated tap water compared with 54% of those without caries. P<0.05.
Cisternas et al 1994	Chile	-	780 pre-school children from cities in Chile. Children from non-fluoridated areas had dmft of 4.7 +/- 3.9 and 4.7 +/- 3.7 and those from fluoridated areas had dmft 3.7 =/- 3.5 and 1.2 +/- 2.0.
Gray and Slowick 2001	UK (England)	-	Used data from national dental surveys to observe change in the percentage of 5 year olds without dental caries before and following the introduction of water fluoridation. In the areas where water fluoride was introduced the prevalence of caries free children increased whereas in non-fluoridated areas it decreased or remained the same.
Tickle et al 2003	UK (England)	-	All 5 year old children residing in fluoridated and non-fluoridated areas of Cheshire, England. Prevalence of ECC was 12.4% higher and dmft 29.4% higher in children from non-fluoridated areas. For non-fluoridated areas prevalence of ECC was 37% and mean dmft 1.34. For fluoridated areas prevalence was 32.4 and mean dmft 1.01. Analysis demonstrated that water fluoridation was effective in reducing ECC after controlling for confounding including SES.
Postma et al 2008	S. Africa	-	Data from national oral health survey of children aged 36-71 months, n=5822. Factors associated with ECC were explored in multivariate analysis. Area based fluoride level was included. Decreased water fluoride concentration was significantly associated with ECC.
Chi et al 2013	USA	-	Pilot study of 115 children aged 3-5 years to explore if developmental delays increased risk of dmfs. Multiple variable Poisson regressions models were used to test the factors associated with risk of dmfs. Living in a non-fluoridated community was associated with increased caries risk.

	Q11: **Does consumption of fluoridated milk reduce the risk of ECC?**			
	Cross sectional			
	Marino et al 2001 and 2004	Chile	-	Cross sectional sample of children aged 3-6 years from communities receiving fluoridated milk (n=152) compared with control (n=150). After 4 years of the milk fluoridation programme the proportion of caries free children in the study community increased from 22% to 48.4%. Following termination of the fluoride milk scheme, dental caries levels in children aged 3, 4, and 5 years increased to levels similar to the control group.
	Q12: **Does salt fluoridation reduce the risk ECC?**			
	Cohort study			
	Wagner et al 2012	Austria	-	A case-cohort study of 5 year old children whose mothers had (intervention) or had not (control) participated in a one off oral health education programme following the child's birth. Analysis of data for total sample of the 471 children showed lower dmft in those that used fluoridated salt; average dmft was 1.81 compared with 2.22 in those using non fluoridated salt (p=0.015).

* '+' denotes a positive association, '0' denotes a null association and '-'denotes a negative association between risk factor and risk of ECC.

References

Al-Malik MI, Holt RD, Bedi R. 2003. Prevalence and patterns of caries, rampant caries, and oral health in two- to five-year-old children in Saudi Arabia. Journal of Dentistry for Children (Chicago, Ill). 70(3):235-242.

Al Ghanim NA, Adenubi JO, Wyne AA, Khan NB. 1998. Caries prediction model in pre-school children in Riyadh, Saudi Arabia. International Journal of Paediatric Dentistry. 8(2):115-122.

Vignarajah S, Williams GA. Prevalence of dental caries and enamel defects in the primary dentition of Antiguan pre-school children aged 3-4 years including an assessment of their habits. 1992. Community dental health. 9(4):349-60.

Ayhan H. 1996. Influencing factors of nursing caries. Journal of Clinical Pediatric Dentistry. 20(4):313-316.

Beal JF, James PM. 1971. Dental caries prevalence in 5-year-old children following five and a half years of water fluoridation in Birmingham. Brit Dent J.. 130(7):284-288.

Bissar A, Schiller P, Wolff A, Niekusch U, Schulte AG. 2014. Factors contributing to severe early childhood caries in south-west Germany. Clin Oral Investig. 18(5):1411-1418.

Chi DL, Rossitch KC, Beeles EM. 2013. Developmental delays and dental caries in low-income preschoolers in the USA: A pilot cross-sectional study and preliminary explanatory model. BMC Oral Health. 13:53.

Cisternas P, Guerrero S, Morales A, Uauy R. 1994. Dietary ingestion of fluoride and caries prevalence in preschool and school children in cities with different fluoride content in the drinking water and diet. Revista Medica de Chile. 122(4):459-464.

Correa-Faria P, Paixao-Goncalves S, Paiva SM, Pordeus IA. 2016. Incidence of dental caries in primary dentition and risk factors: A longitudinal study. Braz Oral Res. 30(1).

da Silva RA, Noia NB, Goncalves LM, Pinho JR, da Cruz MC. 2013. Assessment of mothers' participation in a program of prevention and control of caries and periodontal diseases for infants. Revista Paulista de Pediatria. 31(1):83-89.

Detsomboonrat P, Pisarnturakit PP. 2015. Dental caries and related oral health factors among 9 to 18 month old Thai children. Southeast Asian Journal of Tropical Medicine & Public Health. 46(4):786-797.

Folayan MO, Kolawole KA, Oziegbe EO, Oyedele T, Oshomoji OV, Chukwumah NM, Onyejaka N. 2015. Prevalence, and early childhood caries risk indicators in preschool children in suburban Nigeria. BMC Oral Health. 15:72.

Gray MM, Davies-Slowik J. 2001. Changes in the percentage of 5-year-old children with no experience of decay in Dudley towns since the implementation of fluoridation schemes in 1987. Brit Dent J. 190(1):30-32.

Gu XS, Shen YM. 1989. Effects of stopping water fluoridation on prevalence of dental caries in children. Chinese Journal of Preventive Medicine. 23(6):346-348.

Hoffmeister L, Moya P, Vidal C, Benadof D. 2016. Factors associated with early childhood caries in Chile. Gac Sanit. 30(1):59-62.

Iida H, Auinger P, Billings RJ, Weitzman M. 2007. Association between infant breastfeeding and early childhood caries in the United States. Pediatrics. 120(4):e944-952.

Manowiec J. 2003. Evaluation of caries prevention programmes in preschool children. Annales Academiae Medicae Stetinensis. 49:303-320.

Marino R, Villa A, Guerrero S. 2001. A community trial of fluoridated powdered milk in Chile. Community Dent Oral Epidemiol. 29(6):435-442.

Marino RJ, Villa AE, Weitz A, Guerrero S. 2004. Caries prevalence in a rural Chilean community after cessation of a powdered milk fluoridation program. J Public Health Dent. 64(2):101-105.

Matee M, van't Hof M, Maselle S, Mikx F, van Palenstein Helderman W. 1994. Nursing caries, linear hypoplasia, and nursing and weaning habits in Tanzanian infants. Community Dent Oral Epidemiol. 22(5):289-293.

McInnes PM, Richardson BD, Cleaton-Jones PE. 1982. Comparison of dental fluorosis and caries in primary teeth of preschool-children living in arid high and low fluoride villages. Community Dent Oral Epidemiol. 10(4):182-186.

Nobile CG, Fortunato L, Bianco A, Pileggi C, Pavia M. 2014. Pattern and severity of early childhood caries in southern Italy: A preschool-based cross-sectional study. BMC Public Health. 14:206.

Nunes AM, Alves CM, Borba de Araujo F, Ortiz TM, Ribeiro MR, Silva AA, Ribeiro CC. 2012. Association between prolonged breast-feeding and early childhood caries: A hierarchical approach. Community Dent Oral Epidemiol. 40(6):542-549.

Nunes AM, da Silva AA, Alves CM, Hugo FN, Ribeiro CC. 2014. Factors underlying the polarization of early childhood caries within a high-risk population. BMC Public Health. 14:988.

Olatosi OO, Sote EO. 2014. Association of early childhood caries with breastfeeding and bottle feeding in southwestern Nigerian children of preschool age. J West Afr Coll Surg. 4(1):31-53.

Postma TC, Ayo-Yusuf OA, van Wyk PJ. 2008. Socio-demographic correlates of early childhood caries prevalence and severity in a developing country--South Africa. Int Dent J. 58(2):91-97.

Seaman S, Thomas FD, Walker WA. 1989. Differences between caries levels in 5-year-old children from fluoridated Anglesey and non-fluoridated mainland Gwynedd in 1987. Community Dent Health. 6(3):215-221.

Serwint JR, Mungo R, Negrete VF, Duggan AK, Korsch BM. 1993. Child-rearing practices and nursing caries. Pediatrics. 92(2):233-237.

Tickle M, Milsom KM, Jenner TM, Blinkhorn AS. 2003. The geodemographic distribution of caries experience in neighboring fluoridated and nonfluoridated populations. J Public Health Dent. 63(2):92-98.

Treasure ET, Dever JG. 1991. The prevalence of caries in 5-year-old children living in fluoridated and non-fluoridated communities in New Zealand. New Zealand Dental Journal. 88(391):9-13.

Wagner Y, Greiner S, Heinrich-Weltzien R. 2014. Evaluation of an oral health promotion program at the time of birth on dental caries in 5-year-old children in Vorarlberg, Austria. Community Dentistry & Oral Epidemiology. 42(2):160-169.

Wang WH, Wang WJ. 2008. Caries-related factors for preschool children. Chinese journal of stomatology. 43(2):105-106.

Warren JJ, Blanchette D, Dawson DV, Marshall TA, Phipps KR, Starr D, Drake DR. 2016. Factors associated with dental caries in a group of american indian children at age 36 months. Community Dentistry & Oral Epidemiology. 44(2):154-161.

Ye W, Feng XP, Liu YL. 1999. Epidemiological study of the risk factors of rampant caries in shanghai children. Chinese Journal of Dental Research. 2(2):58-62.

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.