Impact of the first thousand days of life on dental caries through the life course: a transdisciplinary approach

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Abstract: This review aimed to describe the importance of the first 1000 days of a child's life as a golden period for interventions and actions to prevent dental caries and other chronic non-communicable diseases (NCDs) throughout the life course and highlight that the first 450 days of life could be even more important for oral health. During the first 1000 days of life (pregnancy and first two years of life), health care providers can identify unhealthy lifestyles, behaviors, and their determinants. Bearing in mind contextual factors like socioeconomic conditions and cultural aspects, this is a unique period to work together with the family and identify opportunities for adopting healthy habits that might last throughout the life of the expected or newborn child. This is a "window of opportunity" for the prevention of chronic NCDs of both systemic and oral origin, such as overweight, obesity, diabetes, cardiovascular diseases, and dental caries. In fact, to effectively prevent dental caries, pregnancy and the first 6 months of a child's life (first 450 days) should be considered the critical period to work together with families to facilitate the adoption of healthy habits. Knowledge about the first thousand days of life is essential and represents a crucial period for the implementation of actions and interventions that will guarantee good oral and general health development that can persist throughout life.

Keywords: Oral Health; Child Development; Public Health; Evidence-Based Practice; Dental Caries.

Introduction

The Expert Panel at the Bangkok Global Summit on Early Childhood Caries (ECC) showed data abstracted from 72 worldwide studies published between 1998 and 2018 that evaluate caries prevalence in pre-school children. The mean caries prevalence for 1-year-olds was 17% and greatly increased to 36% in two-year-olds. In addition, the 3-, 4-, and 5-year-olds mean caries prevalence were 43%, 55%, and 63%, respectively.[1] Data from these studies clearly show that dental caries prevalence increases with age. If not fully prevented and left untreated in the first two years of life, it becomes a greater problem in the coming years of childhood and even during the life course.

ECC is defined as "the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled surfaces in any primary tooth of a child under the age of six".[1] Despite the worrying situation on EEC, there is evidence that the burden of untreated caries is shifting from children to adults, with 3 peaks in prevalence at ages 6, 25, and 70 years.[2] Globally, there were approximately 3.5 billion cases of oral conditions, of which 2.3 billion had untreated caries in permanent teeth and 532 million had untreated caries in deciduous teeth[3].

Untreated ECC is associated with poor growth,[4] nutritional deficiencies,[5,6] behavioral and sleep problems,[7] poor quality of life, school absenteeism, and poor educational performances.[8,9] In addition, children with untreated ECC had significantly poorer oral health-related quality of life (OHRQoL) than those without ECC.[10]

Two descriptive systematic reviews have shown that several life course factors in childhood are associated with the development of ECC, including sociodemographic, biological, psychological, oral health behaviors, parent's attitudes, as well as the dental status of mothers and children.[11,12] However, life course factors for dental caries could be related even to factors in the gestational period.

A recent systematic review have shown a significantly lower ECC incidence, at least up to age 3, in children whose mothers received oral health care during pregnancy.[13] However, another systematic review found moderate-certainty evidence that providing advice on diet and feeding to pregnant women and mothers of babies up to the age of one probably leads to a slightly reduced risk of ECC.[14] Therefore, the evidence is promising, although it is still challenging to make recommendations on how much oral health care a pregnant woman needs to receive and how much oral health education is needed to effectively prevent ECC.[13] On the other hand, systematic reviews evaluating the effect of taking micronutrients during pregnancy to prevent ECC still show weak scientific evidence.[15]

Cohort studies from pregnancy to first years of life have shown that family socioeconomic characteristics during pregnancy, and mother's habits during the gestational period, like eating, drinking, and smoking can influence the child's preferences, which in turn might facilitate the development of ECC and other chronic diseases that have common risk factors.[16-18] ECC is a disease strongly influenced by behavioral factors; therefore, raising awareness of the importance of family habits since the gestational period should be an achievable goal.

Education and health promotion interventions, including upstream approaches aimed at changing the contexts and socioeconomic conditions in which behaviors develop should be a good strategy to promote good oral health in the first 1000 days of life that could have a benefit throughout the life course. A key aspect is the need to work at different levels: empowering individuals, families, communities; improving infrastructure and access to services; and making structural changes to economic, cultural, and environmental conditions.

Nevertheless, two important issues arise: education does not mean to be literate or to change the unhealthy habits. Two systematic reviews concluded that there is low evidence that oral health education with supervised toothbrushing or professional preventive oral care can reduce dental caries in school setting or at community level.[19,20] On the other hand, a recent systematic review has reported that preventive approaches based on Motivational Interviewing (MI) have the potential to modify knowledge and behaviors and reduce ECC with a more pronounced impact on children with high caries experience, especially in populations with a high disease burden.[21] Indeed, another systematic review concluded that there is a moderate-certainly evidence that providing advice on diet and feeding to pregnant women, mothers, or other caregivers with children up to the age of one year probably leads to a slightly reduced risk (15%) of tooth decay in their children during their early years.[14] This was also observed by a randomized clinical trial, demonstrating that it is possible to reduce the incidence and severity of ECC by 22% and 32%, respectively, when counseling on healthy eating habits is provided early and intensively during the first year of life.[22]

Therefore, the intensity of counselling, the commitment of the professionals, and their ability to convince can result in different effects on dental caries

outcomes when advice on diet and feeding is provided before the first year of life. Moreover, socioeconomic factors and the use of fluoride toothpastes can also explain much of the variation in dental caries burden shifting from children to adults, as described above.[23]

Furthermore, population-based prospective birth cohorts have demonstrated that early introduction of sweets intake during the first year of life can put children in a trajectory of high and severe levels of ECC.[24,25] There is also evidence that ECC is one of the main risk factors for caries in the permanent dentition.[26,27] Hence, preventing the development of dental caries from early life is fundamental for improving long-term oral and general health and well-being. With caries prevalence in 1-year-olds already at 17% worldwide,[1] focusing on prenatal and early postnatal actions before the eruption of the first tooth may further increase a child's chance of lifelong healthy oral conditions. To effectively prevent dental caries, pregnancy and the first 6 months of child's life should be considered the best period to work with families to facilitate the adoption of healthy habits.

Moreover, in 2008, The Lancet published a series on maternal and child malnutrition, which pointed out that focus needs to be on the first 1000 days, when good nutrition and healthy habits bring benefits throughout the life course.[28] After this publication, The Lancet published a new series in 2013 describing how the dietary, behavioral, and health determinants are affected by underlying food security, caregiver resources, and environmental conditions, which in turn are shaped by economic and social conditions and the national and global contexts.[29] Based on these findings, the concept of the first 1000 days has been adopted by the World Health Organization as a reference in the field of health.[30]

This review aimed to describe the importance of the first 1000 days of a child's life as a golden period for interventions and actions that increase the child's chances of achiving good oral health throughout life.

Defining the first 1000 days of life

The span of the first 1000 days range is from conception to the end of the second year of life, and is the sum of the usual 270 days of gestation, 365 days of the first year and the 365 days of the second year of life. This period is crucial for the subsequent development of the individual and in which the maternal eating habits, the type of breastfeeding, and then the complementary feeding affect the risk of developing non-communicable diseases (NCDs).[31]

The first 1000 days of life are particularly relevant for epigenetic studies. Epigenetics describes a variety of reversible modifications to the individual genome that are heritable and may originate in the fetal life. Epigenetic changes include DNA methylation,[32,33] histone modifications, chromatin remodeling, and micro-RNA arrangements.[34,35] These epigenetic mechanisms affect gene expression patterns without altering DNA base sequence. The developmental adaptation due to the plastic interaction between inherited genes and environment factors during the first 100 days of life is defined as programming.[31] The concept of programming has been further developed in the Developmental Origins of Health and Disease (DOHaD) theory.[36] The concept of DOHaD[37,38] corroborates that there habits interfere in the activity or expression of genes through epigenetic mechanisms, and the effects of the environment, and especially nutrition, in early life influence the development of NCDs in the short and long term.[36,38]

Therefore, the period from conception to at least 2 years of age is a "window of opportunity", especially for prevention of NCDs of systemic and oral nature such as overweight, obesity, diabetes, cardiovascular diseases, and dental caries. In this period, it is possible to intervene and modify trajectories to prevent and/or reverse metabolic programming and improve maternal and child health outcomes and even reduce the risk of children developing NCDs in the future. The first 1000 days of life are a programming period that affects not only the metabolisim,[28,31] but also anatomical structures,[39,40] physiology,[41,42] selection of the intestinal[43,44] and oral microbiota,[45] preferences and eating habits which will last throughout the life cycle.[46]

Oral health care providers should contact patients during this "golden period", and it is part of their role to promote healthy eating practices and other behaviors for the prevention of NCDs, taking into account contextual factors like socioeconomic

conditions and cultural aspects. In this context, it is imperative to provide a transdisciplinary view during the prenatal, perinatal, and postnatal periods in order to promote a good general and oral health for the child. Transdisciplinary teams that include dental professionals, nutritionists, gynecologists, pediatricians, nurses and other allied health care professionals should work together to promote access to medical and dental care with active health promotion programs. The co-design/co-production of multidisciplinary research that allow to uncover people's practical knowledge and coping strategies are also necessary.

The pregnancy period

Initial actions to promote oral health in children can be carried in the early stages of life. Pregnancy is an ideal time to promote the prevention of oral diseases in the child and teach the connection between the mouth and the system, as maternal health and behavior have a major impact on children oral health outcomes.[47] During this time, women and families are motivated and more open to healthy habits that will impact the health of their future child. According to the AAPD, "education is an important component of prenatal oral health care and may have a significant effect on the oral health of both mother and child".[48] During this time, pregnant women may be receptive to information that will improve the health of the child.[48]

A recent systematic review has shown a reduced ECC incidence in children whose mothers received oral health care during pregnancy such as primary-primary prevention, oral examination and cleaning, and oral health education.[13] Dental caries is a biofilm-sugar-dependent disease that requires the transmission of habits in addition to bacteria. In this sense, children's dietary and oral hygiene behaviors depend on parents or guardians self-efficacy, oral health knowledge, and beliefs, as well as various psychosocial factors.[16-18]

Moreover, a recent cohort study showed that maternal obesity and high consumption of sugary drinks during pregnancy increased the risk of early exposure (before the second year of life) and high exposure of the child to added sugars, showing perpetuation of unhealthy dietary habits in the first 1000 days of life.[49]

Therefore, maintaining oral health, strengthening and improving oral health knowledge during pregnancy is a critical and promising step in the prevention of ECC and other maternal and child oral health indicators throughout life. The formation of primary teeth and some early erupting permanent teeth (permanent first molars and incisors) begin during pregnancy. Factors of systemic, environmental, and local origin during the prenatal, perinatal, and postnatal periods, as well as genetic predisposition can affect optimal enamel formation resulting in an increased risk of developing deciduous molar hypomineralization (DMH) and molar-incisor hypomineralization (MIH).[50,51] Since enamel formation begins in utero, pregnancy course and outcome may play a role in enamel strength and caries susceptibility. Children with defects in enamel development are 3 times more likely to have ECC.[52] It is essential to highlight that there are common risk factors during pregnancy that lead to systemic and oral consequences for both mother and child. For example, exposure to cigarettes during pregnancy can affect the general health and periodontal health of the pregnant woman, and can lead to birth complications and greater risk for ECC in the baby.[53]

On the other hand, current scientific evidence confirms that the liking for sweet taste is inborn.[54] Individual food preferences are initially based on predetermined biological dispositions, but these can change as the result of new experiences related to social and environmental factors. Flavor perception begins during intra-uterine life and continues during breastfeeding.[55,56] The development and functioning of the sensory, olfactory, and gustatory systems begins in the womb due to the volatile flavors and odors present in the amniotic fluid and breast milk from the mother's diet. The perception of these flavors can help the baby become accustomed to the foods that he or she will soon eat, shaping food preferences early on. There is evidence that early exposure to sweet tastes predicts similar food preferences and eating behavior later in life.[57,58]

There is a positive association between periodontal diseases and birth outcomes such as prematurity

and low birth weight.[59-61] These outcomes, in turn, are associated with an increased risk of enamel development defects,[50] ECC,[52] malocclusions, need for orthodontic treatment, and altered craniofacial morphology compared with full-term infants.

Associations between the mother's psychological factors and socioeconomic inequalities and ECC

The dental literature has already shown the potential role of various risk factors for dental caries in children. For example, a recent literature review concluded that mothers with low sense of coherence were 5.55 times more likely to have children/adolescents with dental caries than mothers with high sense of coherence once other factors such as socioeconomic, demographic and behavioral data were taken into account.[62]

In a cohort study carried out with children born in Pelotas (Brazil), maternal skin color was associated with inequalities in age at childbearing and schooling, as well as with household characteristics.[63]

Children living in poverty, socially marginalized groups, and older people are the most affected by oral diseases and have poor access to dental care.[64,65]

A recent systematic review evaluated studies on parental risk factors associated with the development of ECC studies in low/middle income countries and the main findings showed that socioeconomic status, parental education, oral health knowledge, and attitudes were associated with ECC in children.[12] Authors highlighted the consistent association between low parental income/education and poor oral health outcomes in children. They recommended interventions to improve oral health knowledge and behavior in parents of low-income groups in developing nations. The review concluded that more research is needed to examine the specific influence of parental psychosocial factors, oral health knowledge, and behaviors on ECC development in children and to increase the knowledge in this area.[12]

A systematic review with meta-analysis of case control and cohort studies examined possible associations between various risk factors and ECC. The main result showed that the two strongest risk factors associated with early childhood caries in high- or upper-middle-income countries were the presence of enamel defects and high levels of mutans streptococci. Significant secondary risk factors in high-income countries were the presence of dentinal caries, frequent consumption of sweetened foods, poor oral hygiene, and the presence of visible plaque.[66]7

Other two systematic reviews concluded that low oral health literacy (OHL) of parents was associated with dental caries in their children.[67,68]

The first and second year of life

Current analyses of the World Health Organization (WHO) growth curves confirm the importance of the first two years of life as a "window of opportunity" to promote the health and human capital of a population.[69]

Sugar consumption

A dose-dependent association between the consumption of free sugars and the development of NCDs such as dental caries, overweight/obesity, and type 2 diabetes, as well as the increased risk of developing cardiovascular diseases in children and adults has been scientifically recognized.[70] Free sugars are sugars (refined or unrefined) added to foods by manufacturers, establishments, or consumers. Free sugars also include sugars naturally present in honey, syrups such as high fructose corn syrups, and fruit juices.

The WHO strongly recommends for both adults and children the need to decrease the consumption of free sugars to less than 10% of the total calories ingested daily in order to reduce the NCDs incidence. A moderate recommendation for a further reduction in the consumption of free sugars to less than 5% of the total daily caloric intake is also made, which would bring additional benefits to general health and minimize the risk of caries throughout the life cycle.[70,71]

According to the WHO,[72] free sugar is the essential dietary factor in the development of dental caries, as the disease does not occur in the absence of dietary sugar. Dental caries is a disease that requires one causal factor above all - free sugars.[73] However, caries is a multifactor disease, as the process also involves

other biological, behavioral, and socioeconomic factors, but these simply modify the speed of the cariogenic properties of sucrose or its frequency of consumption.[46] Sugars start the process and trigger the causal chain; without sugars, the causal chain is broken and the disease does not occur.

Dental caries progresses with age, and the effects of sugars on dentition are also lifelong. High sugar intake during childhood increases the risk for new caries lesions throughout the life cycle, regardless of fluoride use.[46] Caries increases with age even among people with low sugar consumption. Moreover, disease will eventually be as high in groups where sugar consumption increases as high as in the high consumption group, indicating that low sugar consumption at a particular stage of life is unlikely to prevent dental caries later in life.[46] In conclusion, the higher the sugar consumption over life course, the higher the dental caries increment.

Although exposure to fluoride reduces the development of dental caries and delays the onset of the cavitation process, it does not completely prevent dental caries if implemented as an isolated action. Addressing the cause (free sugars) is therefore essential in preventing and reducing dental caries.[72,74] There is evidence that the introduction of sugar-sweetened-beverages (SSBs) during the first year of life can put children in a trajectory of high levels of dental caries. The WHO currently recommends to avoid sugars in very young children and taking caries prevention measures that target early eating habits.

Early introduction of SSBs, that is, by the end of the first year of life, places children on a trajectory of higher SSBs consumption and greater caries increment from age 12 to 48 months.[25] A birth cohort of low-income families showed a high risk of severe ECC at 38 months of age in children who had received sweet food before 6 months of age and a higher risk in children who had consumed more sweet food and drinks at 12 months of age compared to children who consumed less.[24] A more detailed analysis of this sample showed that virtually all children (98.3%) had consumed sugar by the age of 6 months and risk groups for the early consumption of foods and drinks containing sugars were identified. The number of sweet items was significantly larger in children from non-nuclear families, those whose mothers were less than 20 years of age, had less than eight years of schooling, and smoked. Moreover, the number of sweet items was significantly lower among children who breastfed in the first hour of life.[75]

The eating frequency in general was also associated with a greater risk of dental caries and eating meals and snacks more than 8 times a day was associated with the development of the disease, which can be explained by the greater exposure to sucrose as the frequency of daily feeding increases.[76]

Sugars in fruits and vegetables are not free sugars.[70] Eating fruits "in natura" during complementary feeding is the ideal for sweet taste. Regarding the consumption of free sugars from fruit juices (high fructose), there are current recommendations that fruit juice should not be offered to children under 1 year of age for the prevention of NCDs.[77,78] The benefits of eating whole fruit over fruit juice are several. Fruit juice contains less fiber than solid fruit, giving children less satiety[79,80] Fruit juice contains free sugar as the only major source of calories and may therefore be less nutritious because juicing fruits typically removes the peel, resulting in the loss of important nutrients and antioxidants.[78,81,82] Moreover, fruit juices are less likely to induce satiety, being associated to unhealthy increase in BMI in young children.[82] Excessive intake of natural juices within the first year may also block the acceptance of "fresh fruit" in the future, and giving fruit juice or soft drinks in bottles at 12 months of age is a risk factor for severe caries in early childhood, at 4 years of age.[22] Industrialized juices (e.g., in carton packs) have low fruit pulp and fructose content, but contain high content of sucrose, the most cariogenic sugar in the diet. Water is essential for the child's hydration and must be offered plain from the beginning of complementary feeding. Water should be the main liquid in infant feeding, and its consumption is unrestricted.

There are currently several reasons for a transdisciplinary dietary practice, since the best evidence today indicates that sugar consumption causes systemic and oral NCDs in both children and adults. Fighting the common risk factors is the best strategy nowadays and for this reason, the

International Association of Paediatric Dentistry (IAPD) and several public health entities recommend that strategies to prevent early childhood caries should include avoiding sugar intake for children under the age of two years.[83-86] The first 1000 days of life is a very sensitive period, when food preferences are shaped and where metabolic programming and developmental origin of health and disease (DOHad) that will determine the entire life cycle occur.

The more the consumption of free sugars in childhood can be postponed beyond 2 years of age, the better the indicators in general health. It must be highlighted that the consumption, frequency, and quantity of these sugars must be low and moderate after this age. Although the development of caries is closely linked to the daily frequency of sugar daily, the development of other NCDs is linked to the amount of sugar consumed. For this reason, it is coherent to work with both recommendations since it is expected that as the frequency of consumption increases, so does the quantity. A cohort with overweight or obese young children found that consumption of foods with added sugar 5 times a day or more was associated with the risk of developing caries.[87]

Breast feeding and bottle feeding

Evidence suggests that infants who are breastfed in the first year of life have lower levels of dental caries than those fed infant formula.[88] A meta-analysis showed that breastfed children were 57% less affected by dental caries than bottle fed children.[88] Despite this, we must consider that many children are both breastfeed and bottle-feed at different points in time. However, it is clear that serving drinks containing free sugars in a bottle is independently associated with risk of ECC.[22,89]

Cohort studies have shown that children who breastfed for up to or beyond 6 months had, on average, lower intake of SSBs than those who were never breastfeed.[25,90,91] There is also evidence that breastfeeding duration shapes food preferences and dietary intake later in childhood.[92,93] All this evidence suggests that some studies overestimated the association of breastfeeding beyond 12 months of age and ECC. While one systematic review and meta-analysis has shown an increased risk of caries in children breastfed after 12 months,[94] another systematic review has indicated that only breastfeeding beyond 24 months is associated with an increased caries risk.[89] Nonetheless, the quality of evidence for both reviews is considered low. Birth cohort studies have also diverged, with either negative[95] or positive associations.[96-99]

It is important to highlight that cohort studies that found an association between breastfeeding and dental caries beyond 12 months[96-99] include populations that were exposed to sugar consumption at an early age, where the natural direct effect of prolonged breastfeeding on dental caries can be overestimated, even when appropriate statistical techniques, such as marginal structural models (MSM) are used to allow for intermediate confounders. In contrast, an Australian birth cohort study found no association between breastfeeding beyond 12 months and dental caries, which may be due to the fact that a relevant proportion of children in their sample consumed free sugars in less than 5% of the time daily at 2 years of age.[95]

Oral hygiene

The role of fluoride (F) toothpastes in the control of dental caries is undisputed and should be used daily by parents to maintain their child's oral health. There is strong evidence of the effectiveness of F toothpastes on caries reduction in the primary dentition of preschool children, reinforcing the anti-caries effect of standard F toothpastes and the need to encourage their use by children, regardless of age.[74,100] It is recommended that a "smear" amount of toothpaste be applied to the brush for children younger than 3 years and a "pea-sized" amount for children 3-6 years.[74,101]

A Cochrane review concluded that brushing twice daily increases the effectiveness of fluoridated toothpaste in decreasing caries increment in children.[102] Tooth brushing with fluoride toothpaste is a healthy habit that should be encouraged by parents on the first years of their child's life. The horizontal scrub technique is recommended and the tooth brushing must be performed by the parents.[103] The horizontal scrub technique was deemed more suitable than the Fones technique for preschool children.[104]

Minimally invasive approach for caries lesions in the first 2 years of life

Preventing the onset of caries is the ultimate goal of a caries management plan. For this reason, approaches to reduce the incidence of ECC should include interventions that start in the first year of a child's life.[1] If all educational and preventive strategies that could be implemented in the first 1000 days of life fail or are not put into practice and the child presents caries lesions, it would be essential to arrest or reverse non-cavitated and cavitated dental caries using non-restorative treatments or, if necessary, to restore a cavitated lesion in dentin.

Recently, the WHO included in its "*Model List of Essential Medicines for Adults and Children*", three dental preparations containing fluoride: topical fluoride preparations (such as toothpaste and varnish), silver diamine fluoride. and glass ionomer, which are the main dental materials used for minimally invasive approach for caries lesions.[105]

There are many evidence-based strategies on how to manage caries lesions according to its development stage. Considering the public health sector that will be involved with the majority of untreated caries lesions and the minimally invasive techniques that should be taken into account when managing these lesions, three main strategies are adopted.

Initial active caries could be arrested and even reversed with preventive approaches. These include avoiding sugar intake in children under the age of two, reducing sugar intake in children aged >2 years, and brushing their teeth twice daily with fluoridated toothpaste (at least 1000 ppm), using an age-appropriate amount of paste.[1]

Another approach for arresting initial caries lesions could be the use of fluoride varnishes. A systematic review reported that at least 64% up to 81% of enamel carious lesions were inactivated after fluoride varnish application. In cavitated lesions, fluoride varnish was effective in only 30% of cases.[106] This option is controversial and needs stronger evidence of its effectiveness in caries control.

According to a systematic review and network meta-analysis, a 38% silver diamine fluoride (SDF) solution applied biannually was the most effective measure for arresting advanced cavitated lesions on any coronal surface (moderate to high certainty).[107] Another meta-analysis concluded that the use of SDF was 89% more effective than other treatments in controlling/arresting caries in primary teeth.[108] SDF has great advantages such as being easy to use, quite affordable, does not require dental equipment, can be used outside the clinical setting, and is well accepted even by young children. Therefore, SDF can be considered a user-friendly material that can be used in dental clinics as well as in remote areas, schools, or disadvantaged communities.[108]

If the caries cavity is deep in the dentin without pulp involvement, atraumatic restorative treatment (ART) can be considered a very good population-based minimally invasive treatment option. ART is a treatment based on the minimal intervention philosophy and supported by strong evidence established in systematic reviews. It presents similar longevity to other treatments for the management of single surface cavities in primary and permanent teeth and is therefore a viable treatment option.[109] Moreover, a meta-analysis concluded that ART restorations have similar survival rates compared to conventional treatments and are a viable option to also restore occlusoproximal cavities in primary molars.[110] ART is also considered a child-friendly technique and it can be used in dental clinics and remote areas.

The Hall technique should also be considered for vital primary molars with deep caries lesions. A systematic review and network meta-analysis found that it outperformed the other restorative techniques such as non-selective and selective caries removal. The stainless steel crown seals the lesion and prevents contact between enamel and biofilm, limiting caries progression. Moreover, the glass ionomer used to cement the crown remineralizes the lesion, increasing pulp survival.[111]

Conclusions and recommendations

General recommendations

A recent paper provided a global perspective on epidemiology, etiology, risk assessment, societal

burden, management, education, and policy of ECC. The severity, societal costs, and impact on quality of life of dental caries in preschool children are enormous. Progress in the global prevention and management of ECC has been slow due to different perceptions of the disease and different management strategies. ECCs is still rarely treated. For these reasons approaches to reduce prevalence should begin in the first year of a child's life. Moreover, evidence-based risk management and reimbursement systems that support preventive care are urgently needed.[1]

Oral health should be considered a human right. The existence of a social gradient in oral health, including dental caries, requires policies and interventions to ensure that all children have access to quality health care, safe and healthy environments, life opportunities, and access to resources that are important for health (social determinants of health).[112]

A recent study estimated changes in oral health outcomes associated with the implementation of taxes on unhealthy foods and beverages in Mexico. There were significant improvements in caries rates.[113]

Since dental caries is related to socioeconomic factors, authorities and stakeholders should ideally find a way to improve families' socioeconomic status, level of education, and access to healthy lifestyles. This would benefit not only oral health but other chronic diseases such as heart problems, diabetes, and obesity. This is an enormous challenge that depends mostly on policymakers, but also involves academia, civil society, and industry.

Cohort studies show that socioeconomic inequities influence the incidence of dental caries in children and adolescents.[114,115] One plausible explanation is that individuals from a low socioeconomic position are exposed to several risk factors that influence general and oral health, including poorer access to healthcare resources and services. Understanding the relationship among these factors is essential for planning health policies aimed at reducing inequalities in a population, as they affect oral health conditions.[115]

Specific recommendations

With caries prevalence at already 17% for one-year-olds worldwide, doubling to 36% for two-year-olds,[1] focusing on prenatal and early postnatal behaviors before the eruption of the first tooth may increase the child's chance of having a good oral health. To effectively prevent dental caries, pregnancy and the first 6 months of the child's life should be considered the best time to work with families to facilitate the adoption of healthy habits. Therefore, the 9 months pregnancy and the 6 months of life before the first tooth erupts, i.e., the first 450 days of the first 1000 days of life, should be considered the real opportunity for caries prevention in childhood, which will reflect throughout the life course. Based on that, children's first dental visit should be advanced and early-life healthcare professionals should be trained on NCD's including dental caries.[116]

Prevention and management of ECC that begins in the first 450 days of a child's life includes primary, secondary, and tertiary prevention, depending on the child's needs. Preventive approaches for this stage of life should include, for the child: avoiding sugar intake and twice-daily tooth brushing with fluoridated toothpaste (at least 1000 ppm), using an age-appropriate amount of paste; for the mother: prenatal dental care and awareness of the importance of exclusive breastfeeding during the first 6 months of life. Taking into account a transdisciplinary approach, it is essential to raise awareness of ECC among all health professionals.

References

1. Tinanoff N, Baez RJ, Diaz Guillory C, Donly KJ, Feldens CA, McGrath C, et al. Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: global perspective. Int J Paediatr Dent. 2019 May;29(3):238-48. https://doi.org/10.1111/ipd.12484
2. Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of untreated caries: a systematic review and metaregression. J Dent Res. 2015 May;94(5):650-8. https://doi.org/10.1177/0022034515573272

3. Bernabe E, Marcenes W, Hernandez CR, Bailey J, Abreu LG, Alipour V et al. Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: a systematic analysis for the global burden of disease 2017 Study. J Dent Res. 2020 Apr;99(4):362-73. https://doi.org/10.1177/0022034520908533
4. Alkarimi HA, Watt RG, Pikhart H, Sheiham A, Tsakos G. Dental caries and growth in school-age children. Pediatrics. 2014 Mar;133(3):e616-23. https://doi.org/10.1542/peds.2013-0846
5. Schroth RJ, Levi J, Kliewer E, Friel J, Moffatt ME. Association between iron status, iron deficiency anaemia, and severe early childhood caries: a case-control study. BMC Pediatr. 2013 Feb;13(1):22. https://doi.org/10.1186/1471-2431-13-22
6. Schroth RJ, Lavelle C, Tate R, Bruce S, Billings RJ, Moffatt ME. Prenatal vitamin D and dental caries in infants. Pediatrics. 2014 May;133(5):e1277-84. https://doi.org/10.1542/peds.2013-2215
7. Edelstein BL. The dental caries pandemic and disparities problem. BMC Oral Health. 2006 Jun;6(S1 Suppl 1):S2. https://doi.org/10.1186/1472-6831-6-S1-S2
8. Moure-Leite FR, Ramos-Jorge J, Ramos-Jorge ML, Paiva SM, Vale MP, Pordeus IA. Impact of dental pain on daily living of five-year-old Brazilian preschool children: prevalence and associated factors. Eur Arch Paediatr Dent. 2011 Dec;12(6):293-7. https://doi.org/10.1007/BF03262826
9. Guarnizo-Herreño CC, Lyu W, Wehby GL. Children's oral health and academic performance: evidence of a persisting relationship over the last decade in the United States. J Pediatr. 2019 Jun;209:183-189.e2. https://doi.org/10.1016/j.jpeds.2019.01.045
10. Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bönecker M, Raggio DP. Impact of oral diseases and disorders on oral health-related quality of life of preschool children. Community Dent Oral Epidemiol. 2011 Apr;39(2):105-14. https://doi.org/10.1111/j.1600-0528.2010.00580.x
11. Abreu LG, Elyasi M, Badri P, Paiva SM, Flores-Mir C, Amin M. Factors associated with the development of dental caries in children and adolescents in studies employing the life course approach: a systematic review. Eur J Oral Sci. 2015 Oct;123(5):305-11. https://doi.org/10.1111/eos.12206
12. Rai NK, Tiwari T. Parental factors influencing the development of Early Childhood Caries in developing nations: A systematic review. Front Public Health. 2018 Mar;6:64. https://doi.org/10.3389/fpubh.2018.00064
13. Xiao J, Alkhers N, Kopycka-Kedzierawski DT, Billings RJ, Wu TT, Castillo DA, et al. Prenatal oral health care and Early Childhood Caries prevention: A systematic review and meta-analysis. Caries Res. 2019;53(4):411-21. https://doi.org/10.1159/000495187
14. Riggs E, Kilpatrick N, Slack-Smith L, Chadwick B, Yelland J, Muthu MS, et al. Interventions with pregnant women, new mothers and other primary caregivers for preventing early childhood caries. Cochrane Database Syst Rev. 2019 Nov;2019(11):CD012155. https://doi.org/10.1002/14651858.CD012155.pub2
15. Carvalho Silva C, Mendes R, Manso MD, Gavinha S, Melo P. Prenatal or childhood serum levels of vitamin d and dental caries in paediatric patients: A systematic review. Oral Health Prev Dent. 2020 Sep;18(1):653-67. https://doi.org/10.3290/j.ohpd.a45089
16. Wigen TI, Espelid I, Skaare AB, Wang NJ. Family characteristics and caries experience in preschool children. A longitudinal study from pregnancy to 5 years of age. Community Dent Oral Epidemiol. 2011 Aug;39(4):311-7. https://doi.org/10.1111/j.1600-0528.2010.00596.x
17. Majorana A, Cagetti MG, Bardellini E, Amadori F, Conti G, Strohmenger L, et al. Feeding and smoking habits as cumulative risk factors for early childhood caries in toddlers, after adjustment for several behavioral determinants: a retrospective study. BMC Pediatr. 2014 Feb;14(1):45. https://doi.org/10.1186/1471-2431-14-45
18. Akinkugbe AA, Brickhouse TH, Nascimento MM, Slade GD. Prenatal smoking and the risk of early childhood caries: a prospective cohort study. Prev Med Rep. 2020 Sep;20:101201. https://doi.org/10.1016/j.pmedr.2020.101201
19. Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, et al. Community-based population-level interventions for promoting child oral health. Cochrane Database Syst Rev. 2016 Sep;9(9):CD009837. https://doi.org/10.1002/14651858
20. Stein C, Santos NM, Hilgert JB, Hugo FN. Effectiveness of oral health education on oral hygiene and dental caries in schoolchildren: systematic review and meta-analysis. Community Dent Oral Epidemiol. 2018 Feb;46(1):30-7. https://doi.org/10.1111/cdoe.12325
21. Colvara BC, Faustino-Silva DD, Meyer E, Hugo FN, Celeste RK, Hilgert JB. Motivational interviewing for preventing early childhood caries: A systematic review and meta-analysis. Community Dent Oral Epidemiol. 2021 Feb;49(1):10-6. https://doi.org/10.1111/cdoe.12578
22. Feldens CA, Giugliani ER, Duncan BB, Drachler ML, Vítolo MR. Long-term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. Community Dent Oral Epidemiol. 2010 Aug;38(4):324-32. https://doi.org/10.1111/j.1600-0528.2010.00540.x
23. Nadanovsky P, Sheiham A. Relative contribution of dental services to the changes in caries levels of 12-year-old children in 18 industrialized countries in the 1970s and early 1980s. Community Dent Oral Epidemiol. 1995 Dec;23(6):331-9. https://doi.org/10.1111/j.1600-0528.1995.tb00258.x
24. Chaffee BW, Feldens CA, Rodrigues PH, Vítolo MR. Feeding practices in infancy associated with caries incidence in early childhood. Community Dent Oral Epidemiol. 2015 Aug;43(4):338-48. https://doi.org/10.1111/cdoe.12158
25. Bernabé E, Ballantyne H, Longbottom C, Pitts NB. Early introduction of sugar-sweetened beverages and caries trajectories from age 12 to 48 months. J Dent Res. 2020 Jul;99(8):898-906. https://doi.org/10.1177/0022034520917398

26. Llena C, Calabuig E. Risk factors associated with new caries lesions in permanent first molars in children: a 5-year historical cohort follow-up study. Clin Oral Investig. 2018 Apr;22(3):1579-86. https://doi.org/10.1007/s00784-017-2253-5
27. Peretz B, Ram D, Azo E, Efrat Y. Preschool caries as an indicator of future caries: a longitudinal study. Pediatr Dent. 2003 Mar-Apr;25(2):114-8.
28. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al.; Maternal and Child Undernutrition Study Group. What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008 Feb;371(9610):417-40. https://doi.org/10.1016/S0140-6736(07)61693-6
29. The Lancet. Maternal and child nutrition: executive summary of The Lancet Maternal and Child Nutrition Series. [cited 2021 Dec 6]. Available https://www.thelancet.com/pb/assets/raw/Lancet/stories/series/nutrition-eng.pdf
30. World Health Organization. Essential nutrition actions: improving maternal, newborn, infant and young child health and, nutrition. Geneva: World Health Organization; 2013.
31. Agosti M, Tandoi F, Morlacchi L, Bossi A. Nutritional and metabolic programming during the first thousand days of life. Pediatr Med Chir. 2017 Jun;39(2):157. https://doi.org/10.4081/pmc.2017.157
32. Jones PA, Takai D. The role of DNA methylation in mammalian epigenetics. Science. 2001 Aug;293(5532):1068-70. https://doi.org/10.1126/science.1063852
33. Jaenisch R, Bird A. Epigenetic regulation of gene expression: how the genome integrates intrinsic and environmental signals. Nat Genet. 2003 Mar;33(S3 Suppl):245-54. https://doi.org/10.1038/ng1089
34. Poulsen P, Esteller M, Vaag A, Fraga MF. The epigenetic basis of twin discordance in age-related diseases. Pediatr Res. 2007 May;61(5 Pt 2):38R-42R. https://doi.org/10.1203/pdr.0b013e31803c7b98
35. Santos F, Hendrich B, Reik W, Dean W. Dynamic reprogramming of DNA methylation in the early mouse embryo. Dev Biol. 2002 Jan;241(1):172-82. https://doi.org/10.1006/dbio.2001.0501
36. Silveira PP, Portella AK, Goldani MZ, Barbieri MA. Developmental origins of health and disease (DOHaD). J Pediatr (Rio J). 2007 Nov-Dec;83(6):494-504. https://doi.org/10.2223/JPED.1728
37. Barker DJ. Developmental origins of chronic disease. Developmental Origins of Chronic Disease. Public Health Nutr. 2012;126(3):185-9. https://doi.org/10.1016/j.puhe.2011.11.014
38. Winett L, Wallack L, Richardson D, Boone-Heinonen J, Messer L. A Framework to Address Challenges in Communicating the Developmental Origins of Health and Disease. Curr Environ Health Rep. 2016 Sep;3(3):169-77. https://doi.org/10.1007/s40572-016-0102-3
39. Malamitsi-Puchner A, Nikolaou KE, Puchner KP. Intrauterine growth restriction, brain-sparing effect, and neurotrophins. Ann N Y Acad Sci. 2006 Dec;1092(1):293-6. https://doi.org/10.1196/annals.1365.026
40. Shonkoff JP, Garner AS, Siegel BS, Dobbins MI, Earls MF, Garner AS, et a. The lifelong effects of early childhood adversity and toxic stress. Pediatrics. 2012 Jan;129(1):e232-46. https://doi.org/10.1542/peds.2011-2663
41. O'Connor TG, Bergman K, Sarkar P, Glover V. Prenatal cortisol exposure predicts infant cortisol response to acute stress. Dev Psychobiol. 2013 Mar;55(2):145-55. https://doi.org/10.1002/dev.21007
42. Fernandes M, Stein A, Srinivasan K, Menezes G, Ramchandani PG. Foetal exposure to maternal depression predicts cortisol responses in infants: findings from rural South India. Child Care Health Dev. 2015 Sep;41(5):677-86. https://doi.org/10.1111/cch.12186
43. Lallès JP. Long term effects of pre- and early postnatal nutrition and environment on the gut. J Anim Sci. 2012 Dec;90 Suppl 4:421-9. https://doi.org/10.2527/jas.53904
44. Moore RE, Townsend SD. Temporal development of the infant gut microbiome. Open Biol. 2019 Sep;9(9):190128. https://doi.org/10.1098/rsob.190128
45. Kennedy B, Peura S, Hammar U, Vicenzi S, Hedman A, Almqvist C, et al. Oral Microbiota Development in Early Childhood. Sci Rep. 2019 Dec;9(1):19025. https://doi.org/10.1038/s41598-019-54702-0
46. Peres MA, Sheiham A, Liu P, Demarco FF, Silva AE, Assunção MC, et al. Sugar consumption and changes in dental caries from childhood to adolescence. J Dent Res. 2016 Apr;95(4):388-94. https://doi.org/10.1177/0022034515625907
47. Iida H. Oral Health Interventions During Pregnancy. Dent Clin North Am. 2017 Jul;61(3):467-81. https://doi.org/10.1016/j.cden.2017.02.009
48. American Academy on Pediatric Dentistry. Guideline on oral health care for the pregnant adolescent. Pediatr Dent. 2016 Oct;38(5):59-66.
49. Pinto DA, Nascimento JX, Padilha LL, Conceição SI, França AK, Simões VM, et al. High sugar content and body mass index: modelling pathways around the first 1000 d of life, BRISA cohort. Public Health Nutr. 2021 Oct;24(15):4997-5005. https://doi.org/10.1017/S136898002000525X
50. Fatturi AL, Wambier LM, Chibinski AC, Assunção LR, Brancher JA, Reis A, et al. A systematic review and meta-analysis of systemic exposure associated with molar incisor hypomineralization. Community Dent Oral Epidemiol. 2019 Oct;47(5):407-15. https://doi.org/10.1111/cdoe.12467
51. Silva MJ, Scurrah KJ, Craig JM, Manton DJ, Kilpatrick N. Etiology of molar incisor hypomineralization - A systematic review. Community Dent Oral Epidemiol. 2016 Aug;44(4):342-53. https://doi.org/10.1111/cdoe.12229
52. Costa FS, Silveira ER, Pinto GS, Nascimento GG, Thomson WM, Demarco FF. Developmental defects of enamel and dental caries in the primary dentition: a systematic review and meta-analysis. J Dent. 2017 May;60:1-7. https://doi.org/10.1016/j.jdent.2017.03.006

53. González-Valero L, Montiel-Company JM, Bellot-Arcís C, Almerich-Torres T, Iranzo-Cortés JE, Almerich-Silla JM. Association between passive tobacco exposure and caries in children and adolescents. A systematic review and meta-analysis. PLoS One. 2018 Aug;13(8):e0202497. https://doi.org/10.1371/journal.pone.0202497
54. Maone TR, Mattes RD, Bernbaum JC, Beauchamp GK. A new method for delivering a taste without fluids to preterm and term infants. Dev Psychobiol. 1990 Mar;23(2):179-91. https://doi.org/10.1002/dev.420230208
55. Mennella JA, Bobowski NK. The sweetness and bitterness of childhood: Insights from basic research on taste preferences. Physiol Behav. 2015 Dec;152(Pt B):502-7. https://doi.org/10.1016/j.physbeh.2015.05.015
56. De Cosmi V, Scaglioni S, Agostoni C. Early taste experiences and later food choices. Nutrients. 2017 Feb;9(2):107. https://doi.org/10.3390/nu9020107
57. Fidler Mis N, Braegger C, Bronsky J, Campoy C, Domellöf M, Embleton ND, et al. Sugar in infants, children and adolescents: a position paper of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2017 Dec;65(6):681-96. https://doi.org/10.1097/MPG.0000000000001733
58. Murray RD. Savoring sweet: sugars in infant and toddler feeding. Ann Nutr Metab. 2017;70 Suppl 3:38-46. https://doi.org/10.1159/000479246
59. Corbella S, Taschieri S, Francetti L, De Siena F, Del Fabbro M. Periodontal disease as a risk factor for adverse pregnancy outcomes: a systematic review and meta-analysis of case-control studies. Odontology. 2012 Jul;100(2):232-40. https://doi.org/10.1007/s10266-011-0036-z
60. Manrique-Corredor EJ, Orozco-Beltran D, Lopez-Pineda A, Quesada JA, Gil-Guillen VF, Carratala-Munuera C. Maternal periodontitis and preterm birth: systematic review and meta-analysis. Community Dent Oral Epidemiol. 2019 Jun;47(3):243-51. https://doi.org/10.1111/cdoe.12450
61. Chambrone L, Guglielmetti MR, Pannuti CM, Chambrone LA. Evidence grade associating periodontitis to preterm birth and/or low birth weight: I. A systematic review of prospective cohort studies. J Clin Periodontol. 2011 Sep;38(9):795-808. https://doi.org/10.1111/j.1600-051X.2011.01755.x
62. Torres TA, Corradi-Dias L, Oliveira PD, Martins CC, Paiva SM, Pordeus IA, et al. Association between sense of coherence and dental caries: systematic review and meta-analysis. Health Promot Int. 2020 Jun;35(3):586-97. https://doi.org/10.1093/heapro/daz038
63. Victora CG, Horta BL, Mola CL, Quevedo L, Pinheiro RT, Gigante DP, et al. Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil. Lancet Glob Health. 2015 Apr;3(4):e199-205. https://doi.org/10.1016/S2214-109X(15)70002-1
64. Bertoldi AD, Barros FC, Hallal PR, Mielke GI, Oliveira PD, Maia MF, et al. Trends and inequalities in maternal and child health in a Brazilian city: methodology and sociodemographic description of four population-based birth cohort studies, 1982-2015. Int J Epidemiol. 2019 Apr;48 Suppl 1:i4-15. https://doi.org/10.1093/ije/dyy170
65. Peres MA, Macpherson LM, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. Lancet. 2019 Jul;394(10194):249-60. https://doi.org/10.1016/S0140-6736(19)31146-8
66. Kirthiga M, Murugan M, Saikia A, Kirubakaran R. Risk factors for early childhood caries: a systematic review and meta-analysis of case control and cohort studies. Pediatr Dent. 2019 Mar;41(2):95-112.
67. Firmino RT, Ferreira FM, Paiva SM, Granville-Garcia AF, Fraiz FC, Martins CC. Oral health literacy and associated oral conditions: A systematic review. J Am Dent Assoc. 2017 Aug;148(8):604-13. https://doi.org/10.1016/j.adaj.2017.04.012
68. Firmino RT, Ferreira FM, Martins CC, Granville-Garcia AF, Fraiz FC, Paiva SM. Is parental oral health literacy a predictor of children's oral health outcomes? Systematic review of the literature. Int J Paediatr Dent. 2018 Jul;28(5):459-71. https://doi.org/10.1111/ipd.12378
69. Victora CG, Matijasevich A, Santos IS, Barros AJ, Horta BL, Barros FC. Breastfeeding and feeding patterns in three birth cohorts in Southern Brazil: trends and differentials. Cad Saude Publica. 2008;24 Suppl 3:S409-16. https://doi.org/10.1590/S0102-311X2008001500006
70. Guideline WH. Sugars intake for adults and children. Geneva: World Health Organization; 2015.
71. Moynihan PJ, Kelly SA. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. J Dent Res. 2014 Jan;93(1):8-18. https://doi.org/10.1177/0022034513508954
72. World Health Organization. Sugars and dental caries. Geneva: World Health Organization; 2017.
73. Sheiham A, James WP. Diet and dental caries: the pivotal role of free sugars reemphasized. J Dent Res. 2015 Oct;94(10):1341-7. https://doi.org/10.1177/0022034515590377
74. World Health Organization. Ending childhood dental caries: WHO implementation manual. Geneva: World Health Organization; 2019.
75. Feldens CA, Vítolo MR, Maciel RR, Baratto PS, Rodrigues PH, Kramer PF. Exploring the risk factors for early-life sugar consumption: a birth cohort study. Int J Paediatr Dent. 2021 Mar;31(2):223-30. https://doi.org/10.1111/ipd.12713
76. 76. Feldens CA, Rodrigues PH, Anastácio G, Vítolo MR, Chaffee BW. Feeding frequency in infancy and dental caries in childhood: a prospective cohort study. Int Dent J. 2018 Apr;68(2):113-21. https://doi.org/10.1111/idj.12333
77. Heyman MB, Abrams SA, Heitlinger LA, Cabana MC, Gilger MA, Gugig R, et al. Fruit juice in infants, children, and adolescents: current recommendations. Pediatrics. 2017 Jun;139(6):e20170967. https://doi.org/10.1542/peds.2017-0967

78. Sociedade Brasileira de Pediatria. Consumo de sucos durante o primeiro ano do bebê pode favorecer a obesidade. Rio de Janeiro: Sociedade Brasileira de Pediatria; 2017 [cited 2021 Dec 6]. Avaiable from: http://www.sbp.com.br/imprensa/detalhe/nid/consumo-de-sucos-durante-o-primeiro-ano--do-bebe-pode-favorecer-a-obesidade/
79. Bolton RP, Heaton KW, Burroughs LF. The role of dietary fiber in satiety, glucose, and insulin: studies with fruit and fruit juice. Am J Clin Nutr. 1981 Feb;34(2):211-7. https://doi.org/10.1093/ajcn/34.2.211
80. Bertenshaw EJ, Lluch A, Yeomans MR. Satiating effects of protein but not carbohydrate consumed in a between-meal beverage context. Physiol Behav. 2008 Feb;93(3):427-36. https://doi.org/10.1016/j.physbeh.2007.09.014
81. Baker SS, Cochran WJ, Greer FR, et al. American Academy of Pediatrics: the use and misuse of fruit juice in pediatrics. Pediatrics. 2001 May;107(5):1210-3. https://doi.org/10.1542/peds.107.5.1210
82. Shefferly A, Scharf RJ, DeBoer MD. Longitudinal evaluation of 100% fruit juice consumption on BMI status in 2-5-year-old children. Pediatr Obes. 2016 Jun;11(3):221-7. https://doi.org/10.1111/ijpo.12048
83. Pitts NB, Baez RJ, Diaz-Guillory C, Donly KJ, Alberto Feldens C, McGrath C, et al. Early Childhood Caries: IAPD Bangkok Declaration. J Dent Child (Chic). 2019 May;86(2):72.
84. Vos MB, Kaar JL, Welsh JA, Van Horn LV, Feig DI, Anderson CA, et al. Added sugars and cardiovascular disease risk in children: a scientific statement from the American Heart Association. Circulation. 2017 May;135(19):e1017-34. https://doi.org/10.1161/CIR.0000000000000439
85. Ministério da Saúde (BR). Secretaria de Atenção Primaria à Saúde. Departamento de Promoção da Saúde. Guia alimentar para crianças brasileiras menores de 2 anos. Brasília, DF: Ministério da Saúde; 2019.
86. Unicef Brasil. Os 10 passos para alimentação e hábitos saudáveis do nascimento até os 2 anos de idade. Brasília, DF: Unicef; 2018.
87. Ribeiro CC, Silva MC, Nunes AM, Thomaz EB, Carmo CD, Ribeiro MR, et al. Overweight, obese, underweight, and frequency of sugar consumption as risk indicators for early childhood caries in Brazilian preschool children. Int J Paediatr Dent. 2017 Nov;27(6):532-9. https://doi.org/10.1111/ipd.12292
88. Avila WM, Pordeus IA, Paiva SM, Martins CC. Breast and bottle feeding as risk factors for dental caries: A systematic review and meta-analysis. PLoS One. 2015 Nov;10(11):e0142922. https://doi.org/10.1371/journal.pone.0142922
89. Moynihan P, Tanner LM, Holmes RD, Hillier-Brown F, Mashayekhi A, Kelly SA, et al. Systematic review of evidence pertaining to factors that modify risk of Early Childhood Caries. JDR Clin Trans Res. 2019 Jul;4(3):202-16. https://doi.org/10.1177/2380084418824262
90. Ha DH, Do LG, Spencer AJ, Thomson WM, Golley RK, Rugg-Gunn AJ, et al. Factors influencing early feeding of foods and drinks containing free sugars: a Birth Cohort Study. Int J Environ Res Public Health. 2017 Oct;14(10):1270. https://doi.org/10.3390/ijerph14101270
91. Tovar A, Vadiveloo M, Østbye T, Benjamin-Neelon SE. Maternal predictors of infant beverage consumption: results from the Nurture cohort study. Public Health Nutr. 2019 Oct;22(14):2591-7. https://doi.org/10.1017/S1368980019000934
92. Beckerman JP, Slade E, Ventura AK. Maternal diet during lactation and breast-feeding practices have synergistic association with child diet at 6 years. Public Health Nutr. 2020 Feb;23(2):286-94. https://doi.org/10.1017/S1368980019001782
93. Jones L, Moschonis G, Oliveira A, Lauzon-Guillain B, Manios Y, Xepapadaki P, et al. The influence of early feeding practices on healthy diet variety score among pre-school children in four European birth cohorts. Public Health Nutr. 2015 Jul;18(10):1774-84. https://doi.org/10.1017/S1368980014002390
94. Tham R, Bowatte G, Dharmage SC, Tan DJ, Lau MX, Dai X, et al. Breastfeeding and the risk of dental caries: a systematic review and meta-analysis. Acta Paediatr. 2015 Dec;104(467):62-84. https://doi.org/10.1111/apa.13118
95. Devenish G, Mukhtar A, Begley A, Spencer AJ, Thomson WM, Ha D, et al. Early childhood feeding practices and dental caries among Australian preschoolers. Am J Clin Nutr. 2020 Apr;111(4):821-8. https://doi.org/10.1093/ajcn/nqaa012
96. Feldens CA, Giugliani ER, Vigo Á, Vítolo MR. Early feeding practices and severe early childhood caries in four-year-old children from southern Brazil: a birth cohort study. Caries Res. 2010;44(5):445-52. https://doi.org/10.1159/000319898
97. Chaffee BW, Feldens CA, Vítolo MR. Association of long-duration breastfeeding and dental caries estimated with marginal structural models. Ann Epidemiol. 2014 Jun;24(6):448-54. https://doi.org/10.1016/j.annepidem.2014.01.013
98. Peres KG, Nascimento GG, Peres MA, Mittinty MN, Demarco FF, Santos IS, et al. Impact of Prolonged Breastfeeding on Dental Caries: A Population-Based Birth Cohort Study. Pediatrics. 2017 Jul;140(1):e20162943. https://doi.org/10.1542/peds.2016-2943
99. Meijeren-van Lunteren AW, Voortman T, Elfrink ME, Wolvius EB, Kragt L. Breastfeeding and Childhood Dental Caries: Results from a Socially Diverse Birth Cohort Study. Caries Res. 2021;55(2):153-61. https://doi.org/10.1159/000514502
100. Santos AP, Nadanovsky P, Oliveira BH. 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 Dent Oral Epidemiol. 2013 Feb;41(1):1-12. https://doi.org/10.1111/j.1600-0528.2012.00708.x
101. International Association of Pedatric Dentistry. Foundation articles and consensus recommendations: use of fluoride for caries prevention. Geneva: International Association of Pedatric Dentistry; 2020 [cited 2021 Dec 6]Available from: https://iapdworld.org/wp-content/uploads/2020/04/03_Use-of-Fluoride-for-Caries-Prevention.pdf

102. Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 2003;2016(1):CD002278. https://doi.org/10.1002/14651858.CD002278
103. Muller-Bolla M, Courson F. Toothbrushing methods to use in children: a systematic review. Oral Health Prev Dent. 2013;11(4):341-7. https://doi.org/10.3290/j.ohpd.a30602
104. Ceyhan D, Akdik C, Kirzioglu Z. An educational programme designed for the evaluation of effectiveness of two tooth brushing techniques in preschool children. Eur J Paediatr Dent. 2018 Sep;19(3):181-6. https://doi.org/10.23804/ejpd.2018.19.03.3
105. World Health Organization. The selection and use of essential medicines 2021. Report of the WHO Expert Committee on Selection and Use of Essential Medicines, 2021. Geneva: World Health Organzaton; 2021 Excecutive summary, p. 7-40. (WHO Technical Report Series, v. 1035).
106. Schmoeckel J, Gorseta K, Splieth CH, Juric H. How to intervene in the caries process: early childhood caries: a systematic review. Caries Res. 2020;54(2):102-12. https://doi.org/10.1159/000504335
107. Urquhart O, Tampi MP, Pilcher L, Slayton RL, Araujo MW, Fontana M, et al. nonrestorative treatments for caries: systematic review and network meta-analysis. J Dent Res. 2019 Jan;98(1):14-26. https://doi.org/10.1177/0022034518800014
108. Chibinski AC, Wambier LM, Feltrin J, Loguercio AD, Wambier DS, Reis A. Silver Diamine Fluoride has efficacy in controlling caries progression in primary teeth: A systematic review and meta-analysis. Caries Res. 2017;51(5):527-41. https://doi.org/10.1159/000478668
109. Amorim RG, Leal SC, Frencken JE. Survival of atraumatic restorative treatment (ART) sealants and restorations: a meta-analysis. Clin Oral Investig. 2012 Apr;16(2):429-41. https://doi.org/10.1007/s00784-011-0513-3
110. Tedesco TK, Calvo AF, Lenzi TL, Hesse D, Guglielmi CA, Camargo LB, et al. ART is an alternative for restoring occlusoproximal cavities in primary teeth - evidence from an updated systematic review and meta-analysis. Int J Paediatr Dent. 2017 May;27(3):201-9. https://doi.org/10.1111/ipd.12252
111. Tedesco TK, Reis TM, Mello-Moura AC, Silva GS, Scarpini S, Floriano I, et al. Management of deep caries lesions with or without pulp involvement in primary teeth: a systematic review and network meta-analysis. Braz Oral Res. 2020 Nov;35:e004. https://doi.org/10.1590/1807-3107bor-2021.vol35.0004
112. Sampaio FC, Bönecker M, Paiva SM, Martignon S, Ricomini Filho AP, Pozos-Guillen A, et al. Dental caries prevalence, prospects, and challenges for Latin America and Caribbean countries: a summary and final recommendations from a Regional Consensus. Braz Oral Res. 2021 May;35 suppl 01:e056. https://doi.org/10.1590/1807-3107bor-2021.vol35.0056
113. Hernández-F M, Cantoral A, Colchero MA. Taxes to unhealthy food and beverages and oral health in Mexico: an observational study. Caries Res. 2021;55(3):183-92. https://doi.org/10.1159/000515223
114. Noro LR, Roncalli AG, Teixeira AK. Contribution of cohort studies in the analysis of oral health in children and adolescents in Sobral, Ceará. Rev Bras Epidemiol. 2015 Jul-Sep;18(3):716-9. https://doi.org/10.1590/1980-5497201500030016
115. Ortiz AS, Tomazoni F, Knorst JK, Ardenghi TM. Influence of socioeconomic inequalities on levels of dental caries in adolescents: A cohort study. Int J Paediatr Dent. 2020 Jan;30(1):42-9. https://doi.org/10.1111/ipd.12572
116. Chattopadhyay A, Christian B, Masood M, Calache H, Carpenter L, Gibbs L, et al. Natural history of dental caries: baseline characteristics of the VicGen birth cohort study. Int J Paediatr Dent. 2020 May;30(3):334-41. https://doi.org/10.1111/ipd.12609