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Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: Global perspective

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Abstract

Background

This paper is a summary of the proceedings of the International Association of Paediatric Dentistry Bangkok Conference on early childhood caries (ECC) held in 3-4 November 2018.

Aim

The paper aims to convey a global perspective of ECC definitions, aetiology, risk factors, societal costs, management, educational curriculum, and policy.

Design

This global perspective on ECC is the compilation of the state of science, current concepts, and literature regarding ECC from worldwide experts on ECC.

Results

Early childhood caries is related to frequent sugar consumption in an environment of enamel adherent, acid-producing bacteria in a complex biofilm, as well as developmental

defects of enamel. The seriousness, societal costs, and impact on quality of life of dental caries in pre-school children are enormous. Worldwide data show that ECC continues to be highly prevalent, yet infrequently treated. Approaches to reduce the prevalence include interventions that start in the first year of a child's life, evidence-based and risk-based management, and reimbursement systems that foster preventive care.

Conclusions

This global perspective on ECC epidemiology, aetiology, risk assessment, global impact, and management is aimed to foster improved worldwide understanding and management of ECC.

Why is this paper important to paediatric dentists:

Progress in the worldwide prevention and management of ECC has been slow due to various understandings of the disease and various management strategies.

This manuscript conveys a uniform, global perspective of ECC definition, aetiology, risk factors, societal costs, management, educational curriculum, research, and policy.

This global and state-of-art perspective on ECC is aimed to foster improved worldwide understanding and management of ECC.

1 ECC DEFINITION AND PREVALENCE

Dental caries in pre-school children has been described by numerous terms and attributed to many aetiologies over the years. Prior to the 1997, NIH sponsored 'Early Childhood Caries Conference' dental caries in pre-school children was first described as "Comforter Caries" in 1911,[1] and in 1962 as "Milk Bottle Mouth".[2] Over the years, it also has been referred to as "Baby Bottle Syndrome", "Nursing Bottle Caries", "Nursing Caries", and "Baby Bottle Tooth Decay". These references to dental caries in pre-school children generally assumed causality to inappropriate feeding with a baby bottle. The current term early childhood caries (ECC) connotes a more complex disease, related to frequent sugar consumption in environment of enamel adherent bacteria that is not necessarily related to bottle feeding.

The Expert Panel at the Bangkok Global Summit on ECC further defined dental caries as a

biofilm-mediated, sugar-driven, multifactorial, dynamic disease that results in the phasic demineralization and remineralization of dental hard tissues, determined by biological, behavioural, and psychosocial factors linked to an individual's environment. The Panel's clinical description of ECC reaffirmed the 1999 definition 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 age six".3 Furthermore, the Panel's lay definition of ECC was "tooth decay in pre-school children which is common, mostly untreated and can have profound impact on children's lives".

To understand the prevalence of ECC for this conference, data were abstracted from 72 worldwide studies between 1998 and 2018 that measured caries prevalence in pre-school children. The caries prevalence for 4-year-old children from these studies ranged from 12% from a 2009 study conducted in France, to 98% from a 2014 study conducted in Australia. Most interesting was the finding from these 72 reports that the mean caries prevalence for 1-year-olds was 17%, and greatly increased to 36% in 2-year-olds. Additionally, the 3-, 4-, and 5-year-olds mean caries prevalences were 43%, 55%, and 63%, respectively. It also was clear from these reports that different criteria used for identifying caries, different examination methods, and lack of examiner calibration made these findings imprecise. The surveys, however, clearly indicate that besides ECC being highly prevalent, it is largely untreated in children under age three.

The high prevalence of ECC in such young children worldwide has a major impact on children's health as well as cost to society. Treatment of ECC often requires extensive restorative treatment, extraction of primary teeth, space maintenance, and in cases where the child may be pre-cooperative for treatment in the dental chair, there can be substantial costs for sedation or general anaesthesia. Consequences of ECC also include higher risk of new carious lesions, acute and chronic pain, hospitalizations and emergency room visits, reports of delays of growth and development, and diminished quality of life. In the United States, medical expenditures' surveys have found that dental cost in 2010 exceeded $1.55 billion for children younger than 5 years old.4

2 AETIOLOGY OF EARLY CHILDHOOD CARIES

The answer to the question "what causes dental caries?" has intrigued researchers throughout the world. Effective management strategies against ECC should be based on the understanding of its complex aetiology, and multi-level conceptual models have been proposed to analyse socioeconomic, behavioural, and biological factors that exert an influence on child health outcomes, including dental caries.

Enamel demineralization is directly caused by acidogenic bacteria that ferment carbohydrates from diet. After carbohydrates are ingested, especially sucrose, there is a rapid fall of pH in tooth adherent biofilms to 5.0 or below. The lower pH leads to a so-called dysbiotic microbiome that is characterized by an increase in the proportion of acidic biofilm species and changes in the composition of the biofilm matrix. Frequent sugar exposure thus leads to sustained acid production and consequent demineralization of the tooth structure.

Colonization of the oral cavity of children by microorganisms occurs both by vertical and horizontal transmission. The transmission of microorganisms, however, should not be considered as synonymous with the transmission of dental caries, since bacteria alone are not sufficient for disease to occur.[5] For this reason, dental caries is considered a non-communicable disease. The biofilm alone does not produce disease, but exposure to dietary sugars is a determining factor as well as an individual's ability to overcome the ecological challenges.[6] ECC shares common risk factors with other non-communicable diseases associated with excessive sugar consumption such as cardiovascular disease, diabetes, and obesity.

Consumption of free sugars (ie sugars added to food and beverages and sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates) is of critical importance to the development of dental caries.[7] There is evidence from cohort studies that two key characteristics are critical in ECC dietary practices: the age at which sugar is introduced to a child and the frequency of its consumption.[8], [9] Regarding sugar introduction, dietary patterns in infancy, characterized by a greater number of highly sweetened foods and drinks in the first year of age, are strongly associated with the incidence of childhood caries in subsequent years.[8] In addition, baby bottle and breastfeeding beyond 12 months, especially if frequent and/or nocturnal, are associated with ECC.[10]

Potential influence of intraoral factors, such as developmental defects of enamel, is also considered a risk factor for ECC. The loss of surface integrity and deficiencies in mineralization may explain the higher risk of ECC in children affected by developmental defects.[11] Developmental defects are believed to be caused by some prenatal conditions and common childhood systemic illnesses.

Socioeconomic factors at the community and family level, such as ethnicity and mother's schooling, are associated with ECC prevalence.[12] Although the pathways by which these factors affect caries have not yet been fully clarified, it is likely that health beliefs, locus of control, and self-efficacy may at least partially explain socioeconomic disparities, as these factors exert an influence on parents' knowledge as well as their attitudes and practices, including dietary and hygiene practices undertaken with their children.

3.CARIES RISK ASSESSMENT

Caries risk assessment (CRA) is the process of establishing the probability of an individual patient, or groups of children, developing carious lesions over a certain time period or the likelihood that there will be a change in size or activity of lesions already present.[13] On the community level, the procedure can guide the design of public interventions, time allocation, and resources to those with the greatest need. For the individual child, risk assessment is an essential key element for the decision-making and management of early childhood caries. The different risk categories should ideally be linked to personalized preventive measures and follow-up intervals.

Practice-based research has shown that most dentists do some form of CRA in children, while formal, objective, and recorded implementation in everyday practice seems less common.[14] There are several CRA tools available and recommended for use in pre-school children. The most common examples are the manual AAPD CRA forms[15] and CAMBRA[16] checklists, comprising of 13 and 14 items, respectively, the algorithm-based software programs Cariogram[17] and NUS-CRA.[18] In general, three levels of caries risk are applied: "low risk", "moderate risk", and "high risk". There is consensus that "low risk" means absence of disease (risk) factors and presence of protective factors, but there are no accepted definitions on the moderate and high-risk categories.

Unfortunately, there is a paucity of studies that have validated risk categories in prospective trials in pre-school children. An updated search through August 2018 using the same strategy as a previous systematic review[19] identified five longitudinal studies[18, 20-23] with moderate and low risk of bias according to the QUIPS tool for prognostic studies.[24] All studies reported a positive correlation between the baseline risk category and the actual caries development with sensitivities ranging from 44% to 100% and specificities between 6% and 95%. The software programs[17, 18] exhibited good to limited accuracy and utility to predict caries increment over a 12-month period with a reasonable balance between sensitivity and specificity. The AAPD and CAMBRA tools were only validated in one single trial from Hong Kong[18] in which both displayed high sensitivities, but moderate to low specificities.

The important question whether or not the CRA process in pre-school children actually resulted in less caries and/or better oral health in infants and pre-school children has not yet been answered due to lack of research. Consequently, the value for children, as well as their parents and the society, is still a knowledge gap. Likewise, the didactic and motivating effects of using CRA tools for young children and their parents remain unclear. Nevertheless, since the possible desirable effects of the CRA process clearly outweigh any undesirable effects, a

strong recommendation can be given for this procedure. This recommendation is based on evidence of moderate quality, but there is insufficient evidence to support or refute one CRA tool over another.

In everyday practice, the clinician must balance the child's risk and protective factors against each other in order to assess the risk of future of caries and some examples for young children are shown in Table 1. Other clinically relevant questions concerning CRA in pre-school children are "when" to do it and "how often". Since the risk assessment ideally should precede the disease, it seems appropriate to carry out a comprehensive CRA at the first dental visit. Furthermore, there are data suggesting that 50% of all pre-school children change their risk category over time,[20] and that a 12-month prediction is more accurate than prolonged periods.[18] Thus, based on low-quality evidence, a conditional recommendation would be that young children's caries risk should be assessed by the first year of life and then be re-evaluated periodically. Further research on the benefits and value for children and families, as well as possible disadvantages of CRA in the ECC context, is urgently needed. Table 2 is an example of utilizing CRA for caries clinical management in pre-school children.

Table 1. Examples of risk and protective factors associated with ECC that can be considered for pre-school children (adapted from reference[71])

Risk factors, social/behavioural
Parent/caregiver has life-time of poverty, low health literacy
Child has frequent exposure between meal sugar-containing snacks or beverages
Bottle or non-spill cup containing natural or added sugar used frequently or at bedtime, breastfeeding beyond 12 months, especially if frequent/nocturnal
Mother/primary caregiver has active dental caries
Child has special healthcare needs
Risk factors, clinical
Child has non-cavitated lesions or enamel defects
Child has visible cavities or fillings or missing teeth due to caries
Child has visible plaque on teeth
Protective factors
Child receives fluoridated drinking water
Child has teeth brushed twice daily with fluoridated toothpaste
Child receives topical fluoride from health professional
Child has dental home/regular dental care

Table 2. Example of utilizing caries risk assessment for caries management in pre-school children

Risk category	Interventions			Restorative
	Fluoride	Diet	Sealants	
Low risk	Twice daily brushing with fluoridated toothpaste Drink optimally fluoridated water where available	Counselling to limit sugar intake	No	Surveillance[a]
High risk	Twice daily brushing with fluoridated toothpaste Professional topical treatment every 3 months Drink optimally fluoridated water where available	Counselling to limit sugar intake	Yes	Active surveillance of non-cavitated caries[a] SDF on cavitated lesions Restoration of cavitated or enlarging lesions

[a] Surveillance and active surveillance: Periodic monitoring for signs of caries progression, and active measures by parents and oral health professionals to reduce cariogenic environment.

4 IMPACT OF ECC ON ORAL HEALTH-RELATED QUALITY OF LIFE

Aside from determining how common ECC is, there is a need to consider how ECC impacts on the day-to-day life of children and their families—the physical, social, and psychological consequences of ECC.[25] This has implications in understanding how ECC impacts on the quality of life of children and the burden it places on the lives of children, their families, and their communities. Assessing children's own feelings about their oral health and how it impacts on their life is challenging owing to differences in cognitive development and ability (even among children of a similar age), the rapidly changing dental and facial features that occur during childhood, and the changes in psychosocial awareness with age.[26] To this end, relying on parents/primary caregivers views has been advocated as a "proxy" of children's own views of their oral health.[27] There are concerns that parents/ primary caregivers' reports may differ from that of children's own perspective of their oral health, and thus, "proxy" reports should be viewed as complimentary rather than alternative sources of information on children's oral health. Among young children, however, it is acknowledged

that because of issues of recall and their limited capabilities of abstract thinking relating to perceptions of health and disease, parents/primary caregivers' reports should be employed.[28]

Over time there have been considerable advancements in the conceptual understanding of the impact of oral health on quality of life (termed "oral health-related quality of life"—OHQoL), and various theoretical models have been proposed to guide the assessment of OHQoL. This in turn has led to the development and testing of a multitude of measures/instruments/questionnaires to assess the impact of ECC on OHQoL that includes generic health measures, generic oral health measures, and condition-specific measures.[29] These differ in terms of underlying theoretical frameworks (or lack of), dimensions and domains of oral health considered, number of items, scoring methods, and who completes assessments. Because of linguistic and cultural differences, OHQoL measures need to be adapted for use in other languages and cultures to facilitate cross-national and cross-cultural research on the impact of ECC globally.

Despite differences in measurement approaches to assessing OHQoL, there is ample evidence to support the validity and reliability of the various OHQoL measures in determining the burden of ECC on children's lives.[30] The evidence suggests that irrespective of measurement approach and irrespective of culture, ECC does place a burden on the lives of children, their families, and communities. While the ability of OHQoL measures to describe the burden of ECC is helpful, it is also important that they can capture and describe the benefits of treatment and care to children's lives. OHQoL measures need to be sensitive to treatment (ie produce a significant change in scores following treatment/intervention) and ideally an ability to identify changes in OHQoL in relation to clinical importance (responsiveness). A systematic review and meta-analysis have identified improvements in OHQoL following dental treatment under general anaesthesia in children in all studies, and an overall "large" magnitude of improvement, at least in the short term.[31] Given the advances in the field and the availability of standardized OHQoL measures, incorporating OHQoL assessments should be encouraged to provide greater understanding of the consequences of ECC locally and globally so as to prioritize need. Moreover, there is a need to provide further evidence of the benefits of managing ECC to children's lives, their families, and their communities, including the benefits of preventive care. OHQoL assessments can provide a useful adjunct measure of oral health gain in the management of ECC beyond clinical parameters.

5 CLINICAL MANAGEMENT OF EARLY CHILDHOOD CARIES

5.1 Primary prevention

Primary prevention for ECC needs to begin before the initiation of disease and is the key to reducing the worldwide prevalence of ECC. Timely delivery of educational information and preventive therapies to the parents/caregivers has been shown to be effective in reducing the prevalence of ECC.[32] Physicians, nurses, and other healthcare workers may have more opportunities to educate the caregivers than dental professionals because of the frequency of contact with the family in the first few years of the child's life. Therefore, it is essential that these providers be aware of caries risk and protective factors and use this information to promote primary care preventive messages that include limiting free sugar intake in foods and drink for children under 2 years; avoiding night-time bottle feeding with milk or drinks containing free sugars; and avoiding baby bottle and breastfeeding beyond 12 months, especially if frequent and/or nocturnal.

In addition, optimal exposure to dietary fluoride is important to all dentate infants and children and can be delivered by fluoridated water, fluoridated salt, and fluoridated milk. Topical fluoride can be delivered at home by having the child's teeth brushed twice daily with fluoridated toothpaste, containing at least 1000 ppm fluoride and using an age-appropriate amount of toothpaste on the brush—a "smear" (approximately 0.1 mg F) for children under age 3, and a "pea size" (approximately 0.25 mg F) for children age 3-6[33] (Figure 1). Ideally, a child should have a dental visit for comprehensive care in the first year of life, and any child at caries risk should have regular 5% fluoride varnish applications.[15]

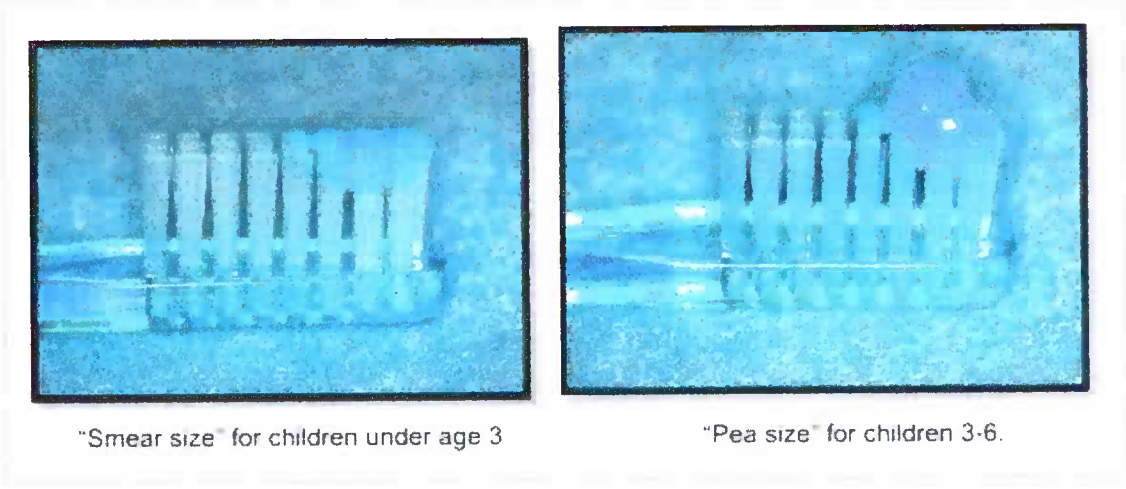

Figure 1

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Amount, by age, of fluoridated toothpaste on a child's toothbrush

5.2 Secondary prevention

Secondary prevention for ECC is preventing the progression of, or stimulating the regression (remineralization) of, caries, prior to the cavitation stage of lesions. Early detection of incipient caries is key to the prevention of cavitation. Besides the primary prevention approaches listed above, more frequent fluoride varnish applications, such as four times per year, and applying pit and fissure sealants to susceptible molars are effective non-invasive measures to arrest caries progression.[34] Glass ionomer cements used for dental sealants have several properties favourable for use in pre-school children, such as fluoride release, chemical bonding to enamel and dentine, as well as reduced moisture sensitivity.[35]

5.3 Tertiary prevention

Tertiary prevention for ECC can involve both non-invasive and invasive preventive management when there are cavitated dentine lesions. Besides all of the primary and secondary prevention approaches, silver diamine fluoride recently has gained popularity for the arrestment of cavitated lesions.[36] The black staining of the exposed dentine due to the infiltration of silver products into the lesion, however, may limit its acceptability in certain populations.[37]

Conservative caries removal and tooth restoration may be necessary to prevent further tooth breakdown, pain, and prevent unnecessary pulp exposures.[38] The use of atraumatic caries removal and tooth restoration with glass ionomer cement (ART) for cavitated dentine lesions is supported from studies in developing countries.[39] For multi-surface restorations in primary teeth, resin-based composite is superior to glass ionomer restorations.[35] Conservative tertiary prevention approaches are supported by the WHO global consultation on prevention of ECC.[40]

The restoration of cavitated carious lesions with restorative material should be made in conjunction with the CRA. In pre-school children, glass ionomer cement and resin-modified glass ionomer cement may be considered for occlusal, Class II, Class III, and Class V restorations since these materials bond to tooth structure and release fluoride which inhibits secondary caries.[35] Additionally, glass ionomer cements can be placed with less than ideal clinical tooth isolation. Due to compressive strength and fracture issues of glass ionomer cement, this material, however, is not recommended for Class II restorations or for the restorations of the incisal section of incisors.[35] Resin-based composite also may be considered for occlusal, Class II, Class III, and Class V restorations. Resin-based composites have stronger bond strength and compressive strength than glass ionomer cement. Resin-based materials can be used for minimally invasive restorative dentistry, but isolation of the tooth to prevent saliva contamination is necessary.[41]

Full coverage crowns may be necessary when restoring ECC in patients with high caries risk and extensive loss tooth structure due to caries.[42] Resin-based strip crowns have been successfully utilized, but excellent tooth isolation is necessary to obtain an adequate bond to acid-etched tooth structure.[43]

6 COMMUNITY MANAGEMENT OF ECC

Community programmes for managing ECC generally target high-risk, low socioeconomic, disadvantaged communities using established caries prevention methods. Programmes that are culturally competent with community-based participation and alignment with community cultures have been successful in reducing ECC in indigenous, low-income, and migrant communities worldwide.[44-47] Similarly, personal approaches such as home visiting and telephone contacts can reduce ECC by increasing caregivers' health literacy and self-efficacy to change behaviours to improve their infants' oral health.[48-50] Knowledge increases, however, may not improve oral health behaviours or reduce caries increment.[51]

Early dental visit strategy at 1-year of age is a key ECC management method and employed in many community programmes.[52] The preventive dental examinations should include CRA, tooth brushing instruction, dietary counselling, anticipatory guidance, and establishment of a dental home. Forming partnerships with non-dental primary care providers, for example, general doctors, paediatricians, and midwives to integrate oral health promotion into general health care may help to increase infants' access for early preventive examinations and referral for dental care.[53] Also, partnerships with nursery school staff to perform school-based oral examinations and tooth brushing are successful in reducing ECC in many socially disadvantaged communities worldwide.[54] Studies also suggest that existing general community health services can be utilized to provide oral health education and anticipatory guidance to pregnant women in low socioeconomic communities to reduce ECC.[55] Social media and telehealth may also be used to improve health literacy.

Primary, secondary, and tertiary prevention methods may be employed to manage ECC in community programmes. The conservative disease management approach for ECC using interim restorations and preventive techniques is cost-effective and may be appropriate for communities that do not have resources for traditional dental care. Multiple prevention methods and culturally competent, flexible community-based participation approaches are effective strategies for community management of ECC.

7 EDUCATION

7.1 Curriculum

Development of a dental school curriculum on ECC is the first step in adopting evidence- and risk-based prevention for ECC, and to give it equal weight to the more traditional surgical elements of caries management. The curriculum on ECC can be based on five domains as proposed by the European and International Cariology Curriculum with elements of ECC fitting into five domains: knowledge; risk assessment and diagnosis; preventive management; restorative care; and clinical and public health policy[56, 57] (Figure 2). Dissemination and implementation of such a curriculum requires building consensus on the content, strategies for dissemination, implementation in educational institutions worldwide, and partnerships with influential organization.

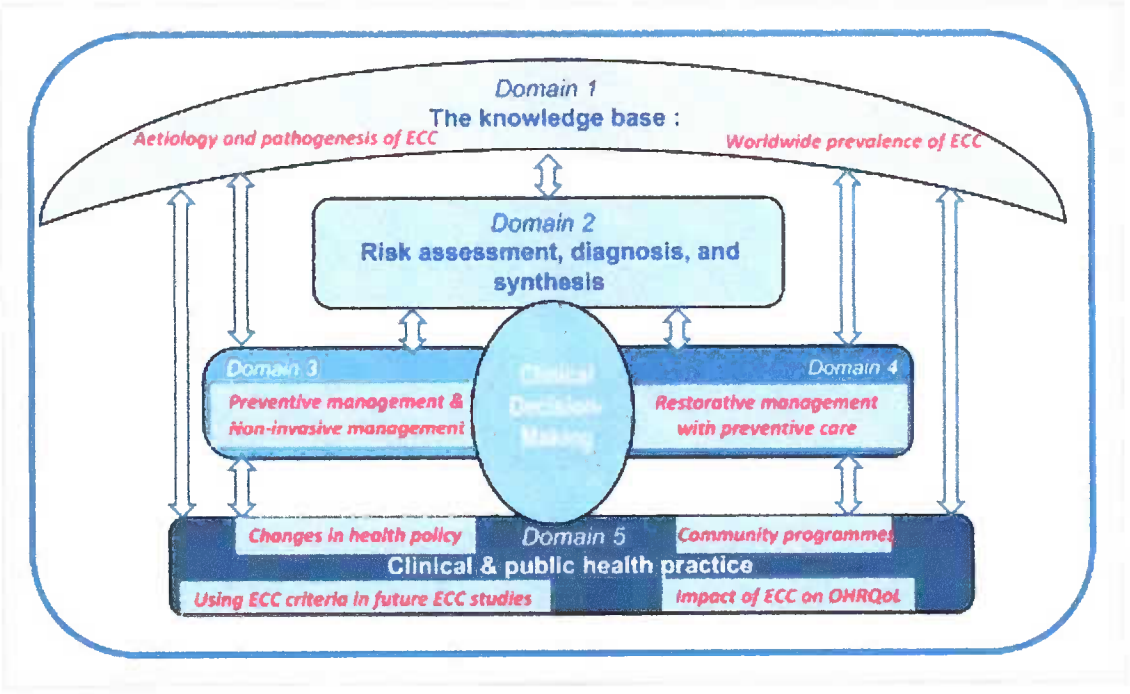

Figure 2

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Educational Curriculum for ECC using the International Cariology Curriculum Model (adapted from reference57)

The development of a comprehensive education curriculum on ECC needs to be preceded by engagement with local stakeholders to secure clarity as to: (a) What is ECC? (b) Why is it important? and (c) Who needs to be educated about it? This information is vital in order to adopt, implement, and maintain a sustainable ECC curriculum addressing the needs of dentists and other health professionals. These efforts are supported with consideration of a "4D System" for caries management (Figure 3) that aids in the understanding of the integrations of personalized diagnosis, risk assessment, treatment planning, and success of

caries management[58, 59] and has been specifically applied to ECC.[60]

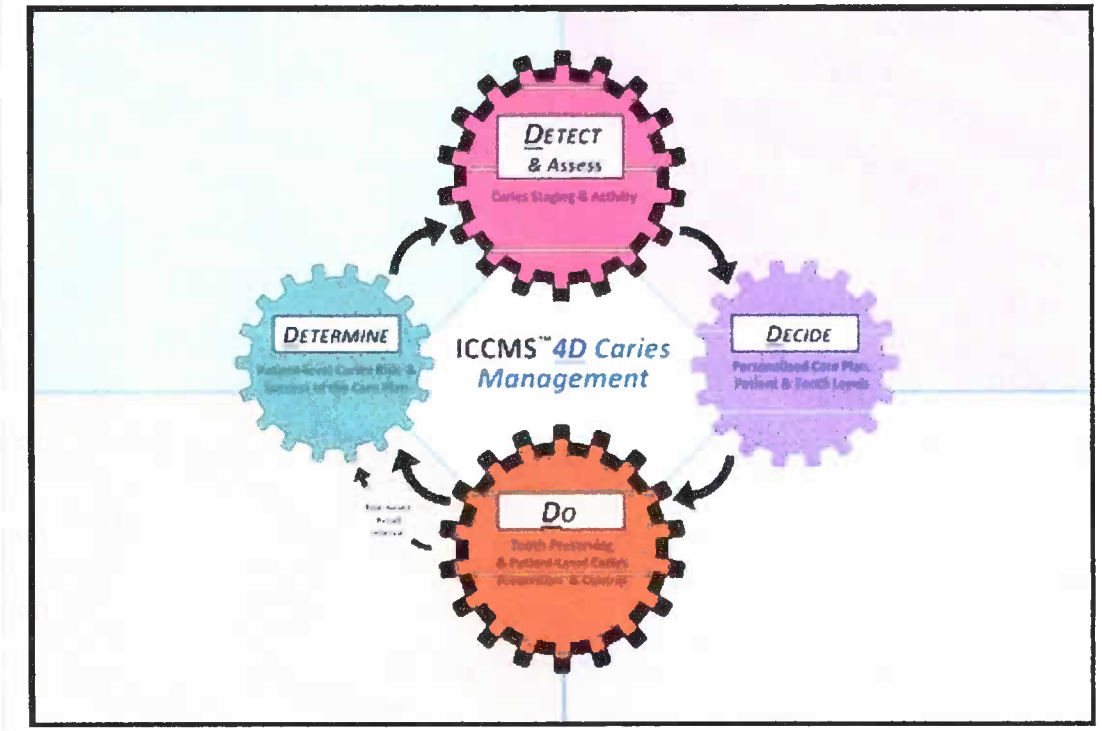

Figure 3

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Caries outcomes focused model that aims to maintain health and preserve tooth structure using a personalized, risk-based management (adapted from reference[59])

7.2 Parents/Caregivers

Educating parents regarding the causes and prevention of ECC for their children is necessary, but perhaps not sufficient to change health behaviours. Family-centred and customized recommendations have been shown to be more successful in engaging parents to change specific parenting practices than such generic recommendations such as "brush your teeth twice a day" and "don't eat candy".[61] One possible method to enhance health behavioural change is motivational interviewing.[62] This counselling technique relies on two-way communication, rapport and trust between the clinician and the parent/caregiver. Following the interviewing, the parent/caregiver may be asked to commit to self-management goals that will be discussed at the child's subsequent appointment.[63] Two randomized trials of motivational interviewing interventions to affect oral health behaviours and dental caries prevalence in low socioeconomic pre-school children, however, have shown no effect on parents' oral health behaviours or progression of ECC.[51, 64]

7.3 NON-ORAL HEALTH PROFESSIONALS

It is important to engage and educate others outside of dentistry if the burdens of ECC are to be improved at a global level. Paediatricians, nurses, obstetricians, and family physicians generally see the caregiver and their child much earlier than oral healthcare professionals. Engaging these professionals in collaborative care with oral health professionals and delegating areas of care pathways to the interprofessional team can provide better outcomes for preventing ECC.[65] But, provision of oral health care by non-dental health providers can be complicated by professional boundaries and lack subject knowledge. Studies have reported that non-oral health providers need further education in oral health assessment, anticipatory guidance, and oral health guidelines, such as recommendations on age of first dental visit.[66]

8 RESEARCH

Literature searches from the past 10 years have identified 915 epidemiology studies of ECC, especially from Brazil, China, and India. Many of the studies, however, do not improve our understanding of the disease because of issues with hypotheses, and research methods. These research efforts could be greatly improved, if prior to the study, the investigators have a better understanding of the specific objectives of previous studies and what is considered "settled science". Additionally, many of these studies have issues with methodology. For instance, most prevalence studies do not have generalizable results because they often examine selected populations or convenience samples that may not represent randomized national or international populations. Also, some of these epidemiology studies use indices and criteria inappropriately. For example, there are many instances in which ECC studies recorded decayed teeth/surfaces, but not missing or filled teeth/surfaces. Additionally, manuscripts regarding ECC epidemiology often did not include how the results of this study compare to previous studies, or what new information and advancement of science can be garnered from this study.

The main research gaps regarding ECC include: (a) cross-sectional studies preferably with representative populations that describe the burden of ECC; (b) prospective longitudinal studies that identify risk factors and their real effect size; and (c) randomized clinical trials that test the effectiveness of interventions against ECC based on identified risk factors. Besides the need to describe the burden of ECC worldwide, identify its risk factors and effectiveness of interventions; it is essential that "upstream" actions to prevent ECC are explored. There is current research to intervene before sugar consumption is established by reducing sugar availability for pre-school children with labelling control of unhealthy food, and by increasing taxes on sugar products.[38, 67]

9 HEALTH POLICY

The payment models for provider reimbursement have been slow to adapt to advances in science, including CRA and dental caries prevention. Presently, the primary reimbursement method in dentistry remains a fee-for-service model that rewards reparative treatment instead of management of the disease process. This fee-for-service model does little to incentivize evidence-based care, or treatment of underlying disease process. A Dental "Policy Lab" brought together key dental, policy, and health economic interests to consider the question "How do we accelerate a policy shift towards increased resource allocation for caries prevention and control?".[68]

It is unlikely however, in the short term, to expect rapid major changes to the entire delivery system. Advocating for minor changes to reimbursement systems, however, could have major impact on the prevalence of ECC should be the goal. Reimbursing providers for dietary counselling on sugar intake, twice daily toothbrushing with fluoridated toothpaste, and payments to heatlh professionals and community health workers for parents/caregivers oral health education and counselling could have a major impact on reducing ECC prevalence. Also, the importance of aligning multiple strategies to be prevented and control dental caries was one of the themes at the US and European Meeting on Shaping the Future of Dental Education[69] (Figure 4). The collaborative involvement of a broad range of dental and wider stakeholders is necessary to bring about changes in policy and practice in order to reduce the burden of ECC. This is why the companion policy brief, "IAPD Bangkok Declaration", has been produced.[70]

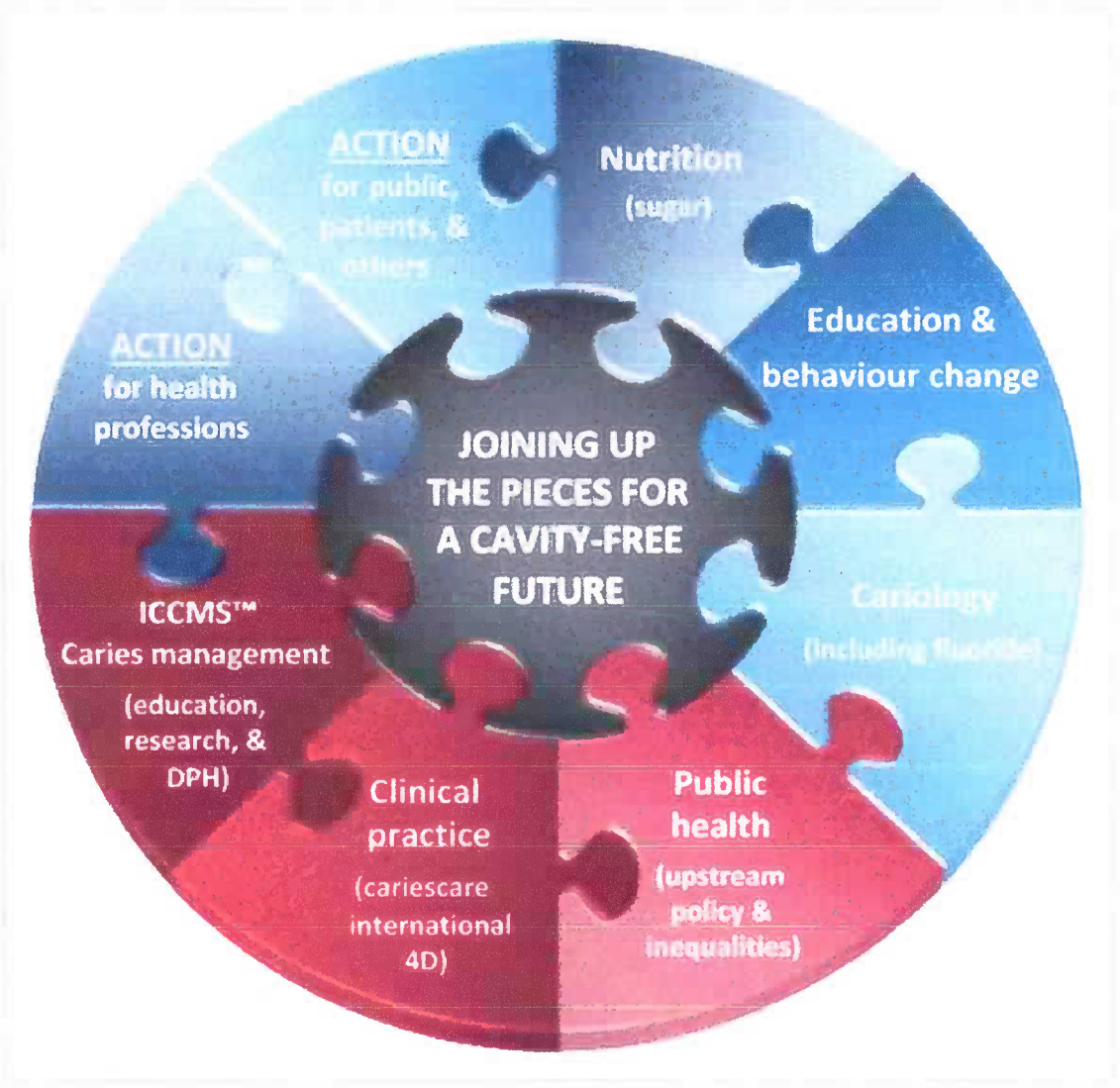

Figure 4

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The "Caries Puzzle" showing the importance of aligning multiple actions if dental caries is to be prevented and controlled to maintain children cavity free (adapted from reference69)

10 CONCLUSIONS

Early childhood caries remains a highly prevalent worldwide disease that has high costs to society and has a major impact of parents' and children's quality of life. Approaches to reduce its prevalence include:

Management of the disease process that start in the first year of a child's life, and depending on the needs of the child includes primary, secondary, and tertiary prevention.

Evidence-based education and risk-based reimbursement systems that foster a shift from surgical to preventive care.

Preventive approaches for all pre-school children should include: (a) avoiding sugar intake for children under age two; (b) limiting sugar intake in children over age two; and (c) brushing their teeth twice daily with fluoridated toothpaste (at least 1000 ppm), using an age-appropriate amount of paste.

Further research on ECC preventive management, oral health-related quality of life, and health economics to support the benefits of worldwide benefits of reducing its prevalence.

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