

Early childhood caries in Indigenous communities

A joint statement with the American Academy of Pediatrics

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Abstract

The oral health of Indigenous children of Canada (First Nations, Inuit and Métis) and the United States (American Indian and Alaska Native) is a major child health issue. This is exemplified by the high prevalence of early childhood caries (ECC) with resulting adverse health effects, as well as high rates and costs of restorative and surgical treatments under general anesthesia. ECC is an infectious disease that is influenced by multiple factors, including socioeconomic determinants, and requires a combination of approaches for improvement. The present statement includes recommendations for oral health preventive and clinical care for young infants and pregnant women by primary health care providers, community-based health promotion initiatives, oral health workforce and access issues, and advocacy for community water fluoridation and fluoride varnish program access. Further community-based research on the epidemiology, prevention, management and microbiology of ECC in Indigenous communities would be beneficial.

Key Words: *American Indians; Dental caries; Early childhood caries; First Nations; Indigenous; Oral health*

Indigenous children of Canada (First Nations, Inuit and Métis) and the United States (American Indian and Alaskan Native [AI/AN]) face many health disparities compared with the general American and Canadian populations. Oral health disparities for Indigenous children exemplify many of the inequities as well as the major need for health promotion, disease prevention and early care services in their communities. Various organizations have guidelines that include health promotion, disease prevention and early visits for dental care; however, the severity of dental disease and the barriers to care in Indigenous communities require special consideration.

Early childhood caries (ECC) is defined as the presence of tooth decay involving any primary tooth in a child younger than six years of age ^[1]. Also referred to as early childhood tooth decay in the vernacular (and formerly called baby bottle tooth decay), the term 'ECC' more effectively reflects the complexity of the disease process, which involves transmission of infectious bacteria, dietary habits and oral hygiene. ECC is an infectious disease, with *Streptococcus mutans* being the most dominant causative organism. The causative triad for caries includes the presence of cariogenic bacteria, diet (exposure to fermentable carbohydrate) and host susceptibility (integrity of tooth enamel). ECC has been termed the most prevalent paediatric infectious disease and the most common chronic disease of children ^[2].

The effects of ECC go beyond the oral cavity and influence overall childhood health and well-being, which are already compromised for many Indigenous children. ECC has been associated with other infectious diseases, such as respiratory tract infections and acute otitis media in the first year of life; however, the relationships are weak and may indicate common risk factors ^[3]. When left to progress, ECC can become painful, resulting in altered chewing, eating and sleeping patterns in addition to potential growth restriction ^[3]. Early tooth loss as a result of ECC may result in speech difficulties and associated self-esteem issues because of altered appearance. Children with ECC are known to be at increased risk of decay in both primary and permanent dentition, and may also experience malalignment and crowding of permanent teeth, resulting in poor bite ^[4]. Dental caries has also been associated with obesity in children from families of low socioeconomic status, possibly from common risk factors ^[5]. The other consequence of more severe ECC is that it frequently requires extensive treatment under general anesthesia - a procedure all too common among Indigenous children ^[6].

Oral health status of Indigenous children

The poor oral health of Indigenous children in Canada and the United States is a major public health issue. In some Canadian Indigenous communities, the prevalence of ECC exceeds 90%^[4]. Similarly, in the United States, the disparities in oral health for Indigenous children are significant and may be increasing. A 1999 Indian Health Services (IHS) survey of 2663 AI/AN children between two and five years of age revealed that 68% had untreated decay – more than three times greater than the rate found in children from the National Health and Nutrition Examination Survey (19%)^[7]. The same survey showed that 60% of AI/AN preschool children had severe ECC constituted by decay on a maxillary incisor, or six or more decayed teeth. When compared with a similar survey from 1991, a statistically significant increase in the number of decayed, missing and filled teeth was found in AI/AN children^[7].

One of the major consequences of more severe ECC is the need for paediatric dental surgery under general anesthesia with the related economic burdens of health care fees and transportation and accommodation costs for families traveling from remote communities to urban centres^[8]. Unfortunately, in addition to the potential health risks of general anesthesia, the benefits of rehabilitative treatment under general anesthesia may be short-lived because relapse and recurrent decay are common if proper oral hygiene behaviours are not maintained postoperatively^{[9][10]}. The reliance on and necessity of operative treatment of ECC is evidenced by the fact that paediatric dental surgery is the most common outpatient surgical procedure performed in many Canadian paediatric hospitals^[11], with substantial wait times^{[12][13]}. Recent studies also suggest that a significant number of First Nations children with dental caries require repeat dental procedures under general anesthesia^[6].

Risk factors for ECC

There are a multitude of risk factors associated with ECC; however, the single greatest risk factor for ECC is poverty^[14]. Unfortunately, Indigenous children in the United States and Canada face poverty rates that are more than double those of the general population, with approximately 52% of Canadian First Nations children living in poverty^{[15][16]}; 36% of AI/AN children in the United States and up to 60% of children of single parents residing on reservations live in poverty^[17].

The infectious disease model of caries suggests the influence of poverty, household crowding, family size, nutrition, health behaviours, parenting practices and other risk factors. An association is found between parents' oral health status and the oral health status of their infants^[18]. Dietary factors influence

the availability of fermentable carbohydrates required for caries formation but also influence host susceptibility because primary tooth enamel development is influenced by prenatal and early infant nutrition^[19]. Among American Indigenous populations, ECC has been found to be associated with parenting practices such as prolonged use of the bottle or training cups with sugar-containing drinks and a high frequency of sugary snacks per day^{[19][23]}. Environmental tobacco smoke and maternal smoking status have been associated with an increased risk of caries among children^{[24][25]}.

Prevention strategies

Restorative or surgical treatment of ECC is challenging and costly for all children, especially for those from remote communities, and is unlikely to solve dental disease in Indigenous communities. Disease prevention is likely to be the most cost-effective alternative and the best long-term solution to oral health problems in these communities^[26]. Primary prevention of dental disease not only preserves healthy teeth but decreases the current tremendous demand for restorative and surgical care. With ECC being the result of the interplay of oral bacteria, substrate and host, as well as family, economic and social conditions, health promotion strategies that emphasize community development and address the determinants of health are required, as are strategies that focus on disease prevention^{[27][28]}. This will require collaboration among Indigenous communities, dental, primary care and public health practitioners, and decision makers, policy makers and researchers involved with young children.

Oral health promotion Oral health promotion, similar to overall health promotion, should be part of a total healthy living strategy because many health disparities have similar underlying issues. Examples include socioeconomic challenges, food availability and costs of nutritious choices in remote communities, exposure to environmental tobacco smoke, and unacceptably low rates of breastfeeding and nutritious food awareness, access and availability.

Disease prevention Unfortunately, the first dental experience for many Indigenous children is for treatment resulting from caries rather than for preventive care. In fact, regular dental visits are not the norm for many Indigenous children^[29]. Perceptions that deciduous teeth are not important, and the acceptance that ECC and dental surgery are inevitable parts of childhood can be barriers to adopting available prevention strategies^{[29][30]}. These barriers may be reduced by increasing awareness of the importance of oral health to the overall well-being of the child; of the consequences of poor oral health including the risks of general anesthesia; and that ECC is a potentially preventable disease.

ECC prevention should start during the prenatal period, progress through the perinatal period, and continue with the

mother and infant within the context of the family and during preschool programs^{[31][32]}. Given the evidence for vertical transmission of cariogenic bacteria, primarily from mother to child, involving pregnant women in oral health screening, dental treatment and education on oral health hygiene, bolstering their nutrition and encouraging the use of fluoride toothpaste are strategies that can assist in the prevention or delay of ECC^[31]. Recent guideline documents support the safety of dental care in pregnancy to reduce or delay ECC in infants^{[33][34][35]}. Prenatal visits may also provide an opportunity to increase awareness of the importance of oral health for mothers and their infants.

Fluoride Many national and international organizations, agencies and governments, including the World Health Organization, the United States Surgeon General, the United States Centers for Disease Control and Prevention, Health Canada, the American Dental Association, the American Academy of Pediatric Dentistry, the Canadian Dental Association, the Canadian Academy of Paediatric Dentistry, the American Academy of Pediatrics and the Canadian Paediatric Society, strongly endorse the use of fluoride for the prevention and control of caries. Fluoride is recognized by the American Dental Association, the American Academy of Pediatric Dentistry and the Canadian Dental Association as a safe and highly effective strategy in the prevention and control of caries^{[36][40]}. Multiple products provide fluoride. Effectiveness may require adherence (eg, toothpastes) or access to dental care or funding (eg, fluoride varnish).

Water fluoridation is regarded as effective, inexpensive, not requiring daily adherence by individuals and promoting equity because it benefits everyone regardless of socioeconomic status^{[2][41]}. The World Health Organization reports that fluoridation has substantial advantages, especially for high-risk groups, when it is culturally acceptable and technically feasible^[42]. The results of a recent unpublished study performed in Alaskan communities demonstrated a reduction in caries by 30% to 50% with community fluoridation, even when other risk factors were accounted for (personal communication, Michael Bruce, Arctic Investigations Program, Centers for Disease Control and Prevention, Alaska, USA, June 6, 2009). In North America, there is wide disparity in the access to water fluoridation. It is estimated that 45% of Canadians benefit from access to fluoridated water^[43], whereas in 1998, less than 10% of First Nations people living on reservations had access to fluoridated water^[44]. In 2006, 69% of United States residents were served with community water fluoridation^[45]. The role of public controversy in hindering the uptake of water fluoridation in Indigenous communities has not been documented.

Topical fluorides have been found to be effective in preventing caries. A Cochrane Collaboration review found that fluoride varnish substantially reduces tooth decay in both primary and permanent teeth^[46]. A randomized controlled trial of

fluoride varnish offered at least two times per year in Indigenous communities in northern Ontario^[47] found an 18% reduction in the two-year mean caries increment in participating Indigenous children, and an adjusted OR for caries incidence that was nearly two times higher in the control group than in the fluoride varnish group. In that trial, Lawrence et al suggested that costs of fluoride varnish, although low, can be reduced and access could be improved through the expansion of providers of fluoride varnish applications to include other dental health workers (such as dental hygienists, dental therapists and dental assistants) and primary care providers (such as public health nurses, physician assistants and other community health workers) trained to administer fluoride varnish^[47]. In more than 140 Canadian First Nations communities participating in the Children's Oral Health Initiative program, dental professionals and trained aides apply fluoride varnish^[48]. Similar initiatives exist in the United States, with 37 states providing primary care provider reimbursement for preventive oral health services, including fluoride varnish application, to Medicaid-eligible children younger than three years of age during well-child visits (personal communication, Amos S Deinard, Department of Pediatrics, University of Minnesota, Minneapolis, USA, November 22, 2009)^[49]. The application of fluoride varnish at the conclusion of 'well-child' visits but before vaccinations at an IHS paediatric clinic was believed to be an effective way of reaching more AI/AN children^[50]. IHS considers four or more topical applications of fluoride varnish between nine and 24 months of age to be the best practice for children participating in Head Start programs in the United States^[51].

According to the American Academy of Pediatric Dentistry, the Canadian Dental Association, the American Academy of Pediatrics and the Canadian Paediatric Society, fluoride supplements are appropriate for children at high risk of dental caries and may be necessary if the patient is not receiving adequate fluoride from other sources such as water and toothpaste^{[37][40]}. Most Indigenous children fit into the high dental caries risk category, and few Canadian Indigenous communities have access to fluoridated drinking water. Importantly, however, adherence can be an issue with supplements, especially in children who are at greatest risk. A recent systematic review of fluoride supplementation concluded that the evidence for the prevention of caries in primary teeth is weak and inconsistent^[52]. Health Canada's First Nations and Inuit Health Branch does not recommend fluoride supplementation for First Nations children, putting more emphasis on oral hygiene, fluoride varnish and fluoridated toothpaste (personal communication, Dr P Cooney, Chief Dental Officer, Health Canada, Ottawa, Ontario, March 23, 2010)^[53].

The Canadian Dental Association and American Academy of Pediatric Dentistry guidelines support the use of fluoridated toothpaste twice daily: children (two to five years of age in the American Academy of Pediatric Dentistry guideline and three to six years of age in the Canadian Dental Association guide-

line) should be assisted during brushing using a small amount (eg, green pea-size portion) of fluoridated toothpaste, and infants (younger than two years of age in the American Academy of Pediatric Dentistry guideline and younger than three years in the Canadian Dental Association guideline) should have their teeth brushed by an adult using a minimal amount or rice grain-size portion of fluoridated toothpaste, especially in children at high risk of dental caries ^{[37][38]}. Because of the high risk of dental caries in Indigenous children, supervised use of fluoridated toothpaste for Indigenous children, starting at the first tooth eruption, should be encouraged.

Sealants Sealants have traditionally been used on occlusal tooth surfaces to protect pits and fissures from dental caries. Recent reviews determined that there is consensus that in populations at high risk of dental caries, such as First Nations and Inuit populations, all children should receive sealants, with some literature supporting the placement of sealants on both primary and permanent molars ^{[54][55]}. However, the use of sealants for primary teeth may need to be promoted because some dental professionals consider sealants for permanent teeth only.

Access to early oral health care and the role of primary health care providers

A measure of the geographical and workforce barriers to ECC prevention and care is the 1999 survey of oral health in AI/AN ^[56], which demonstrated that 68% of AI/AN children two to five years of age had untreated caries, compared with only 19% of the total number of children in the United States. In the face of this ECC epidemic in AI/AN communities, there are severe dental workforce shortages. The dentist to population ratio is 1:2800 for AI/AN communities, compared with the United States average of 1:1500 ^[56]. This is unlikely to improve in the near future because the IHS vacancy rate for dentists is higher than it has been for many years and is currently at 24%, despite recruitment efforts ^[57]. Innovative approaches for recruitment and human resource planning are required, including the expanded roles of other members of the dental health team and other primary care providers in oral health with a focus on the delivery of preventive strategies.

A number of professional associations, including the American Academy of Pediatric Dentistry, the Canadian Dental Association, the American Academy of Pediatrics and the Canadian Paediatric Society, call for comprehensive dental health care through dentists and an oral health examination for infants within six months after the first tooth erupts or by 12

months of age ^{[58][59]}. A lack of access to dental care contributes to the oral health disparities experienced by AI/AN ^[60] and Canadian Indigenous children. Unfortunately, many dentists and primary care providers are still unaware of these new recommendations, or are hesitant to examine and treat very young patients because of inadequate education or training; this limits access to early preventive care for high-risk populations ^[61]. Inadequate numbers of dentists, and the challenges of recruiting and retaining dentists in IHS clinics, tribal health facilities and remote Indigenous communities cause significant issues for access. In some Indigenous communities, other members of the oral health team provide components of a comprehensive oral health program supported by dentists. Health Canada supports training and using dental therapists for First Nations communities ^[48]. Dental therapists are commonly used in northern communities of some Canadian provinces and territories, and more recently, a dental health aide program has evolved in Alaska. The effective use of appropriate dental health aides is regarded by some in the American Dental Association as key to improving the oral health of Alaskan Native individuals ^[26]; however, there is some disagreement regarding the extent of the roles and scope of practice of the various types of dental health aides.

Primary care providers in various Indigenous communities in North America (paediatricians, family physicians, nurse practitioners, community health nurses, physician assistants, etc) are in unique positions to complement the work of dental health professionals. These health care providers are often afforded the opportunity to examine young children long before they are seen by dental personnel. In many Indigenous communities, well-baby, infant health and immunization clinics are provided on a regular basis through community health nurses and physicians. These providers have an opportunity to emphasize the importance of good oral health practices as part of their overall health promotion activities. Furthermore, they may be able to provide oral health screening for infants and young children, and arrange referrals to dental health professionals. The American Academy of Pediatrics, through its Oral Health Initiative, has developed training programs for children's oral health to integrate these concepts into routine paediatric care ^[62]. This training helps complement the current American Academy of Pediatrics policy statements on oral health for children ^{[39][58]}.

Oral health recommendation for Indigenous communities

Refer to Table 1 for the evidence grades of the recommendations ^{[63][64]}. Refer to Table 2 and Table 3 for definitions of the grades of recommendations and levels of evidence or certainty.

TABLE 1
Levels of evidence and grade of recommendations for individual-level 'clinical/prevention' recommendations

Recommendation	US Preventive Services Task Force [63]		Canadian Task Force on Preventive Health Care [64]	
	Grade	Level of Certainty	Grade	Level of Evidence
Utilize motivational interviewing and anticipatory guidance for the parents and caregivers of infants and children on oral hygiene and diet	B	Moderate	B	II-3
Promote the supervised use of fluoridated toothpaste in all Indigenous and other high-risk children after the first tooth has erupted ('smear' of toothpaste for infants and 'green pea-sized' amount for children)	A	High	A	I
Community health nurses, family physicians, or paediatricians should perform oral health screening during child health assessments and provide referrals as needed to dental health providers	B	Moderate	B	II-3
Provide women with preconception and prenatal screening for oral health, anticipatory guidance for oral health and hygiene, and referral for dental care if required	B	Moderate	B	I
Ensure that all Indigenous children have access to a) the series of fluoride varnish, and b) an assessment to determine the need for sealant placement on deep grooves and fissures.	A A	Moderate High	A A	II-1 I

US United States. References are provided in parentheses in the headings. Refer to Appendix 1 (available at www.cps.ca) for definitions of the grades of recommendations and levels of evidence or certainty.

Clinical care

- ECC should be considered to be an infectious disease influenced by a variety of factors including socioeconomic conditions, parenting practices, and maternal and infant nutrition.
- Early childhood oral health should be included as part of overall childhood health and well-being.
- Oral health should be discussed during well-child care visits, using motivational interviewing and anticipatory guidance for the parents and caregivers of infants and children regarding oral hygiene and diet.
- Supervised twice-daily use of fluoridated toothpaste should be promoted in all Indigenous and other high-risk children after the first tooth has erupted (rice grain-size portion of toothpaste for infants and green pea-size portion for children).
- Community health nurses, family physicians or paediatricians should perform oral health screening during early

childhood health assessments and provide referrals as needed to dental health providers.

- Women of Indigenous communities should be provided access to receive preconception and prenatal screening for oral health, anticipatory guidance for oral health and hygiene, and referral for dental care if required.
- Primary care providers should be aware of the access to fluoride in the drinking water for the various Indigenous communities in their service area.

Community-based promotion initiatives

- Change should be promoted in Indigenous communities to alter practices of frequent consumption of sugar-containing drinks and sugary snacks through education and improving the selection of foods available in the communities.
- Community-based activities should be used to emphasize the importance of oral health for the pregnant woman and her infants.

Workforce and access issues

- Early access to dental health professionals (ie, establishing a dental home) should be provided by 12 months of age to provide the full range of oral health promotion and interceptive disease prevention services.
- All Indigenous children should have access to the evidence-based schedule for fluoride varnish and an assessment to determine the need for sealant placement on deep grooves and fissures on primary teeth. Alternative health or child care professionals and dental auxiliaries (or trained lay child care workers such as early childhood development workers) should be used to ensure access to fluoride varnish programs. Fluoride varnish can be provided as part of a regular child health clinic program (well or sick visit) by trained health auxiliaries, community health workers, family physicians or paediatricians. Where specific programs are available, participation should be encouraged.
- Oral health services should be provided to pregnant women of Indigenous communities to have their teeth cleaned and examined, and to have any needed periodontal and dental work performed before their baby is born.
- Roles other dental health and primary health care providers can assume should be considered in areas where it is difficult to recruit and retain an adequate number of dentists to provide oral health services and promote an early dental visit by the first year of life.
- Adequate cultural competency training opportunities should be provided for dentists, dental hygienists, therapists and assistants to work in Indigenous communities. Increased representation of Indigenous people in oral health professions should be advocated.
- Oral health training should be incorporated into paediatric and family medicine residency programs.

Advocacy

- Indigenous communities should be provided with information regarding water fluoridation, and opportunities for fluoridation (capital and maintenance costs, and training for operators) of the community drinking water should be advocated within and for Indigenous communities.
- Appropriate funding for access to fluoride varnish programs as well as for other oral health prevention and treatment services to Indigenous populations should be advocated.

Research

- Additional community-based participatory research on the epidemiology, prevention, management and microbiology of ECC in Indigenous communities and ECC prevention projects should be supported.

Recommended resources

- American Academy of Pediatric Dentistry. [Guideline on Fluoride Therapy](#). Chicago: American Academy of Pediatric Dentistry, 2008. (Accessed on April 15, 2011).
- American Academy of Pediatrics. [Oral Health Risk Assessment](#). Training for Pediatricians and Other Child Health Professionals. (Accessed on April 15, 2011).
- American Academy of Pediatrics, Section on Pediatric Dentistry and Oral Health. [Preventive oral health intervention for pediatricians](#). *Pediatrics* 2008;122:1387-94. (Accessed on April 15, 2011).
- Casamassimo P, Holt K, eds. *Bright Futures in Practice: Oral Health – Pocket Guide*. Washington: National Maternal and Child Oral Health Resource Center, 2004.
- [Indian Health Service Head Start](#)
 - Oral Health for Head Start Children: Best Practices
 - IHS Head Start Oral Health Tools and Resources. (Accessed on April 15, 2011).
- Oral Health and the Aboriginal Child: [Knowledge Transfer Site](#). (Accessed on April 15, 2011).

TABLE 2
Grades of recommendations

Grade	US Preventive Services Task Force	Canadian Task Force on Preventive Health Care
A	High certainty that the net benefit is substantial	Good evidence to recommend
B	High certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial	Fair evidence to recommend

C	Recommends against routinely providing the service. There may be considerations that support providing the service in an individual patient. At least moderate certainty that the net benefit is small	Existing evidence is conflicting and does not allow to make a recommendation for or against; however, other factors may influence decision-making
D	Recommends against the service. Moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits	Fair evidence to recommend against the action
I	Current evidence is insufficient to assess the balance of benefits and harms. Balance of benefits and harms cannot be determined	Insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

TABLE 3
Levels of evidence or certainty regarding the net benefit

US Preventive Services Task Force		Canadian Task Force on Preventive Health Care	
Level of Certainty	Description	Level of Evidence	Description
High	Evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects on health outcomes. This conclusion is, therefore unlikely to be strongly affected by the results of future studies	I	Evidence obtained from at least one properly randomized trial
		II-1	Evidence obtained from well-designed controlled trial without randomization
Moderate	<p>The evidence is sufficient to determine the effects of the service on health outcomes, but confidence in the estimate is constrained by such factors as the following:</p> <ul style="list-style-type: none"> • Number, size, or quality of studies • Inconsistency of findings across studies • Limited generalizability of findings • Lack of coherence in the chain of evidence <p>As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion</p>	II-2	Evidence obtained from well-designed cohort or case-controlled analytic studies, preferably from more than 1 center or research group
		II-3	Evidence obtained from comparisons between times and places, with or without the intervention. Dramatic results in uncontrolled experiments could also be included in this category
Low	<p>The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of the following:</p> <ul style="list-style-type: none"> • Limited number or size of studies • Important flaws in study design/methods • Inconsistency of findings across studies • Gaps in the chain of evidence • Findings not generalizable 	III	Opinions of respected authorities based on clinical experience, descriptive studies or reports of expert committees

<ul style="list-style-type: none"> • Lack of information on important health outcomes <p>More information may allow estimation of effects of health outcomes.</p>		
<i>US United States</i>		

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