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Early Childhood Caries in Indigenous Communities

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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 disparity when compared with the general population of both countries. Early childhood caries (ECC) occurs in Indigenous children at an earlier age, with a higher prevalence, and at much greater severity than in the general population. ECC results in adverse oral health, affecting childhood health and well-being, and may result in high rates of costly surgical treatment under general anesthesia. ECC is an

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infectious disease that is influenced by multiple factors, but the social determinants of health are particularly important. This policy statement includes recommendations for preventive and clinical oral health care for infants, toddlers, preschool-aged children, and pregnant women by primary health care providers. It also addresses community-based health-promotion initiatives and access to dental care for Indigenous children. This policy statement encourages oral health interventions at early ages in Indigenous children, including referral to dental care for the use of sealants, interim therapeutic restorations, and silver diamine fluoride. Further community-based research on the microbiology, epidemiology, prevention, and management of ECC in Indigenous communities is also needed to reduce the dismally high rate of caries in this population.

INTRODUCTION

Indigenous children of Canada (First Nations [FN], Inuit, and Métis) and the United States (American Indian and Alaska native [AI/AN]) face significant health disparities compared with non-Indigenous populations. The oral health disparities Indigenous children experience exemplify the inequities and major need for oral health promotion, caries prevention, and early, locally available dental care services for them. Although general guidelines on oral health promotion, caries prevention, and risk assessment exist, the severity of dental disease and the barriers to care in Indigenous communities require special consideration.

Early childhood caries (ECC) is defined as tooth decay in any primary tooth in a child younger than age 6 years.¹ Also referred to as early childhood tooth decay or baby-bottle tooth decay, the term ECC better characterizes the disease as complex and involving transmission of infectious bacteria, dietary habits, and oral hygiene. ECC is an infectious disease, with *Streptococcus mutans* being the most commonly recognized causative organism. The causative triad for caries includes cariogenic bacteria, fermentable carbohydrates, and host susceptibility (integrity of tooth enamel). Caries has been described as the most prevalent pediatric infectious disease and the most common chronic disease of children.²

Tooth loss as a result of ECC may result in malocclusion and low oral health–related quality of life.³ Children with ECC are at increased risk of further caries throughout childhood and adolescence.^{4,5} 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.^{3,6-8}

Severe early childhood caries (S-ECC) is an aggressive form of ECC and is classified by location of the caries, number of teeth affected, and age.¹ S-ECC commonly requires surgical treatment under general anesthesia (GA).⁹ Children with S-ECC experience more nutritional problems, including iron-deficiency anemia, low vitamin D, and overweight or obesity. S-ECC that penetrates the tooth pulp can lead to painful dental infections or abscesses and, rarely, death.^{6-8,10}

ORAL HEALTH STATUS IN INDIGENOUS CHILDREN

In 2011, the prevalence of ECC in 3- to 5-year-old FN and Inuit children was 85%, and the prevalence of S-ECC was as high as 25%.¹¹⁻¹³ Oral health surveys performed by the Indian Health Service (IHS) in 2014 revealed that 75% of AI/AN children between the ages of 3 and 5 years had ECC, and in many communities, the caries rate was >90% (5 times greater than that of the general US child population).^{14,15} The true burden of ECC in Indigenous children is not only the disparate ECC prevalence but also the disease severity. The average number of decayed or filled teeth in AI/AN children 2 to 5 years old was 5.8, almost 5 times that of the general US preschool population.^{15,16}

An important consequence of ECC severity is the need for dental surgery under GA.^{9,13,17} Rehabilitative surgery is expensive and carries the potential risks of GA. Overall, the rate of dental surgery to treat ECC under GA in Canada was 7 times higher for children from communities with a high proportion of Indigenous peoples than communities with lower Indigenous populations.^{9,17} In the more remote Indigenous regions of Canada, the rates of dental surgery under GA exceed 200 per 1000 children younger than 5 years each year, a rate 15 times higher than the overall annual Canadian rate.^{9,17} Exact data on the overall number of AI/AN children undergoing dental surgery for caries are limited, but one study in the Yukon–Kuskokwim Delta of Alaska reported that by 6 years of age, 73% of Alaska native children had undergone dental surgery under GA, a rate at least 50 times that in the general US population.¹⁸

EPIDEMIOLOGY OF ECC

Indigenous children often develop ECC at earlier ages than other children. The 2014 IHS Oral Health Survey reported that 21% of AI/AN 1-year-olds and 40% of AI/AN 2-year-olds had caries, whereas most dental surveys suggest ECC is rare among US children before 12 months of age, and only 10% of US children younger than 2 years have ECC.¹⁹ The etiology of ECC in Indigenous children is multifactorial. The typical “window of infectivity” for the acquisition of cariogenic microorganisms, including *S mutans*, is between 19 and 31 months. However, 2 recent studies reported that AI/AN children acquire *S mutans* at earlier ages: 37% of 12-month-olds and 60% of 16-month-olds had *S mutans* colonization.^{20,21} Additionally, primary teeth erupt at an earlier age in AI/AN infants, which may result in earlier *S mutans* colonization and earlier progression to caries.²² Authors of a recent review of caries reiterate that newly erupted teeth are much more prone to caries.²³ Additionally, a recent study of Canadian FN children revealed that children with S-ECC had a significantly different plaque microbiome than their caries-free counterparts, with the S-ECC group harboring higher levels of known cariogenic organisms, particularly *S mutans*.²⁴ The early acquisition of *S mutans* in Indigenous children is likely mediated by factors associated with poverty, including household crowding, family size, nutrition, and other health behaviors.²⁵ Unfortunately, Indigenous children in the United States and Canada experience poverty at rates 2 to 3 times greater than the general population. For children younger than 5 years, 52% of FN children live in poverty, as do 25% Inuit and 23% of Métis children, compared with 13% of nonracialized Canadian children.²⁶ More than 37% of AI/AN children in the United States live in poverty, compared with 10% of their white American counterparts.²⁷

Other known ECC risk factors are commonly found in Indigenous children. Caries in parents is associated with increased risk in their infants.²⁸ ECC is also associated with prolonged bottle-feeding, consumption of sugar-containing drinks, high frequency of sugary snacks,²⁹⁻³³ and exposure to tobacco smoke.^{13,34} Breastfeeding for up to 12 months of age can reduce ECC risk by half, most likely via immune-modulating effects and promotion of a healthy microbiome. Furthermore, a recent study demonstrated that breastfeeding did not provoke a decrease in biofilm pH and, therefore, did not facilitate ECC.³⁵ If the infant breastfeeds to sleep, the gums and erupting teeth should be wiped to minimize the risk of caries.³⁶ However, breastfeeding beyond 12 months of age, especially with at-will nighttime feeding, is associated with increased risk of ECC.³⁷⁻³⁹ Obesity has also been shown to be associated with ECC, although it is unclear whether this risk occurs independently from dietary factors.^{3,10,40-42} In addition, gestational diabetes, which is prevalent in Indigenous populations, may have an effect on early childhood dental development and caries risk.⁴³⁻⁴⁵

PREVENTION STRATEGIES

Prenatal Oral Health Care

ECC prevention is optimal if initiated prenatally.⁴⁶ Given the evidence for transmission of cariogenic bacteria from mother to child, routine dental assessments and preventive dental care, oral hygiene education, optimal prenatal nutrition, and the use of fluoride toothpaste for pregnant women are strategies that may prevent or delay ECC in their children.⁴⁶ Recent guidelines conclude that dental care in pregnancy is safe.⁴⁷⁻⁴⁹

Fluoride

All major Canadian and American dental and pediatric societies endorse the use of fluorides as safe and effective for caries prevention.⁵⁰⁻⁵⁴ All of the aforementioned organizations support the use of fluoridated toothpaste twice daily for all children. They recommend that children younger than 3 years have their teeth brushed by an adult with a grain of rice-sized portion of fluoridated toothpaste and that children 3 to 6 years of age be assisted with brushing with a green pea-sized portion of fluoridated toothpaste.^{51,52}

Community water fluoridation is safe, effective, and inexpensive and does not require daily adherence.^{55,56} Community water fluoridation in AN communities has been associated with a 40% reduction in caries.⁵⁷ In North America, there is wide disparity in the access to community water fluoridation. In 2017, 38.7% of Canadians using community water supplies had access to fluoridated water, compared with only 2.3% of FN people.⁵⁸ Although 74.4% of US residents had access to fluoridated community water, only 50% of Alaskans received fluoridated community water, with only 5.3% receiving optimal fluoride levels.^{18,59}

Topical fluorides have been shown to be effective in preventing caries.^{18,59} Studies in Indigenous children in Canada and the United States have shown reduction in caries with fluoride varnish, although the results were not statistically significant.^{60,61}

These modestly favorable results for fluoride varnish in AI/AN children are tempered by 2 larger studies with longer follow-up. First, a 5-year IHS program targeting AI/AN

children initially resulted in a small decrease in ECC in children younger than 2 years, but these benefits were lost for children 2 to 5 years of age.⁶² A second cluster-randomized controlled trial (RCT) testing 4 fluoride varnish applications (and oral health-promotion activities) by trained tribal health workers in Head Start classrooms did not yield a reduction in ECC.⁶³ These studies suggest that fluoride varnish should be initiated with the first tooth eruption in Indigenous children to achieve maximal benefit. Although the data on fluoride varnish are mixed for Indigenous populations, fluoride varnish is still recommended because the potential benefits far outweigh any risks. Fluoride varnish applications help to enhance both the mineralization of healthy enamel (making it more resistant to caries) and the remineralization of early incipient caries lesions (ie, white spot lesions) in primary and permanent teeth that have not yet progressed to the cavitation (ie, cavity) stage. The American Dental Association still recommends fluoride varnish for all children. However, the challenge is that fluoride varnish is not effective in arresting and remineralizing more advanced lesions that have cavitated through the enamel (ie, cavities), which are known to be more prevalent in young Indigenous children. Therefore, early applications of fluoride varnish to newly erupted teeth, beginning at the eruption of the first primary tooth at the 6-month developmental age milestone, is paramount.

Oral Health Education

Evidence surrounding the effectiveness of conducting dental examinations and provision of parental counseling to prevent ECC in preschool-aged children is mixed.^{60,61,64,65} Studies of oral health education in Indigenous families resulted in increased parental knowledge but rarely demonstrate reduction in caries.^{63,66} One large RCT of motivational interviewing in parents of AI preschool-aged children reported increased parent and caregiver knowledge but no reduction in ECC.⁶³ A previous Canadian RCT reported that motivational interviewing was associated with a reduction in the degree of severe caries among Cree children in northern Quebec.⁶⁴ Other studies suggest that oral health education for pregnant women and mothers of infants can reduce S-ECC from 32% to 20%.⁶⁷⁻⁶⁹ Like the early receipt of fluoride varnish, evidence suggests that receiving oral health education at the time of first tooth eruption is more beneficial.

Community-Based Strategies

Evidence is clear that caries were rare in Indigenous communities until the introduction to European settler diets, including refined sugar and other processed foods.⁷⁰⁻⁷³ In Canada, there are several community-based efforts to reduce ECC, some of which promote traditional Indigenous diets.⁷⁴⁻⁷⁷ One program in a Cree community encourages breastfeeding and promotes the introduction of traditional first foods instead of processed infant foods.⁷⁸ These efforts are promising, but there are no data regarding their effects on ECC.

ASSESSMENT AND TREATMENT STRATEGIES

Caries Risk Assessment

Timely caries risk assessment (CRA) is an important first step to reduce the risk for ECC. Several pediatric and dental organizations have developed easy-to-use CRA tools that can

identify a child's risk of developing caries.⁷⁹ CRAs also assist nondental primary health care providers in assessing the need for anticipatory guidance, fluoride varnish, and referral for dental evaluation.

Sealants

Pit and fissure dental sealants have traditionally been used on occlusal tooth surfaces of permanent molars to reduce dental caries. Recent reviews concur that in populations at high risk of caries, such as Indigenous children, sealants can be placed on primary molars after eruption.^{80,81} Studies suggest that 74% of sealed primary molars remain caries-free and that sealing primary molars is cost-effective in reducing caries progression and the need for operative repair.⁸² The American Dental Association recommends sealants on primary molars and fluoride varnish every 3 to 6 months to arrest or reverse noncavitated carious lesions on the occlusal surfaces of primary teeth.⁸³ However, dental sealants may be challenging to apply on the teeth of infants and toddlers.

Interim Therapeutic Restorations

Minimally invasive dental restorative techniques, such as glass ionomer products, provide a practical option for managing cavitated lesions in young children. Interim therapeutic restorations can be used to restore and prevent caries progression in young and uncooperative children, in children with special health care requirements, and in circumstances in which the placement of traditional restorations is not possible.⁸⁴ Interim therapeutic restorations can be provided by midlevel dental professionals, including dental therapists (DTs) and hygienists, in many locales.

Silver Diamine Fluoride

Silver diamine fluoride (SDF) has been used extensively outside North America for caries arrest, with good results.^{85,86} SDF is indicated for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program.⁸³ SDF will turn the carious lesion hard and black, but this side effect is generally well accepted by parents.⁸⁷ At present, the use of SDF in the United States and Canada is limited to the dental profession, because there are no formal guidelines for its use outside of dentistry.

Frank Mendoza, DDS, an IHS dentist, pioneered the use of silver ion products at a tribal health clinic for caries arrest and demonstrated that only 2% of treated patients needed eventual operative repair.¹⁹ Several other IHS and tribal programs now use SDF, with positive results.⁸⁸ There is an emerging consensus that SDF may be an important treatment option for children at high risk for progression to severe ECC.⁸⁹ If the use of SDF becomes more widespread, primary care health providers will play a critical role in identifying patients for referral and in promoting adherence to treatment. Evidence-based clinical guidelines from the American Dental Association and the American Academy of Pediatric Dentistry for nonrestorative treatment of caries recommend biannual applications of 38% SDF to arrest advanced cavitated lesions on primary teeth, with the recognition that additional applications may occasionally be necessary.⁹⁰

Repair Under GA

Given the prevalence and severity of ECC in Indigenous children, operative repair is often required. However, because ECC is largely preventable, each child requiring operative repair is a costly failure of our preventive and treatment systems. Operative repair is expensive, and prevention is more cost-effective, less painful, and less time-consuming for the patient.^{9,91} Furthermore, the acute risks associated with anesthesia and the evidence that GA in young children may have potential cognitive effects are additional reasons to avoid this consequence of ECC.^{92,93}

Authors of a cost-effectiveness review of preventive interventions such as water fluoridation, fluoride varnish, tooth brushing with fluoride toothpaste, and use of sealants concluded that these interventions are collectively relatively inexpensive and cost-saving and, if fully used, could reduce S-ECC requiring operative repair.¹⁸ The major benefit of increased use of SDF is the arrest of the progression of already established caries and a subsequent reduction in the need for operative repair with GA.

ACCESS TO EARLY ORAL HEALTH CARE

Severe dental workforce shortages in Indigenous communities contribute to the high rates of untreated caries in Indigenous children. The 2014 Oral Health Survey reported the ratio of dentists per person was 1:2800 for AI/AN communities compared with the US average of 1:1500¹⁶ and that 45% of 5-year-old AI/AN children had untreated caries compared with 19% of US children.¹⁵

All major Canadian and American dental and pediatric societies have called for comprehensive dental health care from dentists for children by 12 months of age: the “age-one dental visit.”^{94,95} The chronic shortage of dentists in Indigenous communities suggests we look to expanded roles of other dental providers (eg, DTs and hygienists) and other nondental providers to increase access to oral health care, with an emphasis on preventive services.

In the 1970s, Health Canada supported the use of DTs for FN communities, and many began practice in the northern communities of Canada.⁹⁶ DTs are midlevel dental providers who work under the supervision of a dentist. Reviews of DTs in more than 50 countries reported that DTs expand access to dental care in a safe and effective manner.⁹⁷ Unfortunately, over time, an increasing number of Canadian DTs chose to work in urban settings rather than rural communities. The urban migration of DTs and the ongoing opposition by professional dental societies led the Canadian federal government to discontinue funding DT training programs in 2011.⁹⁸

As Canada was reducing its support for the training of DTs, the Alaska Native Tribal Health Consortium began a dental health aide therapist (DHAT) program. The Alaska DHAT program has been linked to better oral health access and outcomes in remote villages and has been well received by health care providers and community members.⁹⁹⁻¹⁰¹ DHAT programs also have been implemented in tribal clinics in the states of Washington and Minnesota. The National Indian Health Board champions the use of DHATs as a strategy to increase

access to oral health and a legitimate exercise of tribal sovereignty.¹⁰² The Department of Indigenous Services Canada and the Canadian Dental Hygienists Association have recently proposed the reestablishment of a training program for dental therapy that would see dental hygienists complete an extra year of education to be able to provide expanded oral health services.¹⁰³

Primary care providers (pediatricians, family physicians, nurse practitioners, community health nurses, physician assistants, and dietitians) in Indigenous communities in North America are in unique positions to complement the work of dental health professionals. These nondental providers provide early and frequent care to children before they see a dental provider. In many Indigenous communities, well-infant, infant health, and immunization clinics are provided on a regular basis through community health nurses and physicians. These nondental providers have an opportunity to assess children's risk for caries and promote oral health as part of their overall health-promotion activities. In addition, they can provide oral health screening for infants and young children, provide fluoride varnish, and coordinate referrals to dental health professionals. Moreover, because of the high rates of obesity and type 2 diabetes mellitus in Indigenous populations, Indigenous youth may undergo dietary assessments and may be seen by dietitians. These visits provide opportunities for collaboration between primary care and dentistry to encourage limited consumption of sugars, a shared risk factor for both obesity and caries.

ORAL HEALTH RECOMMENDATIONS FOR INDIGENOUS COMMUNITIES

Caries prevention interventions that have worked well in the general population have been less effective in Indigenous children; therefore, the prevention and treatment recommendations described here should be informed by what is known of ECC epidemiology in Indigenous children. Indigenous children acquire *S mutans* colonization at an earlier age, develop caries at an earlier age, and commonly experience severe ECC. The health care community needs to recognize that “two is too late” for preventive interventions in Indigenous children to be successful and that new strategies with earlier intervention are needed to reduce this health disparity.

Community-Based Promotion Initiatives

- Promote changes in Indigenous communities to reduce frequent consumption of sugar-containing drinks and sugary snacks through education and improved access to healthy foods in communities.
- Emphasize the importance of oral health for the pregnant woman and her infant(s) through community-based activities.
- Promote exclusive breastfeeding for the first 6 months and breastfeeding until 12 months of age.
- Ensure that Indigenous communities benefit from community water fluoridation and know the fluoridation level of their water supply.
- Promote collaboration between oral health and obesity and type 2 diabetes mellitus prevention efforts for Indigenous communities.

Clinical Care Recommendations

- Consider early childhood oral health as an integral part of overall childhood health and well-being.
- Ensure that Indigenous women receive preconception and prenatal screening for oral health, anticipatory guidance for oral health and hygiene, and referral for dental care.
- Discuss oral health during well-child care visits with a CRA and anticipatory guidance on oral hygiene and diet, starting with the first tooth eruption.
- Recommend the establishment of a dental home by 12 months of age.
- Promote supervised twice-daily use of fluoridated toothpaste for all Indigenous children beginning with the eruption of the first tooth (rice grain–sized portion of toothpaste for children <36 months of age and a green pea–sized portion for children ≥36 months of age).
- Provide fluoride varnish by either dental or nondental health care providers in primary care settings and by trained lay workers in other settings starting with the first tooth eruption (and then every 3–6 months thereafter).
- Promote the incorporation of SDF into caries management protocols for Indigenous children with ECC to decrease or arrest caries progression and reduce or avoid the reliance on GA to facilitate operative repair.
- Consider promoting the incorporation of interim therapeutic restoration into caries management protocols.
- Consider promoting the use of sealants on primary molars to prevent caries and the need for operative repair.

Workforce and Access

- Provide early access to dental health professionals by 12 months of age to establish a dental home with the full range of oral health–promotion and interceptive disease-prevention services.
- Consider roles that DTs, dental hygienists, and primary health care providers can assume in areas where it is difficult to recruit and retain a sufficient number of dentists to provide early oral health services.
- Ensure that dentists, dental hygienists, DTs, and assistants working in Indigenous communities receive education to practice in a culturally appropriate manner.

Advocacy

- Advocate for an adequate dental workforce that can include the training and use of midlevel professionals such as DTs.
- Advocate for increased representation of Indigenous people in oral health professions.

- Advocate for regular and sustained ambulatory dental care in or near Indigenous communities.

Research

- Support further community-based participatory research on the epidemiology, prevention, management, and microbiology of ECC and ECC-prevention projects in Indigenous communities.

RECOMMENDED RESOURCES

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Appendix

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ABBREVIATIONS

AI/AN	American Indian and Alaska native
CRA	caries risk assessment
DHAT	dental health aide therapist
DT	dental therapist
ECC	early childhood caries
FN	First Nations

GA	general anesthesia
IHS	Indian Health Service
RCT	randomized controlled trial
SDF	silver diamine fluoride
S-ECC	severe early childhood caries

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