Prevalence of Dental Caries Among 7- and 13-Year-Old First Nations Children, District of Manitoulin, Ontario

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Abstract

Purpose: *Dental caries is a disease that, although decreasing in the non-Aboriginal child population, remains high for Canadian Aboriginal and Native American children and adolescents. To address dental health issues in First Nations in the District of Manitoulin, Noojmowin Teg Health Centre initiated a multiphase collaborative research project with the department of community dentistry at the University of Toronto. The purpose of this paper was to identify the prevalence of dental caries in children 7 or 13 years of age and to compare these data with published data for the same age groups from other First Nations communities in Canada.*

Methods: *All children 7 or 13 years of age who were in elementary schools on a reserve in 7 First Nations communities were eligible for a dental health examination as part of the survey. Children attending school off the reserve in 6 of the communities were also eligible.*

Results: *A total of 66 children (56% 7-year-old children, 62% girls) were examined. The mean caries score (deft+DMFT) for 7-year-old children was 6.2; the mean decayed, extracted, filled permanent teeth (DMFT) score for 13-year-old children was 4.1. Overall, 96% of children had 1 or more past or active carious lesion.*

Conclusion: *Results indicate that dental caries is highly prevalent and increasing in severity in this population.*

MeSH Key Words: *child; dental caries/epidemiology; Indians, North American/statistics & numerical data*

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Epidemiologic evidence indicates that the prevalence of dental caries in the permanent dentition among United States and Canadian children and adolescents has been decreasing.[1,2] For example, in 1958–1959 the mean decayed, missing or filled permanent teeth (DMFT) score for 13-year-old children in Toronto was 5.7; in 1999–2000, it had decreased to 1.1.[3] Dental caries, however, is still a significant problem. Currently, in the United States, 20% of children between the ages of 2 and 4 years have detectable caries, and approximately 80% of youth will have had a cavity by the age of 17 years.[4]

Although the prevalence of caries has been decreasing in the general population, it remains high among Canadian Aboriginal and Native Americans.[5–12] A comparison of 2 national oral health surveys[7,8] of Canadian Aboriginal children 6 and 12 years of age conducted in 1990–1991 and, most recently, in 1996–1997, found that the mean decayed, extracted or filled deciduous teeth (deft) score for 6-year-old children increased statistically significantly from 8.2 to 8.7, whereas the mean DMFT score increased nonsignificantly from 0.7 to 0.8. Overall, for children 12 years of age, there was little change in mean DMFT score (4.6 to 4.5).

According to these surveys, 6-year-old Aboriginal children in Ontario had the highest deft score of the 9 regions in the survey; their mean score was 11.1 in 1990–1991,

which increased slightly to 11.7 in 1996–1997. This age group also demonstrated a statistically significant increase in their DMFT score from 0.8 to 1.1. Although not the highest in the country, the mean DMFT score increased slightly from 5.2 to 5.4 for 12-year-old children in Ontario. Two of the communities in the District of Manitoulin were included in the 1990–1991 national survey. For West Bay (now M'Chigeeng) and Wikwemikong, the mean deft+DMFT score was 4.5 for children 6 years of age and the mean DMFT score was 2.6 for children 12 years of age.[7]

Although dental health is improving among Canadian children in the general population, First Nations children continue to demonstrate persistently poorer dental health than their peers. This occurs despite the First Nations and Inuit program from Health Canada that provides payment for a comprehensive list of preventive and dental treatment services, including orthodontics.

It is a common misconception that there is an abundance of studies documenting the dental health of First Nations and Native American children. In fact, current epidemiologic data available at the community level for this group of children and adolescents are limited. Continued research initiatives investigating dental health are warranted.

Since the Noojmowin Teg Health Centre needed baseline data to plan a community-based dental health program to comply with the community board's directive to document and deal with the issue of dental health, an epidemiologic survey was conducted to determine the prevalence of dental caries, calculus and debris scores in children 3, 5, 7 and 13 years of age in the District of Manitoulin. This paper presents the results of a survey of the dental caries found in children 7 or 13 years of age, and compares the findings with published data for the same age groups from other First Nations communities in Canada.

Methods

Research Process

This study received ethical approval from the McMaster University Research and Ethics Board, and was supported by the 4 Aboriginal health boards and committees in the District of Manitoulin. The protocol complied with the standards and procedures outlined in the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.*[13] Conducted in collaboration with local Aboriginal communities and the Noojmowin Teg Health Centre, the study followed a participatory action-research framework.[14,15] The health centre, located on Manitoulin Island, provides both traditional and Western health services to all the residents of all 7 First Nations communities in the district. This framework permitted a collaboration between the university-based investigators and a community-based research steering committee in all phases of the project, including the formulation of research questions, data collection, development of research instruments and interpretation. A research partnership formed between Noojmowin Teg and the external researchers was instrumental in ensuring that the research was seen as community-defined and culturally appropriate. This ensured continued community interest and participation over the duration of the investigation.

Population

We set out to examine all First Nations children aged 7 or 13 years in the 7 First Nations communities in the District of Manitoulin. These age groups were selected because children whose ages are an odd number are surveyed by local health units using the Ontario Ministry of Health's Dental Index System. Seven- and 13-year-old children at all elementary schools on a reserve were identified from classroom lists obtained from each school. Community health representatives (CHRs) serving 6 communities had knowledge of and contact with all families, and identified all children 7 or 13 years of age attending school off the reserve in 6 of the 7 communities. We were unable to identify eligible children attending school off reserves in the seventh community because no CHRs were involved. Children were not examined if they were absent or refused examination on the survey day or their caregiver did not provide written consent. Of an estimated 104 potential participants attending schools both on and off reserves, 66 were examined.

Clinical Examinations

All examinations were conducted over a 4-month period from March to June 2000 by 1 dental hygienist (RT) calibrated to conform to the Ontario Ministry of Health Dental Indices Software Program Manual (unpublished manual, 1997) by another investigator (JLL). The examiner was trained in the community to be surveyed and the session included a half-day seminar to review the nature of epidemiologic surveys, examination and record-keeping; the clinical criteria and numeric codes used; and the safe handling of completed data forms. During a second half-day session, clinical examinations were done for 4 children, followed by a review and resolution of the differences between the trainee and the benchmark examiner. All children were examined with a mirror, blunt probe and consistent light source in their school or home. We examined children at home when we were unable to do so at their school or a clinic. Since precision during these examinations was needed to make future policy decisions, we scored tooth status rather than surface-level caries. We did not repeat examinations because of the limited availability of both the examiner and funding for this study. It was thought that the examiner's time could be best used by servicing children who were hard to reach.

Table 1 Comparison of the dental health of subjects by age and sex

Variable	7-year-old children			13-year-old children		
	Overall	Boys	Girls	Overall	Boys	Girls
Number	37	16	21	29	10	19
% male	43			29		
% caries prevalence	94.6	100.0	91.5	96.6	100.0	92.3
Deciduous teeth, mean ± SD						
Sound and sealed	0.0 ± 0.2	0.1 ± 0.2	0.0 ± 0.0			
Decayed	1.2 ± 1.5	1.4 ± 1.8	1.0 ± 1.2			
Extracted	0.3 ± 0.6	0.3 ± 0.4	0.3 ± 0.7			
Filled	4.0 ± 2.8	3.9 ± 2.7	4.0 ± 3.0			
Scores						
deft, mean ± SD	5.4 ± 3.1	5.6 ± 2.9	5.3 ± 3.3			
Median deft	6.0	6.0	6.0			
% f/deft	74	70	75			
Permanent teeth, mean ± SD						
Sound and sealed	1.1 ± 1.5	0.8 ± 1.3	1.3 ± 1.7	1.2 ± 1.8	0.6 ± 1.3	1.5 ± 2.0
Decayed	0.3 ± 0.7	0.2 ± 0.4	0.4 ± 0.8	0.6 ± 1.1	0.4 ± 1.3	0.6 ± 1.0
Missing	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
Filled	0.4 ± 1.0	0.8 ± 1.3	0.2 ± 0.6	3.6 ± 2.7	4.3 ± 2.7	3.2 ± 2.8
Scores						
DMFT, mean (SD)	0.8 ± 1.1	1.0 ± 1.4	0.6 ± 0.9	4.1 ± 2.6	4.7 ± 2.6	3.8 ± 2.6
Median DMFT	0.0	0.0	0.0	3.0	4.5	3.0
% F/DMFT	50	80	33	88	91	84
Total (deft+DMFT), mean ± SD	6.2 ± 3.3	6.6 ± 3.1	5.9 ± 3.6			
% total filled ratio	71	71	71			

SD = standard deviation; deft = decayed, extracted or filled deciduous teeth; f/deft = proportion deft of teeth filled; DMFT = decayed, missing, or filled permanent teeth; F/DMFT = proportion DMFT of teeth filled.

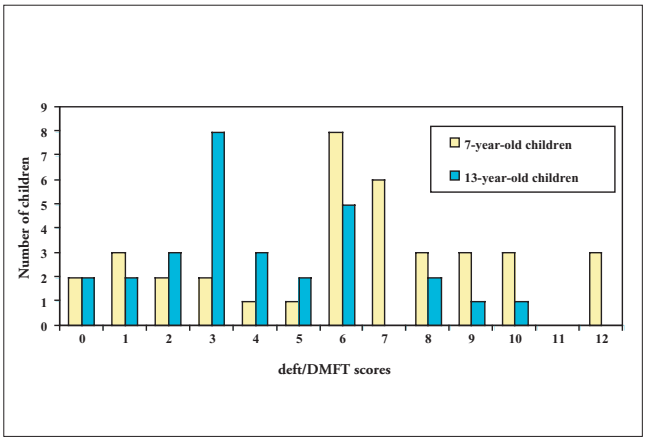

Figure 1: *Frequency distributions of deft+DMFT scores for 7-year-old children and DMFT scores for 13-year-old children.*

According to the Ontario Ministry of Health guidelines, a lesion was considered active if it was located in a pit or fissure, or on a smooth tooth surface and had a detectably softened floor, undermined enamel or softened wall; if the explorer entered the dentine of an approximal surface lesion with examiner certainty; or if a tooth had a temporary filling. Data were recorded on a standardized survey form that also included the child's date of birth, sex, ethnicity and community of residence.

Data Handling and Analysis

The principal investigator (SP) entered the data into EpiInfo6 and transferred them to SPSS 12.0 for analysis (SPSS Inc., Chicago, Ill.). A frequency distribution of the deft/DMFT scores was completed (**Fig. 1**). Analysis of variance (ANOVA) was used to evaluate the effects of age on dental health measures. We conducted a census of the population; therefore, significance testing was not carried out for other measures.

Results

We estimated that 122 children were eligible for the study, of which 104 were invited to participate and 66 were examined, for a response rate of 63%. All First Nations children examined lived on a reserve at the time of the survey.

Table 1 shows the results for the 2 age groups and for both boys and girls. The children had a high prevalence of caries (deft+DMFT or DMFT scores greater than zero): more than 94% of children 7 or 13 years or age had past or active decay. The mean caries score was lower for 13-year-old children. They had lower counts than the 7-year-old children on all measures: the 13-year-old children lost no teeth because of caries; they had fewer actively decayed teeth (an average of 0.6 compared with 1.5 for the 7-year-old children), and fewer filled teeth (3.6 versus 4.4)

Table 2 **Comparison of 7-year-old children with caries from Wikwemikong and other communities combined**

Variable	Wikwemikong	Other
Number	17	20
% male	53	35
% caries prevalence	94	95
Deciduous teeth		
Mean deft ± SD	5.5 ± 3.6	5.4 ± 2.8
% f/deft	71	74
Permanent teeth		
Mean DMFT ±SD	0.9 ± 1.4	0.6 ± 0.8
% F/DMFT	67	67
Total, mean deft+DMFT ± SD	6.4 ± 3.8	6.0 ± 2.9
% total filled ratio	70	72

SD = standard deviation; deft = decayed, extracted or filled deciduous teeth; f/deft = proportion deft of teeth filled; DMFT = decayed, missing, or filled permanent teeth; F/DMFT = proportion DMFT of teeth filled.

Boys, both at 7 and 13 years of age, were worse off on most measures of disease. All boys had 1 or more teeth affected by past or active decay, compared with 91.5% of 7-year-old girls and 92.3% of 13-year-old girls. Boys in both age groups had higher mean deft or DMFT caries scores. Although 7-year-old boys had a lower proportion of deciduous teeth filled, the proportion of permanent teeth filled was greater for both 7- and 13-year-old boys. Compared with 7-year-old children, 13-year-old children had a higher proportion of their teeth filled ($p < 0.001$).

Further analysis found that the children had not only restorations, but also fissure sealants. Overall, 39% of the children had received 1 or more sealants (40% of 7-year-old children, 38% of 13-year-old children). The mean number of sound teeth with sealants was 1.1 for the 7-year-old and 1.2 for the 13-year-old groups. The mean DMFT score for the 13-year-old group with sealants ($n = 11$) was 3.5 (standard deviation [SD] 2.6) and for those without sealants ($n = 18$), 4.4 (SD 2.6).

Table 2 compares the results for the largest community, Wikwemikong Unceeded Indian Reserve, with those for all other communities combined. Wikwemikong is the only First Nations community that provides dental services on the reserve. However, private dentists have offices in communities off the reserve that are equally accessible for these First Nations communities. The table shows no statistically significant differences in dental health for 7-year-old children by community. Since only 6 of the 13-year-old children in Wikwemikong were examined, their findings were not thought to be sufficiently representative to report.

Table 3 shows the different types of decay for both age groups. The 7-year-old group had more smooth-surface decay than pit and fissure decay in their deciduous teeth (0.60 versus 0.20 teeth), but had more pit and fissure decay in their permanent teeth (0.10 versus 0.05 teeth). Pit and fissure decay constituted all incidences of untreated disease in the 13-year-old group. Active decay on previously filled teeth constituted 27% of the total decay score for the 7-year-old group.

Table 3 **Type of tooth decay for 7- and 13-year-old children**

Type of decay	7-year-old children[a] ($n = 37$)	13-year-old children[a] ($n = 29$)
Deciduous teeth		
Smooth surface	0.6 ± 1.0	
Pit and fissure	0.2 ± 0.6	
Pit and fissure and smooth surface	0.0 ± 0.2	
Filled and decayed	0.3 ± 0.5	
Permanent teeth		
Smooth surface	0.0 ± 0.2	0.0 ± 0.0
Pit and fissure	0.1 ± 0.4	0.6 ± 1.1
Pit and fissure and smooth surface	0.0 ± 0.0	0.0 ± 0.0
Filled and decayed	0.1 ± 0.4	0.0 ± 0.0

[a]*Values are expressed as means ± standard deviation.*

Discussion

In this study, we found that dental caries is highly prevalent and increasing in severity in the First Nations children of the District of Manitoulin, Ontario. We found a mean deft+DMFT score of 6.2 for the 7-year-old group and a mean DMFT score of 4.1 teeth for the 13-year-old group. Ninety-six percent of all children had 1 or more active or past carious lesions (94.6% of 7-year-old children: 96.6% of 13-year-old children). In general, boys developed more caries and had similar or higher levels of treatment than girls. This is contrary to previous reports that show that females usually have more caries than males of the same age.[16] The reasons for these differences in our findings are not known.

All First Nations children with positive parent or guardian consent who were either 7 or 13 years of age on the day of the epidemiologic survey were given the opportunity to participate in the study. Sixty-three percent of potentially eligible children participated in the study. To put this response rate in context, we must look at this study within the social and historical context of this community. Because the residents have experienced numerous top-down research studies that examined various health issues over the years, they seem to have research fatigue. Many of these past investigations have not resulted in relevant program improvements. As a consequence, local communities may have little confidence in research leading to observable improvements in health status, which in turn, makes recruiting participants very difficult.

To minimize the effect of the participation rate on the findings, we conducted examinations at places of residence.

However, it is possible that the children we examined had caregivers who had a greater interest in dental health and consequently the children had better dental health, resulting in our underestimating the burden of illness. On the other hand, parents may have more readily given consent for those children who had symptoms, biasing the findings towards a greater prevalence of disease. Overall, we think that these balanced out, resulting in a relatively unbiased finding.

Participation rates were lowest among children residing in Wikwemikong attending schools both on and off the reserve. Because of the limited resources available for this study, we were unable to employ CHRs in this community. Residents of Wikwemikong are dispersed in many satellite communities over a large geographical area (417 square kilometres), some households are without telephones, and many unreturned consent forms could not be followed up because no CHRs were available. In all other communities in which the response rates were higher, CHRs actively encouraged participation among members. However, there were no statistically significant differences in our measures among 7-year-old children between Wikwemikong and the other communities, so we believe that the lower rate of participation in this community did not affect the results.

Overall, boys were also underrepresented in the study. Reasons for this are not known. However, based on our findings, a gender-balanced sample would have increased the mean DMFT score by 0.1, to 4.2 for the 13-year-old group, and would not have affected the mean deft score for the 7-year-old group. Therefore, we believe that our findings closely represent the population values.

Our finding of a 6.2 deft+DMFT score at age 7 years and a 4.1 DMFT score at age 13 years places this population in somewhat better health than national estimates of caries severity place Aboriginal children 6 and 12 years of age[7] and other available published data indicate for 7- and 13-year-old First Nations children in Canada.[5,17,18]

The lower deft and DMFT scores for the children in the District of Manitoulin than those for children of a similar age documented in the literature can be explained by the circumstances of these studies. In the study of "Native children" in British Columbia,[5] those surveyed were seeking dental treatment planning, which may have resulted in the study including children with symptoms and therefore a greater incidence of caries. Smaller regional studies were conducted a decade or longer ago.[5,17–22]

Our findings raise the question of whether the lower deft and DMFT scores observed in 2000 for this population merely reflect similar trends in the improvement in dental health documented for North American children and adolescents in general. Evidence for such a trend among Native American and Canadian Aboriginal children and adolescents comes from the 1991 Indian Health Service Patient Oral Health Status and Treatment Needs Survey[6] of Native American children that reported a decline in mean DMFT scores for children 5 to 19 years of age and in mean DMFT scores for children 0 to 9 years of age. Similarly, at the regional level in Canada, Harrison and Davis[5] reported an improvement in dental health among "Native children" in British Columbia surveyed in 1980 and 1988. Mean deft scores decreased from 7.4 to 6.5 for 7-year-old children, and mean DMFT scores decreased from 9.1 to 6.0 for 13-year-old children. Messer,[19] in his examination of Inuit children in the communities of Nain, Hopedale and Makkovik in Labrador in 1969 and 1984, found improvements in 2 of 3 surveyed age groups: mean deft+DMFT scores decreased from 9.8 to 8.0 for 7-year-old children, but mean DMFT scores increased slightly for 15-year-old adolescents (from 8.2 to 8.4).

However, the most recent data from 2 Canadian studies found virtually no trend. These surveys conducted in 1990–1991 and in 1996–1997 found a slight increase in deft+DMFT scores for 6-year-old children, but very little change in the permanent dentition for 12-year-old children.[8]

Two of the communities participating in our study, West Bay (now M'Chigeeng) and Wikwemikong, were included in the 1990–1991 national survey. The mean deft+DMFT was 4.5 for 6-year-old children and the mean DMFT was 2.6 for 12-year-old children. Our more recent findings for age groups only 1 year older show that dental caries has increased in severity in these communities.

Behavioural and environmental factors, as well as socio-economic status, influence the development of caries in children and adolescents.[23,24] Accordingly, lower deft and DMFT scores may be the result of more accessible dental services, greater use of sealants, higher socio-economic levels, or other factors not analyzed for this report. However, the trend toward increasing severity was unexpected, given the secular trend in caries development in the general population and the completely insured access to dental care offered to First Nations people.

Conclusion

The prevalence of caries is high in this population, confirming the results of a parallel report[25] about children 3 or 5 years of age. However, the older children in our study showed relatively high rates of treated decay: the filled ratio was 88% for 13-year-old children.

There is good evidence that sealants are effective for high-risk children, as long as the sealant is completely retained on the tooth surface. Sealants are more effective in preventing further caries and providing cost savings in a shorter time span when placed in children who have a high risk of caries.[26] Given that all the decay in the teeth of 13-year-old children was pit and fissure, and that those

with sealants had a lower mean DMFT score, future preventive programs should include sealants. ◆

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References

1. U.S. Department of Health and Human Services. Oral health in America: a report of the surgeon general. Rockville, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research, 2000. NIH publication 00-4713. Available from: URL: http://www.nidcr.nih.gov/sgr/oralhealth.asp.

2. Lawrence HP, Leake JL. The U.S. Surgeon General's report on oral health in America: a Canadian perspective. *J Can Dent Assoc* 2001; 67(10):587.

3. Leake JL. Cited in: The need for an examination of, and recommendations to address, inequities in oral health and access to oral health care in Canada. A Brief to the Commission on the Future of Health Care in Canada, 2001. Available from: URL: http://www.caphd-acsdp.org/Romanow%20brief.pdf.

4. Diagnosis and management of dental caries throughout life. *NIH Consensus Statement* 2001; 18(1):1–23.

5. Harrison RL, Davis DW. Caries experience of Native children of British Columbia, Canada, 1980-1988. *Community Dent Oral Epidemiol* 1993; 21(2):102–7.

6. Niendorff WJ, Jones C. Prevalence and severity of dental caries among American Indians and Alaska Natives. *J Public Health Dent* 2000; 60(Suppl 1):243–9.

7. Leake JL, editor. Oral health survey of Canada's Aboriginal children aged 6 and 12, 1990–1. Department of Community Dentistry, University of Toronto and National School of Dental Therapy, 1992. Permission granted from Department of Community Dentistry, University of Toronto.

8. Report on the 1996–7 Oral Health Survey of First Nation and Inuit Children in Canada Aged 6 and 12. Health Canada 2000.

9. Cook HW, Duncan WK, De Ball S, Berg B. The cost of nursing caries in a Native American Head Start population. *J Clinical Pediatric Dent* 1994; 18(2):139–42.

10. O'Sullivan DM, Douglass JM, Champany R, Eberling S, Tetrev S, Tinanoff N. Dental caries prevalence and treatment among Navajo preschool children. *J Public Health Dent* 1994; 54(3):139–44.

11. Douglass JM, O'Sullivan DM, Tinanoff N. Temporal changes in dental caries levels and patterns in a Native American preschool population. *J Public Health Dent* 1996; 56(4):171–5.

12. Jones DB, Schlife CM, Phipps KR. An oral health survey of Head Start children in Alaska: oral health status, treatment needs, and cost of treatment. *J Public Health Dent* 1992; 52(2):86–93.

13. Tri-council policy statement: ethical conduct for research involving humans, 1998 (with 2000, 2002 updates) Available from: URL: http://www.pre.ethics.gc.ca/english/policystatement/policystatement.cfm.

14. Hall BL. Knowledge as a commodity and participatory research. *Prospects* 1979; IX(4):393–408.

15. Cornwall A, Jewkes R. What is participatory research? *Soc Sci Med* 1995; 41(12):1667–76.

16. Burt BA, Eklund SA. Dental caries. In: Dentistry, dental practice, and the community. 5th ed. Philadelphia: W.B. Saunders Company; 1999. p. 212–36.

17. Klooz, D. Dental health status of Native children on selected Saskatchewan reserves. *Can J Community Dent* 1988; 3(1):32–9.

18. Trodden BJ. Swampy Cree Tribal Council dental survey. *Probe* 1991; 25(2):68–72.

19. Messer JG. Dental caries prevalence in school children from two ethnic groups in Labrador: 1969 and 1984 surveys. In: Fortuine R, ed. Circumpolar health 84: proceedings of the Sixth International Symposium on Circumpolar Health. Seattle: University of Washington Press; 1985. p. 298–300.

20. Curzon ME, Curzon JA. Dental caries in Eskimo children of the Keewatin District in the Northwest Territories. *J Can Dent Assoc* 1970; 36(9):342–5.

21. Hargreaves JA, Titley KC. The dental health of Indian children in the Sioux Lookout Zone of Northwestern Ontario. *J Can Dent Assoc* 1973; 39(10):709–14.

22. Nutrition Canada dental report: a report from Nutrition Canada by the Bureau of Nutritional Sciences, Food Directorate Health Protection Branch, Department of National Health and Welfare Canada; 1977.

23. Gillcrist JA, Brumley DE, Blackford JU. Community socioeconomic status and children's dental health. *J Am Dent Assoc* 2001; 132(2):216–22.

24. Irigoyen ME, Maupome G, Mejia AM. Caries experience and treatment needs in a 6- to 12-year-old urban population in relation to socioeconomic status. *Community Dental Health* 1999; 16(4):245–9.

25. Peressini S, Leake JL, Mayhall JT, Maar M, Trudeau R. Prevalence of early childhood caries among First Nations children, Manitoulin, Ontario. *Int J Ped Dent* 2004; 14(2):101–10.

26. Weintraub JA. Pit and fissure sealants in high-caries-risk individuals. *J Dent Educ* 2001; 65(10):1084–90.