ORIGINAL ARTICLE

CAREGIVER KNOWLEDGE AND ATTITUDES OF PRESCHOOL ORAL HEALTH AND EARLY CHILDHOOD CARIES (ECC)

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ABSTRACT

Objectives. Prevention strategies are integral to improving the oral health for young Aboriginal children. For such to be effective, it is important to understand the social value that parents and caregivers ascribe to primary teeth. The purpose of this paper is to report caregiver knowledge and attitudes toward preschool oral health and early childhood caries (ECC) from 4 communities in Manitoba.

Study Design. Cross-sectional study, including a retrospective interview with caregivers.

Methods. Children and their main caregivers served as the sample. Preschoolers underwent a comprehensive dental screening while caregivers completed a questionnaire that explored knowledge and attitudes toward preschool dental health. Caregiver responses were matched with findings from each child's examination.

Results. A majority agreed that primary teeth were important, that dental disease could lead to health problems and that a first dental visit should be made by age 1. Caregivers of children with ECC were more likely to believe that caries could not affect a child's health while those who believed primary teeth are important had children with significantly less decay.

Conclusions. Most caregivers believed that primary teeth are important and correctly responded to inquiries about knowledge and attitudes toward oral health. Attitudes on the importance of baby teeth and bottle feeding after one year of age, the effect of rotten teeth on childhood health and night-time nursing emerged as variables most associated with the absence/presence of ECC and deft rates. Incorporating such questioning into caries risk assessments may be a useful means to determine a child's risk for ECC. (*Int J Circumpolar Health 2007; 66(2) 153-167*)

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INTRODUCTION

Oral health is an integral component of preschool health and well-being. Unfortunately, many children are afflicted with dental caries at an early age, even those as young as 12 months. Decay at this age usually begins in the deciduous maxillary incisors but can later progress to involve primary molars and canines. Those affected often suffer from a reduced oral health-related quality of life when contrasted with their caries-free peers (1,2). Children with rampant dental caries may also have other associated health problems, ranging from local infections to oral pain that manifests as difficulty eating and sleeping, reduced growth and altered behavior (2,3). Primary tooth decay does not discriminate. It crosses ethnic and cultural groupings but is generally concentrated among disadvantaged populations (4-7). Furthermore, there is mounting evidence indicating that children who exhibit ECC are more likely to have an increased caries experience along the continuum of childhood (8-14).

Every effort must be made to reduce the morbidity associated with the most severe cases. Though rehabilitative dental treatment is known to improve the quality of life, including improving eating and sleeping habits and reducing pain (2,15-17), it often necessitates the concomitant use of general anesthesia. However, factors including the age of the child, the aggressiveness of the treatment approach taken, the provider's competence and the child's future oral hygiene habits must be considered prior to surgical intervention, as post-surgical relapse due to new or recurrent caries and restoration failure are significant problems (18-27). This is especially true when

the entire primary dentition is not fully erupted (i.e., prior to the eruption of the deciduous second molars) (28,29). The treatment/restorative approach focuses on the disease rather than on prevention and addressing the underlying contributory causes of early childhood caries (ECC) for what is largely a preventable problem (24).

The term ECC was introduced in the 1990s in an attempt to focus attention on the multiple factors (i.e., socioeconomic, behavioral and psychosocial) (30) that contribute to caries at such early ages rather than ascribing sole causation to inappropriate feeding methods (i.e., bottle use and prolonged breastfeeding on demand). It assumes all previous terminology ascribed to primary tooth decay among those less than 72 months of age (deft > 0) (31-34), including subgroups with minimal or isolated decay extending to those with rampant manifestations (4, 35-59) (Table I). The new standardized case definitions for ECC and its rampant subtype, severe early childhood

 $\label{temperature} \textbf{Table I.} \ \mbox{Previous used terms for ECC among infants and preschoolers.}$

Baby-bottle tooth decay (35-38)

Baby-bottle syndrome (39)

Labial caries (40)

Circular caries (41)

Nursing-bottle mouth (42)

Milk-bottle caries (43)

Nursing caries (44-46,54)

Nursing-bottle caries (4,39)

Nursing-bottle syndrome (47,48,55)

Bottle-propping caries (49)

Bottle-baby syndrome and bottle-mouth caries (50)

Rampant caries (51)

Melanodontie infantile/"les dents noire

de tout-petits" (52,53)

Sucking-cup caries (58)

Sugared-tea caries (56)

Sweet-tea caries (57)

Sugar nursing-bottle syndrome (59)

caries (S-ECC), will ultimately assist in facilitating research into preschool dental caries as past nomenclature and case definitions are fraught with inconsistency (31,34).

Effective prevention strategies are integral to improving the oral health quality of life for the very young. For such activities to be effective, it is important to understand the social value that parents, caregivers and communities ascribe to primary teeth. The purpose of this paper is to report findings from interviews with primary caregivers on their knowledge and attitudes toward preschool oral health and ECC from 4 communities in the Province of Manitoba, Canada, that took part in an epidemiological study of early childhood dental health (60). Two were on-reserve First Nations communities, while the other two were disadvantaged communities in urban centers with sizeable Aboriginal populations.

MATERIALS AND METHODS

As ECC is age specific, participation was restricted to those younger than 72 months of age. Children and their primary caregivers who participated in an institutional review board (IRB) approved study of the prevalence of ECC in 4 Manitoba communities served as the sample for this report (60). Informed consent was obtained from all caregivers prior to enrolment. The communities were South Point Douglas (Winnipeg), Thompson, Roseau River First Nation (Southern First Nation) and an anonymous Northern First Nation. The examinations and interviews occurred during late 2001 and early 2002.

Infants and preschoolers underwent a comprehensive dental screening performed

by a calibrated dentist while a trained dental hygienist assisted caregivers in completing a questionnaire. The dental examination recorded the number of erupted, decayed, filled and extracted primary teeth. For the purposes of this investigation, ECC was defined as the presence of current or past primary caries experience (defs>0 or deft>0) (31). The proctored questionnaire, based on a previously published tool (61), explored family demographics, general child health, infant and child feeding practices and parental/caregiver knowledge and attitudes of childhood dental health. The section pertaining to knowledge and attitudes of oral health included but was not limited to such statements as whether baby teeth are important, the necessity of a first dental visit by 12 months of age, whether problems with the primary dentition could impact the permanent dentition and whether ECC could affect childhood health.

Statistical Analyses

Parent or caregiver responses were matched with findings from each child's dental examination and all identifiers were removed from the data set. Study data were analyzed using SPSS (version 13.0) (SPSS Inc., Chicago, Ill.). Analyses included frequencies of responses to questions gleaning knowledge and attitudes, chi-square testing, Analysis of Variance (ANOVA), and t tests, with the presence/absence of ECC and mean deft as the main outcome variables. Chi-square analysis was performed to determine whether certain categories of knowledge or attitudes caregivers had about preschool oral health were significantly associated with the presence of caries (ECC). ANOVA was performed to evaluate whether there were significant differences in

the extent of decay, measured as mean deft, with these same statements while t tests were used to contrast deft scores of children between the agree and disagree caregiver groupings. Logistic and multiple regression analyses were also employed. Both backwards stepwise logistic regression and multiple regression analyses were performed using all 16 variables of interest. Data were coded so that the correct response (agree or disagree) for each independent variable served as the reference category while the other category was combined with the unsure group. A p value of 0.05 was selected to denote statistical significance.

RESULTS

A total of 408 primary caregiver-child pairs took part in the original study. Characteristics of the caregivers and preschool children appear in Table II. The majority of interviewed caregivers were mothers (85.3%) and the mean caregiver age was 29.0 ± 7.1 years. The mean age for children was 2.9 ± 1.7 years with no differences between the four sites (p=0.9). The

relationship of the caregiver to the child did statistically differ by community (p<0.05) as fewer mothers were the main caregivers for children in the South Point Douglas area of Winnipeg where 10.4% of children were being cared for by a grandparent. There was also a statistically significant difference in the mean age of caregivers by community of residence: caregivers from Thompson were younger than those from Winnipeg and the Northern First Nation, which requested anonymity (p<0.001). There were no significant community differences in the number of males and females participating (p=0.8).

The interviewed questionnaire asked caregivers whether they agreed or disagreed with specific statements designed to glean knowledge and attitudes about the primary dentition of infants and preschoolers. Responses appear in Table III. It was apparent that most caregivers believed primary teeth were important (91.2%), that dental disease could lead to general health problems (87.5%), that a first dental visit should be made by age 1 (74.7%) and that fluoride toothpaste helps prevent decay (75.5%). However, only 161 caregivers

Table II. Characteristics of primary caregiver and child.

Community				Total	
Primary Caregiver Characteristics	Roseau River First Nation	Winnipeg (South Point Douglas)	Thompson	Northern First Nation	
Relationship to child					
Mother (%)	90 (83.3)	52 (77.6)	95 (90.5)	111 (86.7)	348 (85.3)
Father (%)	11 (10.2)	7 (10.4)	3 (2.9)	7 (5.5)	28 (6.9)
Grandparent (%)	2 (1.9)	7 (10.4)	3 (2.9)	5 (3.9)	17 (4.2)
Guardian/Foster					
parent (%)	3 (2.8)	0 (0.0)	4 (3.8)	5 (3.9)	12 (2.9)
Other (%)	2 (1.9)	l (l.5)	0 (0.0)	0 (0.0)	3 (0.1)
Mean age of primary caregiver (years)	28.6 ± 7.4	31.3 ± 7.6	27.0 ± 5.1	29.7 ± 7.7	29.0 ± 7.1
Mean age of child (years)	2.9 ± 1.8	3.0 ± 1.7	2.8 ± 1.7	2.8 ± 1.7	2.9 ± 1.7
Male (%)	51 (47.2)	34 (50.7)	48 (45.7)	55 (43.0)	188 (46.1)

Table III. Caregiver knowledge and attitudes toward preschool oral health.

	Number of respondents who agreed (%)	Number of respondents who disagreed (%)	Number of respondents who were unsure (%)
Baby teeth are important	372 (91.2)	17 (4.2)	19 (4.6)
Problems with baby teeth will affect adult teeth	243 (59.6)	78 (19.1)	87 (21.3)
Rotten teeth could affect a child's health	357 (87.5)	23 (5.6)	28 (6.9)
Babies without teeth need mouths cleaned	326 (79.9)	24 (5.9)	58 (14.2)
Using fluoride toothpaste helps to prevent tooth decay	308 (75.5)	25 (6.1)	75 (18.4)
Mother's diet during pregnancy will affect baby's teeth	161 (39.5)	82 (20.1)	165 (40.4)
Good idea to give baby a bottle to comfort while teething	77 (18.9)	263 (64.4)	68 (16.7)
Frequently giving child pop is okay for child's teeth	18 (4.4)	385 (94.4)	5 (1.2)
Frequently giving child juice is okay for child's teeth	159 (39.0)	198 (48.5)	51 (12.5)
Frequently feeding child milk or formula is okay for child's teeth	304 (74.5)	60 (14.7)	44 (10.8)
Okay to let baby nurse in bed with mother all night	102 (25.0)	243 (59.6)	63 (15.4)
As baby gets older and can hold a bottle easily, he/she should use bottle whenever he/she wants	130 (31.8)	252 (61.8)	26 (6.4)
Okay to put baby to bed with a bottle	104 (25.5)	286 (70.1)	18 (4.4)
Bottle feeding after child is I-year-old is bad for his/her teeth	251 (61.5)	101 (24.8)	56 (13.7)
Breast feeding is important for the health of child's teeth	307 (75.2)	21 (5.2)	80 (19.6)
Babies who do not have bottles will cry more	88 (21.6)	223 (54.6)	97 (23.8)
Children should see dentist or dental therapist by first birthday	305 (74.7)	48 (11.8)	55 (13.5)

(39.5%) believed that a mother's diet during pregnancy could affect the development of the deciduous dentition.

There seemed to be a considerable number of respondents who reported that they were unsure whether to agree or disagree with the 16 statements assessing knowledge and attitudes about early childhood oral health. For instance, many caregivers were unsure whether prenatal diet could influence baby teeth. Furthermore,

75 caregivers (18.4%) were unsure that dentifrices containing fluoride could prevent tooth decay, although this fact is generally understood to be common knowledge given public exposure to media advertisements. This finding is in stark contrast to the relatively low number of caregivers who were unsure about the need for a first dental visit by the age of 1. Considering that this recommendation is not well established in dental circles, let alone the

Table IV. Association between caregiver agreement and ECC.

Parent/Caregiver Knowledge of Oral Health	Caries Free (%)	ECC (%)	p value
Baby teeth are important			
Agree	179 (48.1)	193 (51.9)	p=0.06 df=2
Disagree	5 (29.4)	12 (70.6)	p=0.13 df=1
Unsure	5 (26.3)	14 (73.7)	P 01.0 C
Problems with baby teeth will affect adult teeth	5 (20.5)	()	
Agree	117 (48.1)	126 (51.9)	p=0.67 df=2
Disagree	34 (43.6)	44 (56.4)	p=0.48 df=1
Unsure	38 (43.7)	49 (56.3)	F
Rotten teeth could affect child's health	33 (1311)	(55.5)	
Agree	170 (47.6)	187 (52.4)	p=0.05 df=2
Disagree	5 (21.7)	18 (78.3)	p=0.016 df=1
Unsure	14 (50.0)	14 (50.0)	F
Babies without teeth need mouths cleaned	(****)	(****)	
Agree	147 (45.1)	179 (54.9)	p=0.60 df=2
Disagree	12 (50.0)	12 (50.0)	p=0.64 df=1
Unsure	30 (51.7)	28 (48.3)	'
Using fluoride toothpaste helps to prevent tooth d	` ,	()	
Agree	[′] 145 (47.1)	163 (52.9)	p=0.56 df=2
Disagree	9 (36.0)	16 (64.0)	p=0.29 df=1
Unsure	35 (46.7)	40 (53.3)	•
Mother's diet during pregnancy will affect baby's te	eth `´´	,	
Agree	75 (46.6)	86 (53.4)	p=0.28 df=2
Disagree	32 (39.0)	50 (61.0)	p=0.26 df=1
Unsure	82 (4 9.7)	83 (SO.3)	•
Good idea to give baby a bottle to comfort while t	eething	` '	
Agree	43 (55.8)	34 (44.2)	p=0.03 df=2
Disagree	109 (41.4)	154 (58.6)	p=0.025 df=1
Unsure	37 (54.4) [′]	31 (4 5.6)	•
Frequently giving child pop is okay for child's teeth	, ,	` '	
Agree	8 (44.4)	10 (55.6)	p=0.82 df=2
Disagree	178 (46.2)	207 (53.8)	p=0.88 df=1
Unsure	3 (60.0)	2 (40.0)	·
Frequently giving child juice is okay for child's teeth		` '	
Agree	70 (44.0)	89 (56.0)	p=0.75 df=2
Disagree	95 (48.0)	103 (52.0)	p=0.46 df=1
Unsure	24 (47.1)	27 (S2.9)	

Table IV continues on next page

general public, it is interesting that only 13.5% of caregivers were unsure.

Results of the chi-square analysis appear in Table IV. Children were more likely to have ECC if their caregiver disagreed that primary teeth were important; however, this relationship just failed to reach statistical significance (p=0.06, df=2). In addition, significantly more caregivers of children with ECC believed that caries could not affect a child's health (78.3%)

than caregivers of children who were free from decay (21.7%) (p=0.05, df=2; p=0.016, df=1 when the unsure category was excluded from the analysis).

Interestingly, primary caregivers of children with ECC were significantly more likely to disagree that comforting a baby with a bottle while teething was an acceptable practice (p=0.03, df=2; p=0.025, df=1). This may be because caregivers of children with ECC

Table IV continues from previous page

Parent/Caregiver Knowledge of Oral Health	Caries Free (%)	ECC (%)	p value
Frequently feeding child milk or formula is okay for	or child's teeth		
Agree	138 (45.4)	166 (54.6)	p=0.69 df=2
Disagree	28 (46.7) [^]	32 (53.3)	p=0.86 df=1
Unsure	23 (52.3)	21 (47.7)	•
Okay to let baby nurse in bed with mother all night	\ /	,	
Agree	59 (57.8)	43 (42.2)	p=0.01 df=2
Disagree	99 (̀40.7)́	144 (59.3)	p=0.004 df=1
Unsure	31 (49.2)	32 (SO.8)	•
As baby gets older and can hold a bottle easily, he			e wants
Agree	61 (46.9)	69 (53.1)	p=0.91 df=2
Disagree	117 (46.4)	135 (53.6)	p=0.93 df=1
Unsure	11 (4 2.3)	15 (S7.7)	•
Okay to put baby to bed with a bottle	,	,	
Agree	55 (52.9)	49 (47.1)	p=0.27 df=2
Disagree	127 (44.4)	159 (55.6)	p=0.14 df=1
Unsure	7 (38.9)	II (61.1) ´	•
Bottle feeding after child is 1-year-old is bad for hi	is/her teeth ´	, ,	
Agree	101 (40.2)	150 (59.8)	p=0.002 df=2
Disagree	52 (SI.5)	49 (48.5)	p=0.054 df=1
Unsure	36 (64.3)	20 (35.7)	•
Breast feeding is important for the health of child'	's teeth ` ´	, ,	
Agree	139 (45.3)	168 (54.7)	p=0.56 df=2
Disagree	12 (57.1)	9 (42.9)	p=0.29 df=1
Unsure	38 (47.5)	42 (52.5)	
Babies who do not have bottles will cry more	` /	, ,	
Agree	39 (44.3)	49 (55.7)	p=0.91 df=2
Disagree	104 (46.6)	119 (53.4)	p=0.71 df=1
Unsure	46 (47.4)	51 (52.6)	•
Children should see dentist or dental therapist by	first birthday	` ,	
Agree	135 (44.3)	170 (55.7)	p=0.32 df=2
Disagree	24 (50.0)	24 (SO.0)	p=0.46 df=1
Unsure	30 (54.5)	25 (45.5)	•

df=2 - compares ECC status between agree, disagree and unsure groups

df=I - compares ECC status between agree and disagree groups only

may be more aware of the dangers that bottle contents and their misuse can pose to children's teeth, perhaps because of repeated lecturing by professionals. In addition, caregivers of children with decay were significantly more likely to disagree that the practice of allowing an infant to nurse in bed all night was safe (p=0.01, df=2; p=0.004, df=1) and more apt to agree that bottle feeding beyond 12 months of age could harm primary teeth (p=0.002, df=2; p=0.054, df=1).

Results from ANOVA appear in Table V. Children whose caregivers believed that primary teeth are important had significantly fewer decayed teeth (mean deft 4.0 ± 5.0 vs. 6.4 ± 6.0 , p=0.019). This finding is similar to the results of the chi-square test (Table IV). However, when the unsure category was removed, t testing revealed no significant difference in deft rates between caregivers who agreed or disagreed. Further, children belonging to caregivers who reported they disagreed with the statement that it is a good idea to give an infant the bottle to pacify her/him while teething had significantly higher mean deft scores (ANOVA mean deft 4.7 ± 5.1 vs. 3.1 ± 4.6 , p=0.023) (t test p=0.011). This is also similar to the chi-square findings

Table V. Association between caregiver agreement and mean deft.

Parent/Caregiver Knowledge of Oral Health	Mean deft ± S.D.	p value
Baby teeth are important		
Agree	4.0 ± 4.9	ANOVA p=0.019
Disagree	6.4 ± 6.0	t test p=0.168
Unsure	6.4 ± 5.2	
Problems with baby teeth will affect adult teeth		
Agree	4.0± 4.9	ANOVA p=0.64
Disagree	4.3 ± 4.9	t test p=0.597
Unsure	4.6 ± 5.3	
Rotten teeth could affect child's health		
Agree	4.1 ± 5.0	ANOVA p=0.11
Disagree	6.3 ± 4.8	t test p=0.661
Unsure	3.7 ± 4.7	
Babies without teeth need mouths cleaned		
Agree	4.4± 5.1	ANOVA p=0.43
Disagree	3.5 ± 4.3	t test p=0.108
Unsure	3.6 ± 4.5	
Using fluoride toothpaste helps to prevent tooth decay		
Agree	4.2 ± 5.0	ANOVA p=0.29
Disagree	5.6 ± 5.2	t test p=0.823
Unsure	3.8 ± 4.7	
Mother's diet during pregnancy will affect baby's teeth		
Agree	4.2 ± 4.9	ANOVA p=0.29
Disagree	4.9 ± 5.2	t test p=0.338
Unsure	3.9 ± 5.0	
Good idea to give baby a bottle to comfort while teething		
Agree	3.1 ± 4.6	ANOVA p=0.023
Disagree	4.7 ± 5.1	t test p=0.011
Unsure	3.5 ± 4.6	
Frequently giving child pop is okay for child's teeth		
Agree	4.3 ± 5.4	ANOVA _P =0.90
Disagree	4.2 ± 5.0	t test p=0.835
Unsure	3.2 ± 5.2	
Frequently giving child juice is okay for child's teeth		
Agree	4.2 ± 5.0	ANOVA $p=0.43$
Disagree	4.0 ± 4.8	t test p=0.309
Unsure	5.0 ± 5.6	
Frequently feeding child milk or formula is okay for child's		
Agree	4.1 ± 4.9	ANOVA p=0.70
Disagree	4.2 ± 4.8	t test p=0.786
Unsure	4.8 ± 5.9	T11.77
		Table V continues on next page

(Table IV) and may reflect the increased awareness of caregivers of children with caries. Similarly, children whose caregivers reported that they agreed that bottle feeding beyond 1 year of age could contribute to poor dental health had a higher mean deft score $(4.8 \pm 5.2 \text{ vs. } 3.7 \pm 4.8, p=0.0015)$, which could be a result of information they received from health professionals. However, this specific finding was confounded

by the influence of the unsure category as t test analysis for mean deft between agree and disagree groups was not significant (p=0.24).

T tests contrasting the agree and disagree categories revealed that children whose caregiver disagreed that it was okay to put a baby to bed with a bottle had a higher mean deft score (p=0.014). This too may be due to counseling caregivers of children with ECC received from

Table V continues from previous page

Parent/Caregiver Knowledge of Oral Health	Mean deft ± S.D.	p value
Okay to let baby nurse in bed with mother all night		
Agree	3.5 ± 5.0	ANOVA p=0.12
Disagree	4.6 ± 5.1	t test p=0.232
Unsure	3.8 ± 4.5	·
As baby gets older and can hold a bottle easily, he/she		
should use bottle whenever he/she wants		
Agree	4.2 ± 5.2	ANOVA p=0.88
Disagree	4.1 ± 5.0	t test p=0.692
Unsure	4.7 ± 4.9	·
Okay to put baby to bed with a bottle		
Agree	3.4 ± 4.6	ANOVA p=0.16
Disagree	4.5 ± 5.1	t test p=0.014
Unsure	4.5 ± 4.2	•
Bottle feeding after child is 1-year-old is bad for his/he	er teeth	
Agree	4.8 ± 5.2	ANOVA p=0.0015
Disagree	3.7 ± 4.8	t test p=0.243
Unsure	2.3 ± 3.9	
Breast feeding is important for the health of child's te	eth	
Agree	4.3 ± 5.0	ANOVA _P =0.92
Disagree	4.0 ± 5.5	t test p=0.424
Unsure	4.0 ± 4.8	
Babies who do not have bottles will cry more		
Agree	4.3 ± 5.0	ANOVA _P =0.95
Disagree	4.2 ± 5.0	t test p=0.664
Unsure	4.1 ± 5.0	
Children should see dentist or dental therapist by firs	t birthday	
Agree	4.5 ± 5.2	ANOVA $p=0.063$
Disagree	3.2 ± 4.2	t test p=0.006
Unsure	3.2 ± 4.5	

ANOVA – compares deft between agree, disagree and unsure groups t test – compares deft between agree and disagree groups only

Table VI. Logistic regression analysis for ECC.

Variable	Regression Coefficient	Odds Ratio	p value
Okay to let baby nurse in bed with mother all night	-0.61	0.55	0.018
Rotten teeth could affect child's health	1.47	4.33	0.006
Bottle feeding after child is 1-year-old is bad for his/her teeth	-0.36	0.70	0.162

Table VII. Multiple regression analysis for deft.

Variable	Regression Coefficient (± 95% CI)	p value
Bottle feeding after child is 1-year-old		
is bad for his/her teeth	-1.21 (± 0.66)	<0.001
Baby teeth are important	1.41 (± 1.04)	<0.01

dental staff. Finally, children whose caregivers agreed that the first dental visit should occur by 12 months had higher mean deft scores than those from caregivers who disagreed (p=0.006). However, t tests revealed that the unsure group

was responsible for the significant difference in the deft for the question regarding bottle feeding beyond 1 year of age (Table V).

Results of these regression analyses appear in Tables VI and VII.

DISCUSSION

Currently, there is no co-ordinated oral health promotion in the province of Manitoba targeting early childhood with the exception of the Manitoba Collaborative Project for the Prevention of Early Childhood Tooth Decay (Healthy Smile Happy Child) (60). Results from the baseline study conducted in 2001 are likely to assist in tailoring health promotion activities to high-risk populations throughout the province. However, it is crucial to discover basic caregiver knowledge and attitudes toward infant and preschool dental health and oral health quality of life if advancements are ever to be made.

According to responses in this study, the majority of caregivers believed that baby teeth are important and that primary tooth decay can impact childhood health. Many also responded appropriately to other questions intended to assess knowledge and attitudes surrounding infant and preschool dental health. Perhaps those caregivers who felt this way were more inclined to participate than those who held differing opinions. However, given that caregivers embraced the concept of a first dental visit by the child's first birthday, such knowledge does not necessarily translate into behavioral practices that are likely to prevent ECC. For example, while 74.7% of primary caregivers agreed with the importance of a first preventive dental visit by age 1, only 3.9% of children actually attended a dentist before this developmental milestone (62). Such a discrepancy raises concern over response bias in that participants may have responded accordingly to please the interviewer. Overall dental attendance was low as only 36.2% of infants and preschoolers had visited a dental professional, which is considerably less than reports for low-income preschool children in Washington state (63).

Caregiver responses to the question of whether bottle feeding beyond 12 months of age may pose harm to the primary dentition may be helpful in identifying children at increased risk for caries. For instance, those who disagreed with the practice may have been speaking from first-hand knowledge of the effects this behavioral practice may have. Another explanation may be that these guardians are biased because dental professionals may have repeatedly counseled them on the dire consequences of this practice. The same arguments likely hold for caregivers' attitudes toward "all-night" or "ad libitum" breastfeeding practices in bed.

Certain attitudes and beliefs held by caregivers were significantly associated with both ECC and increased caries activity (deft) (Table IV and Table V). Responses to 2 different statements were significantly associated with the 2 main dental outcomes, mean deft and ECC: (1) it is a good idea to give a baby a bottle to comfort while teething and (2) bottle feeding after the child is 1 year old is bad for his/her teeth. Responses were similar for a third statement that baby teeth are important, but the relationship just failed to reach statistical significance with ECC.

Our results indicate that caregivers who believed that baby teeth are important were more likely to have children with better oral health (i.e., less decay) than those who thought otherwise. Unfortunately, caregivers of children with ECC were more likely to disagree that dental decay could affect a child's overall health.

Three of the 4 variables identified as being significantly associated with ECC on bivariate analysis proved to be associated on backwards

stepwise logistic regression (Table VI). The associations between caregivers disagreeing with nursing throughout the night and increased likelihood of ECC and agreeing that bottle feeding beyond 1 year of age with increased risk for both ECC and increased deft scores are perhaps attributable to reinforcement from public health workers and the wider dental community. It may also be attributable to the previous terminology for ECC that implicated infant feeding practices (e.g., baby-bottle tooth decay, nursing caries).

Only 2 variables remained in the final multiple regression model for deft (Table VII): "baby teeth are important" and "bottle feeding after a child is 1 year old is bad for a child's teeth." It is apparent that those caregivers who recognize the importance of deciduous teeth are more likely to raise children with considerably less dental decay. This awareness and knowledge may be fostering better oral hygiene practices and reducing exposure to cavity-causing risk factors.

The only variable found to be significant or to approach the threshold of significance for both ECC and mean deft on bivariate analysis (and also multiple and logistic regression analyses) related to the potential harm of bottle feeding beyond the age of 1. However, one should not ignore the other variables found in Tables VI and VII. Considering that these relationships stood up to more rigorous statistical techniques, adding elements that assess parental opinions on such issues to a screening tool may give dental and health providers additional assistance in identifying children at risk for developing decay.

Further, brief questioning of caregivers to gain insight of their knowledge and attitudes toward early childhood oral health could also be integrated into caries risk assessment tools that have been recommended for infant dental assessments before 12 months of age by non-dental staff and dental professionals alike (64-66). Currently, such tools only evaluate clinical conditions, scan the environment and assess childhood health (66).

While using traditional health education as a means to reduce the incidence of caries or to change parenting behaviours that contribute to ECC have had limited results, especially among high-risk groups (67-69), new methodology—particularly the use of motivational interviewing and the use of community development approaches for health promotion—show promise or should be explored (38,70-76).

The manner in which populations view the caries process may also influence parental and caregiver attitudes and behaviors that affect childhood oral health. We already know that caregivers with lower levels of education may possess lower dental IQ scores and may not value the importance of deciduous teeth as much as their more educated counterparts (77). Considering the limitations of traditional oral health promotion, the use of culturally appropriate or new methods of delivering and reinforcing anticipatory guidance may be a more promising vehicle to changing attitudes and behaviors about the primary dentition, especially among Aboriginal populations (78).

While this research gives a glimpse into the attitudes of primary caregivers from four Manitoba communities, there is an extreme need for complementary qualitative research exploring the themes underlying early childhood oral health. Qualitative research may uncover issues relating to parenting behaviors and views that could place a child at increased susceptibility for caries (79) and may be more practical than quantitative questioning. They may provide an explanation for the paradoxical associations that have been found and perhaps explain why people are choosing "unsure" for some important questions whose answers ought to be common knowledge (e.g., the benefits of fluoride toothpaste). One possible means to reduce the number of unsure responses in future studies might be to increase the training of interviewers. Regardless, multidisciplinary approaches are needed to combat and improve preschool oral health (79). In addition, complementary multiple research methodologies (i.e., both quantitative and qualitative) are essential in better understanding why certain populations suffer from an increased prevalence of ECC. Communitybased participatory research (CBPR) should be encouraged to help engage at-risk communities in developing research protocols to investigate the mysteries and attitudes contributing to suboptimal preschool oral health.

In areas of deprivation and limited access to dental care, alternatives to delivering oral health promotion and prevention must be explored. Perhaps the examples from the northwestern U.S. may give the necessary impetus to team with primary-care physicians as allies in the battle to improve early child-hood oral health (80). Early identification of these high-risk preschool populations is essential so that proper preventive approaches can be implemented and anticipatory guidance can be used (81).

A key limitation of this study is that the interviews with primary caregivers were retrospective, as this data were from a previous cross-sectional study. The use of retrospective interviews to recall children's past exposures and experiences continues to be a limi-

tation for this form of research. Prospective studies beginning in utero are needed to properly assess the relationship between knowledge and attitudes and early childhood oral health. Such a design would also lend itself to studying ECC risk factors that might occur during pregnancy, including those that could alter the integrity of enamel. Furthermore, caution must be exercised in generalizing from these data to the participating communities and other Aboriginal residents in Manitoba as a whole, given that the proportion of potential participants who actually participated differed among the communities.

Conclusions

Overall, a majority of parents and caregivers believed that primary teeth were important and responded appropriately to other questions assessing knowledge and attitudes about early childhood oral health, yet they did not believe that prenatal diet could affect the primary dentition. Unfortunately, children were more likely to have ECC if caregivers did not agree that primary tooth decay could affect a child's health. In addition, caregivers also believed that allowing an infant to nurse in bed all night was unsafe and agreed that bottle feeding beyond 1 year of age could be of detriment to the primary dentition. Paradoxical findings included higher deft scores among children whose caregivers did not condone the use of a bottle as a pacifier during teething, those who disagreed that putting a baby to bed with a bottle was okay and those who agreed with a first dental visit by 12 months of age. Three statements that emerged as being the most significantly associated with the presence and absence of ECC on logistic regression included "rotten teeth could affect a child's health," "okay to let baby nurse in bed with mother all night" and "bottle feeding after a child is one year old is bad for his/her teeth." Attitudes toward two statements significantly associated with the mean deft score on multiple regression were "baby teeth are important" and "bottle feeding after a child is one year old is bad for his/her teeth."

If oral health promotion efforts are to be effective in improving the oral health of young children, it is essential that there be a good understanding of parental and caregiver knowledge and attitudes. Such findings may help to guide and modify current and future oral health prevention activities.

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