A Cross-Sectional Study to Compare Caries and Fluorosis in 7- year-old Schoolchildren from a Fluoridated Area with those in a Neighbouring Non-Fluoridated Area in Ontario

By

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Abstract

A 2001/02 oral health survey of children conducted in Peel Region, Ontario, Canada, found that 50% from non-fluoridated Caledon had dental caries compared to 37% in fluoridated Brampton. This study was undertaken to confirm the difference in dental caries found in the 2001/02 survey and determine what factors, including fluoridated water, might explain the difference.

Dental surveys of 1047, 7-year-olds matched by SES from the two cities were completed. Parental questionnaires on oral health determinants were returned by 411; home drinking water samples for analysis of fluoride concentration, by 384. Data were entered into SPSS ver 12.0, and adjusted odds ratios were calculated using logistic regression

We found that 61% of Caledon children and 64% of Brampton children had deft + DMFT = 0. The mean deft + DMFT scores were 1.07 and 1.14, respectively. The effect of fluoridation on caries in these two communities was not evident.

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My special thanks to the children attending schools in the Peel District School Board and the Dufferin-Peel Catholic District School Board, and their parents, for their participation in this important study. The information gathered will be invaluable for future oral health planning in the Region of Peel and elsewhere.

Finally, I could not have completed this study without the dedicated work of my research assistant, Dr. Avinash, in handling the day-to-day operation of this research. Thanks also to Susan Deshmuk, for her advice in the production of my presentation.

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GLOSSARY

AAP	**American Academy of Pediatrics**
ADA	**American Dental Association**
ADiA	**American Dietetic Association**
AR	**Attributable Risk**
AuDA	**Australian Dental Association**
b.w.	**body weight**
BDA	**British Dental Association**
BFS	**British Fluoridation Society**
BMA	**British Medical Association**
CDA	**Canadian Dental Association**
CDC	**Centers for Disease Control (United States)**
CDH	**Children's Dental Health (Report, Region of Peel Health Unit)**
CI	**Confidence Interval**
CLD	**Certain Lethal Dose**
CPS	**Canadian Paediatric Society**
CRHA	**Calgary Regional Health Authority**
CTE	**Central Tendency Exposure**
CWF	**Community Water Fluoridation**
D1 or 2	**Decay into enamel of tooth**
D3	**Decay into dentin of tooth**
deft	**decayed, extracted and filled (primary) teeth**
DIS	**Dental Indices Survey**
DHHS	**Department of Health and Human Services (Centers for Disease Control)**
d(m)fs	**decayed and filled (primary tooth) surface**
D(M)FS	**Decayed and Filled (permanent tooth) Surfaces**
DMFS	**Decayed, Missing and Filled (permanent tooth) Surfaces**
DMFT	**Decayed, Missing and Filled (permanent) Teeth**
DPCDSB	**Dufferin-Peel Catholic District School Board**
ECC	**Early Childhood Caries**

EPA	**Environmental Protection Agency (United States)**
et al.	**et alii (“and others”)**
F	**fluoride**
FCFTSG	**Fort Collins Fluoride Technical Study Group**
F Statistic	**Ratio of two sample variances, in ANOVA, the obtained value of F provides a test for the statistical significance of the observed differences among the means of two or more random samples.**
HSREB 1	**Health Sciences I Research Ethics Board (University of Toronto)**
IMHC	**Irish Ministry for Health and Children**
kg	**kilograms**
K-W	**Kruskal-Wallis one way analysis of variance**
L	**Litre**
LOAEL	**Lowest Observable Adverse Effect Level**
mg	**milligrams**
n	**number**
NHMRC	**National Health and Medical Research Council (Australia)**
NNH	**Numbers Needed to Harm**
NNT	**Numbers Needed to Treat**
NOAEL	**No Observable Adverse Effect Level**
NRC	**National Research Council (United States)**
ns	**not significant**
OCDOC	**Office of the Chief Dental Officer of Canada**
OMHLTC	**Ontario Ministry of Health and Long Term Care**
OR	**Odds Ratio**
OSU	**Ohio State University**
p	**p value (probability of getting the characteristics observed in a sample if the null hypothesis were true).**
PDSB	**Peel District School Board**
pH	**Negative log of the hydronium ion molarity (acid potential of a solution)**
ppm	**parts per million**
PTD	**Potential Toxic Dose**

GLOSSARY cont.

RME	Reasonable Maximum Exposure
RPHU	Region of Peel Health Unit
RR	Relative Risk
SES	Socio-Economic Status
SPDPNA	Scientific Panel on Dietetic Products Nutrition and Allergies (European Union)
StatsCan	Statistics Canada
TFCPS	Task Force on Community Preventive Services
TFI	Thylstrup-Fejerskov (fluorosis) Index
TLMTF	The Lord Mayor's Taskforce on Fluoridation (Brisbane)
TSIF	Tooth Surface Index of Fluorosis
UBC	University of British Columbia
UKMRC	United Kingdom Medical Research Council
USCDC	United States Centers for Disease Control
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
yr	year

Introduction and background

The Regional Municipality of Peel has a population of 1,171,372 (StatsCan, 2005) and is on the western border of the City of Toronto in the Province of Ontario, Canada. From 2001 to 2004, the population grew by 18.4%, the second highest rate of growth in Ontario. It consists of the cities of Mississauga, Brampton and Caledon. Municipal water fluoridation has been in place since 1960's and covers about 95% of the population.

The City of Caledon contains the town of Bolton with a population 21,000 (fluoridated in 2002); a rural area of 18,000 people supplied by non-municipal wells; two smaller towns, 6 villages and10 hamlets with a population of 12,000 people, of whom 6,600 are children from 0 to 14 years, that are supplied by 10 non-fluoridated municipal wells. The population of Caledon is characterized as married; unilingual English, lived at same address for at least 5 years, Canadian-born, well educated, employed, having relatively high incomes and owning their own homes.

The Region of Peel published a Children's Dental Health Report (CDH) in June of 2003 (RPHU, 2003). The report was based on dental surveys performed in 2001 and indicated that 50% of children, aged 5 to 13, living in Caledon had a history of dental caries compared to 37% of children in Mississauga and 38% of children in Brampton. The overall mean severity as measured by deft + DMFT (decayed, extracted and filled primary teeth plus Decayed Missing and Filled permanent Teeth) was 1.6 for Caledon compared to 1.0 for Brampton and 1.1 for Mississauga. A higher proportion of the children in Caledon had dental sealants, 32% compared to 13% and 14%; had caries restored 62% compared to 51% and 54%; a lower proportion had un-restored caries, fluorosis and plaque. The lack of fluoridation was postulated as the major factor in the higher dental caries scores for the children in Caledon

Accordingly, the Region of Peel Health Unit (RPHU) decided to recommend fluoridation of Caledon's the water supply. Peel Region enacted a bylaw to do so on condition that the RPHU first commission a study by an independent third party to determine the possible factors associated with the difference in caries scores between the children of Caledon and the children from the rest of the region. The RPHU approached and contracted with the Community Dentistry Department at the Faculty of Dentistry, University of Toronto for the study.

Purpose and objectives

The aim of this study was to provide data to inform decision-makers in Peel Region whether to fluoridate or not fluoridate the water supply in the City of Caledon in order to reduce the prevalence of dental disease. The study investigated all potential explanatory factors for the difference in the deft + DMFT and TSIF (Tooth Surface Index of Fluorosis) indices of children aged 7 years, including levels of fluoride in the water supplies in Brampton and Caledon.

Children aged, 7 years, were selected for this study for a number of reasons. This cohort was not screened for the Peel Region Health Unit's 2001 survey as three year-olds. A fluorosis study in Toronto, several years ago surveyed seven year-olds as the target group (Leake et al., 2002). The mean age of eruption of maxillary central incisors is 7.14 years (Kochhar and Richardson, 1998) which makes them visible for TSIF determination (ADA, 2005). In addition, 7-year-olds have posterior primary molars that have been exposed for about four years, allowing for the measurement of caries experience.

Objective 1

To provide caries and fluorosis prevalence data on a new cohort of 7-year-old schoolchildren from non-fluoridated Caledon and from fluoridated Brampton.

Research question 1

i. Is there a significant difference in caries and fluorosis rates in 7-year-old children from Caledon as compared to those from Brampton?

ii. Is there a significant difference in caries rate between the present cohort of 7 year-olds when compared to the 2001 cohort of the same age?

Objective 2

To compare socioeconomic, demographic, oral health practice and oral health knowledge factors that are associated with caries and fluorosis rates in 7-year-old children in Caledon and Brampton.

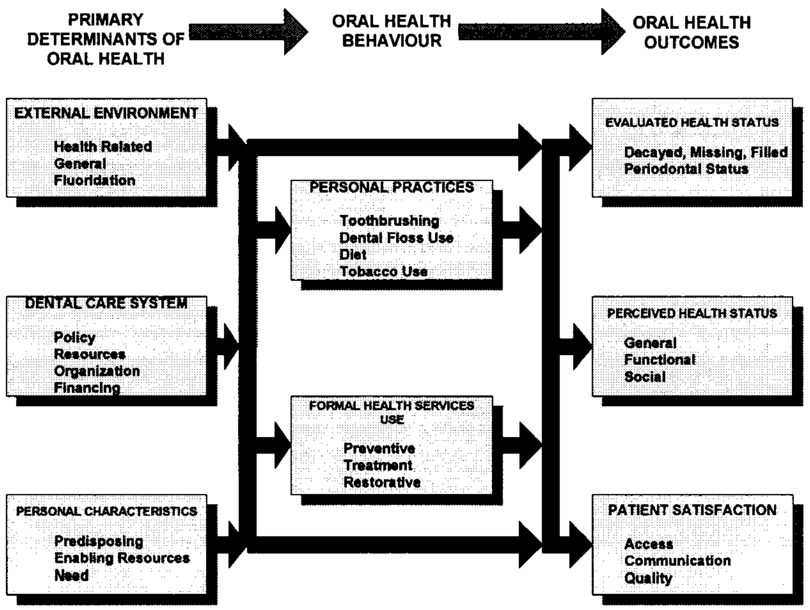
Research question 2

What factors are responsible for the difference in caries and fluorosis, if any, in 7-

year-old children from Caledon as compared to those from Brampton?

The determinants of oral health

Numerous factors influence the prevalence and severity of dental decay. A recent systematic review of the literature from 1966-2002 yielded 106 different factors that have an effect on dental caries (Harris et al., 2004). These factors can be placed under the broad categories outlined in the Anderson and Davidson model that provides a logical framework for the determinants of oral health outcomes (Andersen and Davidson, 1997). From socioeconomic factors to community environment to individual behaviours, factors that can be changed, to human biology that cannot, community water fluoridation is only one of a number of factors that determine the severity and incidence of dental caries. The factors found to affect both caries and fluorosis will be discussed using this model.



Conceptual Framework for the Determinants of Oral Health (Andersen and Davidson, 1997)

In addition, recent research has shown adult oral health is predicted by oral health at a young age, especially when socioeconomic level is taken into consideration (Thomson et al., 2004). In areas with general higher/better living standards, there is low prevalence of dental disease. However, there may be inequality in the distribution of disease, i.e. the people in the lower-socioeconomic status (SES) groups experience an even greater portion of dental disease (Antunes et al., 2004).

Factors affecting caries

On an individual basis, factors that have been shown to be associated with higher caries scores were:

External Environment – community water fluoridation (CWF);

Dental Care System - no access to care;

Personal Characteristics – *predisposing*- gender (females); increasing age; impaired oral hygiene; history of caries in siblings or caregivers; medications taken; radiation treatment; exposed tooth root surfaces; the presence of a high level of cariogenic bacteria; the type of oral; bacteria; reduced salivary flow low salivary buffering capacity; consistency and amount of saliva;

- *enabling resources*- low level of parental education; lower socioeconomic status; no dental insurance; limited access to fluoride products;
- *need*- active caries; malformed enamel or dentin;

Personal Practices - diet and sugar intake;

Formal Dental Services Use – *preventive*- no regular dental care; presence of dental sealants;

- *treatment*- presence of orthodontic or prosthodontic appliances

(TLMTF, 1997; USCDC, 2001; IMHC, 2002).

Risk factors for dental fluorosis

The risk factors that have been shown to be associated with dental fluorosis were:

External Environment - living in an optimally fluoridated area; the fluoride level of the toothpaste; mean daily temperature and altitude above sea-level of the residence; environmental contaminants;

Personal Characteristics – *predisposing*- heredity;

– *enabling*- social class;
- *need*- presence of enamel defects;

Personal Practices – age at which toothbrushing is commenced; the frequency of brushing; the swallowing of toothpaste; prolonged use of infant formula; early weaning from breast feeding;

Formal Health Services Use - use of fluoride supplements (NHMRC, 1999).6

The evidence for water fluoridation

The year, 2005, marked the 60^{th} anniversary of the start of community water fluoridation. Of the 31,584,360 inhabitants of Canada (2005), 42.6% have access to fluoridated public water supplies (Addendum 1, pg. 128), (OCDOC, 2006). For the Province of Ontario, 70.3% of its population of 13, 467,460 are covered by CWF.

As of 2006, 114 national and international dental, allied health and other organizations have endorsed the effectiveness of community water fluoridation in reducing the prevalence of dental decay. These include the Canadian Dental Association (CDA, 2005), American Dental Association (ADA, 1997), British Dental Association (BDA, 2003) and Australian Dental Association (AuDA 2006) and the following organizations: the Canadian Paediatric Association (CPS, 2002), the British Medical Association (BMA, 2006) and the World Health Organization (WHO, 1994). In 1999, the U.S. Centres for Disease Control listed fluoridation as one of the "Ten Great Public Health Achievements of the Century." (USCDC, 1999)

From 1996 to the present, there have been fourteen major reviews of water fluoridation and the effect of fluorides:

Europe	- Scientific Panel on Dietetic Products Nutrition and Allergies (SPDPNA, 2005);
U.K.	- University of York Review (McDonagh et al., 2000)
	- United Kingdom Medical Research Council (UKMRC, 2002));
Ireland	- Irish Ministry of Health and Children (IMHC, 2002));
Australia	- The Lord Mayor's Taskforce of Fluoridation (TLMTF, 1997)
	- National Health and Medical Research Council (NHMRC, 1999);
U.S.A.	- Escambia County Utilities Authority, (Lepo and Snyder, 2000);
	- United States Centre for Disease Control, (USCDC 2001);
	- Task Force on Community Preventive Services, (TFCPS, 2002; TFCPS, 2002a; TFCPS, 2002b) ;
	- Fort Collins Fluoride Technical Study Group, (FCFTSG, 2003);
	- American Dietetic Association, (ADiA, 2005);
	- National Research Council Committee on Fluoride in the Drinking Water, (NRC, 2006));
Canada	- Calgary Regional Health Authority, (CRHA, 1998)
	- An Update of the 1996 Federal-Provincial Sub-committee Report,

(Locker, 1999).

Much of the information in the succeeding sections of this paper was compiled from the data presented in these reviews.

Mechanism of action of fluoride

Fluoride can be found at various concentrations in water, soil and air and is the 13th most abundant element in the earth (NHMRC, 1999). For this reason, all foods contain fluoride and people are exposed to it through their diet, mainly through absorption from the gastrointestinal tract. The amount of fluoride absorbed upon ingestion depends on presence of magnesium, aluminum and calcium (IMHC, 2002). About 35 - 50% of the fluoride in the body is largely found in calcified tissues (with a half-life of 8-20 years (yrs)), and the rest is excreted in urine (Lepo and Snyder, 2000; IMHC, 2002). An increase in urinary acidity (pH) from diet, drugs, altitude and certain diseases can cause a decrease in fluoride retention (NRC, 2006). Plasma fluoride levels are 10-20 micrograms/Litre (L) and are positively related to serum creatinine levels (IMHC, 2002; NRC, 2006). Human saliva has a fluoride concentration of 0.016 parts per million (ppm) if a person is living in a fluoridated community and 0.006 ppm if living in a nonfluoridated community (USCDC, 2001).

To prevent caries, fluoride works on three different levels (Featherstone, 2000). It can penetrate bacterial cells and interfere with enolase, an enzyme necessary for carbohydrate metabolism, thereby reducing acid production. Fluoride, when present in plaque fluid, can be incorporated into remineralizing hydroxyapatite crystals to form fluorapatite which is much more resistant to acid dissolution (Featherstone, 2000). Plaque fluid can be continuously, regenerated with fluoride in the presence of fluoridated drinking water and dental products. Finally, fluoride acts at the surface of the remineralizing apatite crystals to attract calcium ions, which then attracts the phosphate ions, thus speeding up crystal growth.

Start of fluoridation

In the 1930's and 40's, Dr. H. Trendley Dean and colleagues were investigating the effects of fluoride on the prevalence and severity dental fluorosis and of dental caries. They postulated a hypothesis that drinking water at 1 ppm fluoride would have significant anti-cariogenic and little adverse health effects (Lennon, 2006). The evidence for this hypothesis was published between 1936 and 41, in two cross-sectional studies comparing naturally fluoridated communities with control communities, one using 4 towns in Illinois and the other which came to be called the 21 Cities Study (Burt and Eklund, 1999).

In 1945, four prospective studies were started to test communities with artificially optimized fluoride levels against control communities (Burt and Eklund 1999). The first was between Grand Rapids, Michigan, as the site to receive optimal fluoridation, with neighbouring Muskegan to act as a control. Other combinations of cities were; Newburg and Kingston, New York; Evanston and Oak Park, Illinois; and Brantford and Sarnia, Ontario with Stratford as a naturally fluoridated comparator. Outside of North America, major trials of CWF were started in the Netherlands in 1953, New Zealand in 1954, U.K. in 1955 and Germany in 1959 (Lennon, 2006). Arnold et al. (1962) published the results of the Grand Rapids trial in 1962. The researchers stated that 12 to14-year-old children had 50%-63% reduction in caries and children 15-16 years of age reductions of 48%-50% over the control group. In addition, about 10.6% of 12 to 16 year-olds showed signs of dental fluorosis, but most were classified as very mild or less (Lennon, 2006).

Growth of fluoridation

The U.S, the largest country to implement CWF, has seen a continual increase in the population that is covered by optimal water fluoridation (CDC, 1999). The Chief Dental Officer of the U.S. Public Health Service endorsed CWF in 1950 (Lennon, 2006). From then to 1960, 50 million people were placed on optimally fluoridated water systems. The number of people covered increased to 171 million people or 68% of the population by 2002. The U.S. continues to expand CWF and has a target of covering 75% of the population by 2010. Similar increases in the growth of fluoridation have taken place in other countries.

On a worldwide basis, about 350 million people have access to optimally fluoridated drinking water and a further estimated 50 million have access to naturally fluoridated water that is at or around the optimal concentration (BFS, 2004). In 50 countries, optimally fluoridated water supplies are available to some portion of their population. By the size of their population served, some of the major countries are Australia, Brazil, Canada, Columbia, Hong Kong, Malaysia, New Zealand (N.Z.), Singapore, U.K., U.S. and Vietnam. In Canada, 43% of the population have CWF; the provinces with more than 70% of their population covered by CWF are Alberta, Manitoba and Ontario with British Columbia, Quebec and Newfoundland having less than 7% coverage (Addendum 1, pg. 128), (OCDOC, 2006).

The expansion of CWF has been matched by increases in the use of other fluoride products. Today, more than 500 million people worldwide use fluoridated toothpaste, 40 million use fluoridated salt while other forms of fluoride applications (topical fluoride gels/foams, mouthrinses, tablets/drops) are used by about 60 million people (Petersen, 2003).

Fluoride dosages for adverse effects

Fluoride in excess is toxic. The Certain Lethal Dose (CLD) for fluoride is 32-64 milligrams (mg)/kilogram (kg) body weight (b.w.). The Potential Toxic Dose (PTD) is 5 mg/kg (NHMRC, 1999). The following daily intakes of fluoride may result in the corresponding adverse effects (UKMRC, 2002):

≥ 2 ppm, dental fluorosis in children (though fluorosis in an individual can occur at any level)

≥ 8 ppm, skeletal fluorosis (diagnostic signs with or without symptoms)

≥ 50 ppm, in 12 hours gastroenteritis

5-20 mg/meter^3 or 20-80 mg /day, (FCFTSG, 2003) crippling skeletal fluorosis

2,500-10,000 mg orally, acute adult lethal dose

≥ 16 mg/kg b.w. orally, acute child lethal dose.

Community Water Fluoridation and caries

Since the start of community water fluoridation (CWF) and the development of fluoridated toothpaste, the U.S. has seen a secular decline (1971-1991) in the prevalence of caries among 12-17 year-olds of 23%. The mean DMFT decreased from 6.2 to 2.8 (Decayed, Missing and Filled permanent tooth Surfaces (DMFS) scores were 35 - 75% higher than DMFT scores in the same age groups), (NHMRC, 1999; USCDC, 2001). This decline has been attributed to public water fluoridation and the use of fluoride containing dental products, mainly toothpaste.

In a review of studies from 1976-1987, Newbrun (1989) reported reductions in caries rates between fluoridated compared to non-fluoridated areas to be 30% - 60% in primary teeth, 20% - 40% in the mixed dentition and 15% - 35% in permanent teeth. However, these differences have narrowed. Lewis, (1994) in a later review covering 1988-1992, found that half of studies reported less than a 20% difference. Locker's report (1999) on 29 studies from 1994-1999, showed a reduction in deft of 0.4 - 1.57 or 17% - 64% (11 U.K. studies) and a reduction in DMFT of 0.15 - 2.19 or 9% - 48% (5 U.S. and N.Z. studies). A systematic review of 26 prospective studies, by McDonagh et al. (2000) compared deft + DMFT scores in fluoridated and non-fluoridated populations, and reported that in twenty of thirty studies CWF increased the percent of caries-free children by 14.6% (-5% to 64%, number (n) =9 studies) and reduced def+DMF by 2.25 teeth. The group also calculated that the number of people that need to be exposed to CWF or numbers needed to treat (NNT) to prevent one decayed tooth was 6 (95% confidence interval (CI) = 4 - 9).

The protective effect of CWF is more pronounced in primary rather than permanent teeth (Slade et al., 1995; Heller et al., 1997) and it is maximized in lower socioeconomic status (SES) populations (Locker, 1999). Other than fluoride, the population-wide influences that may have contributed to the reduction of caries were; general improvements in diet, nutrition, dental hygiene, dental services, techniques, and the broad use of antibiotics (TLMTF, 1997).

Optimal intake levels for fluoride

The generally accepted recommended intake of fluoride to optimize caries prevention and minimize fluorosis has been reported to be 0.05-0.07 mg/kg/day (AAP, 1986; Levy, 1994; Heller et al., 1999; Heller et al., 2000). Burt (1992) recommends 0.05-0.07 mg/kg/day as a useful upper limit for children. The WHO (1994) suggests that an acceptable threshold for fluoride intake in children and adults of 0.03-0.1 mg fluoride (F)/kg b.w. In agreement are the intake limits from the IMHC (2002) that indicate for children < 8 yrs, the no observable adverse effect level (NOAEL) for fluorosis = 0.05 mg F/kg b.w./day (0.02-0.1) and the lowest observable adverse effect level (LOAEL) = 0.1 mg F/kg/day. For children > 8yrs and adults, the NOAEL = 10 mg F/day.

Others have estimated the total fluoride intake from all sources, using a mathematical model to calculate an average or central tendency exposure (CTE) and a reasonable maximum exposure (RME) of 0.08-0.11 mg/kg/day for infants living in non-fluoridated and 0.11-0.2 mg/kg/day in fluoridated communities (Erdal and Buchanan, 2005). Comparable numbers for children were 0.06-0.21 mg/kg/day and 0.06-0.23 mg/kg/day. This indicates that children up to age 4 years may have actual fluoride intakes exceeding recommended intake levels (Lewis and Limeback, 1996; NRC, 2006). One should be cautious in using these recommended levels as the variation in fluoride intake does not sufficiently explain the variations in fluoride concentration measurements and suggests a large individual variation in uptake or elimination

(NRC, 2006).

The major sources of fluoride intake are food, water, beverages, fluoride containing dental products, with a small fraction from the air (IMHC, 2002; FCFTSG, 2003; ADiA ,2005). The proportions were water 45%, toothpaste 19%, food 31% and pesticides and air, 5% (NRC, 2006). The NRC report provides the following information, for water, 75% of water ingested was from community water systems while 13% was from bottled water with 10% from other sources. The inhaled fluoride amounted to 0.00001 mg/kg/day and the mean estimated intake from soil was 0.04 to 0.16 mg/day for children and 0.02 for adults. Other potential sources of fluoride were some pesticides and some drugs, e.g., Ciprofloxacin. At 0.7 ppm, it was estimated that the total fluoride intake from drinking water was 0.34 mg/day or 0.011 mg/kg b.w./day for 7-10 year-olds. The estimated safe and adequate daily dietary intake of fluoride for 7-10 year olds weighing 28 kg was 1.5 – 2.6 mg/day or 0.054-0.089 mg/kg/day (NRC, 2006).

Other fluoride vehicles

Fluoridated toothpastes account for >90% of the market. Fluoridated adult toothpaste contains 1000-1100 ppm fluoride and each gram of toothpaste has 1 milligram fluoride (USCDC, 2001). The studies have indicated that fluoridated toothpastes have a dose response effect on caries indices and reduce caries experience in children by a median 15-30% (NHMRC, 1999). A meta-analysis of 70 studies, indicated a preventive fraction in decayed and filled permanent tooth surfaces (D(M)FS) of 24% (21 – 28%) and a number needed to treat (NNT) of 1.6 to avoid one D(M)FS, in a population with a caries increment of 2.6 D(M)FS/yr. The NNT becomes 3.7 if the caries increment is 1.1 D(M)FS/yr (Marinho et al., 2003a). For the children of Caledon with a DMFS of about 0.1 / year the NNT becomes 42 (95% CI = 36-48), (Addendum 2, pg. 129).

The concomitant use of both CWF and fluoridated toothpaste has been found to have a partially additive effect. Toothpastes are effective at any age, and brushing at least 2 times /day have been found to be optimal.

However, the ingestion of fluoridated toothpaste in young children is a risk factor for dental fluorosis. Children 2-4 years ingest 0.12-0.38 mg F/brushing and 5-11 year-olds 0.008-0.02 mg F/kg (NRC, 2006). It is recommended that children <2 yrs should not use fluoridated toothpaste and children should be supervised when brushing and use only a pea-size or about

0.25 gm of toothpaste.

Professionally applied topical fluorides applied semiannually reduce caries experience by 26% in permanent teeth in nonfluoridated communities. A meta-analysis of 14 studies indicated a 21% reduction (14 – 28%) in D(M)FS with an NNT of 24 (18 – 36) to avoid 1 D(M)FS in a population with a caries increment of 0.2 D(M)FS/year. The NNT becomes 2 (1 – 3) if the caries increment is 2.2 D(M)FS/yr (Marinho et al., 2004a). For Caledon children the NNT becomes 48 (95% CI = 36-71), (Addendum 2, pg. 129). During topical fluoride gel treatment children can ingest 1.3-31.2 mg fluoride, however they pose little risk for enamel fluorosis (USCDC, 2001; NRC, 2006). This is because fluoride ingestion has to be at specific times and periods during the maturation of the crowns of teeth so one time periodic ingestion should not be a concern for the development of fluorosis.

Fluoride mouthrinses contain 0.05% NaF (Sodium Fluoride) or 230 ppm of fluoride. The average caries reduction from fluoride mouthrinses is 31% (USCDC, 2001). A meta-analysis of 34 studies indicated an NNT of 16 to avoid one D(M)FS in a population with a caries increment of 0.25 D(M)FS/yr. The NNT becomes 2 if the caries increment is 2.14 D(M)FS/yr (Marinho et al., 2003b). For Caledon children the NNT becomes 32 (Addendum 2, pg. 129). As with fluoridated toothpaste young children should not use mouthrinses due to swallowing and risk of fluorosis. As part of a community wide prevention program studies have shown mouthrinses have had little effect on the caries scores of schoolchildren.

Fluoride varnish contains 2.26% NaF (2600 ppm fluoride) or 0.1% difluorsilane (1000 ppm) and has been reported to be efficacious in preventing caries when used semiannually (USCDC, 2001). A meta-analysis of 7 studies indicated a preventive fraction in D(M)FS of 46% (30 – 63%) and in d(m)fs of 33% (19 – 48%) (Marinho et al., 2002). For Caledon children the NNT for primary teeth becomes 8.2 (95% CI = 5.6-14) and for permanent teeth, 22 (95% CI = 16-33), (Addendum 2, pg. 129). There is no evidence of risk for dental fluorosis from the placement of varnish.

There appears to be not much difference in efficacy of caries reduction among the different topical fluoride vehicles (Marinho et al., 2004b). The use of combinations of topical fluorides has been shown to have partially additive effect on caries reduction though the effect is small (Marinho et al., 2004c).

In non-fluoridated communities, for high-risk children aged 6-16 years, after permanent teeth start to erupt, supplements can reduce caries experience. However, the use of fluoride supplements has not consistently been associated with protection from caries, due to problems with compliance. Moreover, those children who were compliant in taking supplements tended to have higher fluorosis rates (NHMRC, 1999). In addition, studies have also indicated that 7 -35% of children in CWF communities receive supplements (USCDC, 2001). When supplements were used in a CWF community, the odds ratio (OR) for fluorosis was 23.74 (3.43 -164.3), (USCDC, 2001). Expectant mothers or post-natal infants should not take supplements as there is no caries benefit for the child.

Canadian studies on CWF

Comparisons of children in fluoridated and nonfluoridated communities in Canada have shown only small differences in caries scores. In 1985, the mean DMFT scores in 13 year olds in Calgary (un-fluoridated) and Edmonton (fluoridated) were 3.0 and 2.8 respectively (CRHA, 1998). A study in Nova Scotia showed the percentage of caries-free children between fluoridated Kentville and un-fluoridated Truro was 23% and 26.8% respectively (Ismail et al., 1993).

In Canadian studies, exposure to CWF explained very little of the variation in caries experience. The type of school attended, fluoride supplement use, gender (Ismail et al., 1990), use of fluoridated toothpaste at an early age (Ismail et al., 1993), and parental educational attainment (Clark et al., 1995), were predictors but water fluoridation was not.

In British Columbia, a study of 6 to 14 year olds found prevalence of Tooth Surface Index of Fluorosis (TSIF) ≥ 1 was 75% in fluoridated compared to 45% in non-fluoridated areas with a relative risk (RR) of 1.7 and attributable risk (AR) of 41% (Clark, 1994). An Ontario study reported no difference at TSIF 1, but for TSIF >2 the difference was 18.8% vs 4.8%, with a RR of 3.9 and an AR 77% (Brothwell and Limeback, 1999). This study also reported that for children aged 7-8 years, surveyed using the TSIF, the adjusted OR's for fluorosis were: fluoridated home water, 2.91; duration of breast-feeding, 0.71; use of fluoride supplements, 1.93; and use of fluoridated mouthwash, 2.73. From a review of 12 studies, the main risk factors for fluorosis were use of infant formula, fluoride supplements and brushing at an early age with fluoridated toothpaste (Locker, 1999).

In Canada, total fluoride exposure for children from 7 months to 4 years was 0.087 - 0.160 mg/kg in a fluoridated community and 0.045 – 0.096 mg/kg in a non-fluoridated community. The corresponding numbers for 5 to 11 years were 0.049 - 0.079 mg/kg and 0.026 -0.044 mg/kg (NRC, 2006).

Recommendations for fluoride intake in Canada

CWF should be targeted to areas where the prevalence of tooth decay is high, with water fluoride ranging from 0.5 to 0.8 ppm (OME, 2000) based on the prevalence of both caries and fluorosis in each community (Locker, 1999).

Possible adverse health effects from Community Water Fluoridation

Dental fluorosis

The definition of dental fluorosis is, "a permanent hypomineralization of enamel (which appears as mottling of the tooth enamel), and is characterized by greater surface and subsurface porosity than normal enamel that results from excess fluoride reaching the tooth during developmental stages"(Burt and Ekland, 1999). Therefore, it provides an indication of the total amount of fluoride that is ingested during a critical period of tooth development. The most critical period for developing fluorosis in the permanent maxillary incisors is 15-24 months for boys and 21 to 30 months for girls, though other teeth can be affected up to 8 years of age (IMHC, 2002; FCFTSG, 2003; Levy, 2003).

The three main fluorosis measurement indices are Dean's (Burt and Ekland, 1999), Thylstrup-Fejerskov (TFI) and the Tooth Surface Index of Fluorosis (TSIF). Of the three, the TFI is the most sensitive and can be related to actual histology of fluorotic enamel. The determination of dental fluorosis due to fluoride can be difficult as tooth mottling may also occur from malnutrition, metabolic disorders, exposure to certain dietary trace elements, tea drinking in early childhood, physical trauma, genetics, high altitude, genetic susceptibility to fluorosis, or exposure to amoxicillin (NRC, 2006).

Enamel fluorosis has been found in all communities whether fluoridated or not, as there is no specific threshold level of fluoride at which dental fluorosis does not occur (NHMRC, 1999; USCDC, 2001). There is a dose response relationship between the level of fluoride intake and the severity of fluorosis as well as a relationship with the amount and severity of dental decay (TLMTF, 1997). The difficulty is that fluoride has a relatively narrow margin of safety between the optimal anticariogenic dose and the dose that will produce more fluorosis (Lepo and Snyder, 2000; UKMRC, 2002).

Studies have found dental fluorosis to be primarily a condition of permanent teeth which increases in severity from anterior to posterior (SPDPNA, 2005). While fluorosis of the primary teeth is uncommon, if fluorosis is detected in primary 2nd molars, it is often predictive of fluorosis in permanent incisors with a relative risk (RR) of 1.86 (95% CI =1.36-2.54), (IMHC, 2002). In 1940's the prevalence of dental fluorosis was 12-15%, but by 1987, this had risen to 22-23% (USCDC, 2001). The prevalence of very mild and mild fluorosis has continued to increase, as has the prevalence of moderate and severe fluorosis, though at lower levels (NHMRC, 1999).

Clark (1993) reported fluorosis prevalence ranging from 35-60% in fluoridated areas and 20-45% in non-fluoridated areas. The RR of fluorosis from CWF was 1.5 to 2.7, while the AR varied from 40 to 63%, preventive fraction was 48% (40, 57) and the prevalence of fluorosis of aesthetic concern was 12.5% (7, 21.5) (Locker, 1999; McDonagh et al., 2000). Fluorosis has been considered aesthetically acceptable at TFI <2 and TSIF ≤ 1 (NHMRC, 1999). The numbers needed to harm (NNH) was calculated to be 6 (4, 21), i.e. 6 children would have to be exposed for one child to be affected by fluorosis (McDonagh et al., 2000). The OR for TFI>1 in a fluoridated compared to non-fluoridated areas was reported as 3.37 (1.9-5.98). In most westernized societies, excessive fluoride intake appears to be common (TLMTF, 1997).

With the availability of multiple sources of fluoride, the percentage of fluorosis attributable to CWF has been estimated to be 40%, with the remaining 60% attributable to fluoride dental products and the halo effect (fluorosis has increased most in non-fluoridated areas as compared to fluoridated, 91% vs 39%), (FCFTSG, 2003). In children, toothpastes were found to contribute 33-50% of total fluoride intake (SPDPNA, 2005). The optimal fluoride level in community drinking water should therefore be one that maximizes the anticariogenic effect of fluoride while minimizing the incidence of fluorosis (Khan et al., 2004). To be able to estimate this optimal level, fluoride ingestion from other sources should be identified (Levy and Guha-Chowdhury, 1999).

The evidence was inconclusive for any delay in teeth eruption in children living in fluoridated areas (Campagna et al., 1995).

Fluoride and effects on bone

About 99% of fluoride in the body is in bone. It is well absorbed from the gastrointestinal tract with 70-90% of intake absorbed (NRC, 2006). Fluoride is cleared by uptake in bones and excretion in urine. The uptake of fluoride is positively associated with the bone-remodeling rate. Its clearance from bone takes 4x longer than its uptake, with a whole body half-life of 20 years (NRC, 2006). Fluoride had a biphasic effect on bone strength, it increases and then decreases, as fluoride concentrations increase (SPDPNA, 2005). At 1 ppm, studies did not support a causal link between CWF and osteoporosis, hip fractures or any adverse effects on bone strength, bone quality, bone mineral density or fractures (TLMTF, 1997; CRHA, 1998; IMHC, 2002; SPDPNA, 2005).

A systematic review of 88 studies, one at evidence level B and the rest at level C, compared bone fracture prevalence at various fluoride concentrations and meta-regression found no association (McDonagh et al., 2000). Another systematic review with meta-analysis found no evidence for the association of bone fractures and CWF (FCFTSG, 2003). A strong study by Kurttio et al. (1999) was suggestive of hip fracture risk, with a continuous gradient from lowest to highest fluoride exposures. However, there was not enough evidence to draw any conclusions (NRC 2006).

Fluoride and cancers

The evidence from reviews have found no causal relationship or association of CWF at 1 ppm or less and increased risk of cancers or in particular, osteosarcomas (TLMTF, 1997; CRHA, 1998; Locker, 1999; NHMRC, 1999; Lepo and Snyder, 2000; FCFTSG, 2003). A systematic review of 26 studies, with 5 rated as B and 18 as C level, indicated no clear association of fluoride with incidence/mortality from bone cancer, thyroid cancer or all cancers (McDonagh et al., 2000). An important 1991 study by Hoover et al. (not included in the review by McDonagh et al), showed no relationship between CWF and osteosarcomas, no trends in cancer incidence or mortality due to CWF, and no suggestion of CWF increasing the risk for cancer or osteosarcoma (UKMRC, 2002). The most recent review by the NRC reported that the weight of the evidence from animal studies indicated a very low probability of mutagenic risk for humans (NRC, 2006).

The Bassin study (Bassin et al., 2006), which reported the OR for the association of osteosarcomas and CWF, for males at 7 years of age, was 7.2 (1.7 - 30), had major limitations. The study: used hospital-based controls; reported no data on the % of controls who were fracture patients; did not collect individual information on key SES factors; did not analyze cumulative exposure to fluoride; provided little data in the results section; and did not provide data on nonparticipation rates (NRC, 2006).

Fluoride and other health effects

People show a variability in response to fluoride exposure due to: genetics, age, sex, nutrient intake, dietary status or other factors (NRC, 2006), however the reviews indicated no other health effects associated with CWF at optimal levels. Chronic low-level exposure to fluoride was not associated with problems in Gastrointestinal, Genitourinary, Hepatic system, Central Nervous System, Respiratory System, and fluoride did not disrupt endocrine or human biological enzyme activity (USCDC, 2001; IMHC, 2002; FCFTSG, 2003).

Specifically CWF was not associated with senile dementia; age of menarche; anemia of pregnancy; Sudden Infant Death Syndrome (SIDS); birth defects; Down's Syndrome and no reduction in children's IQ or effect on the pineal gland was seen (IMHC, 2002; UKMRC, 2002; FCFTSG, 2003). If gastrointestinal irritation occurred, it was dose dependent and appeared at about 200 ppm fluoride (CRHA, 1998). There was no evidence of kidney dysfunction or mortality from kidney disorders from drinking water with up to 8 ppm fluoride (CRHA, 1998). The chance of effects on human reproduction was very low, even in naturally high fluoride areas there was no increase in birth defects or evidence for association with Down's (CRHA, 1998). There were no changes in death rates from heart disease, intracranial lesions, nephritis, cirrhosis or any other causes that was associated with CWF (Lepo and Snyder, 2000).

Fluoride does not compete with iodine for transport into the thyroid gland and high fluoride doses given to patients from 6 months up to 8 years found no change in thyroid function (FCFTSG 2003; NRC 2006). A review by Challacombe (1996) indicated no adverse effects on the immune system. Literature reviews by Taves (1979), Knox (1985), and Kaminsky et al., (1990), indicated no evidence for allergic or sensitivity reactions from CWF (IMHC, 2002). Another study by Morgan et al. (1998) found no association of CWF with negative behaviour (SPDPNA, 2005). The elderly and people with low Ca, Mn and/or vit C levels, renal or CV problems were not affected by CWF (FCFTSG, 2003).

The UKMRC (2002) review stated that the addition of fluoride under normal water system operations presents little likelihood of introducing other chemical compounds into the drinking water. Aluminum leaching is not significant and there is no substantive evidence

CWF increases lead concentrations or its bioavailability in drinking water (UKMRC, 2002).

Cost-effectiveness of Community Water Fluoridation

The most effective, socially equitable and efficient vehicle for providing continuous fluoride exposure to a population is CWF (Lepo and Snyder, 2000; McDonagh et al., 2000; USCDC, 2001). Even with the availability of other sources of fluoride, there seems to be a consensus that CWF is an economically positive preventive measure and the weight of scientific evidence is overwhelming for its protective effect (Locker, 1999). While other vehicles for community-wide fluoride interventions are available, the success of CWF as a preventive measure is that it does not require patient compliance. Studies have shown community preventive programs needing high levels of motivation were generally not successful (McDonagh et al., 2000).

Economic evaluations of CWF from 9 studies indicated that median costs were $2.70/person/yr for 19 public water systems supplying populations <5000; $1.41 for 21 systems supplying populations from 5000-20,000; and $0.40 for 35 systems supplying populations >20,000 (TFCPS, 2002b). CWF has been calculated to cost $4.71 per carious surface saved and a $1.00 per capita invested in CWF saves $38.00 or more in treatment costs (USCDC, 2001; ADiA, 2005). Moreover, CWF remains a cost savings under a wide range of assumptions (FCFTSG, 2003). The factors that influenced the cost were; community size; the number of fluoride injection points; the number and amount of system feeders; the amount and type of fluoride chemical; and expertise of the personnel (USCDC, 2001).

Environmental factors

There is almost universal agreement that fluoride does not increase corrosion problems in water piping and fluoride losses from the water system is minimal (NHMRC, 1999). When the community water system is fluoridated with hexafluorosilicic acid, an estimated 0.1 – 0.24 micrograms (= parts per billion (ppb)) Arsenic/L is added (FCFTSG, 2003). This is well below the U. S. Environmental Protection Agency (EPA) standard for drinking water of 10 ppb Arsenic (USEPA, 2006). There is no measurable difference in Lead (Pb) levels in drinking water upon fluoridation. Furthermore, blood tests on populations living in fluoridated and non-fluoridated areas found no difference in blood Pb levels (FCFTSG, 2003).

Limitations of the studies used in the reviews of Community Water Fluoridation

Many of the available studies on which these reviews based their findings were epidemiological and the reviewers warned that these studies did not use individual water consumption data and reported target fluoride levels not actual levels (TLMTF, 1997). There often was a lack of analysis, lack of measures of variance, lack of controlling for confounding factors and lack of blinding (McDonagh et al., 2000).

Summary of the evidence on Community Water Fluoridation

In this section, the findings from fourteen reviews on community water fluoridation have been discussed. The following summarizes the major conclusions:

- Water fluoridation is still effective against caries even though other sources of fluoride, e.g. toothpastes, topical fluorides, are used.
- Water fluoridation benefits all residents served by community water supplies regardless of their social or economic status.
- Water fluoridation is safe and no strong evidence has been found that it causes cancer, bone disease, kidney disease or birth defects.
- There is no evidence that adding fluoride to the drinking water has negative environmental impacts.
- The only adverse effect linked to community water fluoridation is the possibility of a higher prevalence of dental fluorosis if inadvertent ingestion of other fluoride sources is not controlled.

Research design and methods

This research involved dealing with four different organizations, the University of Toronto, the Region of Peel Health Unit (RPHU), the Peel District School Board (PDSB) and the Dufferin-Peel Catholic District School Board (DPCDSB). Each had its own procedures and protocols for research involving human subjects. At times, there were problems that arose when conflicting interests among the organizations came into play. This definitely had an affect on how the research was carried out and the length of time required to complete the data collection (Appendix B1, 2, pg. 103). Instances of how their decisions influenced the research design and methods will be presented in the affected sections.

Study design

Two RPHU screening teams gathered clinical data as part of the annual Dental Indices Survey (DIS) required by the Province of Ontario's Mandatory Programs(OMHLTC, 1997b). The researchers and senior dental staff from the health unit calibrated the team members on identification of oral attributes of importance to this study, before the teams went into the field.

We collected data on the child and family demographics, child medical and nutritional history, child and family oral hygiene practices and child's access to dental care by means of a parent questionnaire (Appendix C, pg. 106). Along with the questionnaire was a plastic collection tube for the collection of a sample of the child's normal drinking water that we analyzed for fluoride concentration.

Study locations

The study was undertaken in all schools in Caledon and those schools in Brampton that were determined by the Health Unit epidemiologist to have comparable populations of 7-year-old schoolchildren within the communities served by the Peel Region Public Health Department. The study was performed at the request of the Peel Region Health Department under a contract with the Community Dentistry Department, Faculty of Dentistry, University of Toronto.

Participants

The target study population consisted of 7-year-old schoolchildren in non-fluoridated Caledon (n=438) and fluoridated Brampton (n=1173) within the Peel Region (Table 1, pg. 72). All children were examined as part of the routine annual DIS survey by dental hygiene teams experienced in performing surveys. For this project, we asked the parents of the children in all schools in Caledon and a selected sample of schools in Brampton to complete a questionnaire and provide a sample of the home water supply.

Sampling design

Between September and June of each school year, dental teams screen students in selected grades in all schools in the Peel Region with selected age groups surveyed for the DIS. The RPHU designated the schools in the two communities as high, medium and low-risk based on the previous year's prevalence of dental decay in children from junior and senior kindergarten in each school. Due to the statistical power necessary for the study, the researchers requested the participation of the parents of all 7-year-olds (n=438) in non-fluoridated Caledon and more than twice the number of parents of seven years olds (n=1173) from Brampton.

The RPHU epidemiologist selected schools for inclusion in the survey using the following criteria:

- DIS risk-ratings of schools from 2004/5 (the RPHU had rated the Caledon schools as low or medium-risk, so a proportional balance of medium and low-risk schools were selected in Brampton to obtain a matching population of 7-year-olds).
- Socio-economic indicators from the 2001 Census Tract (the areas in which the Caledon schools were located were matched to similar areas in Brampton (to select the schools to be surveyed), by the following criteria: the proportion of low-income families; average family income; the proportion of the population with at least a bachelor's degree or higher; the proportion of population with less than Grade 9 education; and the average employment income), (Addendum 3, pg. 133), ((Funnell, 2005).

Original sample size calculation

The researchers decided to use only data from Caledon excluding Bolton (the town of Bolton started CWF in 2002), and compare it with the data from Brampton. All sample size estimates were calculated with alpha at 0.05 and beta at 0.2. We determined that as a questionnaire would be sent home for the parent(s) to complete and as the response rate was estimated to be 50%, all the sample sizes were doubled to ensure statistical power. Due to its smaller population, the total numbers of children in each age group from Caledon (without Bolton) was the limiting factor for any survey. The following were the numbers for each age group in Caldeon, provided by the Peel Region Health Unit (Otchere, 2005):

5 year olds	450
7 year-olds	438
9 year olds	540
11 year olds	510
13 year olds	525

For the calculations of sample size, the frequency of the risk factor of 0.5 (RPHU, 2003) and the relative risk of 1.5 (Stockwell et al., 1990) were used. From unpublished information provided by Peel, the number of children in Caledon and Brampton with and without dental caries was used to calculate (StatsCalc from Epi-Info) an odds ratio for caries in fluoridated as compared to a non-fluoridated areas of 1.6 (Epi Info, 2005).

Using the percentage of each age group with caries from the "Children's Dental Health, 2003" report, the required power of 0.8 and precision of 0.05, the number of 7-year-old children that would have to be surveyed in each city was 304. At a 50% response rate the numbers rose to 608. As Caledon did not have this many 7-year-olds, a 2:1 ratio of children in fluoridated to those in non-fluoridated areas was used. This resulted in a sample size of 7-year-olds from Caledon of 454 (227 x 2) and from Brampton of 908 (454 x 2).

Study procedures

Phase I: Collecting clinical examination information

In phase I of the study, we identified cases with past and present dental caries and those subjects without. Peel Region Public Health Department dental teams collected data by clinical examination of children in schools during the mandatory dental survey program. Experienced dental hygienists, employed by the Peel Region Public Health Department and assigned to the study, conducted the screening examinations. The hygienists conducted the examinations using the existing Ministry of Health and Peel Region common screening protocol and diagnostic criteria. The screening consisted of a visual examination, using only a mirror, light source and tongue depressor. The hygienists used no other instrumentation.

The screening manual, diagnostic classifications and coding procedures were dictated by the screening protocol developed by the Public Health Branch of the Ontario Ministry of Health for use in the mandatory survey programs and implemented by Public Health Departments, (OMHLTC, 1997; OMHLTC, 1997b). The hygienists used this protocol to assess each child's dental caries experience *(DMFT index)* and treatment needs *(urgent restorative needs. non-urgent restorative need, need for sealants, need for topical fluoride, and need for scaling).* They examined the upper anterior incisors and scored the teeth for fluorosis using the Tooth Surface Index of Fluorosis (TSIF), (Burt and Ekland, 1999). In order to ensure consistent diagnoses, the researchers re-calibrated the examining Dental Hygienists, involved in the study in Caledon and Brampton, in the use of the screening protocol and TSIF prior to the start of the study.

The survey teams recorded all clinical examination data for each child examined using the standard Dental Screening Report Form (Appendix A, pg. 103). The name of each child examined, including their gender, school and the risk level of the school was included on the Dental Screening Report Forms and were required to be retained by the Peel Region Public Health Department for purposes of following up on the findings of the surveyed children. For privacy and confidentiality, only the principal investigator and the research assistant knew the names of participating children.

Intra- and inter-examiner reliability

Prior to the start of the study, experienced dentists (Drs J. Leake and D. Otchere) trained Dr. Ito in the use of the TSIF by using slides of anterior teeth depicting various TSIF scores. After the dentists agreed on the TSIF score for each slide, Dr. Ito used these slides to train the two survey teams. Training continued until Kappa values of 0.8 were achieved.

Clinical measures obtained

Caries experience: As part of the routine, dental survey process, the survey team recorded on a tooth-by-tooth basis, each participating child's caries experience. They further differentiated caries by whether the decay was in pit and fissures or smooth surfaces or both and correspondingly did the same for filling placement. The criteria for recording caries experience were those prescribed by the Public Health Branch, Ontario Ministry of Health (OMHLTC, 1997).

Dental fluorosis: The upper incisors were examined for fluorosis as prescribed by the Ministry using the TSIF, (OMHLTC, 1997; Burt and Ekland, 1999).
Other oral health measures: The process included the number of dental sealants placed, the presence of gingivitis, a debris index and a calculus index (OMHLTC, 1997).
Treatment needs: The survey team also scored each child according to the following treatment needs: urgent restorative and non-urgent restorative need; need for sealants; need for topical fluoride; need for scaling. Criteria for recording these needs were those prescribed by the Public Health Branch, Ontario Ministry of Health (OMHLTC, 1997).

Phase II: Obtaining data from parent questionnaires

In order to preserve confidentiality, the Region of Peel Health Unit (RPHU) and the Community Dentistry Department, University of Toronto, through the research assistant and the dental hygienists, who undertook the clinical survey examination, conducted the couriered survey component of the study. As the survey teams finished the DIS in each school, the completed DIS forms and the names and home addresses, of the surveyed children, were couriered from the RPHU to the research assistant at the Faculty of Dentistry. A package of material was then to be couriered to the parents from the faculty. In the package was a letter explaining the aims and objectives of the study (Appendix B, pg. 104), along with an information sheet giving details of the procedures to be followed by those agreeing to take part. In addition, we enclosed a questionnaire (Appendix C, pg. 106) for completion by a parent, a plastic container for the collection of a drinking water sample and an addressed envelope for the return of the completed questionnaire and the water sample by courier to the Faculty of Dentistry. Two to three weeks after couriering the package, the research assistant was to send a reminder letter to all those parents who had not returned a questionnaire. Two to three weeks later if he still had not received the return material, he was to send a new package to the parents. Finally, the research assistant was to telephone all non-responders to solicit their response. Once the parents returned the questionnaires, the research assistant removed all personal identifying information from data collection instruments (parent questionnaire, plastic container) and prepared the data for input and analysis. As explained in the following section this protocol was eventually followed only for children attending schools of the Dufferin Peel Catholic District School Board (DPCDSB).

Changes to the parent questionnaire survey design:

The researchers received provisional approval of the research proposal, pending receipt of additional approvals from the RPHU, PDSB, DPCDSB and the Faculty of Dentistry, on June 1, 2005, from the University of Toronto Health Sciences I Research Ethics Board (HSREB I), (pg. 94). However, while we received faculty approval for the research by June 15, we did not obtain approvals from the three other organizations until October 3, 2005. Moreover, when the RPHU started the DIS, in October, the research committee of the PDSB reversed its original approval of the research protocol and did not allow the researcher and his assistant access to the names and addresses of the surveyed students held by the RPHU. After much negotiation among the researchers, the RPHU and the PDSB, an agreement on the following operational procedures was reached and implemented.

1. The research assistant sent numbered questionnaire packages to the dental staff at the RPHU.
2. The staff at the RPHU labeled each individual numbered package with the child's name and generated a list associating a number with a name.
3. The RPHU staff then took the labeled packages to the respective schools and to the individual teachers of the surveyed students, if possible.
4. It was left up to the school or the teacher to give the package to the students and for the students to take the package home to their parents.
5. As the questionnaires packages were return-couriered to the researcher at the faculty, he would generate a list of numbers from the received packages and transmit the numbers to the staff at the RPHU.
6. The staff at the RPHU crossed off the numbers and associated names on their list. Only those parents who had not returned a package within a three-week period were then sent a second number package through the school for their children to take home.
7. Steps 5 and 6 were repeated for a third round of package dissemination to the children whose parents still had not returned questionnaires.
8. This protocol was only for the PDSB. We contacted the parents of DPCDSB schoolchildren using the original protocol.

This change in protocol raised the uncertainty about getting the questionnaire packages to the parents of children attending PDSB schools and that it might affect the desired response rate of 50%. Accordingly we decided to offer a small incentive to the all the surveyed children and their parents by including in the questionnaire package a children's toothbrush and a U. of T. logo stick pen. It was hoped that this and existing methods for improving response rates (Edwards et al., 2002) would have the desired effect.

Changes to the sample size

When the DIS was initiated by the RPHU at the beginning of October 2005, a school principal in Caledon refused to have his school involved in the survey. This removed 60, 7-year-olds from the study, (reducing the Caledon numbers to 378). Upon completion of the DIS survey in early December 2005, the number of children who had participated in our survey in Brampton was 810 and in Caledon, 235. With an expected response rate from parents of 50%, the study was short 100, 7-year-olds from Brampton and 125, from Caledon, before the questionnaire portion of the study had even commenced.

To try to increase the numbers, we sought permission from the PDSB and the DPCDSB, to contact 7-year-old students who had participated in a DIS in 2004-5 and their parents. The PDSB refused permission and the DPCDSB never responded to the request. Using StatsCalc in EpiInfo, with a 2:1 ratio of cases to controls at 80% power and 95% confidence, the sample sizes necessary were 453 from fluoridated Brampton and 226 from non-fluoridated Caledon (Epi Info, 2005). With the reduction in possible participants in Caledon to 235 seven-year-olds, a 50% response rate would leave a sample size of 115. This necessitated increasing the ratio of Brampton to Caledon children to 4:1 and reducing the power from 80 to 70% while maintaining 95% confidence. The number of 7-year-olds required from Brampton became 604 and from Caledon, 151. Though final approval of the research was received from the HSREB I on November 21, this change required the filing of an amended research proposal and further delayed the couriering of the questionnaire packages to the parents.

Questionnaire content

Parental questionnaire: This questionnaire (Appendix C, pg. 106), concerned the child's dental health and access to, and use of, dental services. Questions also sought information on the socio-economic status of the households in which the children, under study, lived as follows:

- Child's medical and nutritional history
- Child and parent's oral care practices
- Child's present dietary practices
- Availability of a regular dental care provider
- Time since child's last dental visit
- Place of birth of child
- Family size/composition
- Dental insurance coverage of family (Private or Government Program)
- Household income

The questions in the questionnaire have been used previously in studies by Ismail (1996), Abbey (1998), Brothwell and Limeback (1998) and Watt et al. (2004), (Appendix C, pg. 106).

Just prior to distributing the parent questionnaires, an article by Hong et al. was published which found that amoxicillin use during infancy was associated with the development of fluorosis-like defects in permanent teeth (Hong et al., 2005). As the incidence of fluorosis was an outcome of interest in our study, three questions on middle ear infections and antibiotic use during infancy were added to the questionnaire

Obtaining drinking water fluoride concentrations

The researchers collected drinking water from all the schools of the surveyed children and from their homes to analyze for fluoride concentration. One of the researchers and/or the research assistant performed the analysis in the Preventive Dentistry Laboratory at the faculty by using an Orion 96-09 combination fluoride electrode (Thermo Electron Corp, 2003a) and Orion 930 Ionalyzer System (Thermo Electron Corp, 2003). The fluoride ion electrode, is the most commonly used assay procedure and is one of the most robust analytical tools for determining fluoride concentrations in aqueous solutions (NHMRC, 1999). In a study by Buchalia et al. (2006) the electrode had been found to be accurate and reliable and on par with results from gas chromatography. However, the electrode cannot reliably measure fluoride concentrations below 0.019 – 0.06 ppm (Buchalia et al., 2006; NRC, 2006).

Data handling and preparation

The researchers compared the characteristics of children in fluoridated and non-fluoridated areas using statistical techniques appropriate for cross-sectional designs. For the DIS survey data, we used the Ontario Ministry of Health and Long Term Care (OMHLTC) Dental Indices Software Manual to interpret the codings that the screening teams used on the DIS survey forms. The research assistant entered the data into SPSS (OMHLTC, 1997; SPSS Inc., 2005).

Most of the questions from the parental questionnaires had only one possible answer and were entered as a dichotomy yes versus no. For the few questions that had multiple answers, each answer was treated as a dichotomy or one of the following was done (the designated question represents all in the same category), (Appendix C, pg. 106):

Question 3 – The interest in knowing the towns was to be able to find out its fluoridation status. Once known, for each age category from 1 to 7 years, if the family used public tap water, the data was enter as a dichotomy, fluoridated yes or no. If the family used an alternate source, it was assume to be non-fluoridated

Question 13 - For questions that allowed for: "Other, please specify", if the answer could be placed into any of the provided answers this was done. If there were significant number of answers that were similar but could not be place in any of the provided answers we created a new category.

Question 22a - For questions that asked for all the answers that apply, first we treated each answer as a dichotomy yes or no. Then we combined all the answers in different ways using exponentials of 10 for each answer and adding them to arrive at the combinations.

Data analysis plan for objective 1

Data were analyzed using the survey estimation procedures available in SPSS 12.0 (SPSS Inc., 2005). Simple descriptive statistics (frequency distribution and cross tabulations) and inferential statistics were undertaken to determine if there were statistically significant differences in dental decay and fluorosis prevalence and severity between fluoridated and non-fluoridated communities.

Histograms, box plots and the Kolmogorov-Smirnov tests were used to assess the type of data distribution for continuous variables and frequencies for proportions. The dependent variables of interest were presence or history of dental decay, fluorosis and intake or non-intake of fluoridated communal water (Objective 1). The independent variables were the factors that influenced the differences in the prevalence and severity of caries and fluorosis between fluoridated and non-fluoridated households (Objective 2). Bivariate relationships between each independent variable and the dependent variables were investigated for statistical significance using chi-square tests for categorical predictors and *t*-tests for continuous predictors. In cases where the distribution of continuous variables departed from normal distribution, the Mann-Whitney *U* test was applied to the data. The joint influence of the independent variables on the dependent was tested for statistical significance by means of logistic regression analysis. This analysis included variables that were found to be significant at the bivariate level of analysis, as well as significant covariates or effect modifiers, such age and sex, where allowed by the study design. Statistical tests were two-tailed and interpreted at the 5% significance level.

The dependent variables DMFT and TSIF were analyzed as both a discrete (continuous data) as well as dichotomous outcomes (either as presence or as absence of the condition). When used as a dichotomous outcome the association between independent variables and presence or absence of caries and fluorosis experience were assessed using the stratified, Mantel-Haenzel chi-square test. In addition, the DMFT was broken down to its component parts to examine the contribution of each component to the overall aggregate index score. The joint influence of the independent variables on the dependent was tested for statistical significance by means of logistic regression analysis. When DMFT and TSIF scores were treated as continuous variables, the multivariate analysis of choice was multiple linear regression. Multivariate analysis strategies included variables that were found to be significant at the bivariate level of analysis, as well as significant covariates or effect modifiers, such age and sex. Statistical tests were two-tailed and interpreted at the 5% significance level.

Data analysis plan for objective 2

A second aim of the study was to assess the impact of various demographic, socio-economic and dental care factors on caries rates of 7 year-olds from the two communities. The main outcome variables were prevalence of decay (DMFT > 0) and fluorosis (TSIF > 0) and the main explanatory variable was the amount of fluoride in the drinking water. The analysis included important socio-dental indicators in a multivariate logistic (or linear regression) approach with the purpose of determining whether the concentration of fluoride in the drinking water remained significant once adjustment was made for confounders derived from the parent questionnaires. Similar modeling strategies as those used for Objective 1, were used to analyze this part of the data analysis plan. Specifically, clinically significant variables were evaluated jointly in a multivariate model having city of residence, according to school location, forced into the model.

An independent multivariate model examined the joint contribution of socio-dental factors to DMFT and TSIF. Results obtained from these independent models were combined in a final multivariate model that had city of residence according to school location (presence or absence of water fluoridation) as the main predictor, regardless of its significance level. Where data was dichotomized Adjusted Odds Ratios and 95% confidence limits were obtained by logistic regression analysis.

Informed consent

For this project, consent was both, implicit, signified by the completion of the questionnaire and return of a water sample, and explicit, by signed permission to link that information to the record of the caries and fluorosis status of the child.

Phase 1

The consent process for this stage was identical to that used in other years in the Peel Region. The specific consent procedures were determined at the discretion of the Peel Region Health Department under the legal authority of the Province of Ontario Health Protection and Promotion Act 1990 and legal counsel provided to the Senior Dental Consultant of the Ontario Ministry of Health. For this project, parents of 7 year-old children in the selected schools were informed that the Peel Region Health Department is participating in a study of water fluoridation and dental incidence in their children and that they would receive a questionnaire by mail. The text of the information to parents was printed on the letterhead of the Faculty of Dentistry, University of Toronto. As well, the parents received a copy of a letter from the Region of Peel Health Unit. Both are attached as Appendix B (pg. 104).

Prior to implementing the survey program in each school, children were informed of the nature of the dental assessment by dental hygienists who conducted the program, following which each child was given the opportunity to decline to participate. The survey team informed each child again when the child was called for the assessment and assent to conduct the examination was obtained. Children who refuse to be assessed were excluded from the survey.

Phase 2

Following the conduct of the survey assessment, the hygienist-examiner identified the 7-year-olds from Caledon (n=237) and comparison (n=810) subjects. The parents of all children so identified were couriered a package containing the following:

1) a letter explaining the aims and objective of the study, its data collection procedures and methods of ensuring confidentiality;
2) a copy of the Questionnaire for Parents
3) a consent/assent form
4) a plastic container for a drinking water sample
5) a return envelope with the address of the Community Dentistry Department, University of Toronto

A letter sent to parents informed them about the nature of the study, and that all the 7-year-olds in the school had been selected for participation in the study (Appendix B, pg. 104). In the letter, we asked parents to complete the Questionnaire for Parents and to sign that they consented to linking this information to the results of the child's survey examination. As well, parents were to collect the drinking water sample in the plastic container and to return all, to the Faculty of Dentistry, University of Toronto, in the envelope provided.

All letters and consent forms were printed on the letterhead of the Faculty of Dentistry, University of Toronto, from which the package was couriered. The research assistant and the dental hygienist, who conducted the screening examination, assisted by Peel Region Public Health Department staff and an U. of T. researcher, ran this phase of the study.

Results

Initially, the focus of the study was on the potential difference in oral health outcomes between fluoridated Brampton and non-fluoridated Caledon. Accordingly, the results are presented for the two communities.

Response rate

The potential study population of 7-year-olds was 438 from Caledon and 1173 from Brampton (Table 1, pg. 72). Peel staff enrolled and examined 54% to 69% respectively of the available schoolchildren. Of the children, who were surveyed and whose parents were sent a questionnaire, 52% of Caledon and 36% of Brampton parents completed a questionnaire and returned a drinking water sample. When comparing the response rate of parents whose children attended the two school systems, the PDSB or the Public system response rate was 32% and the DPCDSB or Catholic system was 51%. This reflected the different contact protocols that had to be employed for this study (please see the Methodology section). Questionnaire data were available from about 28% of the potential study population in Caledon and 25% in Brampton.

The urinalysis portion of this study, had a poor response rate as only 18% of the parents in Caledon and 13% in Brampton, who returned completed questionnaires, eventually submitted a urine sample for their child.

Dental indices survey findings

Influence of operator on indices scores

Two screening teams examined the children. Team 1 surveyed 620 children in Brampton only, while Team 2 surveyed all of the 253 children in Caledon and 165 in Brampton. The comparison of the Brampton children caries scores, deft + DMFT (1.13 vs 1.15), indicated virtually no difference in the scoring by the two teams (Table 2a, pg. 73). Breaking the indices into components revealed no statistically significant differences in the separate d, e, f, D, M, F scores. However, Team 2 tended to score more pit and fissure decay (0.13 vs 0.07), smooth surface decay (0.36 vs 0.09), decayed primary and permanent teeth ().59 vs 0.37), filled smooth surfaces (0.10 vs 0.01) and less filled both (0.22 vs. 0.46) than Team 1.

For the TSIF index (Table 2b, pg. 75), in the children from Brampton, Team 1 tended to score much more fluorosis (38% vs 24%) than Team 2 and this difference was significant (K-W, p=0.004). Team 2 found no difference in fluorosis prevalence or severity between Caledon and Brampton (K-W, p=0.11). Accordingly, some of the difference in the prevalence of fluorosis between Caledon and Brampton may be the result of examiner bias.

For the other dental indices in Brampton, Team 2 consistently scored higher for gingivitis (61% vs 47%), debris index (0.80 vs 0.50) and calculus index (0.10 vs 0.07) compared to Team 1. Again, this may indicate that the scores for these indices in the children of Caledon may be biased slightly higher (Table 2a, pg. 73).

Therefore, for one of the two indices of interest in this study, the deft + DMFT, operator bias did not seem to be important. For the TSIF, the Team 1 examiner may have over-reported fluorosis relative to studies un adjacent fluoridated communities (Leake et al. 2002), thereby biasing the Brampton prevalence upwards.

Oral health status of 1047 children in Caledon and Brampton

As seen in Table 3a (pg. 76), compared to Brampton, Caledon had a higher proportion of males (54% to 49%) and a higher percentage of children born in Canada (89% to 80%). Considering only children born in Canada made no difference in deft + DMFT scores by community. Data from the other caries parameters indicated children in Caledon had fewer active caries and more fillings than those in Brampton. Other dental health indices showed a greater proportion of children in Caledon had debris on their teeth and gingivitis, but a lower average debris score as well as a lower average calculus score.

The main findings were that there was no difference in the percentage of caries-free children or mean deft + DMFT scores in both communities. Of the 1047 examined children only 738 children had fluorosis scores, Caledon children had significantly less, 16%, compared to Brampton's 34%, (K-W, $p < 0.001$), but at least some of this appears to be the result of examiner bias. Similarly, there was a statistically significant difference (K-W, $p = 0.023$), for fluorosis of aesthetic concern (TSIF > 1), which was 9.0% in Brampton and 3.6% in Caledon. However, again Team 2 found no statistical difference in TSIF > 1 scores between Caledon and Brampton (Table 2b, pg. 75).

Dental treatment needs of 1047 children in Caledon and Brampton

Other than the dental health status of the children, the DIS is also used to determine the treatment needs in the community. Urgent treatment is one in which the child is experiencing or will soon experience acute symptoms from a pathological condition in the mouth. Fewer children in Caledon have urgent dental treatment needs compared to children in Brampton (Table 3c, pg. 78). Similarly, fewer need non-urgent care and preventive care. This is an indication that the children in Caledon have somewhat better access to dental care and/or better preventive home-care than the children of Brampton.

Oral health status of 411 children whose parents returned a completed questionnaire

For this sub-group of children, there was a higher percentage of children born in Canada and a greater difference in deft + DMFT scores for Canadian-born children living in the two communities, with Caledon having the higher score (Table 3b, pg. 77). All the other parameters and indices were very similar to those for the 1047 children. The dental treatment needs of this subgroup (Table 3d, pg. 78) were also similar to those of the larger group (Table 3c, pg.78). About 11% of parents in both communities expressed unhappiness with the appearance of their child's teeth (Table 3b, pg. 77).

Comparison between responders and non-responders on caries scores

As shown in Table 3e (page 79), when the deft + DMFT scores were compared between responders and non-responders of the parent questionnaire, there was no difference in the distribution of the scores. Therefore, this sub-group is representative of the larger group and there appears to be no selection bias in the 411 responders.

Findings from the 411 parent questionnaires and drinking water samples

Determinants of dental caries

The main external environmental factor that was to be examined in this study was the lack of exposure of the children in Caledon to community water fluoridation (CWF) and the availability of such in Brampton and how this difference affected the prevalence and severity of caries and fluorosis in the two communities. From the analysis of the school drinking water samples (Table C, pg. 71), 8% of Caledon children were exposed to optimal levels of CWF in school, while this occurred for 76% of children in Brampton (Table 4a, pg. 79). Analysis of the 384 home drinking water samples indicated that 24% of the families in non-fluoridated Caledon and only 55% of the families in fluoridated Brampton were drinking optimally fluoridated water. Despite this, of the 298 children whose parents indicated that they drank home tap water, and for whom complete information was obtained, 29% of Caledon children and 73% of Brampton children reported lifetime exposure to optimally fluoridated water. Finally, a relatively high percentage of households in both communities (16% - 20%) stated that they used a reverse osmosis filter, which removes most of the fluoride from the water.

As stated at the beginning of this paper, the Anderson and Davidson model provided a basis for investigating the factors other than CWF that may have an effect on dental caries (Andersen and Davidson, 1997). Personal characteristics or socio-economic status (SES) has been found in many studies to influence oral health outcomes. Of the 411 children, nearly equal proportions were male in both communities (Table 4b, pg. 80). However, of the children and/or one or both parents born outside Canada, a majority resided in Brampton by a greater than 2:1 margin. Of these, many were from "Asia" (for this study, people from East, Southeast and South Asia). More parents of surveyed children, with university degrees resided in Caledon by a small margin, 4%-7%, compared to Brampton. In family income, Caledon had a significantly greater proportion (56%) with levels higher than $80,000/year, than families in Brampton (40%). Six percent less families in the lowest income group resided in Caledon than in Brampton. In general, the Caledon families seemed to be of higher SES than those in Brampton.

In personal oral hygiene and diet, children and their parents from both communities had similar practices. Almost all the children, 97%-98%, brushed once or more times per day (Table 4c, pg. 81). About 93%-91% of parents started brushing their children's teeth before the age of three years and most, 83%-84%, used toothpaste when brushing. The majority of children, 61%-64%, in both communities started brushing their own teeth at 3 years of age and older. A small proportion, 4%-5%, received fluoride supplements. A high proportion of children, 75%-80%, received infant formula with most, 61%-68%, starting before the age of 6 months. Almost all the infant formula, 91%-94%, required the addition of water and a high proportion of parents, 75%-80%, used home tap water. A significant proportion of children, 16%-18%, were still using the bottle by the time they started to walk. Over a third of children did not take multivitamins. In their dietary preferences, a significant proportion of children, 12%-19%, were snacking more than four times a day and on sweets, 19%-16%. Almost a third of the children, 32%-31%, were snacking before or in bed every night.

There were some differences in the behaviour of children and parents in Caledon as compared to those in Brampton. A higher proportion of parents started brushing their children's teeth at a younger age (Table 4c, pg. 81). More children, 64% vs. 49%, were using pea-sized amounts of toothpaste, at present and from age 0 to 4 years, 77% vs. 67%. A small but lower proportion of children, 8% vs. 13%, were prescribed fluoridated mouth rinses. A lower percentage of parents, 53% vs. 61%, stopped giving their child infant formula between 12 to 23 months of age, however a higher proportion of parents, 48% vs. 33%, stopped giving their children the bottle during the same age range. For before, or in-bed snacking, more children in Caledon than Brampton, tended to have fruit, 32% vs. 21%, and to drink water, 62% vs. 31%,. Overall, the children and parents in Caledon had better oral hygiene and dietary practices than those in Brampton.

Relative to accessing dental care, the children and parents in Caledon showed a higher use than those in Brampton. A higher percentage had a family dentist and tended to visit the dentist at an earlier age and more often for routine check-up and cleaning (Table 4d, pg. 82). A slightly higher percentage of the parents of Caledon children had dental insurance compared to parents in Brampton. Brampton children were more likely not to have ever visited the dentist and had longer intervals between appointments.

For this study, the child's place of residence was assumed the same as the location, in one of the two cities, of the school the child attended. This assumption was tested using actual addresses taken from the information received in the questionnaires. The results indicated that about 6% of the Caledon children lived in the City of Bolton, a factor that the research protocol had excluded from this study (Table 6c, 2, pg. 87). Furthermore, 33 of the 34 children born outside of Canada resided in Brampton and these children tended to have much higher deft + DMFT scores than Canadian-born children (Table 6c3, pg. 87). Another finding was a high correlation between deft + DMFT scores and family income levels (Table 6c5, pg. 89). The various dental indices were therefore analyzed using the actual addresses of the children and removing the children from Bolton and those who were not born in Canada from the analysis. However, the results seen in Table 6c4 (pg. 88) were very similar to those seen in Tables 3a and b (pg. 76-7), so the earlier analysis was maintained.

The determinants of dental fluorosis

Many of the factors that influenced dental caries in the children of the two communities were also factors that influenced dental fluorosis. Table 5 (pg. 83), shows that a smaller proportion of children in Caledon had access to optimally fluoridated water, from home and school, than children in Brampton. Fifty-nine percent of children from Caledon had been exposed for at least one year and 29% for 7 years, to optimally fluoridated water. More Caledon children and their parents had been born in Canada and the parents had higher levels of education as well as family income. Children from Caledon had, in the main, better home-care practices, as more of their parents, compared to parents from Brampton, had started brushing their teeth at 6 to 11 months of age. In addition, a higher percentage of parents from Caledon reported their children were given antibiotics and specifically amoxicillin for middle ear infections than children from Brampton.

Bivariate statistical analysis for deft+DMFT > 0

For the presence of any dental decay, bivariate analysis indicated the following were risk factors (Table 6a, pg. 85): child was born outside Canada, (OR=3.06 / 95% CI = 1.48-6.30); mother was born outside Canada, (OR=1.58 / 95% CI = 1.05-2.38); father was born outside Canada (OR=1.61 / 95% CI = 1.07-2.42); debris index > 1 was present on the teeth (OR =1.62 / 95% CI = 1.06-2.46); before or in-bed snacks that were not bread or cereal, (OR=1.93 / 95% CI = 1.07-3.47); did not take multivitamins (OR=1.89 / 95% CI = 1.25-2.87); parent waited until after 3 years of age to start bushing their child's teeth (OR 3.98 / 95% CI = 1.87-8.48); and family income was less than $40,000 per year (OR 1.76 / 95% CI = 1.03-3.02).

The factors that were preventive against dental caries were: did not have dental sealants in the mouth, (OR= 0.48 / 95% CI = 0.23-0.92); never visited the dentist, (OR= 0.07 / 95% CI = 0.01-0.49); the last dental appointment was for a check-up and clean, (OR=0.22 / 095% CI = 0.14-0.35); child was fed infant formula, (OR= 0.54 / 95% CI = 0.33-0.86); and did not use toothpaste when brushing, (OR= 0.50 / 95% CI = 0.28-0.92). Only 12 of the 27 factors listed in Table 6a (pg. 85, in bold) were placed into logistic regression. This is due to a high correlation among factors arising from the same question in the parent questionnaire, and a decision was made to use the factor with strongest preventive OR or strongest risk OR.

Logistic regression model for deft+DMFT > 0

All the factors that were significant for the prevalence of dental caries under bivariate analysis were placed into a model for logistic regression. The one exception was the city of residence based on the location of the school. As the study was the comparison of caries scores of 7-year-olds living in Brampton and Caledon, even though this factor was not significant under bivariate analysis, it was forced into the model. In addition, as a number of the factors had strong correlations with each other, where that occurred, only the factor with the strongest bivariate OR was chosen for the model. The final model had the following adjusted OR's, (Table 6b1, pg. 86): child did not have sealants (OR=0.39 / 95% CI = 0.15-1.00); parent started brushing the child's teeth after the child was 3 years of age (OR=2.60 / 95% CI = 0.95-7.14); last dental appointment was for check-up and clean (OR=0.17 / 95% CI = 0.09-0.32); child was fed infant formula (OR=0.48 / 95% CI = 0.25-0.93); child did not take multivitamins (OR=2.25 / 95% CI = 1.24-4.07); and child was born outside Canada, (OR=5.72 / 95% CI = 1.71-19.2). This model had a Cox and Snell R squared value of 0.23, a Hosmer and Lemeshow Test value of 0.91, a sensitivity of 77% and a specificity of 71%. This model therefore predicts 23% of the variation in the factors associated with the incidence of dental caries. The factor of living in Caledon or Brampton did not survive regression and none of the factors directly related to CWF were found significant under bivariate analysis.

Bivariate statistical analysis for dental fluorosis (TSIF > 0)

The factors significant for the presence of dental fluorosis were (Table 7a, pg. 90): child did not brush their teeth; child was exposed to optimal home water fluoridation for any period over a year; child was exposed to school water fluoridation at levels above 0.2 ppm; one or both parents were born outside Canada; child was screened by screening team I; child did not take antibiotics in the first 6 months of life; parents reported use of reverse osmosis in home water system; parents started brushing the child teeth at 6 to 11 months of age; and child had fruits for in-between snacks.

The protective factors associated with decreased risk for dental fluorosis were, child lives in Caledon; and used pea-sized amount of toothpaste when brushing child's teeth. As with the bivariate analysis for deft+DMFT > 0, only the strongest factors from TABLE 7a (pg. 90, in bold) were placed into logistic regression for dental fluorosis.

Logistic regression model for dental fluorosis (TSIF > 0)

All the factors found to be significant under bivariate analysis were entered into a logistic regression model (Table 7b, pg. 91). The model indicated that using a pea-sized amount of toothpaste was protective and the risk factors were, the parents started brushing the child's teeth between the ages of 6 to 11 months; the child definitely did not take antibiotics and the child was exposed to lifetime optimal levels of home water fluoridation. The Cox and Snell value was 0.124, the Hosmer and Lemeshow Test was 0.976, the sensitivity was 76% and the specificity 56%. The model could therefore explain only 12% of the variation in the factors associated with dental fluorosis.

Bivariate statistical analysis for fluorosis of aesthetic concern (TSIF > 1 vs TSIF = 1 and 0)

The factors significant for the presence of dental fluorosis of aesthetic concern were (Table 7c, pg. 92): the child's last dental visit was within the last 6 months; the child's mother had a college education or higher; the child definitely did not take antibiotics; parents started brushing their child's teeth at 6 to 11 months of age; and the amount of toothpaste used, covered ¾ of the brush head.

Logistic regression model for fluorosis of aesthetic concern (TSIF > 1 vs TSIF = 1 and 0)

All the factors found to be significant under bivariate analysis, with additional factors, were entered into a logistic regression model (Table 7d, pg. 93). The risk factors that survived regression were: the child did not take any antibiotics within the first 6 months of age; the child used toothpaste that covered ¾ of the brush head; the child's last dental visit was within 6 months; and the child's mother had college education or higher. Also in the model were the child lived in Caledon and the child attended a public school, but both were not significant. The Cox and Snell value for this model was 0.12, the Hosmer and Lemeshow Test was 0.32 and the sensitivity and specificity were not applicable. The model could therefore explain only 12% of the variation in the factors associated with dental fluorosis of aesthetic concern.

Findings in relation to the objectives of this study

Objective 1: Research question 1i

The data analysis results indicated no difference in caries scores between the 7-year-old school- children in Caledon and Brampton with mean deft + DMFT for both = 1.1. There was virtually no difference in the percent of 7-year-olds who were caries-free with

64% in Caledon and 65% in Brampton (Tables 3a and b, pg. 76-7). For the percentage of 7-year-olds with fluorosis, there was a significant difference ($p < 0.001$) with Caledon having 16% and Brampton, 34%. Similarly, with fluorosis of aesthetic concern (TSIF > 1), there was a statistically significant difference (K-W, $p = 0.03$) in the proportion of 7-year-olds affected in the two communities. However, we suspect that some of this difference was due to examiner bias.

Objective 1: Research question 1ii

Comparing the caries scores of 7-year-olds from the 2001-2, 2004-5 and 2005-6 (this study) cohorts, the respective mean deft + DMFT's were 1.97, 0.53 and 1.07 for Caledon and 1.53, 1.25 and 1.14 for Brampton (Table A, pg. 69).

Objective 2: Research question 2

There were no differences in the socioeconomic, demographic, oral health practice and oral health knowledge factors that were associated with caries and fluorosis rates between 7-year-old children in Caledon and Brampton that survived logistic regression. However, this study did find factors that were associated with whether the child had caries or not (deft + DMFT > 0) and/or fluorosis or not (TSIF > 0) and/or fluorosis of aesthetic concern or not (TSIF > 1).

Discussion

Review and Summary

A sample survey of school-aged children was conducted in 2001/02 to assess the oral health status of children in Peel Region. The results of the survey were reported to Regional Council in "Children's Dental Health: A Peel Health Status Report" (CDH), (RPHU, 2003). Among the report's several findings, one was that children in Caledon had significantly greater dental decay. Fifty percent (50%) of Caledon children had experienced dental caries (cavities) compared to 37% in Brampton and 38% in Mississauga (CDH, p4).

As a result of the findings from the CDH, our study was commissioned by the Region of Peel Council to provide information on the factors for the difference in caries scores between the children in Caledon and those in the rest of Peel Region and thereby examine the potential benefits of fluoridating Caledon's communal well water.

Accordingly, we conducted a cross-sectional study collecting information via the annual provincial dental indices survey, a parental questionnaire and individual household and school drinking water samples. The target population was 7-year-old schoolchildren, as they would still have most of their caries-susceptible primary teeth, and newly erupted permanent teeth on which we could measure dental fluorosis.

The children were selected from 10 of 11 elementary schools in Caledon and 15 schools in Brampton, matched on a number of socioeconomic parameters. In the fall of 2005, two trained and re-calibrated dental hygiene teams collected data on caries and fluorosis from 810 seven-year-olds from Brampton and 237, using standard Ontario Ministry of Health Dental Indices Survey (DIS) criteria. Parents of all 1047 were invited to complete a parent questionnaire to collect information on demographic, socio-economic, behavioural, dietary and oral care practice factors. Drinking water samples were requested and collected from the homes and schools of 289 children in Brampton and 122 from Caledon, whose parents completed a questionnaire. The water samples were tested using accepted analytical methods to establish accurate fluoride concentrations. The data from the DIS, parent questionnaire and the drinking water samples were combined into one database for statistical analysis using SPSS v. 12.

We found no difference in the percentage of caries-free 7-year-olds from fluoridated Brampton (65%) and non-fluoridated Caledon (64%). The deft + DMFT severity scores were virtually the same in the two populations at 1.1, while the percentage of children with fluorosis was higher in Brampton as compared to Caledon at 34 versus 16%. Logistic regression analysis indicated that the following factors were protective of deft + DMFT scores ≥ 1: the child's last dental appointment was for a check-up and cleaning; and the child was fed infant formula. The risk factors were, the child did not take multivitamins and the child had not been born in Canada.

The factors found to be significant, under bivariate analysis, for the presence of fluorosis were those that were mainly associated with exposure to fluoride. However, exposure to antibiotics, eating fruits at snack-time, being screened by survey team 1 and place of birth were also significant factors. As shown by logistic regression, the use of a pea-sized amount of fluoridated toothpaste when brushing was found to be protective. The risk factors were, parents started brushing the child's teeth between 6 to 11 months of age; the child definitely not taking antibiotics during the first six months and the child being exposed to optimal drinking water fluoride levels throughout his/her life.

Compared to the number of factors significant for the presence of any fluorosis, fewer factors were such for the presence of fluorosis of aesthetic concern (TSIF > 1) under bivariate analysis. As shown by logistic regression, a few factors that were not identified as risks for any fluorosis appeared for "fluorosis of aesthetic concern". These were, the child attending public school (though not significant) and the educational attainment of the mother. The other risk factors were: the child definitely not taking antibiotics during the first 6 months; the child using toothpaste that covering ¾ of the head of the brush-head when brushing; the child's last visit to the dentist being within the last 6 months; and the mother of the child has college or higher educational level.

Completed questionnaire response rate of parents of surveyed 7-year-olds

The percentage of parents, who completed a questionnaire and submitted a drinking water sample, was 39% (Table 1, pg. 72). We had originally estimated a 50% response rate to calculate the necessary sample size of schoolchildren from Caledon and from Brampton for this study. The response rate for this study was slightly better than some reported in the literature for mailed questionnaires. Abbey in 1998 reported a 33% response rate for a dental questionnaire sent to parents of pre-schoolers in North York (Abbey, 1998). Williams and Zwemer (1990) reported a 33.4% response rate. Oklahoma State University's Bureau for Social Research (OSU 2005) stated, "Even an attractive, well–designed survey is likely to be returned by no more than 30% of a sample unless extra steps are taken to improve the response rate." While Kaldenburg (1994) declared, "A response rate of 46.5% is generally considered to be very high,,,"

Other researchers have reported higher response rates. Clarke and Berkowitz (1997) were able to achieve a 50% response rate. While Pendrys and Katz (1989) managed an 80% response rate by offering their subjects $20.00 per completed questionnaire. To reach a 50% response rate for this study, we followed Salant and Dillman's (1994) protocol for surveys with mailed questionnaires (a mailing followed by a reminder letter then a second mailing followed by a phone contact and a final third mailing) that had been shown to achieve a 50 to 70% response rate. In addition, we used some of the most successful strategies found in a systematic review on increasing response rates to mailed questionnaires (Edwards et al., 2002). However, our inability to contact directly the parents of children attending PDSB schools effectively crippled the use of the Salant and Dillman protocol on this group and was a major contributing factor in reducing the overall response rate for this study. Nonetheless, as shown in Table 3e (pg. 79), the low response rate did not appear to introduce selection bias.

Public health implications of the power of the study

Due to potential numbers of participants, the power of the study was reduced to 70% from the accepted 80%, while maintaining the precision at 0.05. Theoretically, this means that, a priori, there would be a 3 in 10 chance of not showing the benefit of a proven public health intervention, i.e., community water fluoridation. However, in this population there was a finite number of 7-year-olds available for the study, meaning we had to increase the ratio and therefore, the number of children examined in Brampton. Sample size was calculated on an expected difference of 0.6 in the mean deft + DMFT between the two communities. Given our finding of a 1% (65% vs 64%) difference in prevalence of caries and a 0.07 difference in mean deft+DMFT scores, in hindsight, tens of thousands of children would have been required to achieve 80% power.

The differences we found are not large enough to be important in either clinical or public health terms. Thus, even if we had been able to commit massively more resources to the study and include more children than were available in all of Brampton to demonstrate statistical difference, there was not sufficient absolute difference in the communities to warrant powering the study to reduce the probability of a false negative finding. The information that these small differences were statistically significant would not alter the policy consideration.

Internal validity of the findings

As much as possible the study was constructed to provide valid and reliable results. The DIS (survey) criteria were the same as those performed every year by the RPHU dental staff for the provincial mandatory programs. The parent questionnaires were developed from the literature on risk and protective factors for caries and dental fluorosis. The questions themselves were taken mostly from studies conducted in Ontario by Brothwell and Limeback (1998) and Abbey (1998). The survey teams are calibrated on the various dental indices at the start of each school year before undertaking the survey and were re-calibrated on the fluorosis criteria specifically for this study.

Tables 2a and b (pg. 73-5), shows a comparison of the dental indices as recorded by both survey teams. From the p values of T-tests, there were no significant measurement differences for 15 of the 25 indices, more importantly there were no differences in deft + DMFT, any of the separate components (d, e, f, D, M, F),and filled primary and permanent measurements that were variables of interest in this study.

Our findings on the prevalence and severity of decay, in this study, were validated by data from the previous 2004-5, RPHU, DIS. When the results of the two surveys were compared, the percent of children that were caries-free was within 2% to 12 %. The difference in deft + DMFT scores was 0.11 for 7-year-olds from Brampton and 0.54 for those in Caledon. There was no difference in the percent of children with fluorosis in Caledon and a difference of 12% for children in Brampton (Table A, pg. 69). For both the 2004-5 and the present study, the dental index scores from Peel Region were consistent with those from the other 18 Ontario Health Units (Tables A and B 1, 2, pg. 69-70).

Possible reasons for a smaller than expected difference

This study could not find a difference in deft + DMFT scores between 7-year-old children living in non-fluoridated Caledon and fluoridated Brampton. There are a number of possible reasons for this result. Maupome et al. (2001) have suggested that the availability of multiple sources of fluoride makes detecting epidemiological changes in caries prevalence and severity, in communities with low caries incidence, high SES and good access to dental care, difficult. Locker (1999) has stated that although CWF has been shown to be effective in reducing caries, in developed countries the magnitude of the effect is unlikely to be large. Honkala and Marstrander (2006) added that caries prevalence tended to fluctuate significantly, longitudinally within age cohorts. Thus, the differences are likely to be small and influenced by factors that mute the effect of fluoridated water

Problems in measuring exposure

We found that exposure to fluoridated water was not well represented by the status of the community's water supply – it was neither consistent nor stable over the child's lifetime. About 8.3% of the families in Caledon and Brampton indicated that their child had lifetime use of non-municipal or other water sources, with an additional 8.5% reporting use of such, at sometime during the child's first 7 years. A relatively high percentage of parents (16% from Caledon and 20% from Brampton) stated that their household water system was equipped with a reverse osmosis filter. Analysis showed no significant association between a family using reverse osmosis and increased caries or decreased fluorosis scores in their children.

The school drinking water samples that were tested for fluoride concentration provided another instance of the difficulties involved in determining the fluoridation status of individuals. The municipal water system that supplied the drinking water for the 15 Brampton schools is fluoridated at 0.5 to 0.8 ppm. The 10 Caledon schools are supplied by municipal well water systems that are not optimally fluoridated. The original drinking water samples indicated that one school in Caledon had optimally fluoridated water and four Brampton schools had water less than 0.5 ppm. It was later discovered that the school in Caledon was receiving trucked drinking water from the Brampton water system and retesting, of the four Brampton schools, indicated the fluoride concentration was now within the optimal range (Table C, pg. 71).

The home drinking water samples also gave unexpected results. Some 24% of the water samples from non-fluoridated Caledon were found to be within optimal fluoride levels. While 45% of the water samples from fluoridated Brampton were found to have below optimal levels of fluoride. It was surmised that in households near the border between the two cities, there might have been crossover of water supplies into the neighbouring community. Other possibilities; reverse osmosis filters or bottled water were being used and/or there were fluctuations in the amount of fluoride that was being injected into the Brampton water system (may also have occurred with the four Brampton schools).

Our findings are supported by Levy, who found that it has become difficult to categorize fluoride exposure by fluoridation status of a specific area due to the availability of many fluoride sources (Levy et al., 2003). In addition, Haugejorden and Birkjeland (2005) reported that net population mobility had a significant affect on measurements of caries prevalence.

Armfield and Spencer (2004), in an Australian study of 9988 children, 6-15 years of age, reported that 45% of the children had greater than 50%, lifetime consumption of non-public, or tank/bottled water. Using general linear models after controlling for sex, age, income, education, occupation, family type, residential location, brushing frequency and fluoride supplement use, they found the use of non-public water was associated with caries in the primary teeth (F Statistic = 3.81, p = 0.10). Additionally, The U.S. National Research Council (NRC, 2006) review determined that 75% of the water ingested by children was from community water systems, 13% from bottled water and other sources constituted 10%. Weinberger (1991) found the fluoride content of bottled water in Canada can range from 0.05 to 4.8 ppm and Warren and Levy (2003) that distillation or reverse osmosis filters can remove greater than 90% of the fluoride from home drinking water. A 1993 survey of Toronto residential households found only 1% had reverse osmosis filters and 6% had activated carbon filters (these cannot remove fluoride from the water), however 41% stated they were using bottled water (Auslander and Langlois, 1993). Therefore, it was possible that parents who filled out the questionnaire may have mistaken reverse osmosis filters with other types of water filters available on the market.

Comparison of these findings with other studies

Prevalence of caries

This study found the percent of children caries-free in the two communities was 64%-65%, with deft + DMFT = 1.1.

A 2002 study by Leake, on 7 year-old children in the City of Toronto, while not comparing caries in a fluoridated and a non-fluoridated area, found that a percent caries-free of 59% and a mean deft + DMFT of 1.59 ($\pm$ 2.7), (Leake et al., 2002). Similarly, Mattila (2005) reported on 7-year-olds in Finland, indicating 59% of the children were caries-free and had a mean dmft + DMFT of 1.37 ($\pm$ 0.07).

Effect of Community Water Fluoridation

Locker's 1999 review reported a difference in deft from 0.7 to 1.57 and in DMFT of 0.15 to 2.19 between fluoridated and non-fluoridated communities. The systematic review by McDonagh et al. (2000) confirmed a difference in the percentage of caries-free between -5% and 64% and a def + DMF score difference ranging from 0.5 to 4.4. Another review recorded a difference of 0.7 DMFT (IMHC, 2002). A 2002 review by the Task Force on Community Preventive Services reported a difference of 29%, but ranging from +67% to -111% (TFCPS, 2002b). Whelton's study, which included 8 year-olds, in Ireland, found no difference reporting identical mean deft + DMFT scores of 0.3. A U.K. study of 5 year-olds reported an overall difference in caries prevalence of 5% and dmft of 0.42, however in 3 of the 18 communities, the non-fluoridated communities had lower dmft scores than the fluoridated (Tickle et al., 2003). These studies again point to very little difference in the mean deft + DMFT scores along with the percentage of children who are caries-free, between fluoridated and non-fluoridated populations

Nonetheless, some of the literature documented a greater effect for community water fluoridation. The CDC in 2001 indicated a difference of 18% to 40 % between fluoridated and non-fluoridated populations (USCDC, 2001). A 1999, Australian review reported a difference of 48% to 57% in deft and 18-53% in DMFT between the two populations (NHMRC, 1999). Harrison found a 15% increase in percent caries-free and a decrease of 2.2 dmftDMFT as a result of CWF (Harrison, 2005). A Scottish study of 5-6 year-olds found the percent caries-free was 87% in a fluoridated area compared to 32% in a non-fluoridated area with dmft scores of 0.13 and 3.21 respectively (Stephen et al., 2002).

The possible reasons for these wide differences in the effect of CWF on caries prevalence and the deft + DMFT scores may be attributed to differences in socioeconomic, regional, national, cultural or ethnic make-up of the study population. Differences in determining decay, filled and missing by the myriad of survey staff involved. In addition, the degree of penetration of CWF in a particular country or region will determine the strength of the "halo effect" on non-fluoridated areas (Griffin et al., 2001).

According to data from various sources, the percentage of the population receiving optimally fluoridated water is 70% in Ontario (OCDOC, 2006), 43% in Canada, 64% in the USA, 61% in Australia, 61% in NZ, 10% in the UK, 66% in Ireland, and 41% in Brazil (BFS, 2006). Our finding that exposure to fluoride is not well represented by living in a fluoridated community goes to explain some of the differences with these studies.

The effect of matching school populations

Caledon is a high SES area according to StatsCan (2005) data. In selecting the comparison school populations in Brampton, 7 criteria were used, 5 of which were related to parents income and education (Addendum 3, pg. 133). It is not surprising, therefore, that both family income and the educational attainment of the mother and/or the father were not significantly associated with differences in prevalence and severity of caries and fluorosis. Most of the 7-year-olds in both communities came from relatively high SES families, so SES could not be used to differentiate the two groups of children. In addition, high SES selects for other characteristics such as better preventive practices, better diet and nutrition, better access to dental services, etc. and this could have obscured the discovery of other statistically significant factors than those revealed by in this study.

Validity of the identified risk and preventive factors for deft + DMFT > 0

The child's last dental appointment was for a check-up and clean was significant as a protective factor against caries. A possible explanation for this is that children who regularly attend dental recall appointments tend to be of high SES, have good preventive behaviours and have knowledgeable parents, all of which are associated with low caries prevalence. Only one study (Singh and Spencer, 2004) has reported the opposite, namely that an increasing number of professional preventive fluoride treatments was associated with higher caries incidence in permanent 1st molars. The authors did not provide any reason for this finding other than to label it a confounding variable in their analysis. A possible explanation for this finding might be some over-treatment with increasing frequency of attendance.

A second protective factor was the child being fed infant formula as a baby. The factor may be plausible as 78 % of the children in this study were given infant formula, most of which needed added water and the majority of parents used tap or other water sources. For the children living in a fluoridated community, before the age of one year, they would have been ingesting fluoride with their formula. An Australian study indicated that the prevalence of first permanent molar pit and fissure caries decreased if the pre-eruptive fluoride exposure was equal to or was greater than the post eruptive exposure to fluoride (Singh and Spencer, 2004). To decrease approximal and smooth surface caries prevalence, both the pre and the post-eruptive fluoride exposure has to have occurred during at least 90% of the child's life. However, the Australian study also reported that the non-use of infant formula was protective against pit and fissure caries.

The first risk factor for deft + DMFT > 0 in this study was a child not taking multivitamins. This factor was consistent with the findings of a of a recent Australia study of under 4-year-olds, which reported a decrease in dmfs in those children taking vitamins (Hallett and O'Rouke, 2006). An explanation for how this could occur comes from a study done at the Hospital for Sick Children in Toronto that found 17% of children with Early Childhood Caries (ECC) had some signs of malnourishment, 13% had low haemoglobin and 60% had low serum ferritin (<22 microg/L), (Clarke et al., 2006).

The second risk factor for deft + DMFT > 0, in this study, was the parent not starting to brush their child's teeth until the child was over 3 years old (though it was not significant). This factor, coincides with results from other research which reported that caries increased as the number of years of toothpaste use decreased, during the first 6 years (Ismail et al., 1993). In addition, caries increased if toothbrushing was delayed past 6 months of age (Hallett and O'Rourke, 2006) and the risk of caries increased by 1.22 if the start of brushing was delayed one year (Vanobbergen et al., 2001).

The third and last risk factor is the strongest and is the child not born in Canada. Of the 7-year-old children in this study, 80%-89% were born in Canada, however only 38% of their parents were born in Canada. This is similar to the 87% of the children born in Canada and 66% of parents born outside Canada from a study on early childhood tooth decay and nutrition, based in Toronto (Clarke et al., 2006). Birthplace of children and their parents have a significance as there appears to be a stark difference in caries prevalence and deft + DMFT scores between those children native to a country and those who are immigrants. This study found that children born outside Canada had a caries prevalence of 62% and children born in Asia, a mean deft + DMFT of 3.44 – 4.50, while Canadian born children had a caries prevalence 35% and mean deft + DMFT of 0.98 -1.13. A study by Davies et al. (2001), in the UK, of three year-olds reported similarly that Asian children had a caries prevalence of 38% and a mean dmft score of 2.58 while non-Asians had a caries prevalence of 20 % and a dmft of 1.4.

A number of other studies, have reported that immigrant children have a higher risk of caries when compared to native-born children (Carvalho et al., 2004; David et al., 2005;

Haugejorden and Birkeland, 2005). Non-Caucasian (Hallett and O'Rourke, 2006), Asian (Hallett and O'Rourke 2002), non-English speaking children (Hallett and O'Rourke, 2002) were at higher caries risk with OR's ranging from 1.74 to 2.98. Bishar et al. (2006) indicated that, in Germany, 11-14 year-old immigrant children had poorer oral health and higher treatment needs than non-immigrants of the same age. Similarly, 5 year-olds with mothers from a "non-Western" background, in Italy, had higher caries prevalence by 64 to 28% and an OR for caries of 3.6 (95% CI=2.8-4.6) when compared to children whose mothers were of a "Western" background (Ferro et al., 2006).

Prevalence of Fluorosis

Background

Both the US and Canada have seen an increase in the prevalence of fluorosis (Levy, 2003). Fluorosis is caused by the intake of excessive amounts of fluoride during the critical period of the tooth development (CRHA, 1998; NRC, 2006). For the permanent incisor teeth, this period is 15-30 months of age. The severity of the condition increases from the anterior to the posterior teeth (SPDPNA, 2005). Even though living in a fluoridated community maybe a risk factor, CWF contributes only about 40% to the development of dental fluorosis (Whelton et al., 2004) and there is potential for fluorosis even in the absence of CWF (CRHA, 1998). Aoba and Fejerskov (2002) have calculated that for every increase in dose of 0.01 mg F/ kg b.w. an increase in the dental fluorosis community index of 0.2, as define by Dean, can be predicted. Griffin et al. (2002) have estimated that about 2% of US schoolchildren may perceive fluorosis of aesthetic concern that could be attributable to the currently recommended optimal water fluoride levels. The scales of the three main fluorosis indices can roughly be grouped for equivalence:

Dean's	0	0.5	1	2	
TSIF	0	1	1	2	
TFI	0	1	2	3	(Griffin et al., 2002)

As stated previously, in this paper, the TFI is the most sensitive of the fluorosis indices.

Screening for dental fluorosis, under survey conditions, can be challenging. The mottling of teeth unrelated to F may be due to malnutrition, metabolic disorders, exposure to certain dietary trace elements, tea drinking in early childhood, physical trauma, genetics, high altitude and intake of amoxicillin during the first 6 months of age (Watts and Addy, 2001;

NRC, 2006). As well individuals may have a genetic susceptibility to fluorosis (NRC, 2006). Expert opinion have suggested that fluorosis is aesthetically acceptable at TF $\leq$ 2 (NHMRC, 1999). Clark et al. (1995) have stated that the increased mobility of population and the halo effect are confounding variables in trying to compare caries and fluorosis indices in fluoridated and non-fluoridated communities.

Prevalence for TSIF > 0

This study has found the prevalence fluorosis in 7-year-olds in fluoridated Brampton was 34% and in non-fluoridated Caledon, 16%. Canadian studies have reported prevalences in a similar range. The study by Leake et al of 7-year-olds in the neighbouring city of Toronto (1.2 ppm), determined a fluorosis prevalence of 27% (Leake et al., 2002). Brothwell and Limeback (1999), in a study of 7 year-olds in rural Ontario, found no difference in the prevalence of TSIF = 1 at various fluoride levels in the drinking water. A recent study by Clark et al. (2006) looked at the trend for the prevalence of TFI = 0 from 1994 to 2003 in fluoridation ended communities and found an increase from 57% to 78% ($p < 0.0001$). Clark and Maupome's studies of B.C. children have generally reported higher prevalences, within a 75% to 45% range for fluoridated to non-fluoridated communities (Clark, 1991; Clark, 1993; Clark, 1994; Maupome et al., 2003). Ismael et al.'s studies in Nova Scotia and Quebec also reported higher prevalence rates within a 69% to 42% range for fluoridated and non-fluoridated communities (Ismail et al., 1990; Ismail et al., 1993).

Locker's (1999) review paper, indicated that the ranges for the prevalence of fluorosis in North America was 35%-60% in fluoridated areas and 20%-45% in non-fluoridated areas; for Europe 54% to 79% and 14% to 36%; and for South America 61% to 64% and 31% to 50%. Recent studies have recorded prevalence rates that have tended to fit within the lower end of these ranges (Stephen et al., 2002; Warren and Levy, 2003; Harding et al., 2005; Harrison, 2005; Khan et al., 2005; Conway et al., 2006; Machiulskiene et al., 2006). One multi-centre study, from the EU, recorded relatively high fluorosis prevalences of 89% for a city with fluoride at 1 ppm in the water and a range of 51% to 84% for 6 cities with 0.01 to 0.13 ppm water (Cochran et al., 2004c).

Prevalence of aesthetically significant fluorosis

The prevalence of dental fluorosis of aesthetic concern, TSIF > 1 (Dean's $\geq$ 2, TFI $\geq$

3), in this study was 9.0% for the 7-year-olds in Brampton and 3.6% in Caledon. This compares to the 14% found in Toronto 7-year-olds by Leake et al. (2002), and the 19% in fluoridated and 5% in non-fluoridated communities, reported by Brothwell and Limeback (1999), in rural Ontario. Other studies from the US (Griffin et al., 2002; DHHS-CDC, 2005), UK (Stephen et al., 2002; Harrison, 2005), Europe (Conway et al., 2006) and Australia (NHMRC, 1999) have prevalence figures of similar magnitude for fluorosis of aesthetic concern.

The public and patients may not agree with the fluorosis indices scores that dentists have determined were of aesthetic concern. A study reported that when patients or non-professionals judge the aesthetics of teeth with mild fluorosis they treat them no different from judgments made of normal dentition, but severe dental fluorosis and untreated decay had significant negative impact on social judgments (Williams et al., 2006). Another study indicated only 7% of parents perceived any problem that could be associated with fluorosis in their children (Sigoujons et al., 2004). These results give some validity to the levels of fluorosis generally thought to
be of aesthetic concern. The one question in our questionnaire that dealt somewhat with this issue explored the degree of happiness or unhappiness of the parents in regards to the appearance of their child's teeth. About 11% of parents in both Caledon and Brampton expressed unhappiness; however, due to the general nature of the question, this could be due to orthodontic or restorative problems and not just the aesthetic appearance of the teeth caused by fluorosis.

Infant formula

In this study, as infants, 76% of the children were fed infant formula and 35% of parents stopped giving their child a bottle at under 2 years of age and 65% at under 3 years of age. The use of infant formula which requires the addition of water has been reported to be a risk factor for fluorosis (Pendrys and Stamm, 1990; Clark, 1993; Maupome et al., 2003; Marshall et al., 2004; Whelton et al., 2004; Browne et al., 2005; Clark et al., 2006). Other studies have specified that it is the prolonged use of infant formula that is associated with fluorosis (Osuji et al., 1988; NHMRC, 1999; USCDC, 2001; Warren and Levy, 2003). In this study, the use of infant formula was not significantly associated with fluorosis under bivariate or logistic regression analysis. A possible explanation is that the study population consists of highly educated mothers who were aware of the causes for dental fluorosis and acted accordingly, by not giving infant formula (21%) or used bottled water (16%) instead of tap water or used reverse osmosis water filters (21%).

Validity of the identified risk and preventive factors for TSIF > 0

The first risk factor for fluorosis was parents started brushing their child's teeth at 6 to 11 months of age (OR = 2.30). This result was also found in other studies (Osuji et al., 1988; Maupome et al., 2003; Whelton et al., 2004; Harding et al., 2005; Franzman et al., 2006). This factor, also coincides with research showing that the severity of fluorosis was related to the timing, duration and dose of fluoride intake and the cumulative fluoride exposure during the entire tooth maturation stage (NRC, 2006). Again, Conway et al.'s (2005) Swedish study reported that age at which parent started brushing, did not survive logistic regression.

The second risk factor was the child definitely not taking antibiotics during the first 6 months (OR = 2.49). This result is in contrast to the findings of Hong et al (2005) who used the Iowa Fluoride Study data and reported that 75% of children had been given amoxicillin before the age of 1 year. The prevalence of dental fluorosis in the Iowa group of children was 24%. Multivariate logistic regression for fluorosis showed use of amoxicillin during the first 3 to 6 months was a risk factor with an adjusted OR of 2.50 (95% CI = 1.21-5.15). The authors cautioned that the children were recruited from a convenience sample and those who took amoxicillin tended to have high fluoride intakes, therefore these findings were not conclusive. A plausible explanation for not taking antibiotics as a risk factor for fluorosis is not obvious, other than to suggest that it might be related to some yet unknown mechanism or factor protective against fluorosis.

The third and strongest risk factor for fluorosis was the child being exposed to lifetime CWF (OR = 3.43), this result is supported by a number of recent reviews (Broadbent et al., 2005; Harding et al., 2005; MacKay and Thomson, 2005). This again refers to the effect of cumulative fluoride exposure on the prevalence of dental fluorosis (NRC, 2006).

Validity of the identified risk and preventive factors for TSIF > 1

Two non-significant factors were included in the model, the child lived in a non-fluoridated community (OR = 0.25, ns) and the child attended public school (OR = 3.10, ns). There were four significant risk factors for TSIF > 1 that survived regression analysis. The first risk factor was the child definitely not taking antibiotics during the first 6 months (OR = 4.44). Again, there is no obvious explanation for this result. The second, was the child used toothpaste that covered ¾ of the head of the toothbrush (OR = 5.16). This result is supported by a number of other studies (Maupome et al., 2003; Whelton et al., 2004; Cochran et al., 2004a; Harding et al., 2005). The third risk factor was the child's last dental visit was within the last 6 months (OR = 10.34). This result was not easily explainable and could be covering a yet unknown mechanism or factor. A suggested explanation is that children during a regular check-up are likely to be given fluoride treatments, however, most research have concluded topical fluoride treatment is not associated with fluorosis prevalence.

The final and strongest risk factor was the child's mother has college education or higher (OR= 18.8). As this is usually a proxy for high SES there are a number of studies that have reported similar results (Pendrys and Stamm, 1990; Maupome et al., 2003; Whelton et al., 2004). The explanation for this is the high SES child has access to more and earlier fluoride modalities than lower SES children. These include food and drink that may be processed in a fluoridated community and contribute to greater fluoride exposure. A few studies found no association of SES with fluorosis (Conway et al., 2005; Michel-Crosato et al., 2005) and others have found that low SES was a risk factor for fluorosis. The explanations for the connection with low SES is that malnutrition contributes to the severity of fluorosis and the low SES child has a higher fluoride intake by using and swallowing more toothpaste than the high SES child (Franco et al., 2005; Ayoob and Gupta, 2006)

Limitations of the study – threats to internal validity

Threats to internal validity can be separated in those caused by the study design, measurements of the dependent and independent variables, and finally by the data analysis. However, it is important to note that studies have found that fluorides are so widespread, as a causative agent, exposure explains little about the distribution of caries or fluorosis (Harris et al., 2004).

Study design

A threat to internal validity, in this study, was the lack of blinding that might have lead to observer bias. The members of the survey teams were aware of the results of the 2001-2 RPHU DIS survey and the caries-risk levels of the schools that were assigned to them. This foreknowledge may have biased the values reported for various dental indices. Another possible threat was the inability to verify the source of the home drinking water samples compared to the school drinking water samples that were collected by the survey teams.

Measurements of the dependent variables

deft + *DMFT* - The OMHLTC guidelines place the threshold for caries at D3 (caries into dentin), instead of using a D1 or D2 threshold (initial carious enamel lesions), though use of a higher criterion may be prone to greater variability (Ohrn et al., 1996; Assaf et al., 2006). Amarante et al. (1998) found that enamel caries comprised 59% of caries in 5 year-olds and 89% of the caries in 12-year-olds. In another study, sensitivity of finding decay was 62% with a specificity of 84% when the determination was made by visual inspection (Lussi, 1991). Taken together these limitations could have resulted in significant underestimation of actual decay in the population of 7-year-olds in Caledon and Brampton.

TSIF - There may have been over or underestimation of dental fluorosis due to difficulties in assessing degrees of severity. Beltran et al. found that screening for dental fluorosis resulted in higher false negatives by dental hygienists when compared to dentists (Beltran et al., 1997). Whelton et al. (2004) states that the examination for fluorosis is affected by: examiner bias, intra and inter-examiner reliability, examiner drift, and index validity. For index validity, the TFI for its greater sensitivity, and as an index based on actual histology of fluorotic enamel (Burt and Ekland, 1999), may have been the better fluorosis index to use than the TSIF, however, the TSIF was mandated for use in the DIS by the OMHLTC (Leake, 2001).

Measurement of the independent variables

This study placed a large reliance on recalled behaviour by using a questionnaire and asking parents to remember things that took place 7 years ago. In addition, much of the data from the self-reported questionnaires could not be verified and as not all the questions in the questionnaires were fully answered, there was the problem of incomplete data. A study has reported that recalled information on early toothpaste use was not reliable (Riordan, 2002). Another study suggests that parents may have given socially desirable answers leading to nondifferential misclassification (Bogaertz et al., 2003).

Data analysis

In comparing, the analyses for dental fluorosis and flurosis of aesthetic concern, it is interesting to see how the use of different "cut-offs" can lead to emergence of a factor, "mother has college education or higher" surviving logistic regression in fluorosis of aesthetic concern that was not significant under bivariate analysis or logistic regression for dental fluorosis.

Generalizability of results to larger populations

As indicated by the comparison of various dental indices for the 411 children whose parents completed the questionnaire and the 1047 children who had completed DIS forms, the results from the smaller group was found to be a good measure for the larger group (Tables 3a,b,c,d,e pg. 76-9). However, this study population, due to intentional selection to match populations, may not have been representative of the general population and may also have limited the analysis (Hamasha et al., 2006). The results may be generalizable beyond this group, if comparing populations of high income, high educational levels, high levels of dental insurance and good access to dental care, as in the two populations that were compared in this study. Generalizing to most of the population in the rest of Ontario, may not be valid as StatsCan figures show that the average income level in Caledon is higher than the average for the rest of Ontario (StatsCan, 2006). As well, the percentage of the atudy population covered by dental insurance is much higher than the Ontario average of about 63% (Sudbury & District Health Unit, 2005)

Areas for more research

Compare areas with a greater difference in deft + DMFT scores than was evident between the children of Brampton and Caledon. Areas that are not fluoridated nor have little fluoride coverage such as Haliburton or Simcoe (Tables B1, pg. 70) could be compared to Brampton that may show an influence of community water fluoridation on decay scores.

The difficulties encountered in dealing with school boards and with attracting parents to enroll for this study indicate that research should be initiated in other ways to conduct this type of research. A study based in one institution and more under the control of researchers may result in better participation, also, a phone-based questionnaire by professional interviewers may allow for better data quality.

Some areas were not covered in this study and may be an area for more research. Studies have shown a significant relationship between maternal smoking and childhood caries and this could be assessed by adding another question on the parent questionnaire (Harris et al., 2004). Other studies have indicated that parental attitudes and actions are significant factors in outcomes and this could be investigated (Adair et al., 2004).

Conclusions

We found virtually no difference in caries prevalence or severity between 7-year-old children from schools in non-fluoridated Caledon and schools matched on socio-economic factors, in fluoridated Brampton. We found that rather than fluoridation, the characteristics of visiting a dentist for check-up; and being fed infant formula were associated with lower prevalence of caries, whereas not-taking multivitamins and being born outside Canada were risk factors for having dental caries. The prevalence of dental fluorosis of any severity was higher (perhaps due to examiner bias) in the fluoridated community, as was fluorosis of aesthetic concern. Residence in the two affluent communities did not accurately represent actual exposure to fluoridated drinking water due to the use of reverse osmosis filters, bottled water and the mobility of families.

As shown by the numerous reviews, fluoridation remains an effective public health preventive intervention. Its effectiveness is due to its basic efficacy, its population-wide coverage through reticulated water systems and its effortless compliance by susceptible people of all ages. This study looked for effects among 7-year-old children residing in affluent areas in Peel Region. The study did not examine the effects of water fluoridation among older children, adolescents, adults of working age, or seniors. Most of the study participants had strong patterns of preventive behaviours and good access to professional care, although some, in fluoridated Brampton were, perhaps inadvertently, avoiding fluoridation by the use of reverse osmosis filters and bottled water.

Since, the community of interest, Caledon, is such an affluent community we drew our comparison children from affluent areas of Brampton. Thus, our study did not determine the effects of fluoridation among poorer areas of Peel where access to dental care might be less and patterns of home care may be different. Accordingly, these findings are not to be taken as a measurement of the effectiveness of fluoridation on a population-wide basis in Peel Region, nor can they be generalized, necessarily, to other communities.

Nonetheless, given these findings, and as long as Caledon continues to be the residence of high socio-economic families, there would appear to be little potential for significant caries reduction if Caledon's reticulated well-water system were fluoridated at this time.

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TABLE A

REGION OF PEEL D.I.S. FOR 7-YEAR-OLD SCHOOL CHILDREN: A COMPARISON OF 2001-2 AND 2004-5 INDICES AND CURRENT STUDY.

City	% Caries Free	% with Sealants	deft	DMFT	deft + DMFT	% Fluorosis	% with TSIF>1
				2001-2			
Brampton N=299	55%	7%	NA	NA	1.53	15%	3%
Caledon N=32	41%	23%	NA	NA	1.97	2%	0%
Peel N=704	54%	8%	NA	NA	1.52	11%	3%
				2004-5			
Brampton N=274	65%	4.38%	1.09	0.15	1.25	22%	11%
Caledon N=91	76%	14%	0.27	0.25	0.53	16%	9%
Peel N=764	67%	7.07%	0.96	0.11	1.07	15% (660)	7% (660)
				Current			
Brampton N=785	65%	5%	1.08	0.05	1.14	34%	9%
Caledon N=262	64%	12%	1.02	0.05	1.07	16%	4%

TABLE B1

2004-5 DIS: def+DMFT and % Fluorosis of 7 Year-Old School Children in 11 Ontario Health Units in Which Less than 50% of the Population has Optimally Fluoridated Community Water Supply (modified from Bowes, 2005)

HU	Pop. F	No.	% Urgent	%Caries Free	def/DMF	%Fluorosis	Pop/dentist
Haliburton	0%	406	16	39	2.9	1	4693
Niagara	0%	560	3	57	1.9	<1	1987
Kingston	7%	401	11	57	1.8		2717
Simcoe	7%	441	10	39	3.0		2347
Oxford	10%	370	12	45	2.3	9	2283
Porcupine	12%	350	15	45	2.2	7	2141
Waterloo	19%	665	3	49	2.4		1999
Leeds	31%	226	6	66	1.3	15	2925
Hasting	38%	364	15	51	2.3		3100
Eastern Ont.	40%	381	12	47	2.2		3101
Sudbury	48%	272	17	51	2.2	13	2188
Total/Ave.		**4436**	**10.1**	**49.2**	**2.3**	**6.3**	

Averages are weighted to number of children surveyed in each Health Unit/total children

TABLE B2

2004-5 DIS: Comparison of def+DMFT and % Fluorosis of 7 Year-Old School Children in 7 Ontario Health Units in Which More than 50% of the Population has Optimally Fluoridated Community Water with those of the Region of Peel and in Particular the Cities of Brampton and Caledon (ex Bolton), (modified from Bowes, 2005)

HU	pop. F	No.	% Urgent	%Caries Free	def/DMF	%Fluorosis	Pop/dentist
Perth	54%	737	6	71	1.1		2995
Chatham	64%	167	8	59	1.6	28	2448
Haldimand	74%	420	7	51	1.7	1	2918
Middlesex	85%	3807	2	49	1.9		1479
York	85%	481	n/a	53	2.0	20	1841
Hamilton	90%	677	10	57	1.6	0	1817
Ottawa	90%	403	18	55	1.8	31	1487
Total/Ave.		**6692**	**4.9(6211)**	**53.3**	**1.8**	**12.6**	
Peel	95%	**764**	**16**	**67**	**1.07**	**15 (660)**	1914
Brampton	100%	**274**	**16**	**65**	**1.25**	**22**	
Caledon	0%	**91**	**7**	**76**	**0.53**	**16**	

Averages are weighted to number of children surveyed in each Health Unit/total children

TABLE C

FLUORIDE CONCENTRATIONS IN DRINKING WATER IN PEEL REGION TEST SCHOOLS: SAMPLES TAKEN OCTOBER AND NOVEMBER 2005

Number	School	City	[Fluoride] in ppm Oct/Nov 05	[Fluoride] in ppm Oct. 13/06
1	Alloa Public School	Caledon	.5791	0.6093 0.5886
2	Alton Public School	Caledon	.1505	
3	Belfountain Public School	Caledon	.1882	
4	Brisdale Public School	Brampton	.7194	
5	Caledon Central	Caledon	.1479	
6	Caledon East Public School	Caledon	.1469	
7	Claireville Public School	Brampton	.4709	0.6006 0.6386
8	CreditView Public School	Caledon	.1845	
9	Father Clair Tipping School	Brampton	.1758	0.5926 0.5959
10	Good Shepherd School	Brampton	.2977	0.6079 0.6028
11	Herb Campbell Public School	Caledon	.0861	
12	Macville Public School	Caledon	.2297	
13	Sacred Heart School	Brampton	.6410	
14	Somerset Dr. Public School	Brampton	.6392	
15	Springdale Public School	Brampton	.6098	
16	St. Cornelius School	Caledon	.2440	
17	St. Jean Brebeuf Elementary School	Brampton	.1309	0.5976 0.6151
18	St. Marguerite Bourgeoys School	Brampton	.5916	
19	St. Nicholas Elementary School	Caledon	.1430	
20	St. Patrick School	Brampton	.5970	
21	St. Rita Elementary School	Brampton	.5896	
22	St. Stephen Elementary School	Brampton	.6358	
23	Huttonville Public School	Brampton	.5036	
24	Guardian Angels	Brampton	.5762	
25	Folkstone	Brampton	.6172	
Test Samples	Faculty of Dentistry		.6213	0.6667
	City of Toronto tap water should be about 0.6 ppm		.5966	0.6074
			.6121	0.5757
			.6102	0.5571
	Brampton water should be 0.5 to 0.8 ppm			

TABLE 1.
PARTICIPATION RATES OF 7 YEAR-OLDS IN BRAMPTON AND CALEDON SCHOOLS

SCHOOLS	POTENTIAL # CHILDREN	DIS FORMS RECEIVED		QUESTIONNAIRES RECEIVED		URINE SAMPLES RECEIVED	
	A	B	% of A	C	% of B	F	% of D
Brampton Public							
Folkstone	108	108	100	35	32	7	33
Claireville P.S	163	132	81	25	19	1	25
Brisdale	168	113	67	23	20	6	75
Huttonville	51	6	12	3	50	0	0
Somerset	47	32	68	11	34	2	50
Sprindale	105	79	75	23	29	2	29
Brampton Catholic							
Father Claire Tipping	34	25	75	18	72	1	25
Sacred Heart	57	27	47	14	52	1	11
Good Shepherd	63	48	76	26	54	4	57
Guardian Angels	124	89	72	39	44	2	15
St. Rita	106	60	57	31	52	3	50
St. Jean Brebeuf	44	33	75	15	45	1	17
St. Marguerite Bourgeoys	37	20	54	8	40	3	75
St. Stephen	22	14	64	6	43	2	67
St. Patrick	44	24	55	12	50	3	100
Caledon Public							
Alloa P.S.	30	30	100	11	37	1	33
Alton P.S.	48	9	19	5	56	1	50
Belfountain	15	11	73	7	64	1	25
Caledon Central	30	30	100	13	43	4	67
Caledon East	26	18	69	13	72	4	57
Creditview P.S.	24	10	42	3	30	1	50
Herb Campbell	86	52	61	25	48	3	33
Macville P.S	56	18	32	10	56	0	0
Caledon Catholic							
St. Cornelius	67	28	42	18	64	4	44
St. Nicholas	56	31	55	17	55	3	60
Brampton	1173	810	69	289	36	38	38
Caledon	438	237	54	122	52	22	43
Public	957	648	67	207	32	33	47
Catholic	654	399	61	204	51	27	39
Total	1611	1047	65	411	39	60	40

TABLE 2a
DENTAL INDICES REPORTED BY THE TWO SURVEY TEAMS

Index	Survey Team	Brampton		Caledon		
		Mean	N	Mean	N	p
Gingivitis	1	0.47	620			
	2	0.61	165	0.68	252	0.001
Ave. Debris Index	1	0.50	620			
	2	0.80	165	0.54	253	<0.0001
Ave. Calculus Index	1	0.07	620			
	2	0.10	165	0.03	253	<0.0001
d	1	0.36	620			
	2	0.57	165	0.23	253	ns
f	1	0.62	620			
	2	0.51	165	0.74	253	ns
e	1	0.11	620			
	2	0.03	165	0.06	253	ns
D	1	0.02	620			
	2	0.02	165	0.01	253	ns
F	1	0.04	620			
	2	0.02	165	0.04	253	ns
M	1	0.00	620			
	2	0.00	165	0.00	253	ns
deft	1	1.07	620			
	2	1.11	165	1.02	253	ns
DMFT	1	0.06	620			
	2	0.04	165	0.05	253	ns
deft + DMFT	1	1.13	620			
	2	1.15	165	1.08	253	ns
d+D/deft+DMFT	1	0.38	215			
	2	0.53	57	0.24	92	0.025
f+F/deft+DMFT	1	0.51	215			
	2	0.53	57	0.70	92	ns
df+DF/deft+DMFT	1	0.89	215			
	2	0.98	57	0.93	92	0.009

p values for difference in the means within Brampton only

Index	Survey Team	Brampton		Caledon		
		Mean	N	Mean	N	
Decayed pit and fissure	1	0.07	620			
	2	0.13	165	0.03	253	0.026
Decayed smooth surface	1	0.09	620			
	2	0.36	165	0.17	253	<0.0001
Decayed both	1	0.16	620			
	2	0.06	165	0	253	ns
Decay primary and permanent	1	0.37	620			
	2	0.59	165	0.23	253	0.026
Filled primary and permanent	1	0.66	620			
	2	0.53	165	0.78	253	ns
Filled pit and fissure	1	0.19	620			
	2	0.21	165	0.29	253	ns
Filled smooth surface	1	0.01	620			
	2	0.10	165	0.15	253	<0.0001
Filled both	1	0.46	620			
	2	0.22	165	0.34	253	0.026
Filled and decayed	1	0.04	620			
	2	0.02	165	0.02	253	ns
Missing due to caries	1	0.11	620			
	2	0.03	165	0.06	253	ns

p values for difference in the means within Brampton only

Revised January 26, 2007

TABLE 2b
DIFFERENCES IN MEASURED TSIF SCORES REPORTED BY THE TWO TEAMS SURVEYING BRAMPTON AND CALEDON CHILDREN

TSIF Score	Brampton Team 1 N=428		Brampton Team 2 N=151		Caledon Team 2 N=168		Total N=747	
0	267	**62%**	115	**76%**	141	**84%**	523	**70%**
1	121	**28%**	24	**16%**	21	**13%**	166	**22%**
2	29	**7%**	9	**6%**	4	**2%**	42	**6%**
3	11	**3%**	3	**2%**	0	**0**	14	**1.9%**
4	0	**0**	0	**0**	2	**1%**	2	**0.1%**

Team 1 vs 2 for Brampton - Kruskal-Wallis, H = 8.1, df = 1, p = 0.004
Team 1 vs. 2 for Brampton (TSIF > 1) – Kruskal-Wallis, H = 0.27, df = 1, p = 0.6

Team 2 Caledon vs Brampton - Kruskal-Wallis, H = 2.5, df = 1, p=0.11
Team 2 Caledon vs. Brampton (TSIF > 1) – Kruskal-Wallis, H = 2.4, df = 1, p = 0.12

Caledon vs Brampton - Kruskal-Wallis, H = 17, df = 1, p < 0.001
Caledon vs Brampton - Kruskal-Wallis (TSIF > 1), H = 4.6, df = 1, p = 0.03

Revised January 25, 2007

TABLE 3a
ORAL HEALTH STATUS OF 1047 CHILDREN SURVEYED IN BRAMPTON AND CALEDON

Oral Health Status Findings	Brampton		Caledon	
	%	n	%	n
Gender - male	49	785	54	262
children born in Canada	80	785	89	262
children caries free	65	785	64	262
children with sealants	5	785	12	262
children with no fluorosis	66	579	84	168
children with TSIF > 1	9	579	4	168
children born in Canada with TSIF>1	1	579	0	168
children with Debris Index >/= 1	34	750	50	262
children with Gingivitis	50	783	68	261
	Mean	n	Mean	N
deft+DMFT	1.14	785	1.07	262
deft+DMFT children born in Canada	1.00	624	1.06	234
deft	1.08	785	1.02	262
DMFT	0.05	785	0.05	262
d + D	0.41	785	0.25	262
Decayed pit and fissures	0.08	785	0.04	262
Decayed smooth surfaces	0.15	785	0.18	262
Decayed both	0.14	785	0.01	262
f + F	0.63	785	0.76	262
Filled pit and fissures	0.19	785	0.29	262
Filled smooth surfaces	0.03	785	0.15	262
Filled both	0.41	785	0.33	262
Filled and decayed	0.04	785	0.02	262
Missing due to caries	0.09	785	0.06	262
Need extraction due to decay	0.01	785	0.01	262
d+D/deft+DMFT	0.41	272	0.25	94
f+F/deft+DMFT	0.50	272	0.68	94
dD+fF/deft+DMFT	0.91	272	0.93	94
Debris Index	0.56	785	0.55	262
Calculus Index	0.08	785	0.03	262

TABLE 3b
ORAL HEALTH STATUS OF 411 CHILDREN WITH COMPLETED QUESTIONNAIRES IN BRAMPTON AND CALEDON

Oral Health Status Findings	Brampton %	n	Caledon %	n
Gender - male	47	271	51	140
child born in Canada	89	270	96	140
children caries free	64	271	61	140
children with sealants	5	271	16	140
children with no fluorosis	67	190	85	94
children with TSIF >/= 2	10	190	3	94
children with Debris Index >/= 1	28	258	51	140
children with Gingivitis	48	271	68	139
parents unhappy with appearance of child's teeth	11	270	11	140
	Means	n	Means	N
deftDMFT	1.15	271	1.17	140
deftDMFT children born in Canada	0.98	270	1.13	140
Deft	1.13	271	1.11	140
DMFT	0.02	271	0.06	140
d + D	0.42	271	0.16	140
Decayed pit and fissures	0.08	271	0.03	140
Decayed smooth surfaces	0.17	271	0.09	140
Decayed both	0.13	271	0.01	140
f + F	0.65	271	0.95	140
Filled pit and fissures	0.19	271	0.38	140
Filled smooth surfaces	0.03	271	0.14	140
Filled both	0.43	271	0.43	140
Filled and decayed	0.03	271	0.02	140
Missing due to caries	0.07	271	0.06	140
d+D/deft+DMFT	0.42	97	0.20	54
f+F/deft+DMFT	0.52	97	0.75	54
dD+fF/deft+DMFT	0.94	97	0.96	54
TSIF Score	0.44	190	0.20	94
TSIF Score of children born in Canada	0.48	190	0.21	94
Debris Index	0.52	271	0.56	140
Calculus Index	0.07	271	0.04	140

TABLE 3c
PERCENT OF CHILDREN WITH DENTAL TREATMENT NEEDS AMONG 1047 CHILDREN SURVEYED IN BRAMPTON AND CALEDON

Dental Treatment Needed	Brampton n=785	Caledon n=262
Non-urgent	5.4	2.7
Urgent	16	12
Scaling	29	19
Prophy/cleaning	8	0
Sealants	29	25
Fluoride	33	29
Preventive instruction	21	21

TABLE 3d
PERCENT OF CHILDREN WITH DENTAL TREATMENT NEEDS AMONG 411 CHILDREN SURVEYED IN BRAMPTON AND CALEDON WHOSE PARENTS RETURNED QUESTIONNAIRES

Dental Treatment Needed	Brampton		Caledon	
	%	n	%	n
Non-urgent	6.4	270	2.9	140
Urgent	16	271	10	140
Scaling	24	271	21	140
Prophy/cleaning	7	271	0	140
Sealants	31	271	27	140
Fluoride	35	271	31	140
Preventive instruction	18	270	24	140

Revised December 9, 2006

TABLE 3e
COMPARISON OF deft + DMFT SCORES, RESPONDERS VS NON-RESPONDERS

deft + DMFT Score	Responders n = 411		Non-responders n = 636	
	Caledon n = 140 %	Brampton n=271 %	Caledon n=122 %	Brampton n=514 %
0	61	64	67	66
1	11	11	12	11
2	7	7	5	6
3	7	5	6	4
4	4	3	3	4
5	3	3	2	2
6 +	6	6	5	7

Responders vs non-responders Chi-Square = 1.75, df=6, p=0.94

TABLE 4a
PERCENT OF CHILDREN WITH EXPOSURE TO FLUORIDATED WATER

Fluoridated water	Brampton		Caledon	
	%	n	%	n
Optimal Fluoridation ≥ 0.5ppm at school	76	271	8	140
Optimal Fluoridation ≥ 0.5ppm at home	55	253	24	131
Reported use of reverse osmosis filter	20	271	16	140
Continuous exposure to CWF for 7 yr	73	206	29	92

TABLE 4b
PERCENT OF CHILDREN ACCORDING TO REPORTED SOCIOECONOMIC DETERMINANTS

Personal Characteristics	Brampton		Caledon	
	%	n	%	n
Gender Male	47	271	51	140
Child born outside Canada	11	270	4	140
Mother born outside Canada	69	270	34	140
Father born outside Canada	66	271	27	140
Child, mother and father born outside Canada	11	271	2	140
Child born outside Can born in Asia	55	29	40	5
Mother born outside Can. born in Asia	42	185	30	47
Father born outside Can. born in Asia	41	178	38	37
Father completed university	26	261	30	138
Mother completed university	25	267	32	139
Family income less than $40k	19	259	13	130
Family income $40k to less than $60k	23	259	14	130
Family income $60k to less than $80k	19	259	17	130
Family Income >$80,000	40	259	56	130

Revised January 8, 2007

TABLE 4c
PERCENT OF CHILDREN ACCORDING TO REPORTED PERSONAL PRACTICES

Determinants of Oral Health	Brampton		Caledon	
a)Toothbrushing	**%**	**n**	**%**	**n**
Brushing once or more per day	98	271	97	140
Amount of toothpaste used now – pea-sized	49	270	64	140
Parent started brushing before 6 months	7	264	9	137
Parent started brushing before 1year	34	264	43	137
Parent started brushing before 2 years	72	264	81	137
Parent started brushing before 3 years	91	264	93	137
Did not use toothpaste when brushing	16	268	17	138
Age when child started brushing ≥ 36 months	64	264	61	139
Amount toothpaste used at 0-4 yrs– pea-sized	67	271	77	140
b) Intake of Other Fluorides				
Fluoride mouthwash was prescribed	13	265	8	139
Received fluoride supplements	5	261	4	139
Age started taking F supp. - < 1 year	60	10	33	6
Age stopped taking F supp - < 3 year	67	9	33	3
c) Use of Infant Formula				
Had infant formula	80	267	75	140
Age started formula – before 6 months	68	212	61	104
Water added to formula	94	212	91	103
Source of water – home tap	80	202	75	100
Age stopped formula – 12 – 23 months	61	208	53	103
Age stopped using bottle – 12 – 23 months	33	214	48	114
When start to walk used bottle	18	269	16	138
d) Diet				
Snacks four or more times per day	19	270	12	139
Type of snack drink - milk	26	271	21	140
Between meal food - sweets	16	259	19	134
Frequency of before bed snacking – every night	31	271	32	140
Before bed food not bread or cereal	79	202	75	106
Before bed food - fruits	21	202	32	106
Before bed drinks – water tap/bottled	35	266	62	131
Did not take multivitamins	36	267	37	139

TABLE 4d
PERCENT OF CHILDREN REPORTING USE OF DENTAL CARE SERVICES

Use of Dental Care Services	Brampton		Caledon	
	%	n	%	n
Have family dentist	85	271	91	138
Has not had first visit to the dentist	8	271	3	140
First dental visit before age two	12	271	21	140
Last dental visit within 6 months	70	246	76	135
Last dental visit more than 2 years ago	12	269	5	140
Last dental visit more than 5 years ago	9	269	4	140
Has never visited a dentist	7	269	4	140
Last appointment check and clean	65	250	73	135
Has dental insurance - full or part	78	270	81	140

Revised January 8, 2007

TABLE 5
PERCENT OF CHILDREN WITH RISKS FOR DENTAL FLUOROSIS

Determinants of Oral Health	Brampton		Caledon	
	%	n	%	n
Fluoridated water				
Optimal Fluoridation ≥ 0.5ppm at home	55	253	24	131
Home water fluoride > 0.2ppm	88	253	53	131
Home water fluoride > 0.4ppm	83	253	44	131
Home water fluoride > 0.6ppm	11	253	8	131
Optimal Fluoridation ≥ 0.5ppm at school	76	271	8	140
School water fluoride > 0.2ppm	95	271	28	140
School water fluoride > 0.4ppm	85	271	8	140
School water fluoride > 0.6ppm	41	271	0	140
Continuous exposure to CWF for 7 yr	73	206	29	92
Continuous exposure to CWF for first 3 yr	81	208	48	94
Continuous exposure to CWF for < 1 yr	82	212	59	102
Reported use of reverse osmosis filter	24	228	18	130
Personal Characteristics				
Child, mother and father born in Canada	26	271	86	140
Child born outside Canada	11	270	4	140
Mother born outside Canada	69	270	34	140
Father born outside Canada	66	271	27	148
Father completed university	26	261	30	138
Mother completed university	25	267	32	139
Family Income >$80,000	40	259	56	130
Has no dental sealants	5	785	12	262
Personal Practices				
a)Toothbrushing				
Present amount toothpaste used now – pea-sized	49	140	64	270
Brushes two or more time per day	64	269	71	140
At 6 to 11 months parent started brushing	27	264	34	137
Child started brushing before 1 year	10	264	13	139
Child brushes	96	264	96	264
Child does not brush	4	264	4	139
Amount toothpaste used at 0- 4 years – pea-sized	67	271	77	140
Parent used toothpaste when brushing	84	268	83	138

Determinants of Oral Health (cont.)	Brampton %	n	Caledon %	n
b) Intake of Other Fluorides				
Used fluoride supplements	5	261	4	136
Fluoride mouthwash was prescribed	13	265	8	139
c) Diet				
Between meal snacks - fruits	33	259	34	134
Between meal drink bottled water	14	271	13	140
Between meal drink likely fluoridated	60	271	66	140
Before bed drink tapwater	22	266	39	131
Before bed drink bottled water	13	266	23	131
Used tapwater with infant formula	80	202	75	100
e) Middle Ear Infections and Use of Antibiotics				
Took or think took antibiotics	51	241	63	134
Took antibiotics during the first 6 months	30	241	35	134
Took amoxicillin during the first 6 months	37	179	43	76
Think took amoxicillin	19	179	25	76
Patient (Parent) Satisfaction				
Parent happy with appearance of child's teeth	89	139	89	270

TABLE 6a
BIVARIATE ANALYSIS FOR deft + DMFT > 1

	Factor	+ Factor D+	+ Factor D-	- Factor D+	- Factor D-	Odds Ratio	95% C.I.
Q12	**Has never visited dentists**	**1**	**24**	**149**	**235**	**0.07**	**0.01-0.49**
Q12	Last dental visit more than 5 yr ago	2	28	148	233	0.12	0.03-0.52
Q11	**Has not had first visit to dentist**	**3**	**22**	**148**	**238**	**0.22**	**0.07-0.75**
Q13	**Last appointment check and clean**	**70**	**190**	**79**	**47**	**0.22**	**0.14-0.35**
Q12	Last dental visit more than 2 yr ago	7	33	143	226	0.34	0.14-0.78
DIS	**Does not have sealants**	**132**	**244**	**19**	**16**	**0.46**	**0.23-0.92**
Q28	Did not use toothpaste when brushing	16	49	134	207	0.50	0.28-0.92
Q21	**Used infant formula**	**106**	**212**	**43**	**46**	**0.54**	**0.33-0.86**
DIS	**Lives in Caledon**	**54**	**86**	**97**	**174**	**1.13**	**0.74-1.72**
DIS	Presence of debris	104	156	47	104	1.48	0.96-2.23
Q35	Mother born outside of Canada	98	136	55	123	1.58	1.05-2.38
Q38	Family income less than $60k	64	79	83	163	1.59	1.04-2.43
Q35	Father born outside of Canada	91	126	60	134	1.61	1.07-2.42
DIS	**Debris index >1**	**64**	**81**	**83**	**170**	**1.62**	**1.06-2.46**
Q27	Parent started brushing after 1 yr	102	150	43	106	1.68	1.09-2.59
Q38	**Family income less than $40k**	**32**	**33**	**115**	**209**	**1.76**	**1.03-3.02**
Q35	Mother born in Asia	46	45	50	91	1.86	1.09-3.18
Q27	Parent started brushing after 2 yr	47	52	98	204	1.88	1.19-2.99
Q26	**Did not take multivitamins**	**68**	**79**	**81**	**178**	**1.89**	**1.25-2.87**
Q18	**Before bed food not bread or cereal**	**101**	**138**	**19**	**50**	**1.93**	**1.07-3.47**
Q35	Father born Asia	45	42	44	84	2.05	1.17-3.57
DIS	Child born outside of Canada	39	32	112	227	2.47	1.47-4.15
Q35	Child, mother, father not born Canada	20	13	131	247	2.90	1.40-6.02
Q35	**Child born outside of Canada**	**27**	**13**	**130**	**259**	**3.06**	**1.48-6.30**
Q27	Parent started brushing after 6 months	140	229	5	27	3.30	1.24-8.77
Q27	**Parent started brushing after 3 yr**	**123**	**245**	**22**	**11**	**3.98**	**1.87-8.48**
Q35	Child born in Asia	14	4	7	9	4.50	1.02-19.9

+ Factor = Child has the Factor; - Factor = Child does not have the Factor
D + = has decay; D - = no decay

TABLE 6b1
LOGISTIC REGRESSION MODEL FOR deft + DMFT > 1
Method = Backward Stepwise (Wald)

	Factor	n	% + Fa	Adj. Odds Ratio	95% C.I.
Q13	**Last appointment check and clean**	**385**	**68**	**0.17**	**0.09-0.32**
DIS	Does not have sealants **(ns)**	411	92	0.39	0.15-1.00
Q21	**Used infant formula**	**407**	**78**	**0.48**	**0.25-0.93**
Q26	**Did not take multivitamins**	**406**	**36**	**2.25**	**1.24-4.07**
Q27	Parent started brushing after 3 years **(ns)**	401	8	2.60	0.95-7.14
Q35	**Child born outside of Canada**	**410**	**8**	**5.72**	**1.71-19.2**

Cox and Snell R Square = 0.233

Hosmer and Lemeshow Test = 0.909

Sensitivity = 77%

Specificity = 71%

(ns) = not statistically significant

TABLE 6c
CITY OF RESIDENCE: CALEDON OR BRAMPTON

TABLE 6C1: RESIDENCE INFERRED BY SCHOOL LOCATION IN CALEDON AND BRAMPTON

City	Frequency	Percent
Caledon	140	34.1
Brampton	271	65.9
Total	411	100.0

TABLE 6C2: RESIDENCE BY ACTUAL ADDRESS IN CALEDON, BRAMPTON AND BOLTON

City	Frequency	Percent
Caledon	110	26.8
Brampton	278	67.6
Bolton	23	5.6
Total	411	100.0

TABLE 6C3: MEAN deft + DMFT SCORES FOR CHILDREN LIVING IN CALEDON, BRAMPTON AND BOLTON

City	Birth	Mean	N	Std. Deviation
Caledon	Born in Can.	1.05	109	1.818
	Born other	.00	1	.
	Total	1.04	110	1.812
Brampton	Born in Can.	.94	244	1.845
	Born other	2.67	33	3.370
	Total	1.15	277	2.151
Bolton	Born in Can	1.91	23	2.314
	Total	1.91	23	2.314
Total	Born in Can.	1.03	376	1.877
	Born other	2.59	34	3.350
	Total	1.16	410	2.079

TABLE 6C4
VARIOUS DENTAL INDICES BY ACTUAL ADDRESS IN CALEDON AND BRAMPTON AND BY BIRTH IN CANADA

Index	Brampton		Caledon	
	%	n	%	n
% gender male	49	243	50	110
% children caries free	67	243	65	110
% children with sealants	6	243	15	110
% children with no fluorosis	63	168	84	71
%of children with TSIF >/= 2	11	168	4	71
% of children with debris index ≥ 1	28	233	44	108
% of children with gingivitis	50	244	64	108
	Mean	n	Mean	n
deft + DMFT	0.94	243	1.05	110
deft + DMFT children not born in Can	2.67	33	0	1
Deft	0.92	243	0.97	110
DMFT	0.02	243	0.06	110
110d + D	0.30	243	0.15	110
decayed pit & fissure	0.06	243	0.03	110
decayed smooth surface	0.11	243	0.07	110
decayed both	0.08	243	0.02	110
f + F	0.59	243	0.85	110
filled pit and fissure	0.17	243	0.36	110
filled smooth surface	0.03	243	0.06	110
filled both	0.39	243	0.42	110
filled and decayed	0.04	243	0.01	110
missing due to caries	0.05	243	0.05	110
d + D / deft + DMFT	0.39	80	0.20	38
f + F / deft + DMFT	0.56	80	0.76	38
dD + fF / deft + DMFT	0.95	80	0.96	38
TSIF scores	0.49	168	0.22	72
TSIF scores children not born in Can	0.13	24	0	1
Debris index	0.50	243	0.51	110
Calculus index	0.07	243	0.04	110

TABLE 6C5
deft + DMFT SCORES BY CITY (USING ACTUAL ADDRESS) BY FAMILY INCOME

family income	City	Mean	N	Std. Deviation
Less than $20,000	Caledon	2.33	3	2.31
	Brampton	3.00	11	3.35
	Bolton	3.00	1	.
	Total	2.87	15	2.97
$20,000 to $39,999	Caledon	2.00	7	3.06
	Brampton	1.74	38	2.88
	Bolton	1.40	5	2.61
	Total	1.74	50	2.83
$40,000 to $59,999	Caledon	1.17	12	1.85
	Brampton	0.97	61	1.56
	Bolton	1.20	5	2.68
	Total	1.01	78	1.66
$60,000 to $79,999	Caledon	0.78	18	1.56
	Brampton	1.49	51	2.70
	Bolton	0.00	1	.
	Total	1.29	70	2.45
$80,000 or more	Caledon	1.00	62	1.76
	Brampton	0.74	105	1.50
	Bolton	2.44	9	2.40
	Total	0.92	176	1.68
Missing	Caledon	0.38	8	1.06
	Brampton	0.50	12	1.73
	Bolton	3.00	2	1.41
	Total	0.68	22	1.62
Total	Caledon	1.04	110	1.81
	Brampton	1.14	278	2.15
	Bolton	1.91	23	2.31
	Total	1.16	411	2.08

Revised January 8, 2007

TABLE 7a
BIVARIATE ANALYSIS FOR THE PRESENCE OF DENTAL FLUOROSIS (TSIF > 0)

	Factor	+ Factor		- Factor		Odds Ratio	95% C.I.
		F +	F -	F +	F -		
Q29	Child brushes	71	196	6	4	0.24	0.07-0.88
Q33	Think took amoxicillin	5	35	49	89	0.26	0.10-0.71
DIS	School water < 0.5ppm	21	110	56	97	0.33	0.17-0.59
DIS	Not exposed to CWF during lifetime	15	70	48	75	0.34	0.17-0.65
DIS	Lives in Caledon	14	80	63	127	0.35	0.19-0.67
Q35	Child, mother and father born in Canada	17	81	60	126	0.44	0.24-0.81
Q32	Took or think took antibiotics	27	111	41	80	0.48	0.27-0.84
Q33	Took amoxicillin during the first 6 months	9	17	45	107	0.49	0.24-0.98
Q7	**Toothpaste pea-sized**	**32**	**113**	**45**	**93**	**0.59**	**0.35-0.99**
Q20	**Between meal snacks - fruits**	**31**	**57**	**44**	**141**	**1.74**	**1.00-3.03**
Q27	**At 6 to 11 months parent started brushing**	**30**	**52**	**46**	**147**	**1.85**	**1.06-3.23**
Q4	Reported use of reverse osmosis	23	40	44	143	1.87	1.01-3.45
DIS	Continuous exposure to CWF for first 3 yr	51	99	12	48	2.06	1.01-4.22
Q35	Father born outside Canada	54	110	23	97	2.07	1.18-3.62
Q32	**Definitely did not take antibiotics**	**41**	**80**	**27**	**111**	**2.11**	**1.20-3.70**
Q35	**Mother born outside Canada**	**58**	**113**	**19**	**93**	**2.51**	**1.40-4.53**
DIS	Continuous exposure to CWF for < 1 yr	54	109	9	46	2.53	1.16-5.56
DIS	School water fluoride ≥ 0.4ppm	60	118	17	89	2.66	1.66-4.88
DIS	School water fluoride ≥ 0.2ppm	66	141	11	66	2.81	1.39-5.68
DIS	**Survey team 1**	**57**	**101**	**20**	**101**	**2.85**	**1.60-5.08**
DIS	School water fluoride ≥ 0.5ppm	56	97	21	110	3.02	1.71-5.35
DIS	**Continuous exposure to CWF for 7 yr**	**48**	**75**	**15**	**70**	**2.99**	**1.54-5.81**
Q29	Child does not brush	6	4	71	200	4.15	1.14-15.1

+ Factor = Child has the Factor; **- Factor = Child does not have the Factor**
F + = has fluorosis; **F - = no fluorosis**

Revised January 8, 2007

TABLE 7b
LOGISTIC REGRESSION FOR THE PRESENCE OF DENTAL FLUOROSIS

(TSIF > 0) Method = Backward Stepwise (Wald)

	Factor	n	%+Fa	Adj. Odds Ratio	95% C.I.
Q7	Toothpaste pea-sized	283	51	0.43	0.22-0.87
Q27	At 6 to 11 months parent started brushing	275	30	2.30	1.09-4.87
Q32	Definitely did not take antibiotics	259	47	2.49	1.22-5.07
DIS	Continuous exposure to CWF for 7 yr	208	59	3.43	1.59-7.39

Cox and Snell R Square = 0.124
Hosmer and Lemeshow Test = 0.976
Sensitivity = 76%
Specificity = 56%

n = number of 7-Year-Olds
% + Fa = percentage of "n" having the Factor

Revised January 8, 2007

TABLE 7c
BIVARIATE ANALYSIS FOR THE PRESENCE OF DENTAL FLUOROSIS OF AESTHETIC CONCERN (TSIF > 2 vs 1 AND 0)

	Factor	+ Factor		- Factor		Odds	95% C.I.
		F2+	F2-	F2+	F2-	Ratio	
Q12	Last dental visit between 7 mon and 5 yrs	1	78	20	183	0.12	0.02-0.89
DIS	**Lives in the City of Caledon**	**3**	**91**	**18**	**172**	**0.32**	**0.09-1.10**
DIS	**Has gingivitis**	**9**	**154**	**12**	**109**	**0.53**	**0.22-1.30**
DIS	**Attends public school**	**13**	**139**	**8**	**124**	**1.45**	**0.58-3.61**
Q	**School water fluoride ≥ 6 ppm**	**9**	**72**	**12**	**191**	**1.99**	**0.81-4.93**
Q30	**Used toothpaste on ¾ of brush head**	**10**	**70**	**11**	**193**	**2.51**	**1.02-6.17**
Q27	Parents started brushing before 12 months.	12	87	9	167	2.56	1.04-6.33
Q37	Mother's education is higher than father's	10	62	11	201	2.95	1.19-7.25
Q32	**Definitely did not take antibiotics**	**13**	**108**	**5**	**133**	**3.21**	**1.11-9.26**
Q27	**Parents started brushing between 6 to 11 mon**	**12**	**70**	**9**	**184**	**3.51**	**1.41-8.70**
Q12	Last dental visit between 2 and 26 weeks	17	134	4	127	4.03	1.32-12.4
Q37	**Mother has college education or higher**	**18**	**151**	**3**	**107**	**4.26**	**1.22-14.7**
Q12	**Last dental visit within 6 months**	**18**	**164**	**1**	**78**	**8.55**	**1.12-66.7**

+ Factor = Child has factor **- Factor = Child does not have factor**
F2 + = has fluorosis of aesthetic concern **F2 - = does not have fluorosis of aesthetic concern**

TABLE 7d
LOGISTIC REGRESSION FOR THE PRESENCE OF DENTAL FLUOROSIS OF AESTHETIC CONCERN TSIF > 2

Method = Backward Stepwise (Wald)

Factor		n	% + Fa	Adj. Odds Ratio	95% C.I.
DIS	Lives in the City of Caledon **ns**	284	26	0.25	0.06-1.08
DIS	Attends public school **ns**	284	54	3.10	0.92-10.5
Q32	**Definitely did not take antibiotics**	**259**	**47**	**4.44**	**1.26-15.6**
Q30	**Used toothpaste on ¾ of brush head**	**284**	**28**	**5.16**	**1.55-17.2**
Q12	**Last dental visit within 6 months**	**261**	**70**	**10.34**	**1.20-89.4**
Q37	**Mother has college education or higher**	**279**	**61**	**18.8**	**2.06-172**

Cox and Snell R Square = 0.125

Hosmer and Lemeshow Test = 0.315

Sensitivity = NA (one of the cells is a 0)

Specificity = NA (one of the cells is a 0)

ns = not statistically significant

APPROVALS:

UNIVERSITY OF TORONTO HEALTH SCIENCES I RESEARCH ETHICS BOARD

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #14451 June 1, 2005

Dr. J. L. Leake
Community Faculty of Dentistry
124 Edward Street
University of Toronto
Toronto, ON M5G 1G6

Dr. D. Ito

Dear Dr. Leake & Dr. Ito:

Re: Your research protocol entitled, "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Flouridated Area with Those in a Non-Flouridated Area in Ontario" by Dr. J. L. Leake (supervisor), Dr. D. Ito (Master's student)

The Health Sciences I Research Ethics Board (REB) has considered this study at its most recent meeting, and has provided comments on the following page(s) for your information and response:

Approval will be granted pending satisfactory response to concerns in the minutes. Researchers are requested to submit 2 copies of cover letter addressing points raised therein, together with 2 copies of revised study documents, with changes in BOLD. Revisions are to be reviewed by the Ethics Review Office.

Please address individual review points in a cover letter and attach the revised materials to your response. **Additions/revisions to the original protocol and supporting documents should be highlighted in some way (e.g., bold, underline or italicize).**

Revisions should be submitted to the Ethics Review Office, Simcoe Hall, 27 King's College Circle, Room 10A. Please quote your Protocol Reference Number on your resubmission.

We hope this is helpful. We look forward to hearing from you.

Yours sincerely,

Marianna Richardson
Ethics Review Coordinator

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1
Telephone 416/ 978-3165 Fax 416/ 946-5763 email: ethics.review@utoronto.ca

Minutes of the Health Sciences I Research Ethics Board
Wednesday, May 25, from 12noon, Falconer Room, 1st Floor, Simcoe Hall

XIV. Leake, J. (supevisor), Ito, D. (Master's student), "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Flouridated Area with Those in a Non-Flouridated Area in Ontario" (Dentistry) #14451

The Board discussed this study and has the following comments, and requests for clarification:

This is a very low risk and well designed study that does not impart any extraordinary risks on the children who participate in the screening- which is done anyway by the regional health department, or with the parents who would fill out the survey.The urine sample should not pose any difficulties. All of the necessary data protection and confidentiality provisions are in place. Informed consent is both implicit by returning the survey and explicit in signed permission to link the information with the caries/fluorosis scores. The REB found this a very clear and precise protocol that was a pleasure to review!

1. The Letter of Approval of Scientific Merit from the Faculty of Dentistry needs to be provided.

2. Funding is provided by the Peel Region Public Health Unit; a copy of the contract needs to be submitted to the REB for review by the Contracts Office.

3. The approvals from the Peel Regional Health Unit and Peel Schools should be submitted to the REB as soon as they become available.

4. SGS Guidelines on Research Involving Humans, Section 6, states, "In the case of thesis research, it is required that the supervisory committee has been established, convened at least once, and has approved the thesis proposal". Please provide this documentation to the REB.

Approval pending satisfactory response to above concerns. Researchers are requested to submit 2 copies of cover letter addressing points raised herein, together with 2 copies of revised study documents, with changes in BOLD. Revisions to be reviewed by the Ethics Review Office.

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1
Telephone 416/ 978-3165 Fax 416/ 946-5763 email: ethics.review@utoronto.ca

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #14451 & #15750

November 21, 2005

Dr. J. L. Leake
Community Faculty of Dentistry
124 Edward Street
University of Toronto
Toronto, ON M5G 1G6

Dr. D. Ito

Dear Dr. Leake & Dr. Ito:

Re: Your research protocol entitled, "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Flouridated Area with Those in a Non-Flouridated Area in Ontario" (Revised Version & Amendments received Oct. 26, 2005) by Dr. J. L. Leake (supervisor), Dr. D. Ito (Master's student)

ETHICS APPROVAL	**Original Approval Date: November 21, 2005** **Expiry Date: November 20, 2006**

We are writing to advise you that the Health Sciences I Research Ethics Board has granted approval to the above-named research study, for a period of **one year**. Ongoing projects must be renewed prior to the expiry date. Your ethics protocol approval is valid for a period of 1 year. It is the responsibility of the investigator to maintain a valid approval throughout the duration of the research activity, and to report to the Ethics Review Office of its completion. Annual Renewal of Ethics Approval forms and Study Completion Report forms can be found at http://www.rir.utoronto.ca/ethics_hsmaterials.html. Consequences of expired ethics protocol approvals may include the freezing of funds and/or refusal to review new ethics protocol submissions.

The following documents (revised versions received October 26, 2005) have been approved for use in this study: Oral Health Survey for Parents of Children Attending the Elementary Schools in Peel Region, Consent, Letter to Principal, Teachers Instructions, Dental Program School Screening Exemption and "Dental Health: Toothy Tips for Parents". The amendments are also approved: 3 new questions added to the Parent Questionnaire, and changing the Study Power to be 70%. We acknowledge receipt of the Letter of Approval of Scientific Merit for this study from the Faculty of Dentistry.

During the course of the research, any significant deviations from the approved protocol (that is, any **deviation which would lead to an increase in risk or a decrease in benefit to participants**) and/or any unanticipated developments within the research should be brought to the attention of the Ethics Review Unit.

Best wishes for the successful completion of your project.

Yours sincerely,

Marianna Richardson
Ethics Review Coordinator

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1
Telephone 416/ 978-3165 Fax 416/ 946-5763 email: ethics.review@utoronto.ca

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #16549

February 15, 2006

Dr. J. L. Leake
Community Faculty of Dentistry
124 Edward Street
University of Toronto
Toronto, ON M5G 1G6

Dr. D. Ito

Dear Dr. Leake & Dr. Ito:

Re: Your research protocol entitled, "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Flouridated Area with Those in a Non-Flouridated Area in Ontario" (Amendment received January 30, 2006) by Dr. J. L. Leake (supervisor), Dr. D. Ito (Master's student)

We are writing to advise you that a member of the Health Sciences I Research Ethics Board has granted approval to the amendment to the above-named research study, for a period of **one year**. Ongoing projects must be renewed prior to the **expiry date (Nov. 20, 2006)**. Your ethics protocol approval is valid for a period of 1 year. It is the responsibility of the investigator to maintain a valid approval throughout the duration of the research activity, and to report to the Ethics Review Office of its completion. Annual Renewal of Ethics Approval forms and Study Completion Report forms can be found at http://www.research.utoronto.ca/ethics/eh_forms.html

Consequences of expired ethics protocol approvals may include the freezing of funds and/or refusal to review new ethics protocol submissions.

The amendment, now approved, will allow for the addition of 7 year olds at the same schools in Brampton and Caledon, but who were examined in the previous year)2004-2005 school year), to be included in this study to increase the sample size.

During the course of the research, any significant deviations from the approved protocol **(that is, any deviation which would lead to an increase in risk or a decrease in benefit to participants)** and/or any unanticipated developments within the research should be brought to the attention of the Ethics Review Unit.

Best wishes for the successful completion of your project.

Yours sincerely,

Marianna Richardson
Ethics Review Coordinator

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1
Telephone 416/ 978-3165 Fax 416/ 946-5763 email: ethics.review@utoronto.ca

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #17420

June 6, 2006

Dr. J. L. Leake
Community Faculty of Dentistry
124 Edward Street
University of Toronto
Toronto, ON M5G 1G6

Dr. D. Ito

Dear Dr. Leake & Dr. Ito:

Re: Your research protocol entitled, "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Fluoridated Area with Those in a Non-Fluoridated Area in Ontario" (Amendment received April 27, 2006) by Dr. J. L. Leake (supervisor), Dr. D. Ito (Master's student)

We are writing to advise you that a Sub-Committee of the Health Sciences I Research Ethics Board has granted approval to the amendment to the above-named research study, under the Board's expedited review process, for a period of **one year**. Ongoing projects must be renewed prior to the expiry date (Nov. 20, 2006). Your ethics protocol approval is valid for a period of 1 year. It is the responsibility of the investigator to maintain a valid approval throughout the duration of the research activity, and to report to the Ethics Review Office of its completion. Annual Renewal of Ethics Approval forms and Study Completion Report forms can be found at http://www.research.utoronto.ca/ethics/eh_forms.html
Consequences of expired ethics protocol approvals may include the freezing of funds and/or refusal to review new ethics protocol submissions.

The amendment, now approved, will allow for re-contact of individuals for the collection of urine samples from the children for fluoride level investigation, a procedure that was previously described and agreed to by parents of the study subjects. The method of analysis was part of the original protocol that was approved by the HS I REB on Nov. 21, 2005. The following documents have been approved for use in this study: Letter to Parents about couriered package to arrive soon (Appendix A), Parent Information Letter (Appendix B), and Consent Form (Appendix C). Participants should receive a copy of their consent form.

During the course of the research, any significant deviations from the approved protocol **(that is, any deviation which would lead to an increase in risk or a decrease in benefit to participants)** and/or any unanticipated developments within the research should be brought to the attention of the Ethics Review Unit. Best wishes for the successful completion of your project.

Yours sincerely,

Marianna Richardson
Ethics Review Coordinator

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1
Telephone 416/ 978-3165 Fax 416/ 946-5763 email: ethics.review@utoronto.ca

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #17420 now #18191

August 22, 2006

Dr. James Leake
Faculty of Dentistry
124 Edward St.
Toronto, ON M5G 1G6

Dr. Dick Ito
Faculty of Dentistry
124 Edward St.
Toronto, ON M5G 1G6

Dear Dr. Leake and Dr. Ito:

Re: Your research protocol entitled "A Cross-Sectional Study to Compare DMFT Rates in 7 Year-Old School Children in a Fluoridated Area with a Neighbouring Non-Fluoridated Are in Ontario"

We are writing to advise you that a member of the Health Sciences I Research Ethics Board has granted approval to an amendment (received July 20, 2006) to the above referenced research study under the REB's expedited review process. *This amendment involves the use of a follow-up reminder letter.*

The following consent document has been approved for use in this study: Follow-up letter (received August 3, 2006). Participants should receive a copy of their consent form.

During the course of the research, any significant deviations from the approved protocol (**that is, any deviation which would lead to an increase in risk or a decrease in benefit to participants**) and/or any unanticipated developments within the research should be brought to the attention of the Ethics Review Office.

Best wishes for the successful completion of your project.

Yours sincerely,

Jenny Peto
Ethics Review Coordinator

Simcoe Hall, 27 King's College Circle, Room 10A, Toronto Ontario M5S 1A1
TEL: 416/ 946-3273 FAX: 416/ 946-5763 EMAIL: ethics.review@utoronto.ca

UNIVERSITY OF TORONTO
Office of the Vice-President, Research and Associate Provost
Ethics Review Office

PROTOCOL REFERENCE #14451, #15750 now #18991

November 27, 2006

Dr. J. L. Leake
Community Faculty of Dentistry
124 Edward Street
University of Toronto
Toronto, ON M5G 1G6

Dr. D. Ito

Dear Dr. Leake & Dr. Ito:

Re: Your research protocol entitled, "A Cross-Sectional Study to Compare DMFT Rates of 7 Year-old School Children in a Flouridated Area with Those in a Non-Flouridated Area in Ontario"

ETHICS APPROVAL	**Original Approval Date: November 21, 2005** **Next Expiry Date: November 20, 2007** **Renewal: 1 of 4**

We are writing to advise you that the Health Sciences I Research Ethics Board has granted annual renewal of ethics approval to the above referenced research study through the REB's expedited process. Ongoing projects must be renewed prior to the expiry date.

We understand that there have been no changes to the consent documents since the original approval date. Participants should receive a copy of their consent form.

During the course of the research, any significant deviations from the approved protocol **(that is, any deviation which would lead to an increase in risk or a decrease in benefit to participants)** and/or any unanticipated developments within the research should be brought to the attention of the Ethics Review Office.

Best wishes for the successful completion of your project.

Yours sincerely,

Jenny Peto
Ethics Review Coordinator

Simcoe Hall, 27 King's College Circle, Room 10A, Toronto Ontario M5S 1A1
TEL: 416/ 946-3273 FAX: 416/ 946-5763 EMAIL: ethics.review@utoronto.ca

APPENDICES

APPENDIX A
ONTARIO DENTAL INDEX SYSTEM - CHILD FORM

Examiner [ ] Health Unit [Peel Region] Recorder [ ]

School Code [| | | | | |] Planning Area [ ]

Date (yyyy/mm/dd) [2005]/[|]/[|]

School Name ______________________________

Sex [ ] DOB (yyyy/mm/dd) [ ][|]/[|]/[|]

Grade [ ] Postal Code [| | | | |]

Born in Canada [ ]

INDICES

Fluorosis [ ] Gingivitis [ ]

Debris Index

16/55	11	26/65
46/85	31	36/75

Calculus Index

16/55	11	26/65
46/85	31	36/75

Trauma Index

12	11	21	22
42	41	31	32

Comment ______________________________

TOOTH STATUS

		55	54	53	52	51	61	62	63	64	65		
17	16	15	14	13	12	11	21	22	23	24	25	26	27

		85	84	83	82	81	71	72	73	74	75		
47	46	45	44	43	42	41	31	32	33	34	35	36	37

NEEDS

Urgent [ ] Non Urgent [ ] Scaling [ ] Prophy/Cleaning [ ]

Sealant [ ] Fluoride [ ] Preventive Instruction [ ]

APPENDIX B

Faculty of Dentistry **Parent Information Letter**

University of Toronto

Dear Parent,

The Community Dentistry Department at the Faculty of Dentistry, University of Toronto, and the Peel Region Public Health Department are conducting a study to examine the reasons for the differences in dental health among the children in Peel Region. The Peel Region Public Health Unit will use the information obtained from this study to plan better preventive dental programmes.

As you know, your child ___________ recently received a dental screening examination from Peel Region Public Health Department staff. We are asking the parents of 7-year-old children attending certain schools to provide information that might explain the differences in dental health, to participate in this study.

Your participation in this study is voluntary. We are asking you to complete the enclosed questionnaire. As one of the possible factors in the difference in dental health is the level of fluoride in the drinking water, we are also asking you to fill the plastic tube with water from your usual source of drinking water (bottled or tap). Please return both to us in the enclosed addressed envelope. Arrangements have been made with Purolator. Please contact them at 1-888-744-7123 to arrange for pick-up or to find the nearest drop-off box/centre. All results are strictly confidential and we will report only group statistics. Your family name or other personal information will not appear at all on the documents that you return to us and all forms will be shredded once the data is analyzed.

Please be aware that there arc no correct answers and we are only interested in your experiences.

If you choose not to participate please return the questionnaire and the water sample tube, in the envelope provided. By returning this, the investigators will know not to contact you again. If you choose not to participate, your child will still be eligible for all of the usual services from the Peel Region Public Health Department.

If you have any questions regarding this study, please contact Dr. Dick Ito at 979-4908 ext. 4.489.

Thank-you for your help.

Dr. D.H. Ito and Dr. J.L. Leake

124 Edward Street, Toronto Ontario MSG 1G6 - FAX (416-979-4936)

APPENDIX B

P Region of Peel
Working for you
Public Health

November 05

Dear Parent/Guardian:

In a few days, you will receive a printed questionnaire from the Faculty of Dentistry at the University of Toronto. We encourage you to fill in the answers to the questions and return it to the University. This information will greatly assist us in developing programs to prevent tooth decay among children in Peel Region.

This study is a follow-up to the Health Department's report on the oral health status of children in Peel Region. One of the major findings of that report was that relatively more children in Caledon had had dental caries (cavities, fillings) when compared to children in Brampton and Mississauga. In learning of this, Peel Regional Council directed the Health Department to explore further the factors that contribute to cavities among all children. Accordingly, the Region of Peel Health Department has arranged with researchers at the University of Toronto to conduct this study.

Again, we ask you for your cooperation and encourage you to fill in and return the questionnaire. Your contribution will be valuable in improving the future oral health of the children in the Region of Peel.

Should you have any questions about this study please contact me at (905) 791-7800 ext 2089.

Sincerely,

Dr. Dan Otchere
Dental Consultant

9445 Airport Road 3rd Floor, West Tower, Brampton ON L6S 4J3 Tel: 905-791-7800 www.peelregion.ca

APPENDIX C

ORAL HEALTH SURVEY FOR PARENTS OF CHILDREN ATTENDING ELEMENTARY SCHOOLS IN PEEL REGION

DENTAL HEALTH QUESTIONS:

Please answer the following questions concerning your child's dental health.

All answers are strictly confidential ? completed.

Identification Code ____________

Name of the school presently attended by this child: ___________________________

What is this child's date of birth?

_____/ _____/ _____
dd mm yr

Is this child male __________or female________?

Unless otherwise instructed, please a check mark in the box with the one most appropriate response for each question.

First, we would like to know your child's oral health practices from age 5 to now.

3. Please indicate all places (city/town/community and province/country) where your child lived for most of the year, during the first 7 years of his/her life.

AGE	CITY/TOWN/AREA	PROVINCE/COUNTRY	USED PUBLIC (Town/City) WATER SUPPLY
Birth to less than age 1			Yes ☐ No ☐ Don't Know ☐
1 to less than age 2			Yes ☐ No ☐ Don't Know ☐
2 to less than age 3			Yes ☐ No ☐ Don't Know ☐
3 to less than age 4			Yes ☐ No ☐ Don't Know ☐
4 to less than age 5			Yes ☐ No ☐ Don't Know ☐
5 to less than age 6			Yes ☐ No ☐ Don't Know ☐
6 to less than age 7			Yes ☐ No ☐ Don't Know ☐

See Table on page 17 for frequency distribution

4. Is the drinking water for your house treated by a reverse osmosis filter?

☐ Yes **(n =78 / 19.0)**
☐ No **(n = 280 / 68.1)**
☐ Missing **(n = 43 / 10.5)**
☐ Don't know **(n = 10 / 2.4)**

5. How often does your child brush his/her teeth?

☐ Less than once a day **(n = 8 / 1.9)**
☐ Once a day **(n = 131 / 31.9)**
☐ Twice or more a day **(n = 270 / 65.7)**
☐ Do not know **(n = 1 / 0.2)**
☐ Missing **(n = 1 / 0.2)**

6. What is the full name of the toothpaste your child uses?

☐ Colgate **(n = 236 / 57.4)**
☐ Crest **(n = 78 / 19.0)**
☐ Aquafresh **(n = 24 / 5.8)**
☐ Oral B **(n = 30 / 7.3)**
☐ Natural **(n = 4 / 1.0)**
☐ Sensodyne **(n = 3 / 0.7)**
☐ Vajradanti **(n = 1 / 0.2)**
☐ Palmolive **(n = 1 / 0.2)**
☐ Aim **(n = 2 / 0.5)**
☐ Other **(n = 2 / 0.5)**
☐ Missing **(n = 30 / 7.3)**

Kids Toothpaste **(n = 140 / 34.1)**
Adult Toothpaste **(n = 241 / 58.6)**
Missing **(n = 30 / 7.3)**

7. Which of the following pictures best shows the amount of toothpaste your child normally uses?

a) **(n = 222 / 54.0)** ☐ 

b) **(n = 170 / 41.4)** ☐ 

c) **(n = 18 / 4.4)** ☐ 

Missing **(n = 1 / 0.2)**

8. Does your child routinely use mouthwash recommended by your dentist in order to prevent dental cavities?

- ☐ Yes **(n = 46 / 11.2)**
- ☐ No **(n = 358 / 87.1)**
- ☐ Don't know **(n = 4 / 1.0)**
- ☐ Missing **(n = 3 / 0.7)**

Now, your child's dental history.

9. How happy are you with the appearance of your child's teeth?

- ☐ Very happy **(n = 64 / 15.6)**
- ☐ Quite happy **(n = 168 / 40.9)**
- ☐ Moderately happy **(n = 133 / 32.4)**
- ☐ Quite unhappy **(n = 31 / 7.5)**
- ☐ Very unhappy **(n = 12 / 2.9)**
- ☐ Multiple answers **(n = 1 / 0.2)**
- ☐ Missing **(n = 2 / 0.5)**

10. Do you have a dentist whom your family usually visits?

- ☐ No **(n = 52 / 12.7)**
- ☐ Yes **(n = 355 / 86.4)**
- ☐ Don't know **(n = 2 / 0.5)**
- ☐ Missing **(n = 2 / 0.5)**

11. At what age did your child have his/her first dental visit?

- ☐ Before age 2 years **(n = 62 / 15.1)**
- ☐ 2 – 5 years **(n = 267 / 65.1)**
- ☐ Older than 5 years **(n = 55 / 13.4)**
- ☐ Never **(n = 25 / 6.1)**
- ☐ Do not know **(n = 2 / 0.5)**

12. How long has it been since your child last visited a dentist?

- ☐ Within the last 2 weeks **(n = 47 / 11.4)**
- ☐ Between 2 weeks to 6 months **(n = 228 / 55.5)**
- ☐ Between 7 months to 12 months **(n = 68 / 16.5)**
- ☐ Between Over 1 and up to 2 years **(n = 26 / 6.3)**
- ☐ Between 2 and 5 years **(n = 12 / 2.9)**
- ☐ More than 5 years **(n = 1 / 0.2)**
- ☐ Never obtained care **(n = 25 / 6.1)**
- ☐ Do not know **(n = 3 / 0.7)**
- ☐ Missing **(n = 1 / 0.2)**

13. Why did your child go to the dentist last time?

☐ Check-up and cleaning	**(n = 260 / 63.3)**
☐ Check-up/cleaning and filling(s)	**(n = 64 / 15.6)**
☐ Filling a tooth or teeth (no check-up/cleaning)	**(n = 22 / 5.4)**
☐ Something was wrong, hurting/bothering him/her	**(n = 10 / 2.4)**
☐ Orthodontic treatment (tooth straightening)	**(n = 11 / 2.7)**
☐ Tooth pulled (extracted)	**(n = 18 / 4.4)**
☐ Never obtained care	**(n = 13 / 3.2)**
☐ Do not know	**(n = 4 / 1.0)**
☐ Missing	**(n = 9 / 2.2)**

14. Do you have any kind of dental plan which pays for all or part of the dental care for your child?

☐ No	**(n = 87 / 21.2)**
☐ Yes – part	**(n = 196 / 47.7)**
☐ Yes – all	**(n = 127 / 30.9)**
☐ Do not know	**(n = 1 / 0.2)**

Please provide us with information on your child's eating and drinking habits.

15. How many times does your child have food or drink (other than water), between meals? (please check only one answer)

☐ Never	**(n = 7 / 1.7)**
☐ 1 time per day	**(n = 32 / 7.8)**
☐ 2 times per day	**(n = 146 / 35.5)**
☐ 3 times per day	**(n = 155 / 37.7)**
☐ 4 or more times per day	**(n = 69 / 16.8)**
☐ Missing	**(n = 2 / 0.5)**

16. Which type of drink does he/she have most often between meals? (Please place a check mark in one box only.)

☐ Milk	**(n = 99 / 24.1)**	☐ Tea	**(n = 5 / 1.2)**
☐ Undiluted fruit juices	**(n = 78 / 19.0)**	☐ Tap Water	**(n = 66 / 16.1)**
☐ Diluted fruit juices	**(n = 96 / 23.4)**	☐ Bottled water	**(n = 57 / 13.9)**
☐ Soda pop	**(n = 9 / 2.2)**	☐ Herbal drinks	**(n = 1 / 0.2)**

17. Thinking about food, nowadays how often does your child have something to eat or drink before bed, in bed or during the night?

- ☐ Every night **(n = 129 / 31.4)**
- ☐ 4– 6 nights a week **(n = 41 / 10.0)**
- ☐ 1 – 3 nights a week **(n = 88 / 21.4)**
- ☐ Less often than once a week **(n = 82 / 20.0)**
- ☐ Never **(n = 71 / 17.3)**

18. When your child does have something to eat before bed, in bed or during the night, what does he/she have most often? (Please place a check mark in one box only.)

☐ Sweets	**(n = 33 / 8.0)**	☐ Cheesy biscuits	**(n = 18 / 4.4)**
☐ Chocolate	**(n = 8 / 1.9)**	☐ Fruit	**(n = 77 / 18.7)**
☐ Sweet biscuits or cake	**(n = 39 / 9.5)**	☐ Vegetables	**(n = 13 / 3.2)**
☐ Ice cream	**(n = 21 / 5.1)**	☐ Potato chips	**(n = 29 / 7.1)**
☐ Bread	**(n = 17 / 4.1)**	☐ Cereal	**(n = 52 / 12.7)**
☐ Other (please specify)	**(n = 1 / 0.2)**	☐ Missing	**(n = 103 / 25.1)**

19. When your child does have something to drink before bed, in bed or during the night, what does he/she have most often? (Please place a check mark in one box only.)

☐ Milk	**(n = 160 / 38.9)**	☐ Tea	**(n = 3 / 0.7)**
☐ Undiluted fruit juices	**(n = 17 / 4.1)**	☐ Tap Water	**(n = 109 / 26.5)**
☐ Diluted fruit juices	**(n = 38 / 9.2)**	☐ Bottled water	**(n = 64 / 15.6)**
☐ Soda pop	**(n = 4 / 1.0)**	☐ Herbal drinks	**(n = 2 / 0.5)**
☐ Missing	**(n = 14 / 3.4)**		

20. When your child does eat between meals, what does he/she have most often?

☐ Sweets	**(n = 66 / 16.1)**	☐ Cheesy biscuits	**(n = 42 / 10.2)**
☐ Chocolate	**(n = 25 / 6.1)**	☐ Fruit	**(n = 131 / 31.9)**
☐ Sweet biscuits or cake	**(n=72/17.5)**	☐ Vegetables	**(n = 11 / 2.7)**
☐ Ice cream	**(n = 17 / 4.1)**	☐ Potato chips	**(n = 27 / 6.6)**
☐ Bread	**(n = 5 / 1.2)**	☐ Cereal	**(n = 5 / 1.2)**
☐ Other (please specify)	**(n = 2 / 0.5)**	☐ Missing	**(n = 8 / 1.9)**

Please tell us about your child's early feeding history from birth to age 4.

21. Was your child fed infant formula as a baby?

- ☐ Yes **(n = 319 / 77.6)**
- ☐ No **(n = 88 / 21.4)**
- ☐ Don't know **(n = 4 / 1.0)**

KEY

a) If yes, at what age did your child start receiving formula?

☐ Before 6 months of age	**(1)**	☐ 24 to 35 months of age	**(1000)**
☐ 6 to 11 months of age	**(10)**	☐ 36 months of age or older	**(10000)**
☐ 12 to 23 months of age	**(100)**	☐ Don't Know	

c) If formula fed, what source of water did you use to dilute or mix the formula?

☐ Home tap water	**(100000)**
☐ Any other water source	**(1000000)**
☐ Don't know	

d) If formula fed, at what age did your child stop receiving formula?

☐ Before 6 months of age	**(10000000)**
☐ 6 to 11 months of age	**(100000000)**
☐ 12 to 23 months of age	**(1000000000)**
☐ 24 to 35 months of age	**(10000000000)**
☐ 36 months of age or older	**(100000000000)**
☐ Don't Know	

Q 21 (Frequencies)

a) If yes, at what age did your child start receiving formula?

☐ Before 6 months of age	**(n = 206 / 50.1)**	☐ 24 to 35 months of age	**(n = 1 / 0.2)**
☐ 6 to 11 months of age	**(n = 98 / 23.8)**	☐ 36 months of age or older	**(n = 1 / 0.2)**
☐ 12 to 23 months of age	**(n = 11 / 2.7)**	☐ Don't Know	**(n = 5 / 1.2)**
☐ Not fed formula	**(n = 88 / 21.4)**	☐ Missing	**(n = 1 / 0.2)**

b) If formula fed, was water added to the formula?

☐ Yes	**(n = 293 / 71.3)**
☐ No	**(n = 22 / 5.4)**
☐ Don't know	**(n = 9 / 2.2)**
☐ Not fed formula	**(n = 87 / 21.2)**

c) If formula fed, what source of water did you use to dilute or mix the formula?

☐ Home tap water	**(n = 239 / 58.2)**	☐ Ready made formula	**(n = 1 / 0.2)**
☐ Any other water source	**(n = 66 / 16.1)**	☐ Missing	**(n = 6 / 1.5)**
☐ Not fed formula	**(n = 87 / 21.2)**	☐ Don't know	**(n = 12 / 2.9)**

d) If formula fed, at what age did your child stop receiving formula?

☐ Before 6 months of age	**(n = 7 / 1.7)**	☐ 24 to 35 months of age	**(n = 32 / 7.8)**
☐ 6 to 11 months of age	**(n = 78 / 19.0)**	☐ 36 months of age or older	**(n =12 / 2.9)**
☐ 12 to 23 months of age	**(n = 182 / 44.3)**	☐ Don't Know	**(n = 11 / 2.7)**
☐ Not fed formula	**(n = 87 / 21.2)**	☐ Missing	**(n = 2 / 0.5)**

Combination frequency: **n=309**

88 – No infant formula fed

42 - answer combination started formula before 6 months, Home tap water, stopped formula 6 -11 mon.

19 - answer combination started formula before 6 months, Any other water source, stopped formula 6 -11 months

88 – answer combination started formula before 6 months, Home tap water, stopped formula 12 -23 months

54 - answer combination started formula 6 – 11 months, Home tap water, stopped formula 12 – 23 months

18 - answer combination started formula 6 - 11 months, Home tap water, stopped 24 – 35 months

22. Did your child receive other liquids by bottle?

☐ Yes	**(n = 314 / 76.4)**		
☐ No	**(n = 96 / 23.4)**	☐ Missing	**(n = 1 / 0.2)**

a) If yes, what did you put in the bottle?
(Please place a check mark on all the answers that apply.)

KEY

	During Day	At Night	Never	Don't Know
Cow's milk	**1**	**10**	**100**	**1000**
Plain (tap) water	**10000**	**100000**	**1000000**	**10000000**
Bottled water	**100000000**	**1000000000**	**10000000000**	**100000000000**
Sweetened water	**5**	**50**	**500**	**5000**
Juice (reconstituted)	**50000**	**500000**	**5000000**	**50000000**
Other (please specify)	**500000000**	**5000000000**	**50000000000**	**500000000000**

	During Day	At Night	Never	Don't know
Cow's milk	**Yes (n = 184 / 44.8)** **No (n = 227 / 55.2)**	**Yes (n = 128 / 31.1)** **No (n = 283 / 68.9)**	**Yes (n = 12 / 2.9)** **No (n = 399 / 97.1)**	**Yes (n = 410 / 99.8)** **No (n = 1 / 0.2)**
Plain (tap) water	**Yes (n = 113 / 27.5)** **No (n = 298 / 72.5)**	**Yes (n = 47 / 11.4)** **No (n = 364 / 88.6)**	**Yes (n = 31 / 7.5)** **No (n = 380 / 92.5)**	**Yes (n = 5 / 1.2)** **No (n = 406 / 98.8)**
Bottled water	**Yes (n = 99 / 24.1)** **No (n = 312 / 75.9)**	**Yes (n = 41 / 10.0)** **No (n = 370 / 90.0)**	**Yes (n = 34 / 8.3)** **No (n = 377 / 91.7)**	**Yes (n = 11 / 2.7)** **No (n = 400 / 97.3)**
Sweetened water	**Yes (n = 21 / 5.1)** **No (n = 390 / 94.9)**	**Yes (n = 9 / 2.2)** **No (n = 402 / 97.8)**	**Yes (n = 63 / 15.3)** **No (n = 348 / 84.7)**	**Yes (n = 5 / 1.2)** **No (n = 406 / 98.8)**
Juice (reconstituted)	**Yes (n = 201 / 48.9)** **No (n = 210 / 51.1)**	**Yes (n = 32 / 7.8)** **No (n = 379 / 92.2)**	**Yes (n = 19 / 4.6)** **No (n = 392 / 95.4)**	**Yes (n = 2 / 0.5)** **No (n = 409 / 99.5)**
Other (please specify)	**Yes (n = 37 / 9.0)** **No (n = 374 / 91.0)**	**Yes (n = 11 / 2.7)** **No (n = 400 / 97.3)**	**Yes (n = 7 / 1.7)** **No (n = 404 / 98.3)**	**Yes (n = 2 / 0.5)** **No (n = 409 / 99.5)**

Combination Frequency:

See Table on pages 17-20 for frequency distribution

b) At what age did you stop giving this child a bottle?

- ☐ 0 – 11 Months **(n = 19 / 4.6)**
- ☐ 12 – 23 Months **(n = 125 / 30.4)**
- ☐ 24 – 35 Months **(n = 114 / 27.7)**
- ☐ 36 – 47 Months **(n = 44 / 10.7)**
- ☐ 48 – 59 Months **(n = 11 / 2.7)**
- ☐ 60 – 71 Months **(n = 10 / 2.4)**
- ☐ 72 – 83 Months **(n = 3 / 0.7)**
- ☐ 84 – 95 Months **(n = 2 / 0.5)**
- ☐ Missing **(n = 81 / 19.7)**
- ☐ Don't know **(n = 2 / 0.5)**

23. After the child began to walk did (s)he use a tippee cup when (s)he wanted a drink?

- ☐ Bottle **(n = 50 / 12.2)**
- ☐ Tippee cup **(n = 332 / 80.8)**
- ☐ Both **(n = 21 / 5.1)**
- ☐ Neither **(n = 4 / 1.0)**
- ☐ Missing **(n = 4 / 1.0)**

24. What did you put in the tippee cup **between** meals?
(Please place a check mark on all the answers that apply.)

KEY

	Never	sometimes	often	always
Water	**1**	**10**	**100**	**1000**
Milk	**10000**	**100000**	**1000000**	**10000000**
Fruit Juice	**100000000**	**1000000000**	**10000000000**	**100000000000**
Pop	**5**	**50**	**500**	**5000**
Kool-Aid	**50000**	**500000**	**5000000**	**50000000**

	Never	sometimes	often	always
Water	**Yes (n = 16 / 3.9)** **No (n = 395 / 96.1)**	**Yes (n = 130 / 31.6)** **No (n = 281 / 68.4)**	**Yes (n = 129 / 31.4)** **No (n = 282 / 68.6)**	**Yes (n = 68 / 16.5)** **No (n = 343 / 83.5)**
Milk	**Yes (n = 11 / 2.7)** **No (n = 400 / 97.3)**	**Yes (n = 96 / 23.4)** **No (n = 315 / 76.6)**	**Yes (n = 166 / 40.4)** **No (n = 245 / 59.6)**	**Yes (n = 47 / 11.4)** **No (n = 364 / 88.6)**
Fruit Juice	**Yes (n = 13 / 3.2)** **No (n = 398 / 96.8)**	**Yes (n = 177 / 43.1)** **No (n = 234 / 56.9)**	**Yes (n = 124 / 30.2)** **No (n = 287 / 69.8)**	**Yes (n = 41 / 10.0)** **No (n = 370 / 90.0)**
Pop	**Yes (n = 156 / 38.0)** **No (n = 255 / 62.0)**	**Yes (n = 13 / 3.2)** **No (n = 398 / 96.8)**	**Yes (n = 1 / 0.2)** **No (n = 410 / 99.8)**	**Yes (n = 2 / 0.5)** **No (n = 409 / 99.5)**
Kool-Aid	**Yes (n = 148 / 36.0)** **No (n = 263 / 64.0)**	**Yes (n = 21 / 5.1)** **No (n = 390 / 94.9)**	**Yes (n = 4 / 1.0)** **No (n = 407 / 99.0)**	**Yes (n = 2 / 0.5)** **No (n = 409 / 99.5)**

Combination frequency:

See Table on pages 20-23 for frequency distribution

Next, we want to know about your child's early oral hygiene practices from birth to age 4.

25. Did your child ever receive fluoride tablets, drops, or lozenges for preventing tooth decay?

☐ Yes	**(n = 17 / 4.1)**
☐ No	**(n = 380 / 92.5)**
☐ Don't know	**(n = 13 / 3.2)**
☐ Missing	**(n = 1 / 0.2)**

If yes, at what ages did your child **start** and **stop** taking the fluoride tablets, drops, or lozenges?

AGE STARTED TAKING		AGE STOPPED TAKING	
☐ 1 year of age or younger	**(n = 7 / 1.7)**	☐ 1 year of age or younger	
☐ 2 years of age	**(n = 5 / 1.2)**	☐ 2 years of age	**(n = 3 / 0.7)**
☐ 3 years of age	**(n = 1 / 0.2)**	☐ 3 years of age	**(n = 4 / 1.0)**
☐ 4 years of age	**(n = 2 / 0.5)**	☐ 4 years of age	**(n = 1 / 0.2)**
☐ 5 years of age or older	**(n = 1 / 0.2)**	☐ 5 years of age or older	**(n = 4 / 1.0)**
☐ Did not take	**(n = 380 / 92.5)**	☐ Did not take	**(n = 380 / 92.5)**
☐ Missing	**(n = 1 / 0.2)**	☐ Missing	**(n = 5 / 1.2)**
☐ Don't know	**(n = 14 / 3.4)**	☐ Don't know	**(n = 14 / 3.4)**

26. Did your child take multivitamins?

☐ Yes **(n = 259 / 63.0)**
☐ No **(n = 147 / 35.8)**
☐ Missing **(n = 5 / 1.2)**

a) If yes, what was the name of the vitamins? (Please print)

☐ Arthur	**(n = 6 / 1.5)**	☐ Trivisol	**(n = 14 / 3.4)**
☐ Bugs bunny	**(n = 8 / 1.9)**	☐ D-vsol	**(n = 9 / 2.2)**
☐ Centrum	**(n = 15 / 3.6)**	☐ Other	**(n = 35 / 8.5)**
☐ Flinstones	**(n = 125 / 30.4)**	☐ Did not take multivitamins	**(n = 147 / 35.8)**
☐ Gummy bears	**(n = 10 / 2.4)**	☐ Missing	**(n = 15 / 3.6)**
☐ Jamieson	**(n = 9 / 2.2)**	☐ Don't know	**(n = 7 / 1.7)**
☐ Polyvisol	**(n = 11 / 2.7)**		

27. At what age did you start to routinely brush your child's teeth?

☐ Younger than 6 months of age **(n = 32 / 7.8)**
☐ 6 to 11 months of age **(n = 117 / 28.5)**
☐ 12 to 23 months of age **(n = 153 / 37.2)**
☐ 24 to 35 months of age **(n = 66 / 16.1)**

☐ 36 months of age or older **(n = 27 / 6.6)**
☐ Did not routinely brush child's teeth **(n = 6 / 1.5)**
☐ Don't Know **(n = 9 / 2.2)**
☐ Missing **(n = 1 / 0.2)**

28. Did you use toothpaste when brushing your child's teeth?

☐ Yes **(n = 341 / 83.0)**
☐ No **(n = 65 / 15.8)**
☐ Don't know **(n = 3 / 0.7)**
☐ Missing **(n = 2 / 0.5)**

29. At what age did your child start brushing his/her own teeth?

☐ Younger than 6 months of age	
☐ 6 to 11 months of age	**(n = 5 / 1.2)**
☐ 12 to 23 months of age	**(n = 39 / 9.5)**
☐ 24 to 35 months of age	**(n = 89 / 21.7)**
☐ 36 months of age or older	**(n = 254 / 61.8)**
☐ Does not routinely brush his/her teeth	**(n = 16 / 3.9)**
☐ Don't Know	**(n = 6 / 1.5)**
☐ Missing	**(n = 2 / 0.5)**

30. Which of the following pictures best shows the amount of toothpaste your child normally used from birth to 4 years of age?

a) **(n = 289 / 70.3)** ☐ 

b) **(n = 107 / 26.0)** ☐ 

c) **(n = 15 / 3.6)** ☐ 

31. In the first two years of your child's life, how often did he or she get middle ear infections?

☐ Never	**(n = 199 / 48.4)**
☐ 1 – 5 times	**(n = 130 / 31.6)**
☐ 6 – 10 times	**(n = 23 / 5.6)**
☐ 11 or more	**(n = 6 / 1.5)**
☐ More than once, but can't remember the number of times	**(n = 28 / 6.8)**
☐ Don't remember	**(n = 25 / 6.1)**

32. Did your child take an antibiotic (medicine) prescribed by a doctor during his/her first 6 months?

☐ No, definitely	**(n = 167 / 40.6)**
☐ I don't think so	**(n = 88 / 21.4)**
☐ I think yes	**(n = 51 / 12.4)**
☐ Yes, definitely	**(n = 69 / 16.8)**
☐ Do not recall	**(n = 35 / 8.5)**
☐ Missing	**(n = 1 / 0.2)**

33. If you think or know that s(he) took an antibiotic sometime in his/her first 6 months, did s(he) take 'amoxicillin'?

☐ No, definitely	**(n = 113 / 27.5)**
☐ I don't think so	**(n = 43 / 10.5)**
☐ I think yes	**(n = 53 / 12.9)**
☐ Yes, definitely	**(n = 46 / 11.2)**
☐ Do not recall	**(n = 65 / 15.8)**
☐ Missing	**(n = 91 / 22.1)**

Finally, we would like to know a little of your child's family history.

34. Who completed this questionnaire?

☐ Mother	**(n = 313 / 76.2)**	☐ Guardian	
☐ Father	**(n = 70 / 17.0)**	☐ Baby-sitter	**(n = 5 / 1.2)**
☐ Grandparent	**(n = 4 / 1.0)**	☐ Father & mother together	**(n = 19 / 4.6)**
☐ Other __________________			

35. In what country were the following members of your family born?

	Canada	Other Country	Missing
Child	**n = 377 / 91.7**	**n = 34 / 8.3**	
Mother	**n = 178 / 43.3**	**n = 232 / 56.4**	**n = 1 / 0.2**
Father	**n = 197 / 47.2**	**n = 217 / 52.8**	

<u>KEY</u>

	Canada	Other Country
Child	1	0
Mother	10	0
Father	100	0

Combination frequency:
0 – Child, mother and father born in other country **(n = 33 / 8.0)**
1 – Child born in Canada; Mother and Father born in other country **(n = 162 / 39.4)**
11 – Child and mother born in Canada; Father born in other country **(n = 22 / 5.4)**
100 – Child and mother born in other country; Father born in Canada **(n = 1 / 0.2)**
101 – Child born in Canada; Mother in other country; Father born in Canada **(n = 37 / 9.0)**
110 – Child born in other country; Mother and father born in Canada **(n = 1 /0.2)**
111 – Child, mother and father born in Canada **(n = 155 / 37.7)**

36. If the child was born outside of Canada, in what year did he/she immigrate to Canada?

1998 – 3
1999 – 4
2000 – 7
2001 – 5
2002 – 5
2003 – 1
2004 – 5
2005 – 2
2006 – 1
Missing – 1

37. What is the highest level of school completed by the child's mother and father? (please check one for each parent)

	Mother	Father
No formal schooling	**n = 1 / 0.2**	
Some grade school	**n = 6 / 1.5**	**n = 5 / 1.2**
Grade school completed	**n = 3 / 0.7**	**n = 3 / 0.7**
Some high school	**n = 20 / 4.9**	**n = 38 / 9.2**
High school completed	**n = 74 / 18.0**	**n = 70 / 17.0**
Some college, technical school	**n = 49 / 11.9**	**n = 52 / 12.7**
College, technical school completed	**n = 108 / 26.3**	**n = 100 / 24.3**
Some university	**n = 34 / 83**	**n = 22 / 5.4**
University degree completed	**n = 111 / 27.0**	**n = 109 / 26.5**
Missing	**n = 5 / 1.2**	**n = 12 / 2.9**

KEY

	Mother	Father
No formal schooling	1	5
Some grade school	10	50
Grade school completed	100	500
Some high school	1000	5000
High school completed	10000	50000
Some college, technical school	100000	500000
College, technical school completed	1000000	5000000
Some university	10000000	50000000
University degree completed	100000000	500000000

Combination frequency:

See Table on pages 23-24 for frequency distribution

38. What is the total household income of all persons in your household?

☐ Less than $20,000	**(n = 15 / 3.6)**
☐ $20,000 to $39,999	**(n = 50 / 12.2)**
☐ $40,000 to $59,999	**(n = 78 / 19.0)**
☐ $60,000 to $79,999	**(n = 70 / 17.0)**
☐ $80,000 or more	**(n = 176 / 42.8)**
☐ Missing	**(n = 22 / 5.4)**

This ends the formal part of the questionnaire – but please read on.

CONSENT:

My signature confirms that I have read the consent letter and agree to have researchers at the University of Toronto use the information from the school screening for scientific study.

I understand that this information will be kept confidential and no names will be used in reporting the study results.

I understand that my child will receive no direct benefit from this study.

I understand that I can refuse to participate in this study without prejudice to my child, and with no change to my child's eligibility for health unit programs.

CHILD'S NAME: ______________________________

SCHOOL ATTENDED: ______________________________

PARENT/GUARDIAN: ______________________________

SIGNATURE: ______________________________

TODAY'S DATE: ____________________

Please use the supplied envelope to send the water sample vial AND this completed questionnaire back to the University of Toronto.

To thank you for your time in completing this questionnaire, the results of your water fluoride test will be mailed to you when they are available.

The information that you have provided to us will be invaluable in determining the factors associated with dental caries. However, there is a test, which may provide an accurate indication of the amount of fluoride that is ingested by your child. The study would involve the collection of 15 ml. of your child's urine which will be analyzed for fluoride levels. If you participate, we will inform you of the findings from the analysis.

- ☐ **Yes, we would be interested in participating.**
- ☐ **No, we do not wish to participate.**

The questionnaire is completed. Thank you for taking the time to help us on this important issue.

If you have any questions, please contact:

Dr. Dick Ito
Simcoe County District Health Unit
15 Sperling Drive Barrie, Ont. L4M 6K9 (705) 721-7330 ext. 1205

Dr. James L. Leake
Faculty of Dentistry, University of Toronto
124 Edward St. Toronto, Ont. M5G 1G6 (416) 979-4908 ext. 4491

References: Questions for this survey were obtained from the following sources:

Reference Type: Thesis
Author: Abbey P
Year: 1998
Title: A Case-Control Study to Determine the Risk Factors, Markers and Determinants for the Development of Nursing Caries in the Four-Year Old Population of North York
Academic Department: Graduate Department, Faculty of Dentistry
University: University of Toronto

Reference Type: Personal Communication
Author: Brothwell D, Limeback H
Year: 1998
Title: Fouride Exposure Questionnaire
Publisher: Wellington-Dufferin-Guelph Public Health Unit and the Faculty of Dentistry, University of Toronto

Reference Type: Government Report or Document
Author: Ismail A
Year: 1996
Title: Nova Scotia Oral Health Survey 1995/6: Parent/Guardian Questionnaire
Pages: B1-5

Reference Type: Book
Author: Watt RG, Harnett R, Daly B, Fuller S, Kay E, Morgan A, Munday P, Newjack-Raymer R, Treasure E
Year: 2004
Title: Oral Health Promotion: Evaluation Tool Kit
Publisher: Stephen Hancocks Ltd.
ISBN: 0 9546145 OX

QUESTION # 3: Number of years child was exposed to CWF

Years	Number of children	Percent
0	57	13.9
1	6	1.5
2	10	2.4
3	12	2.9
4	11	2.7
5	10	2.4
6	14	3.4
7	178	43.3
Total	298	72.5
Missing	113	27.5
Total	411	100.0

QUESTION # 22: EXAMPLE OF Q22 Combination Totals

Combinations		Frequency	Percent
0	no other liquids by bottle	96	23.4
1	Cow's milk during the day	10	2.4
5	Sweetened water during the day	2	.5
10	Cow's milk during at night	2	.5
11	Cow's milk day and at night	18	4.4
10000	plain water during day	7	1.7
10001	milk and water day	6	1.5
50000	Juice during the day	21	5.1
50001	juice and milk day	7	1.7
50011	juice day, milk day + night	12	2.9
60000	juice and water day	11	2.7
6001	1 juice water day milk day nt	10	2.4
100050000	bottled water juice dy	12	2.9
"	"	"	"
"	"	"	"
"	"	"	"
	Total	411	100.0

QUESTION # 24: EXAMPLE OF Q 24 Combination Totals

Combinations		Frequency	Percent
0	no answer	22	5.4
1	water never	1	.2
10	water sometimes	2	.5
100	water often	1	.2
1000	water always	8	1.9
1000100010	juice milk water some	29	7.1
"	"	"	"
"	"	"	"
"	"	"	"
	Total	411	100.0

QUESTION # 37: EXAMPLE OF Q 37 Combination Totals

Combinations		Frequency	Percent
0	no answer	5	1.2
1	mother no schooling	1	.2
60	mother father some grade sch	2	.5
600	mother father comp grade sch	1	.2
1500	mother completed HS father completed GrSc	1	.2
"	"	"	"
"	"	"	"
"	"	"	"
	Total	411	100.0

APPENDIX D1

TIMELINE FOR THE REGION OF PEEL CROSS-SECTIONAL STUDY

TASK	NO. DAYS	START DATE	COMPLETION
Thesis Proposal	50	Tue 01/03/05	Mon18/04/05
Approval from the advisory Com.	1	Tue 19/04/05	Tue 19/04/05
Faculty Research Grant Application	35	Tue 10/05/05	Mon 13/06/05
Approval from Faculty of Dentistry	1	Mon 13/06/05	Mon 13/06/05
Provisional HSRB I Approval	42	Thur 20/04/05	Thur 01/06/05
Region of Peel Health Unit Approval	107	Wed 01/06/05	Mon 26/09/05
Peel District School Board Approval	13	Fri 02/09/05	Thur 15/09/05
DPCDSB Approval	39	Fri 02/09/05	Mon 03/10/05
Calibration of Dental Hygienists	1	Tue 27/09/05	Tue 27/09/05
DIS Survey	68	Mon 03/10/05	Fri 9/12/05
Final HSRB I Approval	26	Wed 26/10/05	Mon 21/11/05
HSRB I Approval of amendment 1	24	Tue 20/12/05	Fri 13/01/06
Couriered questionnaire + water sam	101	Mon 16/01/06	Thur 27/04/06
Mail reminder letter			
Re-mail questionnaire			
Telephone Reminder			
Analyze water	131	Fri 20/01/06	Wed 31/05/0
Research and writing thesis	629	Fri 11/03/05	Fri 30/11/06
Input Data	241	Tue 03/01/06	Thur 31/08/06
Analyze Results	46	Fri 01/09/06	Mon 16/10/06
HSRB I Approval of amendment 2	41	Thur 27/04/06	Tue 06/06/06
Approval for extension of funding from Region of Peel Health	34	Wed 24/05/06	Mon 26/06/06
HSRB Approval for amendment 3	35	Wed 19/07/06	Tue 22/08/06
Completion of Thesis	32	Fri 30/11/06	Fri 31/12/06

APPENDIX D2

ESTIMATED TIMELINE FOR THE REGION OF PEEL CROSS SECTIONAL STUDY

TASK	NO. DAYS	START DATE	COMPLETION
Thesis Proposal	59	Tue 01/03/05	Fri 28/04/05
Ethics Approval	38	Wed 11/05/05	Fri 17/06/05
Peel Health Approval	38	Wed 11/05/05	Fri 17/06/05
Board of Education Approval	38	Wed 11/05/05	Fri 17/06/05
Separate School Board Approval	38	Wed 11/05/05	Fri 17/06/05
Calibration of Dental Hygienist	1	Tue 27/09/05	Tue 27/09/05
DIS Survey	60	Mon 03/10/05	Fri 23/12/05
Mail questionnaire + water sample	74	Mon 03/10/05	Thu 12/01/06
Mail reminder letter	60	Mon 17/10/05	Fri 06/01/06
Re-mail questionnaire	60	Mon 31/10/05	Fri 20/01/06
Telephone Reminder	60	Mon 07/11/05	Fri 27/01/06
Analyze questionnaire + water	74	Mon 03/10/05	Thu 12/01/06
Research and writing thesis	356	Fri 11/03/05	Fri 21/07/06
Input Data	60	Tue 03/01/06	Mon 27/03/06
Analyze Results + writing	60	Mon 03/04/06	Fri 23/06/06
Completion of Thesis	60	Fri 24/06/05	Thu 15/09/05

ADDENDUMS

ADDENDUM 1

Provincial and Territorial Estimates for Community Water Fluoridation Coverage

Province	Total Population	Population with Fluoridated Water	Population without Fluoridated Water	Percent With Fluoridated Water	Percent without Fluoridated Water
British Columbia	4,055,195	159,070	3,896,125	3.9%	96.1%
Alberta	3,124,923	2,329,857	795,066	74.6%	25.4%
Saskatchewan	978,993	310,677	668,316	31.7%	68.3%
Manitoba	1,103,695	807,793	295,902	73.2%	26.8%
Ontario	12,392,721	8,707,055	3,685,666	70.3%	29.7%
Quebec	7,509,928	519,309	6,990,619	6.9%	93.1%
New Brunswick	729,498	139,550	589,948	19.1%	80.9%
Nova Scotia	936,025	419,000	517,025	44.8%	55.2%
Newfoundland	515,946	17,969	497,977	3.5%	96.5%
Prince Edward Island	137,864	32,245	105,619	23.4%	76.6%
Nunavut	26,745	1,899	24,846	7.1%	92.9%
Yukon	29,967	0	29,967	0.0%	100.0%
Northwest Territories	42,810	23,036	19,774	53.8%	46.2%
National Totals	31,584,310	13,467,460	18,116,850	42.6%	57.4%

This information was collected from Provincial or Territorial Environment Ministries and then verified by the Dental Directors of each province and territory.
The Ministries of Environment provided detailed data on the community fluoridated, or the water plant
as well as population numbers.

Office of the Chief Dental Officer of Canada, 2006

ADDENDUM 2

CALCULATION OF THE NNT FOR CWF, FLUORIDATED TOOTHPASTE, FLUORIDE MOUTHRINSES AND FLUORIDE VARNISH IN THE CHILDREN OF CALEDON

CWF

Caries increment for children in Caledon

For primary teeth from TABLE 3a the deft for 7-year-olds in Caledon is 1.02
Primary teeth start to erupt at about 8 months of age, but to simplify calculations 1- year-old will be used
Caries increment for primary teeth in the children of Caledon is:

1.02 deft / 6 years = 0.17 deft / year

Using data from Angelillo et al. and Lopez (Angelillo 1998; Lopez 2003)
2.1 deft = 5.1 defs or 2.3 deft = 4.32 defs, conversion factor of 2.2 deft / defs
In Caledon the caries increment in primary teeth is 0.37 defs / year

For permanent teeth from the RPHU 2004-5 DIS the DMFT for 13-year-olds is 0.47
The first permanent molars erupt at about age 6
Caries increment for permanent teeth in the children of Caledon is

0.47 DMFT / 7 years = 0.07 DMFT / year

Using data from Brunelle et al.(Brunelle 1980)
1.08 DMFT = 1.58 DMFS or conversion factor of 1.46 DMFT / DMFS
In Caledon caries increment in permanent teeth is 0.1 DMFS / year

Preventive fraction for CWF (McDonagh 2000)
Risk difference for primary teeth 11.4 (6.5 - 15.3)
Risk difference for permanent teeth 19.1 (11.4 -26.7)

For primary teeth
Absolute Risk Reduction = Prevented Fraction x incidence in the Controls

0.114 x 0.17 deft / yr	0.114 x 0.37 defs / yr
0.019	0.042
NNT = 1 / 0.019 = 53	NNT = 1 / 0.042= 24
1 / 0.011 = 91 upper limit	1 / 0.024 = 42 upper limit
1 / 0.026 = 39 lower limit	1 / 0.057 = 18 lower limit

53 (39 – 91) children would have to be exposed to CWF in Caledon to save one primary tooth from decay
24 (18 – 42) children would have to be exposed to CWF in Caledon to save one primary tooth surface from decay

For permanent teeth

Absolute Risk Reduction = Prevented Fraction x incidence in the Controls

DMFT	DMFS
0.191 x 0.07 DMFT / yr	0.191 x 0.1 DMFS / yr
0.013	0.019
NNT = 1 / 0.013 = 77	NNT = 1 / 0.19 = 53
1 / 0.008 = 125 upper limit	1 / 0.011 = 91 upper limit
1 / 0.019 = 53 lower limit	1 / 0.027 = 37 lower limit

77 (53 - 125) children would have to be exposed to CWF in Caledon to save one permanent tooth from decay or
53 (37 - 91) children would have to be exposed to CWF in Caledon to save one permanent tooth surface from decay

Fluoridated toothpaste

Preventive fraction (Marinho 2003a) = 24% (21%-28%)
Absolute Risk Reduction = Prevented Fraction x incidence in the Controls
0.191 x 0.1 DMFS / yr
0.024
NNT = 1 / 0.024 = 42
1 / 0.021 = 48 upper limit
1 / 0.028 = 36 lower limit

42 (36 - 48) children would have to be exposed to fluoridated toothpaste in Caledon to save one permanent tooth surface from decay

Topical fluoride treatments

Preventive fraction (Marinho 2004a) = 21% (14%-28%)
Absolute Risk Reduction = Prevented Fraction x incidence in the Controls
0.21 x 0.1 DMFS / yr
0.021
NNT = 1 / 0.021 = 48
1 / 0.014 = 71 upper limit
1 / 0.028 = 36 lower limit

48 (36 - 71) children would have to be exposed to topical fluoride treatments in Caledon to save one permanent tooth surface from decay

Fluoride mouthrinse

Preventive fraction (Marinho 2003b) = 31%
Absolute Risk Reduction = Prevented Fraction x incidence in the Controls
0.31 x 0.1 DMFS / yr
0.031
NNT = 1 / 0.031 = 32

32 children would have to be exposed to fluoride mouthrinse in Caledon to save one permanent tooth surface from decay

Fluoride varnish

Preventive fraction for primary teeth (Marinho 2002) = 33% (19%-48%)

Absolute Risk Reduction = Prevented Fraction x incidence in the Controls

0.33 x 0.37 defs / yr

0.122

NNT = 1 / 0.122 = 8.2

1 / 0.070 = 14 upper limit

1 / 0.178 = 5.6 lower limit

Preventive fraction for permanent teeth (Marinho 2002) = 46% (30%-63%)

Absolute Risk Reduction = Prevented Fraction x incidence in the Controls

0.46 x 0.1 DMFS / yr

0.046

NNT = 1 / 0.046 = 22

1 / 0.030 = 33 upper limit

1 / 0.063 = 16 lower limit

8.2 (5.6 - 14) children would have to be exposed to fluoride varnish in Caledon to save one primary tooth surface from decay

22 (16 - 33) children would have to be exposed to fluoride varnish in Caledon to save one permanent tooth surface from decay

NNH (using the UBC Clinical Significance Calculator,(UBC 2006))

The Number Needed to Harm for CWF in Caledon

Primary teeth the NNH = 6 (95% CI = 3 – 14)

Permanent teeth the NNH = 14 (95% CI = 7 – 214)

Of 6 (3 - 14) children exposed to water fluoridation, one would develop dental fluorosis (TSIF > 0) in Caledon

Of 14 (7 - 214) children exposed to water fluoridation, one would develop dental fluorosis of aesthetic concern (TSIF $\geq$ 2) in Caledon

References:

Angelillo, J., Anfosso R, Nobile CGA, Pavia M, (1998). "Prevalence of dental caries in schoolchildren in Italy " European Journal of Epidemiology 14(4): 351-351.

Brunelle, P., Basuyau JP, Le Bihan G, Bourreille, Bohuon C, (1980). "A method to assess cariogenic potential of foodstuffs." Journal of the American Dental Association 100(5): 677-81.

Lopez, L. (2003). Dental and Periodontal Health and Treatment Needs in a Mother/Child Rural Puerto Rican Population. AADR, San Antonio, Texas.

Marinho, V., Higgins JPT, Logan S, Sheiham A (2002). "Fluoride varnishes for preventing dental caries in children and adolescents." Cochrane Database of Systematic Reviews(1).

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ADDENDUM 3

CALEDON DENTAL STUDY - SCHOOL SELECTION (Revised October 4, 2005)

NOTES:

For the Peel Board, used data from the file named "Enrolment Projections for Staffing Purposes for January 2005.xls" For the Dufferin-Peel Separate School Board, used data from the file named "Dufferin-Peel Enrolments March 31 2004.xls" Public Board data were on separate sheets by name of School Superintendent, so were merged for Brampton and Caledon only

Only schools with junior elementary students in Brampton and Caledon (excluding Bolton) were kept (i.e. senior elementary schools were excluded) and all Bolton schools were excluded because Bolton is supplied with town water

In the Public board data, used the cohort of children in Grade 1, as they will be in Grade 2 for the 2005-2006 school year

In the Separate board data, used the cohort of children in SK, as they will be in Grade 2 for the 2005-2006 school year

Public board data did not give the number of classes

The following criteria were used to select schools:

Dental Indices Survey (DIS) Risk Rating from 2004

Schools were selected based on the risk rating from results of the DIS in 2004 (high, medium, low or no data) In Caledon (excluding Bolton), there were no schools with risk rating equal to high, so only selected schools with medium or low ratings

Socio-economic indicators from the 2001 Census These factors, mapped by Census Tract (CT), were used to compare areas in Brampton to those in Caledon (excluding Bolton):

proportion of low income economic families*

average family income

proportion of population with bachelors degree or higher (note: includes individuals aged 15 or older, not families)

proportion of population with less than Grade 9 education (note: includes individuals aged 15 or older, not families)

average employment income (note: includes individuals aged 15 or older, not families)

* Proportion of low income economic families is defined as the percentage of economic families who spend 20% more of their total income than the average economic family on food, shelter and clothing. For example, if the average family spends 35% of their

total income on food, shelter and clothing, a family of the same size having low income would spend 55% of their total income on these basic necessities. The 2001 Census low income cut-offs were based on a matrix that included family size and size of the community of residence.

Using the proportion of low income economic families and risk ratings of medium, low or no data as the main criteria, elementary schools in the following CTs were identified:

Caledon:	585.02	Brampton:	562.08
	585.07		562.09
	585.08		562.10
	586.00		564.01
	587.01		573.05
	587.02		576.01
			576.04
(excluding Bolton)			576.08

Some CTs with same % low income did not have any elementary schools so were not included

576.09
576.13

This yielded the following numbers of students in the appropriate cohorts:

422 for Caledon (excluding Bolton schools but including St. Nicholas**, which is located on the border of Bolton) 537 for Brampton (i.e. not enough, need 900+)

** St Nicholas is located in Census Tract 585.02 which borders Bolton on the west. It was decided to include the school with the rest of Caledon, even though it may be supplied with town water, because its catchment of students may be from a wider jurisdiction.

In order to augment Brampton numbers, CTs with similar Average Income levels between Brampton & Caledon were examined

528.20 no schools
570.02 two schools, but one is senior elementary (Gr6-8)

576.06 one school
576.07 no schools

This only added a possible 76 students, from 2 separate schools (i.e. not enough, still need 300 more)
Rather than Average Income, CTs with the next level of low income (i.e. greater by one level in Brampton compared to Caledon) were examined
This resulted in being able to add another 20 CTs and thus select from a possible 16 schools with risk ratings medium, low or no data

In this second round of selections, schools situated further to the north of Brampton were chosen over schools in central or south Brampton
In addition, two new schools not screened in 2004 but found in the Peel Board's enrolment report were included:

Brisdale School (Creditview and Wanless)

Sunny View (Middle) School (Bramalea and Sandalwood) (currently K-8)
this school needed to be removed; Middle School

Numbers based on schools selected from both Boards and removing Sunny View were as follows:

Municipality	Public Bd	Separate Bd	Total
Brampton	425	435	860
Caledon	357	65	422

October 4, 2005
Requested to select another school to replace Sunny View Middle School, as this school no longer has K-5
Only one other school in Brampton had a risk rating equal to "Medium"

Revised Numbers by Board:

Folkstone Public School
104 Folkstone Crescent
Brampton, ON L6T 3M5
School Family: Bramalea
enrolment of Grade 2's should equal 120

Municipality	Public Bd	Separate Bd	Total
Brampton	545	435	980
Caledon	357	65	422

Note: This school's SES indicators do not match those of Caledon (higher % of Low Income by 2 levels and lower Avg Fam Inc by 1 level) but it is the best fit for Risk Rating (all other schools in Brampton have risk rating equal to "High") and should have enough students in Grade 2. If the SES indicators are too different and another choice would be preferred, it is suggested to use:

Great Lakes Public School
285 Great Lakes Drive
Brampton, ON L6R 2R8
School Family: Harold Brathwaite
enrolment of Grade 2's should equal 98

Revised Numbers by Board:

Municipality	Public Bd	Separate Bd	Total
Brampton	523	435	958
Caledon	357	65	422

Note: This school's SES indicators match those of Caledon, but the Risk Rating is equal to "High"