

## The Prevalence and Risks of Early Childhood Caries (ECC) in Toronto, Canada

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### Abstract

**Aim:** To determine the prevalence and risks of early childhood caries (ECC) among children less than 71 months of age in Toronto, Canada, and to evaluate the association between parental/caregiver depression and ECC.

**Methods and Materials:** A secondary analysis of data previously collected by the Toronto Public Health as part of the 2003 Toronto Perinatal and Child Health Survey was performed. The 90-item survey was conducted over the telephone to 1,000 families with children from zero years (birth) to six years of age. Parents/caregivers were asked about factors related to the development and health of their children. For this study, only children younger than six years of age (less than 71 months) were included (n=833). The primary outcome of interest was self-reported and measured by the response to the question of whether a physician/dentist had ever told the parent/caregiver his/her child had ECC.

**Results:** The prevalence of ECC was 4.7 percent (37 of 791 children). The child's age, his/her history of dental visits, teeth brushing, the use of fluoridated toothpaste, the parent's/caregiver's depressive tendencies, the language spoken at home, and the household annual income were all significant in the bivariate analysis. Multiple logistic regression identified four factors associated with ECC: the child's age (being three years of age or older), having at least one parent/caregiver with depression, not speaking English at home, and having an annual household income less than \$40,000 in Canadian dollars (CAD).



**Conclusion:** While a child's age, home language, and household income are known risks for ECC, the finding that parental/caregiver depression may be related to ECC is new.

**Clinical Significance:** Multiple risk factors are involved in the development of early childhood caries. Of particular importance are demographic (e.g., child's age), social (e.g., annual household income), and psychosocial factors (e.g., parental/caregiver depression) that are indirectly linked to ECC. More attention needs to be placed on understanding the role and process by which these factors influence the development of ECC.

**Keywords:** Early childhood caries; ECC; dental caries/epidemiology; depression; risk factors psychosocial factors

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## Introduction

Early childhood caries (ECC), also referred to as early childhood tooth decay (ECTD) in Canada, is a virulent form of dental caries that affects children's primary teeth. In Toronto, where the city water is currently fluoridated at 0.6 ppm, previous studies reported a prevalence of approximately 9 percent for ECC in one of Toronto's communities (North York, Ontario) and 10 percent for the weighted sample of five-year-old participants in the Toronto Dental Indices Survey 2000.<sup>1,2</sup> Disadvantaged children (e.g., children of low income, uninsured, and immigrant families) are more vulnerable to ECC. A recent case-control study reported a 35 percent prevalence rate of early childhood caries among children of Portuguese-speaking immigrants in Toronto.<sup>3</sup>

Many risk factors are involved in ECC development<sup>4</sup> such as a diet high in sugar, poor oral hygiene, the child's age (older than three years), low parental education level, and the family's low socioeconomic status.<sup>2,5-8</sup> Results from a 2004 systematic review of 73 studies identified 106 risk factors associated with the incidence of ECC.<sup>9</sup> Recent studies have pointed to a previously overlooked risk factor: parental depression.<sup>10</sup> In fact, the occurrence of depression among parents raising their children has been measured in a variety of different Canadian populations.<sup>11</sup> In Ontario, the prevalence of parental depression was found to be 45.4 percent among single parents receiving social assistance.<sup>11</sup> Thus, depression can adversely affect parental engagement in preventive health activities for the parents themselves as well as their children.<sup>12</sup> However, the effect of parental depression on the child's dental health is not yet understood.

This study sought to determine the prevalence and risks of ECC among Toronto children, from birth to 71 months of age, and to evaluate the relationship between parental/caregiver depression and ECC.

## Methods and Materials

This study was approved by the Research Ethics Board of the University of Toronto and by the Toronto Public Health (TPH). A secondary analysis of cross-sectional data collected in the "Toronto Perinatal and Child Health Survey (TPCHS)," performed by TPH in 2003, was performed.<sup>13</sup> The survey provided representative data on the prevalence of selected risk and protective factors related to the health and development of children from birth to six years of age who lived in Toronto, Canada. Interviews were conducted by telephone initiated through random digit dialing. A 90-item questionnaire with questions adopted from different, validated sources was used.<sup>13</sup> Some questions were taken from the National Longitudinal Survey of Children and Youth (NLSCY), which was a source for items related to child health status, birth information, parenting practices, and parental depression. Questions on breastfeeding were taken from the Canadian Community Health Survey (CCHS) and the Public Health Research, Education and Development Program (PHRED) Benchmarking Support Document: Provincial Breastfeeding Survey. The demographic questions were based on the NLSCY, the Rapid Risk Factor Surveillance System (RRFSS), and the CCHS. Telephone calls were made to 23,046 phone numbers in the original 2003 TPH survey and 1,000 parents/caregivers in Toronto, with children until six years of age residing with them, agreed to participate.

### Study Variables

To correspond to the American Academy of Pediatric Dentistry definition of early childhood caries, in the present study only children 71 months of age or younger (younger than six years old) were included in the analysis ( $n=833$ ). A number of factors, known from previously published research to be related to the development of ECC, were selected from the questionnaire with the addition of parental/caregiver depression as a potential risk factor.

The variables chosen were then categorized using the conceptual framework for understanding the determinants of oral health developed by Andersen and Davidson.<sup>14</sup> This model holds that the external environment, the dental care system, and personal characteristics are primary determinants of oral health (e.g., predisposing factors, enabling factors). Oral health behavior is regarded as an

intermediate variable influenced by the primary determinants, and this intermediate variable, in turn, may influence one's oral health outcomes.

### **Predisposing variables**

Each child's age was recoded into one of two categories: either as  $\geq 3$  years old or  $< 3$  years old. The child's gender and birth weight also were considered during the analysis. The extent of parental/caregiver depression was assessed in the TPCHS through 12 items adopted from the 20-item Centre for Epidemiological Studies Depression Scale (CES-D Scale). This short version was first applied in Cycle 2 of the 1996 Canada NLSCY<sup>15</sup> and showed acceptable discriminatory ability, construct validity, criterion validity, and internal consistency.<sup>16</sup> The scale also demonstrated no significant differences when used in a telephone interview compared to in-person interviews.<sup>17</sup>

### **Depression tendencies**

For each item, parents/caregivers were asked to indicate the extent of their perceived depression tendencies during the past week. Responses were coded from 0 to 3 (0= $< 1$  day, 1=1–2 days, 2=3–4 days, 3=5–7 days) except for three items that were reverse-coded. The reverse-coded items were feeling hopeful about the future, feeling happy, and enjoying life. The scores ranged between 0 and 36. Higher scores indicate more frequent depressive tendencies. Scores  $\geq 13$  measure depressive tendencies at the 30th percentile compared to the 20th percentile cut-offs of the 20-item version ( $\geq 16$ ).<sup>18,19</sup> Therefore, parental/caregiver depression scores in the current study were dichotomized into (a) "Yes (scored  $\geq 13$ )" to describe the presence of moderate to severe depression and (b) "No (scored  $< 13$ )" to describe no or mild depression.

### **Immigration status**

Immigration status was defined by the respondent's length of stay in Canada. Recent immigrants were classified as those who had lived in the country for 10 years or less, while long-term immigrants were those who immigrated to Canada more than 10 years ago.

### **Breastfeeding**

Five questions were asked in the questionnaire about the history and duration of breastfeeding. For this analysis, only two relevant questions were included. The history of breastfeeding was

categorized into "Yes" and "No," while the overall breastfeeding duration was collapsed to three categories: (1) zero months, (2)  $< 12$  months, or (3)  $\geq 12$  months. This categorization followed the World Health Organization's recommendations on breastfeeding.<sup>20</sup>

### **Language spoken at home**

The predominant language spoken at home, whether English or other, also was recorded.

### **Other variables**

Parental gender, marital status, educational level, employment status, and race were collapsed to form binary responses.

### **Enabling variables**

Annual household income levels were obtained and then referenced to Statistics Canada's Low Income Cutoffs (LICOs) for the year 2006. The LICO takes into account both the size of the family and the population of the city they reside in. In the year 2006, the LICO in Toronto for a single person and for a family of four was \$17,570 CAD and \$33,221 CAD, respectively. In this study, the majority of the families consisted of fewer than four ( $< 4$ ) members, and the responses were highly skewed. Therefore, responses were grouped into  $< \$40,000$  CAD and  $\geq \$40,000$  CAD. Respondents also were asked whether they had dental insurance.

### **Oral health behavior and outcome variables**

The TPCHS questionnaire included six items pertaining to the dental health of the child. Parents/caregivers were asked if they had ever been informed by a dentist or a physician that their child had a condition known as ECC. They were provided with a definition that described the condition in lay terms as having multiple cavities especially of the front baby teeth that requires the intervention of a specialist and treatment under general anesthesia. To increase the potential for accurate responses, parents/caregivers were told that "a child who has had less than two cavities on the back teeth does not have ECC."

For this analysis, ECC was deemed as present or absent based on the respondents' self-report and was labeled "self-reported ECC." Responses of all subjects who reported that they "don't know," refused to answer, or reported "not applicable (no teeth yet)" were all excluded from the analysis. Participants also were asked about the history

of their children's dental visits and to provide reasons for failed visits, the extent of teeth/gum cleaning (dental prophylaxis), and the use of fluoridated toothpaste (and, if used, the amount applied). All aforementioned items were included in this analysis.

SPSS version 15 for Windows was used to analyze the data. Chi-square tests, Fisher's exact tests, and their odds ratios (ORs) and 95 percent confidence intervals (CI) were used to determine the association between ECC and the independent variables. Factors found statistically significant were then assessed jointly in multivariate analyses using a logistic regression model created by forward stepwise regression with variables entered independently if the  $p$ -value was  $\leq 0.05$ . Statistical tests were two-tailed and interpreted at the 5% level of significance.

## Results

Parent- or caregiver-reported results for 833 preschool children were included in this study. Of the respondents, 98 percent (525/534) were birth parents and the remaining 2 percent (9/534) were caregivers. Fifteen percent of the respondents (122/786) were single parents. The mean and standard deviation (SD) age of the children was 2.6 years ( $\pm 0.5$ ). The prevalence of self-reported ECC was 4.7 percent (37/791). The results from the bivariate analysis are presented in Table 1.

### Predisposing variables

Children who were three years of age or older had six times higher odds of developing ECC compared to children younger than three years old ( $p < 0.001$ ). The child's gender and birth weight were not significantly related to ECC. A parent's age, educational level, gender, employment status, and marital status showed no significant association with the development of ECC among their children.

### Depressive tendencies

Overall, 3.4 percent (24/706) of the parents/caregivers had depression, 96 percent (23/24) of whom were mothers. Children with parents/caregivers with depression had significantly higher prevalence of ECC than children of parents/caregivers without depression.

### Immigration status

Recent immigration status of the family was significantly related to the development of ECC ( $p = 0.07$ ).

### Breastfeeding

Neither the history nor the duration of breastfeeding revealed a significant relation to ECC.

### Language spoken at home

Children of families that did not speak English as the main language at home had almost three times higher odds of developing ECC than children of English-speaking families ( $p = 0.007$ ).

### Enabling variables

Ninety-nine percent (12/821) of the families had dental insurance. Low annual household income (less than \$40,000 CAD) was found to be significantly related to having a child with ECC at the bivariate level of analysis ( $p < 0.012$ ).

### Oral health behavior and outcome variables

Children who did not visit the dentist within the last year, who brushed their teeth less than once a day, and who did not use fluoridated toothpaste reported a significantly lower prevalence of ECC.

The results of the logistic regression analysis are presented in Table 2.

The model confirmed that a child's age, being three years of age or older, is strongly related to ECC. Also, children who had a depressed parent/caregiver, who had parents/caregivers who are not native English speakers, and who were members of families in the low-income category had higher odds of developing the disease ( $p < 0.05$ ). Based on Andersen's conceptual framework,<sup>14</sup> three predisposing factors (child's age, parental/caregiver depression, and language spoken at home) and one enabling factor (household income) were significant at the multiple-regression stage. These four significant factors accounted for 22 percent of the total variance.

## Discussion

This secondary analysis of data collected in a cross-sectional telephone survey in Toronto included 833 children less than six years of age. The prevalence of self-reported ECC was 4.7 percent, a prevalence

Table 1. Bivariate relationships between self-reported ECC and independent variables.

Independent Variables	N <sup>a</sup>	Percentage (%) of Positive Responses	Odds Ratio (OR) (95% confidence interval)	p-Value
Overall prevalence of ECC		4.7		
<b>Parent/caregiver</b>				
<b>Age (yrs)</b>				
<25	32	6.3	1.39 (0.32–6.12)	0.91
25 to <30	107	4.7	1.02 (0.39–2.72)	
30 or older	590	4.6	1.0 (ref)	
<b>Educational level</b>				
High school level or less	164	3.1	1.70 (0.67–4.56)	0.25
Post high school	614	5.0	1.0 (ref)	
<b>Gender</b>				
Female	582	4.1	0.65 (0.32–1.30)	0.22
Male	209	6.2	1.0 (ref)	
<b>Employment status</b>				
Not employed	297	5.1	1.10 (0.57–2.17)	0.77
Employed	480	4.6	1.0 (ref)	
<b>Marital status</b>				
Single, widowed, separated, or divorced	122	3.3	0.65 (0.23–1.87)	0.42
Married or Common-law	664	5.0	1.0 (ref)	
<b>Race</b>				
Not Caucasian	704	5.0	2.22 (0.53–9.41)	0.42 <sup>b</sup>
Caucasian	87	2.3	1.0 (ref)	
<b>Parental/caregiver depression</b>				
Yes (scored >13)	24	17.6	4.20 (1.35–13.03)	0.026 <sup>b</sup>
No (scored <13)	682	5.2	1.0 (ref)	
<b>Immigration status</b>				
Recent (0 to 10 yrs)	236	7.2	1.82 (0.93–3.56)	0.07
Not recent (>10 yrs)	547	4.3	1.0 (ref)	
<b>History of breastfeeding</b>				
No	44	6.5	1.59 (0.47–5.42)	0.44
Yes	728	4.4	1.0 (ref)	
<b>Breastfeeding duration (months)</b>				
0	44	6.5	1.26 (0.26–6.12)	0.95 <sup>b</sup>
<12	429	4.4	0.84 (0.37–1.91)	
>12	299	5.2	1.0 (ref)	
<b>Language spoken at home</b>				
Other	384	7.5	2.62 (1.27–5.37)	0.007 <sup>c</sup>
English	407	3.8	1.0 (ref)	
<b>Annual household income</b>				
Less than \$40,000 CAD	205	7.8	2.60 (1.21–5.73)	0.012 <sup>c</sup>
\$40,000 CAD or higher	412	3.8	1.0 (ref)	
<b>Presence of dental insurance</b>				
No	12	8.3	3.01 (0.49–19.15)	0.31 <sup>b</sup>
Yes	821	2.9	1.0 (ref)	
<b>Child</b>				
<b>Age (yrs)</b>				
>3	404	8.2	6.10 (2.35–15.87)	<0.001 <sup>c</sup>
<3	372	1.3	1.0 (ref)	
<b>Gender</b>				
Female	405	4.4	0.64 (0.33–1.25)	0.18
Male	386	6.8	1.0 (ref)	
<b>Birth weight</b>				
Low (<2500g)	45	10.8	2.83 (1.04–7.70)	0.051 <sup>b</sup>
Normal (>2500g)	685	4.1	1.0 (ref)	
<b>Teeth brushing</b>				
Less than once a day	140	0.7	0.12 (0.02–0.89)	0.013 <sup>c</sup>
At least once a day	647	6.4	1.0 (ref)	
<b>Use of fluoridated toothpaste</b>				
No	227	0.9	0.12 (0.03–0.51)	0.001 <sup>c</sup>
Yes	390	7.6	1.0 (ref)	
<b>History of dental visits</b>				
More than a year ago	330	3.0	0.28 (0.13–0.60)	<0.001 <sup>c</sup>
Within the last year	360	6.9	1.0 (ref)	

OR=odds ratio  
CI= confidence interval  
<sup>a</sup>Denominator, numbers may not add up to 833 due to missing data.  
<sup>b</sup>Determined using Fisher's exact test.  
<sup>c</sup>Determined using Chi square test.

**Table 2. Multiple logistic regression model for odds of self-reported ECC.**

Variable	Adjusted Odds Ratio (OR)	95% Confidence Interval	p-Value <sup>a</sup>
<b>Child's age (yrs)</b>			
>3	11	1.8–86.7	0.019
<3			
<b>Parental/caregiver depression</b>			
Yes (scored >13)	5.08	1.08–23.9	0.040
No (scored <13)			
<b>Language spoken at home</b>			
Other	3.39	1.13–10.2	0.030
English			
<b>Annual household income</b>			
Less than \$40,000 CAD	2.88	1.08–7.64	0.034
\$40,000 CAD or higher			
Nagelkerke R <sup>2</sup> =22%			
<sup>a</sup> Significance level determined at p<0.05.			

somewhat lower than the general population-based clinical studies carried out in Toronto.<sup>1,2</sup> This rate also is well below the prevalence (57 percent) among children admitted for care at the Children's Aid Society of Toronto.<sup>21</sup>

Our lower prevalence estimates may have resulted from the fact that no clinical examination was performed. It also may be attributed to the lack of diagnosis by physicians who tend to assume that oral health is not part of general health; thus, many parents/caregivers are unaware of the presence of ECC in their children.

In the full regression model, the predisposing and enabling factors of a child's age, parental/caregiver depression, language spoken at home, and household income were the significant risks for ECC. These findings are consistent with the multidimensional determinants of oral health problems summarized in Andersen's framework.<sup>14</sup>

### **Predisposing variables**

The child's age was the strongest predictor of ECC in the study (Tables 1 and 2). Regardless of the ECC definition, many earlier studies have shown that children aged ≥3 had higher ECC prevalence.<sup>22,23</sup> Over time, more children become affected, so the prevalence increases as the child ages, but the natural tooth loss of the deciduous anterior teeth may serve to reduce the ability to clearly identify the condition among children who are older than five years of age.

### **Depressive tendencies**

This analysis revealed that 3.4 percent of the parents/caregivers reported depression

(Table 1). This prevalence is slightly lower than that previously reported in Ontarian women (5.4 percent).<sup>24</sup> There may well be a social bias against self-reporting mental health conditions such as depression. After controlling for the child's age, language spoken at home, and household income, we found that parental/caregiver depression was significantly associated with ECC. This finding conflicts with the findings from Finlayson et al.,<sup>10</sup> who concluded that maternal depression was not significantly related to ECC, although they did find that low parenting stress scores and the age of the child were significantly associated. This difference might be explained by the fact that our study reported depression for both parents as compared to that reported for mothers in the study by Finlayson et al.<sup>10</sup> Our cross-sectional data do not permit assumptions about the history of previous episodes of depression. However, if the depression were chronic, it could have resulted in the parent/caregiver developing coping mechanisms harmful to the child's oral health (e.g., offering comfort bottles in the crib) as it would be difficult to deal with a crying child at a time when the parent is depressed him/herself.

### **Language spoken at home**

The language spoken at home variable has been assessed previously.<sup>25</sup> This study found that this factor is significantly related to ECC. Although our telephone survey was conducted in English, nonnative speakers may have cultural differences in oral health beliefs and nurturing habits compared to native English speakers. Also, language barriers may hamper the efforts of health care professionals, with dental health knowledge, to educate new parents about dental hygiene.<sup>26</sup>

## Enabling variables

The study also demonstrated that a child's risk of ECC was inversely related to the family's annual household income. In other words, as household incomes rise, the prevalence of ECC decreases and vice versa. Furthermore, this social determinant of health has been well documented in the literature.<sup>25,27</sup> In our study, 33 percent of the families surveyed were in the low-income group. Families in this category have less financial and job security. They also face more obstacles, such as difficulty getting time off work to take their children to the dental office. In addition, they may not have the income needed to purchase all the dental hygiene supplies they need to maintain the routine oral hygiene on their children.

## Oral health behavior and outcome variables

Unlike previous studies,<sup>25,28</sup> a child's history of dental visits was not found to be significant in the regression model. Yet, the bivariate analysis indicated a lower risk of ECC among children who did not visit the dentist within the last year. This apparent contradiction may indicate that parents/guardians had not sought dental care and, as a result, were not told that their children had ECC, rather than ECC not actually being present.

This study had limitations, among them the fact that the findings are only valid within the limits of the original survey methods. The telephone survey process excludes households without phones or with only cell phones and includes only those respondents who would consent and had the ability to respond in English. The outcome of interest was reported by the parents/caregivers and depended on these individuals having been given that diagnosis and in recalling it for the interviewer. Dentists, dental hygienists, and physicians will vary in their definition of ECC and, therefore, their communication of this diagnosis to a parent or caregiver. Furthermore, the sample overrepresented more affluent, insured, and highly educated families. The logistic regression model only explained 22 percent of the variation in the disease. Other factors that determine ECC, such as the use of sweetened drinks in bottles and the presence of maternal caries,<sup>8</sup> were not measured in the original survey, so they are not part of this analysis.

Additionally, evidence of changed behaviors or, perhaps, social desirability were found in the responses. In Table 1, more parents of children

with ECC claimed that their child brushed with fluoride toothpaste and more than once a day. This is understandable because if they had been told by a professional that their child had ECC, it is highly likely they would have been told they needed to brush the child's teeth more frequently, and use a fluoridated toothpaste. Those statements may honestly reflect what preventive practices were being followed at the time of the interview, or at least that the parents knew what oral hygiene practices they should have been performing on their children.

## Conclusion

The secondary analysis of data collected in the Toronto Perinatal and Child Health Survey found that in children  $\leq 71$  months there was a statistical association between the development of self-reported ECC and a child's age, language spoken at home, parental/caregiver depression, and household income. While a child's age, home language, and household income are known determinants of ECC, the finding that parental/caregiver depression was associated with ECC is unique. Given the limits of a survey, as opposed to an actual clinical examination, in establishing risks, future studies should employ methods such as prospective studies to examine the cause-and-effect relationship between ECC and the other risk factors. Moreover, a previous qualitative study<sup>26</sup> of ECC in Toronto recommended a community-wide preventive approach involving such efforts as encouraging an early initial visit to the dentist by the age of 12 months, advocating for the incorporation of dental policies into medical processes, making the variety of services at the community level more responsive, reducing barriers to accessing dental care among disadvantaged families, and calling for more accurate advertising and warnings for the oral health consequences of consuming juices and drinks that are high in sugar frequently and for longer durations.

## Clinical Significance

Multiple risk factors are involved in the development of early childhood caries. Of particular importance are demographic (e.g., child's age), social (e.g., annual household income), and psychosocial factors (e.g., parental/

caregiver depression) that are indirectly linked to ECC. More attention needs to be placed on understanding the role and process by which these factors influence the development of ECC.

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