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Québec



QUÉBEC LONGITUDINAL STUDY
OF CHILD DEVELOPMENT
(QLSCD 1998-2002)

FROM BIRTH TO 29 MONTHS

COLLECTION
**Health and
Wellness**

Parental Behaviours Related to Children's
Dental Health

Volume 2, Number 6

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May 2002

Foreword

The publication of this second volume of the QLSCD 1998-2002 series is the result of close collaboration among university researchers, the public health network and the *Direction Santé Québec*¹ (Health Québec Division) of the *Institut de la statistique du Québec* – ISQ (Québec Institute of Statistics), who have been working on this project since 1996.

Two years after the publication of Volume 1 in this series, an interdisciplinary group of more than 80 researchers contributed to producing this second volume, which presents the very first longitudinal results of our survey. These much-anticipated results describe the environment and development of the children based on the first three data collections conducted when they were 5, 17 and 29 months of age. To fully comprehend the importance of these data on early childhood, I would like to remind the reader of the primary goal of the Québec Longitudinal Study of Child Development 1998-2002 as stated in Volume 1 of this series. The QLSCD will help gain a better understanding of the PRECURSORS of social adjustment by first studying adjustment to school, identifying adjustment PATHS and PROCESSES, and examining the CONSEQUENCES of these later in life.

By analyzing data from the first three years of the survey, the ISQ is pleased to be associated with the development of a such powerful survey and research instrument, and particularly with the accomplishment of a study that will serve both as a preventive tool and an aid in the design of effective early interventions. As Director General, I cannot help but take great pride in the model of partnership which has produced such impressive results, many of which may indeed be harbingers of the future.

Yvon Fortin
Director General

1. Certain French appellation in italics in the text do not have official English translations. The first time one of these appears, the unofficial English translation is shown immediately after it. Following this, for ease in reading, only the official French name appears in the text in italics and it is suggested the reader refer to the Glossary for the English translation.

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This analytical paper is also available in French. (Ce numéro est aussi disponible en version française sous le titre « Comportements parentaux à l'égard de la santé buccodentaire des enfants » dans *Étude longitudinale du développement des enfants du Québec (ÉLDEQ 1998-2002) – De la naissance à 29 mois*, Québec, Institut de la statistique du Québec, vol. 2, n° 6).

<p>A Word of Caution, Symbols and Abbreviations can be found in Section "Review of the Methodology and Caution"</p>
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Acknowledgements

Given that the QLSCD 1998-2002 has been in existence for more than six years, the task of thanking each person who has collaborated on the project seems daunting, and frankly, nearly impossible. Each year new colleagues join those who have been with us from the very beginning, and they in turn have faced innumerable logistical and methodological challenges, whether in terms of the contents of the survey or navigating their way through a world of knowledge which is in a state of constant progress.

Indeed, the network of university researchers associated with the QLSCD now stretches across Québec to include the rest of Canada and beyond our nation's borders. Hence the wealth of data from this survey is being disseminated through a variety of channels, whether in post-doctoral work being pursued by young researchers outside of Québec, or the multiplier effect of seasoned veterans constantly establishing new international working relationships in this era of the globalization of knowledge. This multiplication of partnerships is closely linked to the exceptional leadership shown by the scientific director of the QLSCD. In addition to contributing to the advance of knowledge, our "conglomerate" of research teams has resulted in the injection of significant funds devoted to analyzing the wealth of data being generated. Indeed, the pooling of research funds obtained through the excellence of the scholars involved has maximized the investment in the QLSCD 1998-2002 by the *ministère de la Santé et des Services sociaux*, sole sponsor of the project's 10 data collections, surveys and pretests.

New partners in our public health network are constantly joining this ever-expanding group of researchers. Increasing numbers of health professionals are becoming actively involved in the QLSCD, coming from the *ministère de la Famille et de l'Enfance* (Ministry of Family and Child Welfare), the education network, etc.

The increase in the number of external experts and growing complexity of this first provincial longitudinal study has led to more ISQ staff devoting their time, in whole or in part, to the QLSCD. New statisticians from

the *Direction de la méthodologie et des enquêtes spéciales – DMES* are now associated with the survey. Their tasks include addressing all questions related to the sample design, analyzing the results of the annual data collections in terms of response rates, and producing the weights required to infer the results to the population of children targeted by this large-scale survey. They also provided support to QLSCD researchers in conducting statistical analyses published in this report. With regards to the *Direction Santé Québec (DSQ)*, chief architect of the QLSCD, it was necessary to hire two people experienced in longitudinal analyses to consolidate the rather small team who have been overseeing the surveys year after year, with all the intense concentration of energy this implies. By coordinating the work of numerous partners, developing new tools and instruments to understand the real world of the growing child, closely collaborating with the survey firm collecting the data, and participating in the dissemination of knowledge by publishing original analyses, the seven members of the *Direction Santé Québec* QLSCD team have accomplished their mission with remarkable success.

Over the years, another partnership that continues to flourish is the one we have with the coordinators of the National Longitudinal Study of Children and Youth (NLSCY, Canada). The fact that these pioneers allowed the QLSCD to use certain instruments administered by the CAPI (Computer Assisted Personal Interview) has meant that our Québec longitudinal study is complementary and comparable to this large-scale Canadian study, and at a reasonable cost.

Québec hospitals, who continually face many challenges because of increasing demands for efficiency, are also important partners in our study, as are birthing centres. They manage to weather whatever storms they face by continuing each year to provide certain data from the medical records of the mothers and children. These data are sent to us with the strict proviso that the mothers have furnished prior written consent.

The *Bureau d'interviewers professionnels (BIP)*, the survey firm, continues to be an indispensable partner in arranging and conducting this first large-scale survey of a cohort of Québec children. BIP, masterfully managed with a hands-on approach by its president, is responsible for organizing and ensuring the smooth functioning of the annual data collections in both the pretests and surveys. Their data is of invariably high quality, and the data banks they produce biannually retain a high degree of reliability. BIP's team of interviewers² and recruiters, skilfully supervised by a seasoned veteran of field work, has become expert in winning and maintaining the loyalty of the some 2,000 families who annually participate.

Finally, we would like to single out the exceptional participation of Québec families. We truly believe that the success of the QLSCD comes first and foremost from the hours of precious time they grant us every year, during which we feel privileged to share moments in the lives of their little munchkins who, in 2000, were 2½ years of age.

Acknowledging how difficult it is to truly thank everyone who contributed to the day-to-day accomplishment of this Québec first, we would like to cite the words of Serge Bouchard:

Progress is a totally collective process in both time and space. We owe so much to others... We desire a society of good people..., because there is a link between individual and collective excellence.³

A heartfelt thank-you!



Mireille Jetté
Coordinator
*Direction Santé Québec,
Institut de la statistique du Québec*

2. All the interviewers in this survey were women.

3. BOUCHARD, Serge (2001). « Je ne suis pas seul sur terre », *Le Devoir Édition Internet*, 23 juillet. (Unofficial translation).

Introduction to QLSCD 1998-2002

When this second report is published, the children in the QLSCD study will have begun their fifth year on this planet. Despite the use of extraordinary tools to closely monitor their development, it is obvious that, in early childhood, development is too fast for science to keep up with.

In our first report, we described our observations concerning the data collected five months after birth. Because of the cross-sectional nature of these observations, our study was limited to describing the characteristics of the children and their families. We mainly wanted to describe the situation of babies born in Québec in 1997 and 1998. Bursting with enthusiasm and eager to understand things, the researchers who, at the time, provided the broad strokes of analyses to explain the observed characteristics were fully aware those were just the first in a long series of analyses designed to provide a deeper understanding of children's development.

This second report, however, is based on the collective data gathered when the children were respectively 5, 17 and 29 months old. At last, we can now describe the changes that occur in the lives of children and their families from birth to the third year. This is the first time that such a large sample of Québec newborns has been studied as intensively during early childhood. As far as we know, this is the very first time since science began studying children's developmental that researchers have tried to understand the factors leading to academic success or failure by collecting data as frequently as this from such a large sample of such young children.

Researchers now have available more data than ever before about this stage of life. But this abundance of data has a perverse effect. If cross-sectional studies allow us to draw conclusions on the causes of problems observed, why shouldn't we go ahead and indulge in longitudinal data as well? When one has access to data available to no one else, it is easy to forget the limitations of such data. However, while the researchers involved in drafting this report tried to obtain the maximum benefit from prospective longitudinal data collected at three different stages

during early childhood (at 12-month intervals), they also accepted to respect the limitations of this data.

This prospective longitudinal study allows us to describe the changes over time for each measured variable concerning each individual. The researchers thus recorded the changes during the first three years of the children's lives. Profiles of children, parents and families as well as some developmental trajectories were drawn based on the data collected during these three stages. These original results should facilitate discerning the beginning of the course taken by the children and their families. However, it is important to remember that these results only described the first three points of a curve that ideally should comprise fifteen points of time. Since in most cases, it is not very likely that behaviour is consolidated at 2½ years, we asked the authors to primarily limit themselves to describing the development of observable changes. It is obviously too early in the child's life for us to attempt causal analyses in order to identify determinants, especially since these would only be associations. Finally, whenever we approach a problem, our questions are generally much too simplistic. Longitudinal studies such as the QLSCD indicate that there are many ways to observe a problem and that it is dangerous to draw definitive conclusions after the first analyses, no matter how brilliant these appear to be.

It is important to remember that the main objective of the QLSCD is to understand the paths during early childhood that lead to success or failure once the child enters the school system. In order to successfully reach this objective, we must obviously wait for information collected once the child begins school. The QLSCD children will complete their first school year in the spring of 2005. At the time when this report will be published, they will be old enough to enter Junior Kindergarten, which some of them will do in September 2002. Data collection is also planned for the end of Junior Kindergarten year (spring 2003) and at the end of Senior Kindergarten (spring 2004). If, as desired, these significant data collections are funded, the information generated will allow us to check the level of preparation for school at the entry into the first cycle of elementary school. Later during

this longitudinal study, description of the developmental trajectories of these children is planned throughout their school years. If, following the example of many researchers in Québec, the Québec Government confirms its financial involvement in pursuing QLSCD throughout the children's elementary and secondary school, we can increase our understanding of the factors that lead to academic success and therefore be in the best possible position to improve support to the all-too-many children for whom school is an endless succession of failures.

Through recent discoveries about the development of the human brain, we have come to see the importance of investing early in children's development, just as it is important to invest early in our pension plans. Longitudinal studies on the development of children must obviously be based on the same principle. They must begin as soon as possible, and this is what the *ministère de la Santé et des Services sociaux* did as early as 1997, by investing nearly \$5 million in a study on Québec children aged 5 to 54 months old. And obviously, just like for a pension plan, in order for these investments to bear fruit and provide the best possible returns, they must be maintained and even increased.



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Review of Methodology and Caution

The Québec Longitudinal Study of Child Development (QLSCD 1998-2002), launched in 1998, is being conducted on a cohort of nearly 2,000 children surveyed annually from the age of 5 months to approximately 4 years. This second volume covers longitudinal data from the first three rounds when the children were approximately 5, 17 and 29 months of age respectively.

The longitudinal analyses of data collected in the 1998, 1999 and 2000 rounds allow inferences to be made to the population of children born in Québec in 1997 and 1998 (singleton births) who in 2000 were still living in Québec or who had only left the province temporarily. Therefore, in terms of the methodological approach, choosing not to sample children from those who arrived in Québec after birth limits inferences to this population.

Participation of families in the 1999 and 2000 rounds of QLSCD was excellent. Indeed, 94% of families who participated in the 1998 round continued to participate in the second and third rounds, for a 71%¹ longitudinal response rate for the two main questionnaires, the Interviewer Completed Computerized Questionnaire (ICCQ) and the Interviewer Completed Paper Questionnaire (ICPQ). Response rates for the Self-Administered Questionnaire for the Mother (SAQM) and Self-Administered Questionnaire for the Father (SAQF) remained stable from 1998 to 2000, namely 96% for the former and 90% for the latter, among annual respondents to the ICCQ. However, since respondent families were not necessarily the same from one round to the next, the weighted proportion of families who participated in all the rounds was lower, namely 92% for the SAQM and 83% for the SAQF, among respondents to the ICCQ in all three rounds (n = 1,985). The longitudinal response rates of these instruments, obtained by multiplying the weighted proportion of longitudinal respondents to the SAQM or SAQF by the longitudinal response rate of the ICCQ, were 65% and 59% respectively.

1. The unweighted number of families who responded to QLSCD went from 2,120 in 1998 to 2,045 in 1999, to 1,997 in 2000. The number of families who participated in the three rounds of the survey was 1,985 (namely 94% of the 2,120 families in the first round).

It was decided to minimize potential biases induced by non-response by adjusting the weights based on characteristics differentiating respondents from non-respondents for the five major instruments of QLSCD – the ICCQ, ICPQ, SAQM, SAQF and the IST (Imitation Sorting Task testing cognitive development). Since only respondents to the 1998 round were eligible for longitudinal study, longitudinal weights were based on the cross-sectional weights of the ICCQ calculated in 1998. In addition, for longitudinal analyses involving data from the SAQM, SAQF or IST, an additional adjustment to the weights was required to compensate for overall longitudinal non-response in each of these instruments. Unfortunately, in the third round as in the first, even though the response rates of non-resident fathers improved, it was impossible to weight their data since response rates to the SAQFABS were still too low.

Moreover, given QLSCD's complex sample design, it was important that the variance associated with the estimates was correctly identified. This required using a software program that could take into account the complex sample design, otherwise the variance would tend to be underestimated, thereby resulting in a threshold of statistical significance that would be too low. SUDAAN (Survey Data Analysis; Shah *et al.*, 1997) was therefore used for prevalence estimates, chi-square tests, repeated measures analyses of variance, linear regressions, logistic regressions and Cox regressions. The threshold of significance for these statistical tests was set at 0.05. With regards to other tests not supported by SUDAAN such as the McNemar, the threshold was lowered to 0.01 to prevent identifying results as significant that might not be, given the complex sample design.

All the data presented that have a coefficient of variation (CV) higher than 15% are accompanied by one or two asterisks to clearly indicate their variability.

For further information on the survey's methodology, please read Number 1 of both Volume 1 and Volume 2. For more detailed information on the sources and justifications of questions used in the first three rounds of QLSCD as well as the components of the scales and indexes, please read Number 12 of both Volume 1 and Volume 2.

Caution

Unless indicated otherwise, "n" in the tables represents the sum of the individual weights reset to the size of the initial sample. This quantity is used to estimate the prevalences, and is slightly different from the real sample, namely the number of children in a given sub-group. In the body of the text, the number presented to describe the sample size also represents the sum of the individual weights reset to the size of the initial sample. This occurs when an analysis concerns a particular sub-group. The weighted frequency in these cases serves only as a link with the tables. The real sample size, and coefficient of variation remain the quantity to interpret as far as the precision of the estimates is concerned.

Because the data were rounded off, totals do not necessarily correspond to the sum of the parts.

Unless explicitly stated otherwise, all the differences presented in this report are statistically significant to a confidence level of 95%.

To facilitate readability, proportions higher than 5% were rounded off to the nearest whole unit in the text, and to the nearest decimal in the tables and figures.

Symbols

.. Data not available
... Not applicable (N/A)
- Nil or zero
p < Refers to the threshold of significance

Abbreviations

CV Coefficient of variation
Not signif. Not significant

Parental Behaviours Related to Children's Dental Health

In
2002...
I'll be 5 years old!

1. Introduction

A number of studies have been conducted in Québec on the dental health of children. They have been cross-sectional and have mainly focused on caries (tooth decay) in children 5 years of age and over (Brodeur *et al.*, 2001; 1999; Corbeil *et al.*, 1996; Payette *et al.*, 1991; Payette *et al.*, 1987). The most recent study (Brodeur *et al.*, 2001) examined notably primary dentition in children 5 to 6 years of age and revealed that in 1998-1999, 42% of children in this age group had caries. This proportion was approximately 10% when only the four upper incisors were considered (Brodeur *et al.*, 2001, unpublished data). The results also showed that not all children were affected with the same severity, since 24% of them accounted for 90% of all caries in this age group. Compared to other children, those most affected were more likely to be in a family whose annual income was below \$30,000, to have parents who had not gone beyond high school, to have one parent on welfare, to have one parent with teeth missing, or to not reside in a metropolitan area. These same children were also more likely to have recently visited a dentist and to brush their teeth less than twice a day.

It is widely recognized that the fact of having already had tooth decay is a predictor of future dental caries (Demers *et al.*, 1992; NIH, 2001; Pitts, 1998; Powell, 1998; Tinanoff and Douglass, 2001). However, maintaining good dental health in children of preschool age depends on preventive practices most often controlled by the actions and attitudes of the parents. In general, the attention given by parents to the health of their child is defined as being any behaviour that has as its goal the promotion of health, prevention of disease and identification of a health problem to ensure, maintain or improve the health of a fetus or child for whom they are responsible (Green and Kreuter, 1991). This definition can certainly be applied to the specific behaviour of parents regarding the dental health of their child. It indicates both prevention through personal care and use of professional dental services.

The high proportion of 5 and 6 year old children in Québec who have experienced caries has drawn the attention of professionals and researchers in dental

health to the importance of identifying the characteristics associated with tooth decay as early as possible, namely at preschool age. The Québec Longitudinal Study of Child Development (QLSCD 1998-2002) provides a unique opportunity, because it has made it possible to study parental behaviours related to dental health from the time the children were approximately 5 months old.

The first three rounds of *QLSCD* addressed the trajectories of and changes in the behaviours of parents related to dental health when the children were approximately 5, 17 and 29 months of age. Some of these behaviours can foster the development of caries. The data have provided a means of defining in detail various baby bottle practices, namely the inappropriate use of a bottle containing a sugary liquid during the falling asleep or sleep periods. Also examined was the use of a pacifier dipped in a sugary substance and the frequency of consuming certain cariogenic snacks. Other behaviours were studied that can be considered protective with regards to tooth decay, namely toothbrushing (age of introduction, daily frequency, adult help) and the use of fluoride toothpaste and supplements.

The analyses presented in this paper aim to paint a portrait of the evolution of parental behaviours with regards to dental health in children between the ages of 5 and 29 months. They also aim to describe the characteristics of children around 29 months of age according to baby bottle practices and the age when their teeth were being brushed for the first time. Relationships between these dental health behaviours and other variables measured in *QLSCD* are also investigated, such as sleep and feeding characteristics, child and family characteristics, and parent-child relations. The results generated can be used to suggest directions in dental public health interventions and improve the organization of dental services for young children and their parents.

2. Current State of Knowledge

Considerable research has been conducted on early childhood caries in the last 15 years. Some investigators have examined various aspects of these studies with a critical eye, identifying their limitations and proposing new avenues of research (Burt and Pai, 2001a and 2001b; Ismail, 1998; Ismail and Sohn, 1999; Milnes, 1996; Reisine and Douglass, 1998; Reisine and Psoter, 2001; Ripa, 1988; Tinanoff and Douglass, 2001; Valaitis *et al.*, 2000). Difficulties have been revealed such as obtaining data on caries in primary dentition representative of young children, meeting with young children to clinically observe their dentition, and the absence of universally accepted criteria for estimating the prevalence of caries (Ismail and Sohn, 1999; Milnes, 1996; Ripa, 1988; Reisine and Psoter, 2001). In addition, most studies have been conducted on specific groups of children and have been cross-sectional, with small samples and a wide range of age groups (Ismail and Sohn, 1999; Reisine and Douglass, 1998).

In the United States it has been estimated that approximately 1% of children 1 to 2 years of age have maxillary anterior caries (Kaste *et al.*, 1996). Other studies on groups of children 5 years of age and under (Barnes *et al.*, 1992; Broderick *et al.*, 1989; Johnsen *et al.*, 1984; Kelly and Bruerd, 1987; Powell, 1976) reveal that this type of caries can vary from less than 5% to more than 70% in certain native populations. In Canada, Locker and Matear (2001) report that from 6% to 8% of children of preschool age living in urban areas have caries, whereas this proportion is around 65% in children 4 years of age in the Northwest Territories. In Québec, approximately 10% of children 5 to 6 years of age have caries, when only the four upper incisors are considered (Brodeur *et al.*, 2001, unpublished data). In terms of overall primary dentition, Kaste *et al.* (1996) have shown that 17% of American children 2 to 4 years of age have caries. In Québec, 42% of children 5 to 6 years of age present this disease (Brodeur *et al.*, 2001).

In general, the terminology used for caries of primary dentition has been evolving. For example, "nursing caries" derive from inappropriate baby bottle or breastfeeding practices that foster the development of caries in the first teeth that erupt, namely the

upper incisors (Milnes, 1996; Ripa, 1988). "Early childhood caries" may better reflect the multi-factor etiology of the disease (Ismail, 1998; Ismail and Sohn, 1999; Reisine and Douglass, 1998; Valaitis *et al.*, 2000). If the four upper incisors are affected, this may indicate a severe form of "early childhood caries" (Ismail and Sohn, 1999).

Studies that have been conducted on the links between caries and certain parental behaviours regarding children's dental health or various family characteristics do not, however, reveal consensus. Thus far, only socio-economic status seems to be inversely associated with caries in children under 12 years of age (Reisine and Psoter, 2001).

2.1 Behavioural Risk Factors for Caries

A review of the literature shows that the use of a baby bottle at night may be as frequent in children both with and without caries (Ismail and Sohn, 1999; Reisine and Douglass, 1998). Yet two studies (Hinds and Gregory, 1995; Kaste and Gift, 1995) seem more valid since they measured current use of the bottle in bed in a representative, random sample of a population of children. They report prevalences of approximately 20% in children 32 to 42 months and 6 to 60 months. Use of a bottle in bed seems to be significantly more common, especially if the parent has not completed secondary school or is of Hispanic origin, and when family income is insufficient. Moreover, the propensity of using a bottle in bed increases among children aged 24 to 35 months (Kaste and Gift, 1995). The liquids involved were milk, fruit juice or any other sugary liquid. Frequent and prolonged exposure to the teeth and the duration of this practice beyond the weaning period (in general close to the age of one year, although it could be longer or shorter depending on social norms or cultural influences) may be implicated in the development of caries. Even the definition of bottle use in bed differs from one study to another (Reisine and Douglass, 1998). Reisine and Psoter (2001) report that univariate or multivariate studies do not consistently show an association between the risk of

caries and duration of bottle use, use in bed and the contents of the bottle. However, these researchers state that studies employing a longitudinal model reveal that the contents of the baby bottle is significantly associated with the risk of caries but the duration of the habit is not. The results of Litt *et al.* (1995) reveal that a nighttime bottle is associated with greater sugar consumption in children 3 to 4 years of age.

Breast-feeding, prolonged or on demand during the night, seems to be a risk factor, although again, few accurate epidemiological studies have been conducted (Valaitis, 2000). Like other risk factors, the habit of dipping a pacifier in a sugary substance (honey, sugar granules) to sooth the child has been reported (Eronat and Eden, 1992; Ripa, 1988).

It is fairly clear that sugar or foods containing carbohydrates such as flour play a fundamental role in the development of caries. However, it seems that this association is weaker today than in the past because of exposure to various sources of fluoride such as fluoridated water, fluoride toothpaste, fluoride treatments, and foods and beverages containing fluoride (Burt and Pai, 2001a; Tinanoff and Douglass, 2001). The control of sugar consumption, however, remains completely justifiable in the prevention of caries (Burt and Pai, 2001a).

2.2 Behavioural Protection Factors Against Caries

According to scientific evidence, beyond behavioural factors, water fluoridation is highly effective in preventing caries in primary dentition (Ismail, 1998; NIH, 2001; Tinanoff and Douglass, 2001). Fluoride supplements constitute an alternative prevention method that can be used in children at risk of caries. However, the real effectiveness of these supplements, which depends on parents assiduously administering them every day, remains unknown (Ismail, 1998).

The same applies to other personal prevention practices. According to Ismail (1998), few studies have examined their real effectiveness in young children (0-3 years). Fluoride toothpaste is however recognized as being effective in preventing caries (O'Mullane, 1994; Stamm, 1993), and regular

brushing should be promoted as a method of distributing fluoride (Tinanoff and Douglass, 2001). Controlled use of fluoride twice a day is now considered a major approach to reducing caries. However, in children, only a pea size amount of toothpaste should be used, and toothbrushing should be supervised (Tinanoff and Douglass, 2001). The effectiveness of toothbrushing may depend on the attention and care of the mother or caregiver (Karjalainen *et al.*, 1994). A high frequency of toothbrushing and the involvement of the parents seem to be associated with a decrease in caries on the smooth surfaces (Paunio *et al.*, 1993; Persson *et al.*, 1985; Schroder and Granath, 1983; Wendt *et al.*, 1994; Winter *et al.*, 1971). The absence of brushing may not be associated with increased caries in the incisors (Winter *et al.*, 1971) and other studies show no association between the frequency of brushing and caries (Febres *et al.*, 1997; Grytten *et al.*, 1988).

Certain researchers have observed no association between the age of introducing toothbrushing and early childhood tooth decay (Serwint *et al.*, 1993; Silver, 1992; Williams and Hargreaves, 1990), whereas others have indeed reported such an association (Hinds and Gregory, 1995; Winter *et al.*, 1971). In a study in England, the proportion of children 1½ to 4½ years of age afflicted with caries significantly varied with when brushing began, namely before the age of one (12%), from one to two years (19%), or from the age of two years (34%) (Hinds and Gregory, 1995). Brushing the teeth began before the age of one in 49% of the children in this study, and this proportion varied with whether the major source of household income was non-manual employment (55%) or manual (44%) labour. However, in a sub-group of these children 18 to 30 months of age, the gap narrowed (non-manual, 55%, manual, 51%). The authors kept these employment categories as indicators of the social class of the household. In Québec, a study conducted in 1983-1984 revealed that 25% of parents of children 5 years of age indicated that their children had begun brushing their teeth at 12 months of age and under (Leduc, 1992).

2.3 Individual and Family Characteristics of Children with Caries

Certain characteristics of young children with caries have been identified. The majority of these children may be more likely to present with a health problem (Johnsen, 1982) and have a difficult temperament, harrasing their parents (Marino *et al.*, 1989; Weinstein *et al.*, 1992). To identify children at risk of developing caries, some researchers have suggested examining their temperament and behaviour (Quinonez *et al.*, 2001), and to this end, various measurement scales have been used, such as the *Toddler Temperament Scale (TTS)*, the *Behavior Style Questionnaire (BSQ)* and the *Emotionality, Sociability, Activity (EAS) Temperament Survey for Children* (Kendrick *et al.*, 1998; Lochary *et al.*, 1993; Moy, 1992; Quinonez *et al.*, 1997). These instruments were developed based on the work of Thomas and Chess (1977), who defined temperament as "how the child reacts." According to their model, a difficult temperament refers to children who become easily upset, present irregular biological functioning and demonstrate frequent, intense, negative reactions to changes in their environment. Caring for these infants is difficult and can lead to inappropriate bottle and breastfeeding practices that can foster dental caries. However, Quinonez *et al.* (2001) have shown that temperament cannot predict the duration of bottle use or breastfeeding, although the characteristic of shyness and the duration of these habits seem to be associated with caries in children with a mean age of 43 months.

Young children with caries may also have sleep problems (Marino *et al.*, 1989). For example, the fact that a child sleeps fewer hours at night has already been shown to be associated with tooth decay. This is also the case for breastfeeding or bottlefeeding to stop night crying instead of holding and comforting, rocking, speaking to or distracting the child (Lopez Del Valle *et al.*, 1998; Shantinath *et al.*, 1996).

The results of some studies suggest that being the youngest child in a family is related to an increased frequency of caries (Dilley *et al.*, 1980; Elarabi *et al.*, 2001; Muller, 1996), while others report a lower frequency (Kinirons and McCabe, 1995) in the second and third children. Low birthweight has been suggested as an indicator of risk for caries in primary

dentition, either because it is associated with a defect in the enamel (increased susceptibility to caries) or indirectly because it is a marker of lower socio-economic status (Tinanoff and Douglass, 2001). It has been suggested that available studies are not conclusive in establishing a link between low birthweight and future onset of caries (Burt and Pai, 2001b).

Among family characteristics, with the exception of socio-economic status which seems inversely associated with caries in children under 12 years of age (Reisine and Psoter, 2001), there is not a unique profile that predisposes young children to tooth decay. Some studies suggest over-indulgence on the part of parents (Johnsen, 1982; Johnsen *et al.*, 1984). However, while certain parents give in to the demand of the child for a baby bottle at night or naptime, others consciously decide to give the child a bottle to help him/her fall asleep to avoid the stress associated with crying, then remove it for the night (Milnes, 1996). Although other characteristics have not proven significant in all studies, it seems that parents of young children with caries are less educated (Johnsen, 1982; Marino *et al.*, 1989), tend to be obese (Johnsen, 1982; Johnsen *et al.*, 1984), are more pessimistic about their dental condition, and are ignorant of the negative effect of milk or other sugary liquid in a baby bottle at night (Dilley *et al.*, 1980; Johnsen, 1982; Johnsen *et al.*, 1984). They raise more often their children alone (Marino *et al.*, 1989) and have less help with caring for the children (Weinstein *et al.*, 1992) or delegate care to a surrogate caregiver (Dilley *et al.*, 1980). The influence of cultural factors related to feeding practices has also been suggested (Febres *et al.*, 1997). For example, it has been reported that Asian parents are more likely to give their baby a bottle with a sugary liquid over a period of several years (Davies *et al.*, 2001).

Among cognitive factors, the parents' feeling of self-efficacy or beliefs regarding their capability of fulfilling the role of parent, and their expectations vis-à-vis the impact of their actions (Bandura, 1989) may be at the heart of the quality of parental involvement and parent/child dynamics in early childhood (Boivin *et al.*, 2000). According to Bandura (1989), an individual's beliefs regarding his ability to perform a given task (self-efficacy) and his positive outcome expectations are the primary determinants of

succeeding at the task. Reisine and Douglass (1998) have observed that the parents' feeling of self-efficacy regarding their parental role has not been the subject of much study as it relates to caries in young children. However, it may be important to identify parents whose children are at risk of caries and those who could benefit from interventions designed to improve their perception of self-efficacy. The authors refer to the results of Litt *et al.* (1995), who show that personal efficacy is a significant predictor of sugar consumption. Parents of children 3 to 4 years of age who perceive themselves as not being very effective in taking care of their child's teeth report higher sugar consumption in their child.

Furthermore, mothers' perception that their behaviours have a low impact on their child's development seems to be linked to a higher score on the overprotection scale (Boivin *et al.*, 2000). These mothers have a greater tendency to have parenting practices that reflect excessive concern for the safety and protection of their child. In this regard, some researchers suggest that caries in young children is a problem of lack of parental restraint in taking care of their child, not a problem of negligence (Febres *et al.*, 1997).

In general, the current state of knowledge indicates the need to establish a universally accepted definition of early childhood caries and develop better diagnostic tools and examination procedures. Moreover, there is not only a need to use larger and more representative samples, but also to conduct prospective longitudinal studies to evaluate the natural course of the disease. This will lower the memory bias of parents with regards to their dental health behaviours. Health organizations have recently examined the current state of knowledge of early childhood caries and have suggested avenues of research in this direction (NIH, 2001).

2.4 Recommendations of Dental Associations

Recommendations for parents on dental health are published by organizations such as the *Ordre des dentistes du Québec* (ODO, 2002) and the Canadian Dental Association (CDA, 2002). It is recommended to clean a baby's gums before the first teeth appear, to brush the teeth twice a day, to use less than the

equivalent of a small pea of a fluoride toothpaste, to brush a child's teeth for him when he is very young and to brush with him until he is 6 or 7 years of age. Allowing for exceptions, it is not recommended to give fluoride supplements to children before the age of 6 years. In terms of feeding practices, it is recommended to not let a child sleep with a bottle containing anything other than water, to limit the frequency of food consumption and snacks containing sugars, and to never put sugar or any other similar sweet substance on a pacifier. In order to prevent problems with the position of permanent teeth, it is suggested parents stop sucking habits before the child reaches the age of 5 years.

Various guides to children's health are available for parents and health professionals, such as *Mieux vivre avec son enfant de la naissance à deux ans* (From Tiny Tot to Toddler) (Doré and Le Hénaff, 2001), given free of charge to all mothers who give birth in a hospital or birthing centre, and *La santé des enfants... en services de garde éducatifs* (ministère de la Famille et de l'Enfance, 2000). These guides contain prevention practices with regards to children – toothbrushing, fluoride, appropriate bottle use, etc. Parents of the children in QLSCD may have been exposed to messages different from those contained in these publications, given the lag between editions in updating the scientific information.

3. Contribution of QLSCD 1998-2002 to Dental Knowledge

QLSCD contains a series of five annual measurements of the behaviours of 2,120 parents related to their children's dental health, beginning when the children were about 5 months of age. The paper on dental health in Volume 1 documented baby bottle practices, availability of the pacifier while falling asleep, and use of fluoride supplements (Veilleux *et al.*, 2000). The current paper will provide a portrait of certain parental behaviours with regards to the dental health of 1,985 children who participated in the first three rounds of QLSCD when they were approximately 5, 17 and 29 months of age. Given the age of the children, the following behaviours were examined: baby bottle practices, use of a pacifier dipped in a sugary product, consumption of snacks containing sugars, toothbrushing and the taking of fluoride supplements.

Factors associated with two parental behaviours related to dental health were also examined – one that can foster the development of caries in children (inappropriate baby bottle practices), and the other involving prevention (brushing teeth with fluoride toothpaste). From data on baby bottle contents and practices, a typology was developed. This typology was then analyzed for possible associations with diverse variables related to the child, the family environment, parental behaviours with regards to the child's sleep and diet, and parent-child relations when the latter was 29 months of age. Toothbrushing in the children was examined using a survival analysis. The goal was to discover the factors that would in some way "predict" the age at which toothbrushing begins, in a perspective of early intervention with the parents; therefore, characteristics of the child, mother, household and parent-child relationship when the latter was about 5 months old were retained for investigation. Other parental characteristics related to dental health such as baby bottle practices and fluoride supplements were also studied to determine the strength of association between these and the age at which toothbrushing was introduced.

Data on bottle-feeding practices and fluoride supplements were collected from the Interviewer Completed Paper Questionnaire (ICPQ) administered in the household to the Person Most Knowledgeable of the child (PMK)¹ when the latter was approximately 5, 17 and 29 months old. The questions covered toothbrushing at 17 and 29 months, as well as the frequency of consuming snacks containing sugars. Questions on sucking a pacifier were in the Self-Administered Questionnaire for the Mother (SAQM) when the child was 17 and 29 months.

While bottle practices and age at which toothbrushing was introduced were dependent variables in this study, they became intermediary or independent variables in terms of caries. The cross-tabulated variables in the analyses that follow essentially flow from the current state of knowledge of caries in young children. Data on some of these cross-tabulated variables were obtained for the mother and father living in the household. But since similar associations were observed in most cases, only analyses conducted with characteristics of the mother, whether living with a spouse or not, are presented. The data come from the Interviewer Completed Computerized Questionnaire (ICCCQ), the Interviewer Completed Paper Questionnaire (ICPQ) and the Self-Administered Questionnaire Completed by the Mother (SAQM). They cover characteristics of the child such as sex, premature status, low birthweight, birth order, and mother's perception of the child's health status. Sociodemographic aspects include mother's immigration status and education, type of family and income sufficiency status. Other behaviours, such as those related to sleep and diet, were also studied.

Parent-child relations were examined using scales validated and analyzed by other QLSCD researchers (Boivin *et al.*, 2000; Japel *et al.*, 2000a and 2000b): the Parental Perceptions and Behaviours Regarding the Infant Scale (PPBS) which assessed cognitions of

1. Since virtually all the PMKs (Persons Most Knowledgeable of the Child) were the biological mothers of the children, the term "mother(s)" will be used to designate them.

the mother reflecting the quality of her involvement with her child (self-efficacy, perception of parental impact, tendency to overprotect); the difficult temperament scale, developed from seven questions from the Infant Characteristics Questionnaire (ICQ), designed by Bates *et al.*, (1979), administered to the mother when the child was about 17 months of age; the scale of Positive Interactions between the PMK and the Infant with five questions was also investigated. All the results in this paper present data on children born in Québec in 1997 or 1998 who, at the age of 29 months, had not permanently left the province.

4. Parental Behaviours Related to the Dental Health of Children 5, 17 and 29 Months of Age

4.1 Baby Bottle Practices

Table 4.1 shows parental behaviours related to the dental health of the children when they were approximately 5, 17 and 29 months of age. Use of the baby bottle at the age of about 5 months seems to have been widespread, since 91% of infants were being fed with it either exclusively or not. Quite a few children were still being bottle-fed at 17 months (72%), though the proportion dropped to one third (29%) at the age of 29 months.

As indicated earlier, inappropriate use of the baby bottle, namely while falling asleep or sleeping periods day or night, may play a role in the development of

caries when the bottle contains something other than water. The results show that 14% of 5-month-old babies had a bottle while falling asleep. The proportion rose to 59% when the children were 17 months and one out of four children still had this habit when they were 29 months of age.

At 17 months of age, 19% of children slept with a bottle and 10% did so at 29 months of age. The bottle was also used during awake periods (ex.: playtime, in front of the television, while walking around, etc.) by 43% of children at 17 months and 17% at 29 months. This variable was not measured at 5 months.

Table 4.1

Distribution of children of approximately 5, 17 and 29 months of age by certain parental behaviours related to their dental health, Québec, 1998, 1999 and 2000

	5 months		17 months		29 months	
	Yes	No	Yes	No	Yes	No
	%					
Baby Bottle Use	90.6	9.4	71.5	28.5	28.6	71.4
To help the child fall asleep night or day	13.7	86.3	59.1	40.9	24.5	75.5
During sleeptime night or day	..	..	19.2	80.8	10.2	89.8
During wake periods ¹	...	...	42.9	57.1	16.8	83.2
Sugary Snacks						
At least 2 snacks a day, during the week preceding the interview	...	...	..	..	25.7	74.3
Pacifier Use	..	..	45.5	54.5	23.4	76.6
Toothbrushing	4.3	95.7	84.4	15.6	99.2	0.8 **
At least 2 times during the day preceding the interview	..	..	28.8	71.2	47.7	52.3
Brushed by an adult	..	..	44.6	55.4	26.6	73.4
Brushed using toothpaste	..	..	44.3	55.7	90.4	9.6
Fluoride supplements taken (alone or in combination with vitamins and/or minerals)	1.7 *	98.3	14.9	85.1	7.6	92.4

1. During wake periods (ex.: playtime, in front of the television, while walking around, etc.)

* Coefficient of variation between 15% and 25%; interpret with caution.

** Coefficient of variation higher than 25%; imprecise estimate for descriptive purposes only.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

When the bottle was used at falling asleep time or during sleep periods, it rarely contained water – the proportion was 2% or less, irrespective of age. Mothers reported that it most often contained infant formula at 5 months (more than 75% of cases in which the bottle was used while falling asleep or during sleep periods). However, cow's milk was the liquid most used during these periods at 17 and 29 months (more than 80% of cases in which the bottle was used while falling asleep or during sleep periods) (data not shown).

Mothers revealed that juice or juice diluted with water was in the baby bottle in less than 1% of cases during the falling asleep period and/or while sleeping. This proportion grew to 5% at 17 months and dropped to 2% at 29 months. Other cariogenic contents reported in varying proportions accounted for less than 1% at each age of observation (data not shown).

Baby bottle practices related to the risk of caries at the age of 29 months are treated in more details in Section 5 of this document.

4.2 Sugary Snacks

Although questions on the consumption of sugary snacks were not asked until the third round of QLSCD, it was still possible to examine the daily consumption of two categories of cariogenic substances, namely juice and/or fruit beverages, and cake/pastry, candies, cookies and chips. More than half of mothers (53%) revealed that their child had, on average, drunk fruit juice or a fruit beverage twice or more a day in the week preceding the interview. A much smaller proportion (6%) reported the same frequency of the child consuming cake/pastry, candies, cookies and chips in the same period (data not shown).

When the children were 29 months of age, it was possible to estimate their consumption of cariogenic snacks between meals or just before bedtime based on the mothers' responses to a list of foods presented during the interview (see Table A.1 in Annex). More than a quarter of children had consumed one or more of these foods at least twice a day, on average, during the week preceding the survey (Table 4.1).

4.3 Pacifier Use

Use of a pacifier is being documented in the 1999 and 2000 rounds. It appears that 46% of children were using a pacifier at the age of 17 months and 23% at the age of 29 months (Table 4.1). However, the habit of dipping it in a sugary substance was very rare, given that only 1% of mothers whose 17 month old child used a pacifier were doing this (data not shown).

4.4 Toothbrushing

By the age of 29 months, toothbrushing had begun in nearly all the children studied (99%). In approximately 4% of them, toothbrushing had already begun at 5 months, and in 84% at 17 months (see Table 4.1). Only 29% of mothers of children 17 months of age reported a frequency of toothbrushing at least twice on the day preceding the interview. This proportion increased to approximately 48% by the time the child was 29 months. In children 17 months of age, 45% were having their teeth brushed by an adult; at 29 months, this proportion dropped to 27% (see Table 4.1).

Between 17 and 29 months of age, toothpaste use in the children went from 44% to 90% (Table 4.1). With regards to the quantity of toothpaste used², approximately 43% of children at 17 months used a pea size amount or a thin ribbon, and this quantity was rarely greater (1%); 40% did not use toothpaste. One year later, when they were 29 months, even though brushing had begun in virtually all the children, 9% of mothers reported that they were not using toothpaste with their child, 84% indicated that they used only a pea size amount or thin ribbon, and 7% a somewhat larger amount (see Table A.2 in Annex).

The QLSCD data provide a means of analyzing the age of introducing toothbrushing in more depth, as will be shown in Section 6 of this document.

2. Illustrations were used by the interviewer to help the mother identify the amount of toothpaste used by her child.

4.5 Fluoride Supplements (taken alone or with vitamins and/or minerals)

At the age of 5 months, it was possible to draw up a list of products known to contain fluoride,³ from a list of names of vitamin and/or mineral supplements reported by the mothers. When the children were 17 and 29 months, the interviewer showed the mother a table with the names of the main products containing fluoride, completing the information by recording the name on a product's tube or container.

As indicated in Table 4.1, approximately 2% of infants at 5 months were taking fluoride supplements (alone or in combination with vitamins and/or minerals). More children were taking them at 17 months (15%), while 8% were taking them at 29 months. At 29 months, only a very small proportion (0.3%) were taking fluoride supplements while living in a municipality with a fluoridated water supply (data not shown).

3. To appropriately identify the name of fluoride supplements (alone or in combination with vitamins and/or minerals) given to the child, the interviewer asked the mother to show her the product at each interview in the home.

5. Baby Bottle Practices Related to Caries

5.1 Definition of a Typology

From research on factors associated with early childhood caries, a typology of baby bottle practices was developed. Children were then put into categories based on the bottle's contents and bottle-feeding practices.

When the bottle contained only water or was not used in bed at night or during naps, whether for falling asleep or while asleep, or if the child did not use a bottle (exclusively breastfed or had stopped using it), the child was put in the category "Not at risk." This first category therefore grouped together children who were not using the baby bottle with those who were using it appropriately.

When the bottle contained a sugary liquid – milk (infant formula, cow's milk, other types of milk and cariogenic products mixed with milk) or juice (diluted or not with water) – a more or less prolonged contact with the teeth constituted the main classification criterion. In these cases, a child who was given a bottle only to fall asleep (shorter duration) was classified in the "Risk 1" category, whereas a child who had a bottle to fall asleep and kept it while asleep, or who had it only while asleep, was classified in the "Risk 2" category.

The results presented in Table 5.1 show that at the age of 5 months, 13% of children were classified as being at risk of developing caries, given the parents' baby bottle practices. At the age of 17 months, the proportion of children in this category grew in pronounced fashion, attaining 59%. In the third round, when the children were 29 months, almost a quarter of children were still in this "At Risk" category. The results for these 29-month-old children also revealed the existence of a "Risk 2" sub-group (approximately 10%), for whom the duration of bottle use was longer, given that they had the bottle not only to fall asleep but also while they were asleep.

The data confirm the existence of an association between the habit of having a baby bottle during awake periods (ex.: during play, in front of the

television, while walking around, etc.) and use of a bottle containing a sugary liquid during the falling asleep period or while asleep, at the age of 29 months. Children using a bottle during awake periods were between five and six times more likely to be involved in the aforementioned practices than those not using a bottle (77% vs. 14%) (data not shown).

Table 5.1
Distribution of children of approximately 5, 17 and 29 month of age by usage of a baby bottle containing a sugary liquid during falling asleep or sleep periods, Québec, 1998, 1999 and 2000

	5 months	17 months	29 months	
	%			
"Not at risk" ¹	86.7	41.0	75.6	
"At risk" ²				
"Risk 1" ³	} 13.3	} 59.0	14.5	} 24.4
"Risk 2" ⁴			9.9	

1. "Appropriate" baby bottle practices or bottle not used.
2. Baby bottle used at night or at naptime for falling asleep or while asleep, containing a sugary liquid – milk (infant formula, cow's milk, other types of milk and cariogenic products mixed with milk) or juice (or juice diluted with water).
3. Baby bottle used only for falling asleep.
4. Baby bottle used for falling asleep and for the entire duration of the sleep period or only during the sleep period.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

To obtain a clearer picture of children in the "At Risk" category in terms of baby bottle practices, we cross-tabulated characteristics of the child, mother, household, certain diet and sleep habits, and aspects of the parent-child relationship.

5.2 Baby Bottle Practices and Characteristics of the Child, Mother and Household

Among sociodemographic characteristics (see Table 5.2), children of non-European immigrant mothers were given a baby bottle containing a sugary liquid during falling asleep or asleep periods in a greater proportion than those whose mothers were non-immigrant or European immigrant (58% vs. 20%). While the latter showed the expected frequency in the population for the two "At Risk" sub-categories, children of non-European immigrant mothers were twice as likely to have a bottle containing a sugary liquid for falling asleep only ("Risk 1") and three times as likely to use such a bottle for falling asleep and during the sleep period

("Risk 2") (data not shown). We also observed a difference in baby bottle practices according to household income sufficiency. Significantly more children in low-income households had a bottle containing a sugary liquid compared to those in other households (31% vs. 23%). This was particularly attributable to the fact that more "Risk 2" baby-bottle users were living in households with incomes below the low-income cutoff (15% vs. 9%) (data not shown).

No significant differences were observed in baby bottle practices related to characteristics such as mother's educational level or age group, type of family, or child's birth order.

Table 5.2

Distribution of children of approximately 29 months old by usage of a baby bottle containing a sugary liquid during falling asleep or sleep periods,¹ and by certain sociodemographic characteristics of the child, mother and household, Québec, 2000

	Yes %	No	χ^2
Child's Birth Order			
Firstborn	22.3	77.7	Not signif.
Second or younger	25.6	74.4	
Mother's Educational Level			
No high school diploma	25.4	74.6	Not signif.
High school diploma, vocational/technical school diploma	26.5	73.5	
College diploma or university degree	22.4	77.6	
Mother's Immigrant Status			
Non-immigrant or European immigrant	20.1	79.9	p < 0.001
Non-European immigrant	57.9	42.1	
Mother's Age Group			
Under 25 years of age	19.3 *	80.7	Not signif.
25 years and over	25.3	74.7	
Sufficient Household Income ²			
Yes	22.5	77.5	p < 0.01
No	30.8	69.2	
Type of Family			
Two-parent	23.6	76.4	Not signif.
Single-parent	30.4	69.6	
Total	24.4	75.6	

1. Baby bottle used at night or at naptime for falling asleep or while asleep, containing a sugary liquid – milk (infant formula, cow's milk, other types of milk and cariogenic products mixed with milk) or juice (or juice concentrate diluted with water).

2 "Sufficient" household income is based on the threshold of the low-income cutoff as defined by Statistics Canada (Desrosiers, 2000).

* Coefficient of variation between 15% and 25%; interpret with caution.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

However, with regards to certain characteristics of the child, the mother's perception of the child's health status was significantly associated with baby bottle practices. Children perceived as not being in excellent health were more likely to be given a bottle containing a sugary liquid during falling asleep or sleep periods than other children (30% vs. 22%) (data not shown). The data did not show any difference in bottle practices by sex of the child, premature birth status or low birthweight (data not shown).

5.3 Baby Bottle Practices Related to Certain Diet and Sleep Behaviours, and Parent-Child Relations

The results presented in Table 5.3 show that breastfeeding was significantly associated with being in the "At Risk" category. Indeed, 30% of children who had been breastfed were in the "At Risk" category, whereas this was the case for only 22% who had never been breastfed. With regard to certain diet behaviours, a higher proportion of children who were having more than two sugary snacks a day were in the "At Risk" category (29% vs. 23%).

Table 5.3

Distribution of children of approximately 29 months old by usage of a baby bottle containing a sugary liquid during falling asleep or sleep periods,¹ and by certain feeding and sleep practices, Québec, 2000

	Yes	No	χ^2
	%		
Breastfeeding			
Had been breastfed	30.1	69.9	p < 0.001
Never breastfed	21.5	78.5	
Number of Sugary Snacks a Day ²			
Less than 2	22.6	77.4	p < 0.05
At least 2	29.2	70.8	
Time Taken to Fall Asleep			
Less than 30 minutes	23.6	76.4	p < 0.05
30 minutes and more	30.5	69.5	
Sleep Duration			
Sleeps through the night	22.5	77.5	p < 0.001
Does not sleep through the night	40.8	59.2	
Night Wakings			
Given something to drink or eat	53.8	46.2	p < 0.001
Lets cry	24.1 **	75.9	
Comforted in or outside his/her bed or brought to parents' bed	22.9	77.1	
Does not awaken	14.7 *	85.3	
Total	24.4	75.6	

1. Baby bottle used at night or at naptime for falling asleep or while asleep, containing a sugary liquid – milk (infant formula, cow's milk, other types of milk and cariogenic products mixed with milk) or juice (or juice concentrate diluted with water).

2. Number of snacks between meals or just before bedtime, on average, per day, in the week preceding the interview.

* Coefficient of variation between 15% and 25%; interpret with caution.

** Coefficient of variation higher than 25%; imprecise estimate for descriptive purposes only.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

As shown in Table 5.3, three sleep characteristics of the child were significantly associated with baby bottle practices. Children who took 30 minutes and more to fall asleep primarily had a baby bottle containing a sugary liquid while falling asleep or when sleeping (31% vs. 24%). In addition, children who were not sleeping through the night were more likely to have a bottle with these contents, 41% compared to 23% of other children. This difference was particularly marked in "Risk 2" children (22% vs. 9%) (data not shown). With regards to parental behaviours with children who awoke at night, more than 50% of children who were given something to drink or eat were in the "At Risk" category (16% in "Risk 1" and 38% in "Risk 2") (data not shown). This was the case for 24% of children whose parents let them cry or who were comforted outside their bed (23%), and only 15% who did not wake up.

Certain characteristics of the mother's perception of parent/child relations were also examined, namely self-efficacy, parental impact and overprotectiveness. Mothers whose children were given a bottle containing a sugary liquid while falling asleep or during sleep seemed to perceive themselves as being less effective and having less impact on their children development than those whose children was not given such a bottle. There was also an association between this behaviour and the tendency to overprotect, with mothers scoring higher on the overprotection scale than their counterparts who did not engage in this practice (data not shown).

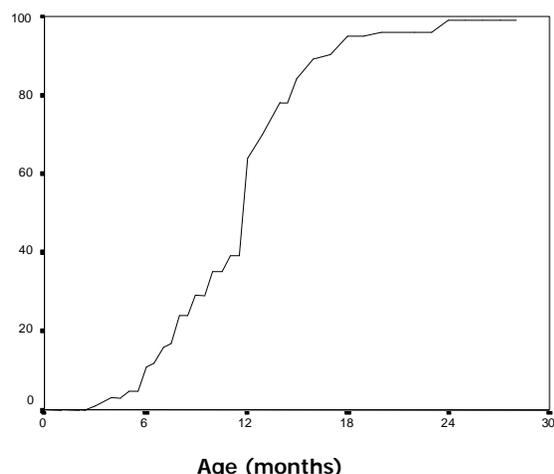
Although questions forming the scale were not asked when the children were 29 months, it is interesting to observe that children in the "At Risk" category at this age were perceived by their mother as having a more difficult temperament at 17 months. The data did not show any difference in PMK/child positive interactions at 17 months, based on baby bottle practices a year later at 29 months (data not shown).

6. Age of Introducing Toothbrushing in Québec Children

Data on the age of introducing toothbrushing was obtained from the Interviewer Completed Paper Questionnaire (ICPQ) administered in the household to the person who best knows the child (Person Most Knowledgeable of the child – PMK), who in the vast majority of cases was the mother.⁴

Figure 6.1 shows the distribution of children by age of introducing toothbrushing. As seen in Section 4.4, the figure shows that nearly all Québec infants targeted by the study had begun toothbrushing before the age of 29 months.

Figure 6.1
Cumulative percentage of children having begun toothbrushing, Québec, 1998, 1999 and 2000



Source: Institut de la statistique du Québec, QLSCD 1998-2002.

As the graph indicates, only 4% of mothers indicated toothbrushing in their child had begun at the age of

5 months or under. In more than half of Québec children (58%), toothbrushing had begun between the ages of 6 and 12 months (note that 26% of mothers indicated the age of 12 months). This proportion gradually increased to attain 90% at the age of 18 months and nearly 99% at the age of 24 months.

To identify the main factors associated with the age of introducing toothbrushing, bivariate analyses⁵ were conducted to examine links between it and certain characteristics of the child, parents, family environment or other habits related to dental health (see Table A.3 in Annex). Only variables significant at the threshold of 0.15 in the log-rank test were retained for the analyses using the Cox semiparametric regression model⁶ (Hosmer and Lemeshow, 1999). This statistical procedure proved quite effective in the presence of local modes which characterized the data.

The final model comprised 7 variables (Table 6.1), and showed the individual contribution of each of these to the rapidity with which toothbrushing was introduced in the life of the child. The partial non-response rate for the model was approximately 5%.

4. 1,985 PMKs responded twice to this question, once when their child was 17 months and once when their child was 29 months of age. The age indicated at the first positive response of the PMK was retained for the analysis. On occasion the first positive response contradicted a negative response given previously. Among the PMKs who reported that toothbrushing had not yet begun at the age of 17 months (16%), approximately a third indicated that it had begun before this age when the data was collected at 29 months. It should be noted that local modes of response were obtained every six months, which is explained by the fact that the mothers often tended to round off their responses to the six months closest to the event.

5. Test of association between time and covariates.

6. The Cox semi-parametric regression model consider the duration as a function of various explanatory variables (continuous, categorical, etc.). Though the choice of explanatory variables included in the analyses in Table 6.1 are based on the results of log-rank tests, those of Wilcoxon tests are also shown in Annex, Table A.3.

Table 6.1

Influence of certain characteristics on the children's age of introducing toothbrushing (Cox Semiparametric Regression Model), Québec, 1998, 1999 and 2000

Variables ¹	Hazards Ratio ²	p
Child's Characteristics		
Birth order		
Firstborn	1.09	p < 0.05
(Second or younger)	1.00	
Born premature < 37 weeks		
Yes	0.81	p < 0.05
(No)	1.00	
Mother's Characteristics (5 months)		
Age group		
Under 25 years of age	1.16	p < 0.01
(25 years and over)	1.00	
Educational Level		
No high school diploma	0.84	Not signif.
High school diploma, vocational/technical school diploma	0.98	
(College diploma or university degree)	1.00	
Household Characteristics (5 months)		
Sufficient Income		
Yes	1.11	Not signif.
(No)	1.00	
Characteristics of Parent-Child Relationship (5 months)		
Positive parenting practices (PMK)		
Positive interactions	1.08	p < 0.001
Scale of 0 to 10		
Maternal perceptions and behaviours		
Perception of parental impact	1.03	p < 0.05
Scale 0 to 10		
Chi-square 57.59, with a degree of freedom of 8		p < 0.000

1. The reference category is indicated in parentheses.

2. A hazards ratio of > 1 indicates that toothbrushing began earlier, whereas a hazards ratio of < 1 indicates toothbrushing began later.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

The first observation is that newborns and those whose mother was under 25 years of age were more likely to start toothbrushing early. In contrast, children born prematurely started later.

Data on characteristics of parent/child relations, namely positive interactions and the perception of impact, revealed that children whose mother obtained a higher score on these scales had a greater likelihood of introducing toothbrushing early.

Although the results were not significant, children whose mother did not have a high school diploma were less likely to have begun toothbrushing at a young age. In contrast, there was a trend to begin toothbrushing earlier in children living in a household with income above the low-income cutoff.

7. Conclusion

The QLSCD data have provided interesting information with regards to two parental behaviours related to dental health – inappropriate use of the baby bottle at 29 months, associated with increased risk of early childhood caries, and the age of introducing toothbrushing, considered a protective factor when brushing with fluoride toothpaste.

With regards to the age at which toothbrushing was introduced, this practice seems to have begun in nearly all children before the age of 29 months, bearing witness to the attention parents give to their child's dental health. The dental profession recommends brushing teeth as soon as they appear in the mouth.

However, since primary anterior teeth appear at around the age of 6 to 10 months (CDA, 2002), it is surprising to observe that less than 40% of Québec children had had their teeth brushed for the first time before the age of 12 months. This proportion rapidly increased to 63% at 12 months and 99% at 24 months of age.

A study conducted in England on more than 1,500 children representative of the preschool population also revealed that by age of 24 months, toothbrushing had begun in the vast majority of children (95%). The study also showed that 54% of the 497 parents of a sub-group of children 18-30 months of age reported having begun brushing their child's teeth before the age of 12 months (Hinds and Gregory, 1995). It can therefore be stated that this practice seems to begin later in Québec children, since only 37% of mothers reported introducing toothbrushing before the age of 12 months.

A 1983-1984 study conducted on a representative sample of 5-year-old children in kindergarten (n = 391) in a region of Québec provided an estimate of the age at which toothbrushing was introduced. Approximately 25% of parents responded that brushing the teeth had begun at the age of 12 months or under, 40% between 13 and 24 months and 35% at over 24 months (Leduc, 1992). In spite of the limits associated with the cross-sectional and retrospective nature of this study, and the absence of

representativeness of all Québec children, these data show a trend that can be compared to that of the QLSCD data. It can be hypothesized that toothbrushing began earlier at the end of the 1990s and there are explanations for this situation. It is possible that when they were young, a large proportion of the parents of QLSCD children had access to information on the prevention of tooth decay as part of the *Programme de services dentaires pour les enfants* (Children's Dental Program) which began in 1974 and is administered by the *Régie de l'assurance-maladie du Québec* (Québec Health Insurance Board – Medicare) (RAMQ, 2000). They could have also been aware or taken advantage of the free prevention services provided by the CLSCs (Local Community Service Centres), which also began in the 1970s when they were in primary school. In addition, a guide for parents entitled *Mieux vivre avec son enfant de la naissance à deux ans* (From Tiny Tot to Toddler), first published in 1977, was likely read by many parents twenty years later, since it is still handed out free of charge to all mothers who give birth in a hospital or birthing centre in Québec (Doré and Le Hénaff, 2001).

The dental associations' recommendation on the frequency of toothbrushing seems not to have been widely followed, since only 29% of children at 17 months had brushed their teeth two times or more on the day preceding the interview, and this proportion did not even attain 50% of children at 29 months.

Fluoride as an ingredient in toothpaste was not specified in the survey, but because almost all brands contain it, we can conclude that a fluoride toothpaste was indeed being used. It should be noted that the parents of the children targeted by QLSCD were exposed to different messages in publications designed for them, given the lag in updating the scientific information between editions. For example, previous editions of *Mieux vivre avec son enfant de la naissance à deux ans* (From Tiny Tot to Toddler) (Doré and Le Hénaff, 2001) advised using a fluoride toothpaste only after the age of 24 months. It is interesting to note that at 17 months, approximately 45% of children were using toothpaste, and that the

recommended quantity, namely a pea size amount or a thin ribbon, was almost always followed.

Regarding baby bottle use, dental associations recommend not letting a child fall asleep with a bottle containing anything other than water (CDA, 2002; ODQ, 2002). What is worrisome is that at the age of 29 months, one in four Québec children were using a baby bottle containing a sugary liquid during the falling asleep or sleep period. This practice is widely considered to be a risk factor associated with early childhood tooth decay. The literature reveals similar proportions in population studies in which 35% of children 1½ to 2½ years of age in England use a bottle at night, mainly containing milk (Hinds and Gregory, 1995). In the United States, Kaste and Gift (1995) have observed that 20% of children 6 to 60 months of age use a baby bottle in bed. The fact that 24% of Québec children are using the bottle inappropriately at the age of about 29 months, suggests that we will continue to observe this situation in the coming rounds of QLSCD. The data collected to date allow us to examine at least the characteristics of those children.

In terms of two birth characteristics of the child, birth order and prematurity, no difference in baby bottle practices (bottle containing a sugary liquid while falling asleep or when asleep) was observed. However, the mother's perception of the child having less optimal health was associated with this bottle practice. This characteristic has already been shown to be associated with early childhood caries (Milnes, 1996). Inappropriate use of the baby bottle at 29 months was also associated with the perception of a difficult temperament in the child when he/she was 17 months old. It is possible that taking care of this type of child is stressful and can lead to breastfeeding and baby bottle practices that can foster tooth decay. Other studies show that having a particularly difficult temperament seems to be a characteristic of young children with caries (Marino *et al.*, 1989; Weinstein *et al.*, 1992).

The data did not show any association between baby bottle practices and the mother's educational level, but children in families with income below the low-income cutoff had a higher frequency of being classified in the "At Risk" category, as reported by Kaste and Gift, 1995. It can therefore be surmised

that this practice is related to the stress and constraints engendered by low-income status. It can also be suggested that such bottle practices constitute a low-cost means for parents to ensure their child is well nourished.

No association was found between using a baby bottle filled with a sugary liquid while falling asleep or when asleep and the mother's age. However, there was an association between this baby bottle practice and the mother's immigrant status. Children whose mother was a non-European immigrant were more likely to use the bottle in this way. Given that immigrant status is often associated with income level, a similar interpretation can be given to the association with immigrant status. It can also be suggested that cultural factors influence feeding practices (Febres *et al.*, 1997). Indeed, some researchers have reported that Asian parents are more likely to give their children a bottle containing a sugary liquid for several years (Davies *et al.*, 2001). Given the diversity of suggested associations between socio-economic or sociocultural characteristics and early childhood caries found in the literature (NIH, 2001), there seems to be no definitive portrait of the parents of children afflicted tooth decay. This diversity is not surprising since each of these subcultures, based on income level or cultural practices, has its own set of beliefs, attitudes and values with regards to health and disease (Helman, 1990). Therefore, the culture that flows from these subcultures dictates diet norms, dress codes, etc. (Massé, 1995). It is possible that parental behaviours regarding their children's dental health, such as age of introducing toothbrushing and the use of a baby bottle containing a sugary liquid during the falling asleep or sleep periods, are also dictated by these norms.

It should be emphasized that young children with tooth decay are more likely to have sleep problems (Marino *et al.*, 1989). The fact that a child sleeps fewer hours has been shown to be associated with caries (Lopez Del Valle *et al.*, 1998; Shantinath *et al.*, 1996). The QLSCD 1998-2002 data show associations between the use of a baby bottle containing a sugary liquid during the falling asleep and sleep periods and the time taken to fall asleep, as well as not sleeping through the night. The results also show that 54% of children who were given something to drink or eat when they woke up at night were classified as users

of a bottle containing a sugary liquid during the falling asleep or sleep periods, compared to approximately 23% of those whose parents let them cry or comforted outside the bed, and 15% of those who did not awaken. The fact of breastfeeding or giving a bottle to stop the child crying at night instead of holding, rocking, speaking to, or distracting him/her has been demonstrated to be associated with caries (Lopez Del Valle *et al.*, 1998).

Breastfeeding was associated with the use of a baby bottle containing a sugary liquid while falling asleep or when asleep. This undoubtedly explains in part the association observed between the mother's immigrant status and baby bottle practices, since breastfeeding was also more prevalent in non-European immigrants. Also observed was an association between the daily consumption of at least two sugary snacks and the child having a bottle containing a sugary liquid while falling asleep or during sleep. This suggests a cumulative set of risk factors. It has already been demonstrated that mothers who have a greater tendency to giving a baby bottle at night are more likely to give their children foods containing high levels of sugars (Litt *et al.*, 1995).

Children whose mothers perceived themselves as having less impact or lower self-efficacy tended to use a baby bottle containing a sugary liquid during the falling asleep or sleep period. The fact that a mother perceives her behaviours as having little impact on her child's development has been associated with a higher score on the overprotection scale (Boivin *et al.*, 2000). This tendency to overprotect can lead to behaviours reflecting excessive concern for the safety and protection of the child. Giving a baby bottle containing a sugary liquid during the falling asleep or sleep period could therefore be a way to prevent night wakings or the child crying when separated from the mother, etc. Some researchers have suggested that early childhood tooth decay is a problem of lack of parental restraint in the way they care for their child and not one of negligence (Febres *et al.*, 1997). Litt *et al.* (1995) have shown that parents with a perception of low self-efficacy related to taking care of their children's teeth report higher sugar consumption among the latter.

The first three rounds of QLSCD suggest that by the age of 29 months, virtually all Québec children had

begun brushing their teeth. It was therefore opportune to conduct a multivariate analysis to investigate the influence of certain variables on the timeframe of introduction. The results show that among a child's characteristics, being second or later in birth order or not being born prematurely increased the risk of late introduction of toothbrushing. It can be suggested that the youngest in the family, though often benefiting from special attention, increases the burden of family tasks. Therefore it is plausible that certain practices are simply delayed. Studies on the link between birth order and early childhood caries have obtained varying results. In terms of premature births (< 37 weeks), it can be suggested that mothers are more concerned with the overall health of the baby than his/her dental health in particular.

We should also emphasize that once other characteristics were taken into account, children whose mother was 25 years of age or over were also at risk of starting toothbrushing later. The trend of late introduction was observed in children in low-income families and in those whose mother had less education. Therefore we can postulate that the constraints inherent in a low-income situation, often associated with a lower educational level, relegate behaviours like introducing toothbrushing to a later timeframe. Hinds and Gregory (1995) have observed a similar link between social class of the household and age of introducing toothbrushing.

When the mother perceived herself as having little impact on the development of her child at 5 months, toothbrushing might start later. While the first two determinants of achieving a task were tested, namely the perception of impact and feeling of self-efficacy (Bandura, 1989), it is interesting to see that the model retained only one of the two. At 5 months, a low level of positive interactions (praising, playing, speaking, laughing) between the mother and child also increased the risk of late introduction of toothbrushing.

In conclusion, the question arises whether it is productive in the context of public dental health intervention to administer a group of questions measuring parental behaviours instead of referring to obvious sociodemographic and cultural characteristics. The same can be said in terms of scales measuring characteristics of the parent/child relationship

(perception of impact or positive interactions). Indeed, perceptions and behaviours seem to be linked to the mother's age and educational level, to household income, and to other variables which are often used to identify target groups. However, knowledge of certain characteristics of the mother/child relationship, as shown in the results on the age of introducing toothbrushing, can certainly help strengthen the contents of interventions. Current interventions in public dental health are too often focused on recommendations for parents, and do not take into account the psychological and social dimensions underlying their behaviours. In this regard, the QLSCD data can help implement more effective and better targeted interventions.

Table A.1

Type of snacks consumed between meals or just before bedtime by children at approximately 29 months of age, Québec, 2000

Type of snacks

Dried fruits (ex. : raisins, dates, apricots, etc.)
Ice cream, sherbet, frozen yogurt, Popsicle
Fruit beverage, soft drink
Sugary cookies, cake/pastry, granola bars
Candies, jam, syrup, honey

Source: *Institut de la statistique du Québec, ÉLDEQ 1998-2002.*

Table A.2

Distribution of children of approximately 17 and 29 months of age by quantity of toothpaste used, Québec, 1999 and 2000

	17 months	29 months
	%	
In general, how much toothpaste is used when brushing the child's teeth?		
No toothpaste	40.1	8.8
A small amount, about the size of a small pea	37.2	71.6
A small amount, equivalent to a thin smear	5.7	12.3
More than the size of a small pea	0.9 **	5.1
The whole length of the brush	0.5 **	1.5 *
Teeth have never been brushed	15.6	0.8 **

* Coefficient of variation between 15% and 25%; interpret with caution.

** Coefficient of variation higher than 25%; imprecise estimate for descriptive purposes only.

Source: *Institut de la statistique du Québec, QLSCD 1998-2002.*

Table A.3

Rank tests for the association of age at introducing toothbrushing and certain characteristics of the child, mother, household, parent-child relationship and certain parental behaviours related to dental health, Québec, 1998, 1999 and 2000

Variables	Log-rank	Wilcoxon
	χ^2	
Child's Characteristics		
Sex	0.1251	0.0597
Female		
Male		
Birth Order	0.0009	0.0001
Firstborn		
Second or younger		
Born prematurely < 37 weeks	0.0954	0.0205
Yes		
No		
Low birthweight < 2,500 grams	0.2788	0.0575
Yes		
No		
Mother's Characteristics (5 months)		
Age group	0.0960	0.0175
Under 25 years of age		
25 years and over		
Educational Level	0.0082	0.0307
No high school diploma		
High school diploma, vocational/technical school diploma		
College diploma or university degree		
Immigrant status	0.0112	0.0046
Non-immigrant or European immigrant		
Non-European immigrant		
Working at the time of the survey	0.2955	0.2624
No		
Yes		
Worked during the preceding 12 months	0.1800	0.4366
No		
Yes		
Household Characteristics (5 months)		
Type of family	0.5000	0.4784
Two-parent		
Single-parent		
Sufficient income	0.0085	0.0484
Yes		
No		
Family functioning (PMK)	0.0191	0.0010
Scale of 0 to 10		
Characteristics of Parent/Child Relationship (5 months)		
Mother's perceptions and behaviours (PPBS)		
Scales of 0 to 10		
• Self-efficacy	0.0186	0.0013
• Perception of impact	0.0006	0.0001
• Tendency to overprotect	0.1982	0.0314
Perception of a difficult temperament by the mother	0.7390	0.4611
Scale of 0 to 10		
Positive parenting practices (PMK)	0.0001	0.0001
Positive interactions		
Scale of 0 to 10		

Continued on next page...

Variables	Log-rank	Wilcoxon
	χ^2	
Parenting Behaviours Related to Dental Health		
Baby bottle practices (17 months)	0.0984	0.1276
"At Risk"		
"Not at Risk"		
Given fluoride supplements alone or in combination with vitamins and/or minerals (29 months)	0.0950	0.0594
Yes		
No		
Feeding practices		
Breastfed (5 months)	0.6112	0.6909
Yes		
No		
Juice, sugary beverages, per day (17 months)	0.4961	0.3250
Less than 2 times a day		
At least 2 times a day		
Sugary snacks per day (29 months)	0.0576	0.0284
Less than 2 sugary snacks a day		
At least 2 sugary snacks a day		

Source: Institut de la statistique du Québec, QLSCD 1998-2002.

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Glossary

<i>Direction de la méthodologie et des enquêtes spéciales, ISQ</i>	Methodology and Special Surveys Division, ISQ
<i>Direction des normes et de l'information, ISQ</i>	Standards and Information Division, ISQ
<i>Direction Santé Québec, ISQ</i>	Health Québec Division, ISQ
<i>Institut de la statistique du Québec</i>	Québec Institute of Statistics
<i>ministère de la Famille et de l'Enfance</i>	Ministry of Family and Child Welfare
<i>ministère de la Santé et des Services sociaux du Québec (MSSS)</i>	Ministry of Health and Social Services of Québec
<i>Personne qui connaît le mieux l'enfant (PCM)</i>	Person Most Knowledgeable (PMK)

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At the half-way point in the Québec Longitudinal Study of Child Development 1998-2002 (QLSCD, 1998-2002), this paper paints a portrait of certain parental behaviours related to the dental health of their children at the ages of approximately 5, 17 and 29 months. According to age, these include baby bottle practices, using a pacifier dipped in a sugary substance, consumption of sugary snacks, toothbrushing and taking fluoride supplements.

Two of these behaviours are examined in more detail. The first, using a baby bottle containing a sugary liquid during the falling asleep or sleep period day or night, can foster the development of caries, while the second, toothbrushing, can protect the teeth when brushing with a fluoride dentifrice. A typology of baby bottle practices based on the contents and practices was developed. This typology was investigated for associations with various characteristics of the child at approximately 29 months, the family environment, parental behaviours regarding sleep and diet, and certain aspects of parent/child relations. The second behaviours examined was toothbrushing. A survival analysis identified variables associated with the age of introducing toothbrushing, and a Cox semiparametric model of regression identified factors associated with the early or late introduction of this habit in the child's life.



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