Caries experience in preschool children referred for specialist dental care in hospital

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Abstract
Background: Increasing numbers of preschool children are being referred for specialist dental management in a paediatric hospital. Most cases have severe early childhood caries and require comprehensive management under general anaesthesia. The present study investigated risk factors for disease presence at initial consultation.

Methods: A convenience sample of 125 children under four years of age from the north Brisbane region were examined and caries experience recorded using dmft and dmfs indices. A self-administered questionnaire obtained information regarding social, demographic, birth, neonatal, infant feeding and dental health behaviour variables. The data were analysed using the chi-square and one-way analysis of variance procedures.

Results: Ninety-four per cent of referred children had severe ECC with mean dmft of 10.5±3.8 and mean dmfs of 27.1±15.1. Prevalence of severe ECC was significantly higher in children allowed a sweetened liquid in the infant feeding bottle (99 per cent) and allowed to sip from an infant feeding bottle during the day (100 per cent). Mean dmfs was significantly higher in children allowed to sleep with a bottle (28.7) and sip from a bottle during the day (29.9), children from a non-Caucasian background (31.8), those children that commenced regular toothbrushing between 6 to 12 months of age (28.1), had no current parental supervision of daily toothbrushing (34.2) and had not taken daily fluoride supplements (27.8), vitamin supplements (27.8) or prescription medicine previously (27.6).

Conclusions: The behavioural determinants for severe early childhood caries presence in hospital-referred children were similar to those identified in the regional preschool population.

Key words: Early childhood caries, severe caries, social factors, behavioural factors, infant feeding.

INTRODUCTION
Severe dental caries in infants and preschool children, termed early childhood caries (ECC), has been recognized as an infectious and transmissible childhood disease with long-term growth and developmental implications.1-9 The prevalence of this disease is high in disadvantaged preschool children from lower socio-economic, immigrant and indigenous community groups within industrialized nations.10-15 Their parents often accept dental caries at an early age as inevitable and these children are often poorly nourished and suffer delayed growth and development compared with their healthy peers.16

In 1999, nearly 50 per cent of 5–6 year old children in Queensland experienced dental caries with 67 per cent of these children found to have untreated decay.17 Similarly, in north Brisbane, 34 per cent of 4–5 year old children had caries experience and 75 per cent of these had active disease.18 Multiple logistic regression analysis determined the key risk factors for ECC presence in this population were sleeping with a bottle, sipping from a bottle, ethnicity other than Caucasian and low annual family income.19 It is thought that most active decay remains untreated until children become eligible for public school dental services when they start preschool at four years of age. Children under four years that present to public community dental clinics are referred to the Children’s Oral Health Service (COHS), Royal Children’s Hospital, for specialist paediatric dental care. The severity of their dental disease often necessitates comprehensive management in a hospital day procedure unit under general anaesthesia.

Review of the most recent available Queensland Health admitted patient episodes of care for diagnostic related data group D40Z (dental extractions and restorations) shows there were 2083 public and private admissions of 1–4 year old children for the year

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Two paediatric dentists were instructed to perform dental examinations in the traditional manner with overhead lighting, mouth mirror and dental probe. Paediatric bitewing and panoramic dental radiographs were taken in the hospital outpatient dental clinic in cooperative children. All primary teeth were examined and caries experience from both clinical and radiographic examination was recorded to calculate a decayed, missing and filled tooth (dmft) and surface (dmfs) index for each participating child. It could be argued that the risk determinants of caries using the currently accepted case definition of asymptomatic dental caries, now termed early childhood caries (ECC), sample mean dmft and dmfs with standard deviation of the mean. The proposed case definition for severe ECC (S-ECC) is age dependent. Cases required the presence of one or more carious smooth surfaces in a primary maxillary anterior tooth or a dmfs score of four or more (at 36–47 months of age), five or more (at 48–59 months of age) and six or more (at 60–71 months of age). To avoid potential misclassification of S-ECC, the latter case definition for S-ECC was used in this study. The percentage of children with S-ECC was analysed using the chi-square procedure with regard to the variable of interest. The mean dmfs index for each group was then compared using the ANOVA procedure. The level of significance was p<0.05 for all statistical calculations.

RESULTS

Overall, the parents of 123 children consented to participate during the three-month study timeline. The consent rate was 84 per cent of children referred to the hospital dental clinic during this period for assessment and management of ECC. Seventy-five male and 48 female children with a mean age of 3.3±1.4 years (range 1.9 to 4.3 years) were examined. Five children had ECC and 118 had S-ECC. The sample mean dmft and dmfs was 9.4 and 26.1, respectively (Table 2).

Table 3 shows the association between previous infant feeding practice and ECC severity. Thirty-eight (95 per cent) children that were not breast-fed had S-ECC compared with 60 (97 per cent) children breast-fed up to 12 months and 20 (95 per cent) children breast-fed for longer than 12 months. All children that were not bottle-fed had S-ECC compared with 56 (97 per cent) bottle-fed to 18 months of age and 43 (94 per cent) bottle-fed beyond 18 months of age. Thirty-nine (91 per cent) children that were bottle-fed with unsweetened liquids had S-ECC compared with 67 (99 per cent) that were bottle-fed with sweetened liquids such as fruit juice, cordial and soft drink during infancy (p=0.05). Seventy-three (97 per cent) children that were put to sleep with a bottle had S-ECC.

Table 1. Potential determinants for early childhood caries evaluated in hospital-referred children

<table>
<thead>
<tr>
<th>Variables obtained from questionnaire</th>
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<tr>
<td>Infant feeding practice variables</td>
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<tr>
<td>1. History and duration of breast-feeding</td>
</tr>
<tr>
<td>2. History and duration of bottle-feeding</td>
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<td>3. Contents of bottle-feeding</td>
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<td>4. History of bottle-feeding to sleep at night</td>
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<td>5. History of bottle sipping during day</td>
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<td>6. Age of commencement of solids</td>
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<td>7. Age of commencement of cup drinking</td>
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<tr>
<td>Social variables</td>
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<tr>
<td>1. Gender</td>
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<tr>
<td>2. Ethnicity</td>
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<td>3. Language spoken at home</td>
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<td>4. Family status at birth</td>
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<tr>
<td>5. Maternal age at birth</td>
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<tr>
<td>Dental health variables</td>
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<tr>
<td>1. Age of commencement of tooth brushing</td>
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<tr>
<td>2. Current tooth brushing frequency</td>
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<tr>
<td>3. Adult supervision of tooth brushing</td>
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<tr>
<td>4. Current use of fluoride toothpaste</td>
</tr>
<tr>
<td>5. Dummy use with and without sweetener</td>
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<tr>
<td>6. History of fluoride supplements</td>
</tr>
<tr>
<td>7. History of vitamin supplements</td>
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<tr>
<td>Neonatal and infancy variables</td>
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<td>1. Gestation term</td>
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<tr>
<td>2. Birthweight</td>
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<tr>
<td>3. History of chronic medical illness</td>
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<td>4. History of prescription medication</td>
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2002–2003. Of these, 558 were admitted to the Royal Children’s Hospital, Brisbane day surgical unit. Ninety-six per cent of admission diagnoses were classified as asymptomatic dental caries, now termed early childhood caries using the currently accepted case definition criteria. It could be argued that the risk determinants for ECC in this particular group may differ from those factors identified in the sample of 4–5 year old children examined in the preschool environment previously.

The aim of this study was to report the ECC experience in children referred for specialist paediatric dental care at a tertiary paediatric hospital. Secondly, investigation of selected social and behavioural risk factors for ECC presence at consultation was undertaken.

METHODS

A study protocol was approved by the Research Ethics Committee of the Royal Children’s Hospital, Brisbane. COHS records indicated that approximately 700 preschool children are referred to the service annually for assessment and management of ECC from regional community dental clinics within south-east Queensland. A convenience sample of children referred to the COHS during the period May to July 2004 was recruited for the study.

Consent was obtained from the attending parent and a self-administered 34-point survey questionnaire was completed at the initial consultation. Confidential information was obtained regarding previous infant feeding practice, social, dental health, neonatal and infancy and general behavioural variables by a series of closed questions (Table 1). Validation of the survey instrument had been undertaken previously.
compared with 41 (93 per cent) children that were not put to sleep with a bottle. The mean dmfs index (28.7) for children put to sleep with a bottle was significantly higher (p=0.03) compared with children not put to sleep with a bottle (22.4). All children (73) allowed to sip from a feeding bottle ad lib during the day had S-ECC compared with 37 (93 per cent) of children that were not allowed to sip from the feeding bottle (p=0.02). Similarly, the mean dmfs index (29.9) for children allowed to sip from a bottle during the day was significantly greater (p=0.01) compared with those children that did not sip from a bottle (22.5). Forty-four (94 per cent) children that commenced solids before four months had S-ECC compared with 38 (97 per cent) that started solids between 4 to 6 months of age and all children (18) that started solids after seven months of age. Sixty-two (94 per cent) children that started cup drinking before 12 months had S-ECC compared with 47 (96 per cent) born to mothers with a maternal age 25 years or less had S-ECC compared with 47 (96 per cent) born to mothers 26 or more years of age.

Table 4 shows the association between social background and ECC severity. Seventy-two (96 per cent) male and 46 (96 per cent) female children had S-ECC. Sixty-two (94 per cent) Caucasian children had S-ECC compared with 40 (98 per cent) of non-Caucasian children. The mean dmfs index for non-Caucasian children (31.8) was significantly higher (p=0.002) compared with Caucasian children (22.4). All children (10) from non-English speaking backgrounds had S-ECC compared with 108 (96 per cent) of English speaking children. All children (35) from a single-parent family unit had S-ECC compared with 82 (94 per cent) of children from a two-parent family unit. Sixty-eight (96 per cent) children born to mothers with a maternal age 25 years or less had S-ECC compared with 47 (96 per cent) born to mothers 26 or more years of age.

The association between dental health behaviours and ECC severity is shown in Table 5. Twenty-four (92 per cent) children that started toothbrushing before six months had S-ECC compared with 46 (96 per cent) children that started between 6 and 12 months and all children (27) that started after 12 months of age. Children that started toothbrushing before six months had a significantly (p=0.03) lower dmfs index (18.6).
compared with those that started between 6 to 12 months (28.1) and later than 12 months (25.1). Forty-three children (98 per cent) that currently brushed their teeth once a day or less had S-ECC compared with 59 (95 per cent) that brushed twice or more a day. Eighty-six (95 per cent) children that brushed with parental supervision had S-ECC compared with all children (16) without parental supervision. The dmfs index for children that brushed with parental supervision was 23.7 compared to 34.2 for those with no supervision (p=0.009). Ninety-eight (95 per cent) children that took daily fluoride supplements had S-ECC compared with 6 (97 per cent) that did not take daily fluoride supplements. However, the dmfs index of children taking daily fluoride supplements was significantly lower compared with children that did not (16.2 vs. 27.8, p=0.01). Twenty-two (96 per cent) children that took daily vitamin supplements had S-ECC compared with 92 (97 per cent) that did not take daily vitamin supplements. Those children taking daily vitamin supplements had a significantly (p=0.05) lower dmfs index (20.7) compared with those that did not take daily vitamin supplements (27.8).

Table 6 shows the association between neonatal and infancy history and ECC severity. All pre-term infants (6) had S-ECC compared with 70 (96 per cent) full term and 12 (92 per cent) late-term infants. All low birth-weight infants (10) had S-ECC compared with 70 (95 per cent) normal birthweight and all high birth-weight infants (12). Seventeen (94 per cent) children with a history of previous medical illness had S-ECC compared with 96 (96 per cent) without a history of previous childhood illness. Eighteen (90 per cent) children that had taken prescription medicine had S-ECC compared with 99 (97 per cent) that had not taken prescription medicine previously. Children that had taken a prescription medicine had significantly (p=0.02) lower dmfs index (19.1) compared with those children that had not (27.6).

**DISCUSSION**

This study reports a high caries experience in preschool children referred to the Royal Children’s Hospital for specialist paediatric dental care. The most recently reported caries experience in 5–6 year old Queensland children is 49.8 per cent prevalence and mean dmft 2.25.17 In 4–5 year old preschool children from the north Brisbane region the prevalence of ECC is 33.7 per cent with a mean dmft of 1.4.18 The severity of disease experience in this sample (98 per cent caries, mean dmft 9.4) was not unexpected assuming only severe cases would normally be referred for specialist dental care in a tertiary paediatric hospital.

However, this study used the dmfs index to report caries data, which was commensurate with more...
recently published ECC epidemiological surveys and review articles on this subject.\(^\text{5,24-34}\) Whilst no disease index can expect to cover all clinical scenarios, the dmfs index is potentially a more sensitive measure of disease severity than dmft. Using the dmft index, a buccal pit lesion in a six-year-old would have the same weighting for disease severity as a broken down crown in a two-year-old. However, using the dmfs index, the two-year-old child would score five diseased tooth surfaces and thereby be classified as a severe ECC case whereas the six-year-old would only be considered an ECC case for statistical analysis. Furthermore, comparison of dmfs scores between various age groups allows for discriminant analysis of age-related risk factors for disease presence.

Statistical analysis of previous infant feeding practice of hospital-referred children demonstrated that sleeping or sipping from a feeding bottle were significant risk factors for S-ECC presence. These behaviours were also identified by logistic regression analysis as key risk determinants in the regional preschool child population along with adding sweetened liquids in the bottle, commencement of cup drinking after 24 months, commencement of solids after nine months, bottle-feeding beyond 12 months and breast-feeding beyond 24 months.\(^\text{27}\) However, these other behaviours were not significant in the hospital-referred sample. This unexpected finding was probably due to the small sample size and the high percentages of S-ECC cases in the sample preventing differential analysis. Interestingly, the practice of pacifying the infant with a bottle, either at night or during the day, is reportedly more prevalent in hospital-referred children compared with other regional children. This conclusion is supported by other recent studies using similar risk analysis methodology.\(^\text{28-34}\)

The finding that non-Caucasian preschool children are over represented in the referral case-load is consistent with the higher reported prevalence of ECC in Aboriginal, Torres Strait Islander, Asian and Pacific Islander ethnic groups within the Australian community.\(^\text{11,13,19,24,36,37}\) Non-Caucasians account for less than 10 per cent of the Australian urban population,\(^\text{11}\) yet children from an ethnic minority background have a much higher disease experience and treatment need. Ethnicity and socio-economic status are now considered the most significant social predictors of ECC experience as confirmed in many recent studies performed in multicultural Westernized communities.\(^\text{11,13,19,24,36,37}\)

Preventive dental health behaviours, such as earlier commencement of toothbrushing, current parental supervision of toothbrushing and daily fluoride supplementation, were shown to significantly reduce ECC experience in this study population. Other recent cross-sectional studies have demonstrated that earlier toothbrushing has a strong counter effect on poor infant feeding practice.\(^\text{30,34,38,39}\) Our study also confirmed the finding that parental supervision of current toothbrushing habits helps to reduce ECC severity in preschool children.\(^\text{31,39}\) Whilst drinking optimally fluoridated water\(^\text{30}\) and daily brushing with a fluoride toothpaste has been shown to reduce caries increment in a prospective trial,\(^\text{40}\) there are no published reports of the relationship between fluoride supplementation and ECC severity to date. Our study demonstrated that daily fluoride and vitamin supplementation, whilst confined to a small percentage of respondents, does significantly reduce the severity of ECC in this particular group.

Previously reported neonatal and infancy risk factors such as birth prematurity (<36 weeks gestation),\(^\text{41}\) low birthweight (<2500g),\(^\text{42}\) and history of previous childhood illness\(^\text{43,44}\) were not significantly associated with ECC severity in hospital-referred children. However, a history of prescribed medicine (most commonly antibiotic therapy) was associated with significantly less severe ECC in our study. This protective effect may be explained by the frequent use of antibiotic therapy to manage childhood illness, thereby reducing the level of active oral Mutans streptococci infection and predisposition for dental caries development.\(^\text{45,47}\)

A number of limitations need to be considered when interpreting the findings from this study. One hundred and eighteen of the sample of 123 had S-ECC, which limits the validity of statistical comparison with the remaining five ECC cases with regard to the variables of interest. Comparison of the study findings with previously published regional data, which reported a dmft index in 5–6 year old children, also has methodological limitations. However, in general terms, both studies show that inappropriate infant feeding practices, such as putting a child to sleep with a bottle and allowing a child to sip from a bottle during the day, continue to be significant risk factors for ECC presence (severe or otherwise) at examination. The use of the dmfs index in future studies may help to overcome the problem of a valid and reproducible estimation of disease severity experienced in this study.

**CONCLUSION**

The majority of preschool children referred to a tertiary paediatric hospital for assessment and management of dental caries have the severe form of early childhood caries. The disease experience in these children is up to seven times higher than preschool-aged children living in the same health region. Key behavioural determinants for caries severity are sleeping and sipping from a bottle during infancy. Oral health promotion programmes within the region should target non-Caucasian mothers and discourage the inappropriate use of a feeding bottle during infancy.

**REFERENCES**


