Influence of Maternal Dental Anxiety on the Child's Dental Caries Experience

In most developing countries, data on the prevalence and distribution of early childhood caries (ECC) and associated factors are scarce [Piovesan et al., 2010]. ECC risk factors can be broadly divided into those associated with lesion development (biological risk factors) and socioeconomic, cultural and ethnic backgrounds which promote the establishment of biological risk factors (social risk factors) [Petti, 2010]. Thus, although there are common ECC etiological pathways involving bacteria and diet, these can be modulated by the relative contribution of other factors [Seow et al., 2009].

It has been reported that parents' behaviors and attitudes towards oral health are associated with the child's dental health [Skeie et al., 2008; Wigen and Wang, 2010]. In adults, dental anxiety has proven to restrict prophylactic measures and is associated with impaired oral health status [Mehrstedt et al., 2004]; it is possible that children learn these less favorable behaviors from their parents [Tuuti and Lahti, 1987]. Tuuti and Lahti [1987] assessed the influence of maternal dental anxiety on the oral health status of 7- to 12-year-old children and found that children's DMFT correlated positively with their parents' dental anxiety. As parents bear the responsibility for their preschool children's oral health, anxiety may influence parental attitudes and habits regarding the child's oral health care.

Identification of children at risk based on parental characteristics would be less time- and resource-con-

Table 1. Number and percentage of preschool children with untreated caries experience, mean number of teeth evaluated and mean dmft, by age in Pelotas, Brazil (n = 608)

Age (months)	n	Erupted teeth (mean ± SD)	Untreated caries n (%)	dmft (mean ± SD)	dt (mean ± SD)	mt (mean ± SD)	ft (mean ± SD)
24–35	175	18.53 (1.87)	31 (17.71)	0.64 (1.65)	0.63 (1.65)	–	0.01 (0.11)
36–47	186	19.96 (0.31)	81 (43.55)	1.77 (3.00)	1.74 (2.94)	0.02 (0.21)	0.01 (0.10)
48–59	199	19.99 (0.71)	97 (48.74)	1.88 (2.69)	1.83 (2.68)	–	0.03 (0.32)
60–71	48	20.00 (0.00)	28 (58.33)	2.73 (3.98)	2.73 (3.98)	–	–
All	608	19.56 (1.21)	237 (38.98)	1.56 (2.74)	1.53 (2.71)	0.01 (0.11)	0.02 (0.20)

suming as compared with the clinical examination of these children. Nevertheless, the relation between parental characteristics and dental caries in preschool children is not fully understood [Wigen et al., 2009]. This study aimed to assess the influence of maternal dental anxiety-related behavior, including the mother's level of dental anxiety, on the child's dental caries experience.

Subjects and Methods

This study was carried out in Pelotas, Brazil in June 2009 with approval from the Ethics Committee of the Federal University of Pelotas and health authorities. Pelotas is located in southernmost Brazil and has about 350,000 inhabitants [IBGE, 2009]. A sample of 2- to 5-year-old children and their mothers was included. A two-stage stratified sample design was adopted to select sampling during the Children's National Immunization Campaign. Nine out of 25 health care centers (HCCs) were randomly selected by using a probability selection method, with probability proportional to HCC size. They were used as sampling points, as the city is divided into 7 administrative areas, each one having at least one HCC responsible for the vaccination of those living in that area, ensuring representativeness of the city. The estimated minimum sample size was calculated assuming the following parameters: dental anxiety occurrence was estimated at 50% with a 5% margin of error, 95% confidence level and a 1.2 design effect. To cover non-response, the sample was increased by 10% to 507 mother-child dyads.

After the children had been vaccinated, mothers were invited to participate in the survey in order of arrival at the HCC. Mothers' dental anxiety was measured by using the Brazilian version of Corah's Dental Anxiety Scale (DAS) [Hu et al., 2007]. Mothers' dental anxiety as classified as low (DAS scores up to 11), moderate (DAS scores from 12 to 14) and high (DAS scores 15 or more). Demographic characteristics and socioeconomic status were also collected (family monthly income, family structure, maternal schooling and dental service use) by a questionnaire answered prior to the child's examination. Twelve previously trained dental students performed the interviews with the mothers.

Children's dental examinations were performed by 12 previously calibrated dentists [Peres et al., 2001]. Kappa statistics was used to test inter- and intra-examiner reliability. World Health Organization [WHO, 1997] criteria were used for dental caries assessment, the main dependent variable of the study. Examination was performed at dental offices under artificial light with a dental mirror and a WHO periodontal probe. Mothers were informed of the oral health status of their children and those children who needed treatment were referred to Dentistry School. Children with neurological or systemic diseases were not included. To test the proposed methodology, a pilot study was carried out before data collection.

Data analysis was performed using the Stata 10.0 (Stata Corp., College Station, Tex., USA) software. Two outcomes were used in this study: untreated dental caries prevalence and mean caries experience (dmft). Multivariate Poisson regression analyses taking into account the cluster sample were performed. This strategy allowed estimating the prevalence ratio (PR) (95% CI) and the rate ratio (95% CI) to assess predictors for untreated caries prevalence and caries experience (dmft), respectively. Variables with p values ≤0.20 in unadjusted analyses were included in model-fitting using a backward stepwise procedure. Variables were considered significant if they had a p value ≤0.05 after adjustment.

Results

Inter-examiner kappa values ranged from 0.85 to 0.96 and intra-examiner kappa values ranged from 0.70 to 1. A total of 685 mothers were invited to participate in the survey, 92% of whom agreed to participate. Of the 630 mothers who answered the questionnaire, 3.5% (n = 22) were excluded because of children's refusal during clinical examination, totaling 608 mother-child dyads. The mean dmft was 1.56 (SD = 2.74). The decayed component accounted for most of the dmft index (table 1). Approximately 80% of the children had never visited a dentist before.

Table 2. Prevalence of untreated dental caries and associated factors in Pelotas, Brazil (n = 608 mother-child dyads)

Variables	Total[a]	With caries n (%)	PR crude (95% CI)	p	PR adjusted (95% CI)	p
Sex						
Male	301	133 (44.1)	1.00		1.00	
Female	307	104 (33.9)	0.77 (0.63–0.94)	0.01	0.78 (0.64–0.94)	0.01
Age, months						
24–35	175	31 (17.7)	1.00		1.00	
36–47	186	81 (43.5)	2.45 (1.77–3.52)	≤0.01	2.39 (1.68–3.42)	≤0.01
48–59	199	97 (48.7)	2.75 (1.94–3.90)	≤0.01	2.73 (1.92–3.87)	≤0.01
60–71	48	28 (58.3)	3.29 (2.21–4.91)	≤0.01	3.27 (2.20–4.88)	≤0.01
Monthly family income						
≥1.5 BMW	316	109 (34.5)	1.00		–	
<1.5 BMW	282	125 (44.3)	1.29 (1.05–1.57)	0.01	–	
Maternal schooling						
>8 years	261	85 (32.6)	1.00		–	
≤8 years	345	150 (43.5)	1.34 (1.08–1.65)	≤0.01	–	
Family structure						
Nuclear	435	167 (38.4)	1.00			
Non-nuclear	173	70 (40.5)	1.05 (0.85–1.30)	0.64		
Mother visits dentist						
Regularly	242	79 (32.6)	1.00		–	
Non-regularly	366	158 (43.2)	1.32 (1.06–1.64)	0.01	–	
Maternal anxiety						
Low	362	124 (34.2)	1.00		1.00	
Moderate	110	52 (47.3)	1.38 (1.08–1.76)	0.01	1.39 (1.10–1.75)	≤0.01
High	136	61 (44.9)	1.31 (1.04–1.66)	0.02	1.27 (1.02–1.59)	0.03

[a] The total was smaller than the effective sample (n = 608) due to missing information.
BMW = Brazilian minimum wage; – = variables not included in model after adjustment.

Untreated dental caries prevalence and associated factors are shown in table 2. In the unadjusted analysis, age, sex and family income, as well as maternal schooling, dental anxiety and use of dental services were associated with untreated caries occurrence. In the multiple regression analyses, the presence of maternal dental anxiety and the child's sex and age remained associated with the outcome. Children whose mothers presented a moderate (PR 1.39; 95% CI 1.10–1.75) or high (PR 1.27; 95% CI 1.02–1.59) level of dental anxiety were more likely to have untreated dental caries when compared to children from mothers with low dental anxiety.

Table 3 expresses the dental caries experience (dmft) and associated factors. Unadjusted analyses demonstrated that the variables associated with untreated caries prevalence were also associated with mean dmft. After adjustment, however, family income, age and sex remained associated with outcome.

Discussion

This study assessed family and maternal factors affecting the oral condition of preschool children, and provided some new information that adds to current knowledge concerning the influence of social risk factors on the oral health of preschoolers: presence of dental anxiety was associated with a higher prevalence of untreated dental caries, while family income influenced mean dmft. Besides, boys and older children showed a higher risk of presenting both untreated dental caries and higher dmft means.

In adults, the association between dental anxiety and deteriorated oral condition is well established [McGrath and Bedi, 2004; Mehrstedt et al., 2004]. Also, people from lower socioeconomic status are generally more fearful of dental treatment [Armfield et al., 2006]. Thus, one could argue that the effect of maternal dental anxiety on caries prevalence results from socioeconomic condition. How-

Table 3. Dental caries experience (dmft) and associated factors in Pelotas, Brazil (n = 608 mother-child dyads)

Variables	Total[a]	dmft (mean ± SD)	RR crude (95% CI)	p	RR adjusted (95% CI)	p
Sex						
Male	301	1.81 (2.90)	1.00		1.00	
Female	307	1.31 (2.55)	0.72 (0.54–0.96)	0.02	0.74 (0.56–0.97)	0.03
Age, months						
24–35	175	0.64 (1.65)	1.00		1.00	
36–47	186	1.77 (3.00)	2.75 (1.75–4.31)	≤0.01	2.85 (1.81–4.50)	≤0.01
48–59	199	1.88 (2.69)	2.91 (1.90–4.46)	≤0.01	2.82 (1.83–4.34)	≤0.01
60–71	48	2.73 (3.98)	4.23 (2.42–7.37)	≤0.01	4.07 (2.37–6.97)	≤0.01
Monthly family income						
≥1.5 BMW	316	1.08 (1.95)	1.00		1.00	
<1.5 BMW	282	2.11 (3.36)	1.95 (1.48–2.55)	≤0.01	1.94 (1.49–2.53)	≤0.01
Maternal schooling						
>8 years	261	1.12 (2.07)	1.00		–	
≤8 years	345	1.88 (3.12)	1.68 (1.27–2.24)	≤0.01	–	
Family structure						
Nuclear	435	1.46 (2.56)	1.00			
Non-nuclear	173	1.80 (3.13)	1.23 (0.91–1.67)	0.18		
Mother visits dentist						
Regularly	242	1.11 (2.18)	1.00		–	
Non-regularly	366	1.86 (3.02)	1.67 (1.24–2.25)	0.001	–	
Maternal anxiety						
Low	362	1.31 (2.51)	1.00	0.016	–	
Moderate	110	1.97 (3.01)	1.50 (1.06–2.12)	0.021	–	
High	136	1.88 (3.03)	1.43 (1.02–1.99)	0.038	–	

[a] The total was smaller than the effective sample (n = 608) due to missing information.
BMW = Brazilian minimum wage; – = variables not included in model after adjustment.

ever, the presence of dental anxiety at any level remained strongly associated with untreated dental caries presence in children in this study, even after confounder adjustment. As the effect was similar for moderate anxiety versus low anxiety to the one for high anxiety versus low anxiety, it can be concluded that scores higher than 11, on a scale that ranges from 0 to 20, are associated with untreated caries in children.

Maternal dental anxiety is likely to be associated with dental treatment avoidance, similarly to what occurs with adults [Eitner et al., 2006; Lee et al., 2008], so this situation could prevent children from receiving appropriate dental care. Thus, the presence of untreated dental caries in preschool children of dentally anxious mothers reflects their negative beliefs and attitudes towards dental care [Wigen et al., 2009]. In preschoolers, maternal dental anxiety might be correlated with the children's oral condition through their mothers' attitudes toward their children's oral health care [Tuuti and Lahti, 1987].

The relation between the mother's dental anxiety and dental attendance pattern and the child's dental health has shown conflicting results. Thomas and Startup [1992] found a correlation between the mothers' dental anxiety and untreated carious teeth of 5-year-olds. However, a study using multivariate analysis failed to find an association between caries in 5-year-old children and parental dental anxiety [Wigen et al., 2009]. In the latter study, the prevalence of anxiety was low, different from the present study, which may have contributed to the difference in results.

The results of this research showed that family income is associated with caries severity. Though an association with dental caries prevalence was not found, children from low-income families presented a higher mean number of affected teeth. These results are in agreement with those of a previous study that showed disease polarization in preschool children in Brazil according to different socioeconomic profiles [Piovesan et al., 2010]. It is assumed that socioeconomic conditions affect parents' oral health knowledge and attitudes, which in turn influence their children's oral health homecare and dental attendance [Gao et al., 2010].

Despite the limitation of , the current study could be useful to identify risk indicators that can be assessed in longitudinal studies. In this case, influence of maternal dental anxiety on the child's oral health should be further assessed. The association between predictors and outcomes was assessed by Poisson regression analysis. When using binary outcome, this analysis can estimate the PR and its respective CI. Poisson regression is also an adequate method to be used with count results truncated at low values, highly skewed in the positive direction [Gagnon et al., 2008]. Dmft values usually present these characteristics [Piovesan et al., 2010].

DAS is the most widely used instrument to assess dental anxiety, as it has satisfactory reliability and validity [Newton and Buck, 2000]. On the other hand, the sampling method employed might question external validity. To ensure variability, it would be appropriate to include a higher number of sampling points [Bennett et al., 1991]. However, the vaccination program has a wide coverage and the centers selected encompass nearly 60% of the children attending the vaccination program. Therefore, such a process provides a sound conclusion on the research issue for preschool children living in the city. In addition, the high response rate and the acceptable level of inter/intra-rate agreement increased the internal validity of the study.

Behavioral pathways, which can further our health disparity understanding, may have practical implications in health promotion and policy-making [Gao et al., 2010]. Children from dentally anxious parents are more likely to be anxious when compared with children from non-fearful parents [Milgrom et al., 1995]. Also, another study in this sample showed the influence of maternal dental anxiety on the perception of the child's oral health-related quality of life [Goettems et al., 2010]. The latter and the present studies also lead to more questions, as: How can oral health treatment be encouraged among parents who may themselves be fearful of the dentist?

A change in parental behavior may represent an important part of a caries-preventive strategy for children; the mother's own oral behavior is thought to be especially important [Okada et al., 2008]. Improving dental care access for low-income mothers, for example, would increase their children's dental care probability. According to Grembowski, mothers who have a regular source of dental care also have a higher dental care use for their children [Grembowski et al., 2009].

This study showed that age, sex and family income determined the mean dmft, while caries prevalence was influenced by age, sex and maternal dental anxiety level. These findings suggest that preventive strategies for the child's oral health should pay closer attention not only to the child's and his family's characteristics, but also to maternal dental anxiety-related behaviors.

Disclosure Statement

The authors declare that there are no conflicts of interest.

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