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Severe early childhood caries and behavioral risk indicators among young children in Ajman, United Arab Emirates

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Abstract

Objective: To estimate the prevalence of severe Early Childhood caries (s-ECC) in the primary dentition of young children in Ajman, UAE, and investigate its association with child and family characteristics, dietary habits, oral hygiene practices and dental services utilization.

Methods: A one-stage cluster sample was used to randomly select children aged five or six years old who were enrolled in public or private schools in Ajman, UAE. Clinical examinations for caries were conducted by a single examiner using WHO criteria. Parents completed questionnaires seeking information on child and family characteristics, dietary habits, oral hygiene, and dental service utilization. Bivariate and multivariate analyses were used to identify risk markers and risk indicators for s-ECC experience.

Results: The total number of children sampled was 1297. Dental examination and questionnaire data were obtained for 1036 (79.9%), of whom 50.0% were female. The overall prevalence of s-ECC was 31.1% (95% CI, 23.6, 38.9). The prevalence of s-ECC was higher among children of low-income families, those who had a high snack consumption level, and those who utilized dental services only when they had a problem.

Conclusions: The prevalence of s-ECC in young children in Ajman is high, and socioeconomic characteristics, dietary habits, and dental utilization are important determinants of their dental caries experience. There is an urgent need for oral health programs targeted at the treatment and underlying causes of dental caries in these children.

Introduction

Severe early childhood caries may have an impact on children's oral health status throughout life. Children who have caries in their primary teeth are more likely to develop dental caries in their permanent dentition [Horowitz, 2000]. Premature loss of primary teeth may predispose to malocclusion in the permanent dentition [Thomson et al., 2004]. The severe form of ECC may require treatment under general anesthesia. The cost of the treatment is high [Peressini et al., 2004].

Severe early childhood caries (s-ECC) is rampant caries affecting the primary dentition. Investigators have used a multitude of different definitions and diagnostic criteria in studying this disease; for example: one or more lesions (defined as decalcified lesions, decay, and fillings) in the maxillary incisors (all surfaces) [Lopez et al., 1998]; one or more carious labial or palatal surfaces of upper primary incisors using the WHO criteria (cavitation) [Wyne et al., 1995]; two or more decayed maxillary anterior teeth; defined as visible evidence of a cavity that was thought by the examiner to involve dentine [Harrison et al., 1997]. Severe Early Childhood Caries has not previously been studied in the United Arab Emirates.

The aim of the study was to estimate the prevalence of s-ECC in the primary dentition of young children in Ajman, UAE, and to investigate its association with child and family characteristics, dietary habits, oral hygiene practices and dental services utilization.

Method

Ethical approval for the study was obtained from both the Ministry of Health in UAE and the ethics committee of Otago University (New Zealand). There are a total of 22 urban and rural schools (kindergartens) in the Emirate of Ajman. A one-stage cluster sample was used, with the school (kindergarten) selected as the primary sampling unit. The main reason for selecting 5-6-year-olds was to compare their dental caries status with estimates from findings published previously (Al-Mughery *et al.*, 1991; Al-Hosani and Rugg-

Gunn, 1998; Naqvi *et al.*, 1999). In addition, studying the caries experience of older children can be problematic because of their being in the mixed dentition stage.

Half of those schools were selected randomly from updated lists obtained from the Ministry of Education, using a computer program for generation of random numbers. All of the students in each sampled school were selected. A questionnaire was used to elicit information on age, sex, level of parental educational attainment and parental income. Information was also collected on dietary habits, oral hygiene practices and their utilization of dental services. The questionnaire was sent to the parents, and written consent was obtained before each child was dentally examined. The questionnaire was pre-tested before use in the field, in order to examine the extent to which parents could easily understand its content. As the questionnaires appeared to be easily understood, no changes were made. No formal examination of the validity and reliability of questionnaires responses were undertaken.

Because 13 variables were used in this study to elicit information about the frequency of consumption of snacks and drinks containing sugar, the variables were combined in two ways. First, the items for chocolate, candies and jelly beans were combined to form a single variable for confectionery; those for sweet biscuits and sweet pastries were combined to form a variable called sweet baked goods; those for ice-cream and ice-muncher were combined to form a variable called frozen confectionery; and that for dates was retained. The variables for drinks were combined in a similar way. Second, a principal components analysis was undertaken using all 13 of those variables (excluding milk), as described in Hashim et al (2009). This enabled representation of the overall consumption of sugary snacks using a single variable, labeled “snack consumption”, which was a summated scale computed by adding the frequency scores for the 13 variables. This was then divided into three ordinal categories using half a standard deviation above and below the mean score as the cutpoints. Those categories were designated “low”, “moderate” and “high” snack consumption. The association between these variables and s-ECC was examined.

Dental examinations were carried out using a disposable mouth mirror. Children were examined at the school health clinic while sitting on an ordinary chair. Natural daylight was used for illumination, and no radiographs were taken. The World Health Organization criteria were used [WHO, 1997], and caries was diagnosed at the cavitation stage. In this study, the case definition for "severe Early Childhood Caries" (s-ECC) was one or more decayed, missing (due to caries) or filled smooth surfaces in the primary maxillary anterior teeth [AAPD, 2010-11].

The reliability of the dental examining process was assured by using (a) initial calibration with the research supervisor, and (b) assembling a replicate data-set by examining 97 participants (approximately ten percent). The examination and re-examination were separated by at least one day. In the calibration session (where ten children were examined), the intra-class correlation coefficient for dmfs scores was 1.00. In the replicate data-set, the intra-class correlation coefficient for dmfs was 0.99.

Because schools (rather than individuals) were the primary sampling unit, the data were analyzed using the "survey" commands in Stata (Stata version 9.0). The data from each school were weighted using post-hoc weights to account for the different response rates within each school. Statistical tests were used to determine whether the association between the dependent variable and the overall effect of the explanatory variable was statistically significant. $P<0.05$ was regarded as statistical significance. Results are presented for bivariate associations, or associations adjusted for background factors (age, sex, maternal education and family income). Logistic regression was used where severe Early Childhood Caries was the dependent variable. No adjustment was made for multiple testing.

Results

The total number of children approached to take part in this study was 1297 (from 11 schools). Dental examinations and questionnaires were completed for 1036 individuals, giving an overall participation rate of 79.9%. Severe Early Childhood Caries was

observed in 31.3% (95% CI 23.6, 38.9) of the children examined. Estimates of the association between the s-ECC and the background factors in the form of Odds Ratios (OR) and (95% CI) are shown in Table 1. There were socio-economic gradients apparent in caries prevalence, whereby children from the poorest households had higher prevalence of s-ECC than those from households with the highest incomes, and children of university-educated mothers had lower prevalence of s-ECC than children of mothers with only a primary-school education.

The association of dietary factors and the prevalence of s-ECC are presented in Table 2. Because only 755 of the parents answered all eight questions about snacks, the analysis was based on the responses of the 912 respondents who completed at least 6 of the questions and who also had complete data for maternal education and family income. While all the questions about specific drinks were completed by 823 parents, the analysis for drinks was based on the 920 respondents who completed at least five questions and had complete data for maternal education and family income. The only dietary variable associated with s-ECC was that related to snack consumption level and derived from the principal component analysis. The odds ratio for children who had a high level of snack consumption was 1.93 (1.38, 2.70), using children with low level of snack consumption as the reference category. The overall effect of this variable was statistically significant. The odds ratio was reduced to 1.84 (1.31, 2.57) after adjusting for background factors.

Data on the association of brushing habits with s-ECC prevalence are presented in Table 3. In the bivariate analysis, the odds ratio for those who brushed once per day was 0.64 (0.43, 0.93), using those who brush less than daily as the reference group. There were no significant associations between s-ECC prevalence and assistance with brushing or the skipping of brushing.

Data on the association of dental utilization with s-ECC prevalence are presented in Table 4. The odds ratio for children who had visited the dentist because of a problem was 1.81 (1.38, 2.37) higher than those who never visited the dentist in the previous year using the latter as reference group. Adjusting for background factors showed (Table 4)

that dental visiting was independently associated with s-ECC prevalence; the odds ratio for those visited a dentist because of a problem was 1.92 (1.49, 2.49), a higher rate than for those who had not visited the dentist in the previous year.

The multivariate model describing the association between child and family characteristics, snacking between meals per day, consumption level of snack, frequency of the child's brushing and s-ECC is shown in Table 5. The associations between s-ECC and monthly income were statistically significant; the odds ratio for children from low-income families was 1.43 (1.11, 1.85), using children from high-income families as the reference group. The odds ratio for children with a high level of snack consumption was 1.80 (1.26, 2.58), using children with a low level of snack consumption as the reference category.

Discussion

The majority of studies on dental caries in young children in the Middle East have considered only one factor or a relatively small number of factors [Al-Malik et al., 2001; Sayegh et al., 2005]. The present study investigated the associations between oral health (in terms of s-ECC) and a wide range of factors, such as child and family characteristics, dietary habits, oral hygiene practices and dental service utilization. It showed that the prevalence of s-ECC was higher among children of low-income families, those who had a high snack consumption level, and those who utilized dental services only when they had a problem.

Before discussing the findings, it is appropriate to examine the weaknesses and strengths of the study. A cross-sectional design was employed and putative risk factors were recorded at the same time as the disease outcome under study. It is not possible, therefore, to infer a direct cause-and-effect association between putative risk factors and concurrent dental status in this study. Conducting a longitudinal study would have provided stronger evidence on the temporal relationship between these factors and severe

early childhood caries. A potential criticism of the study is that we included 6-year-olds in our identification of cases of s-ECC, notwithstanding the AAPD's strict criteria for the condition which specifically mention only children aged up to 5 years old. We chose to do this because of the nature of the disease in question: dental caries is a cumulative, progressive condition; its manifestation in the deciduous anterior teeth of 6-year-olds is as likely (as that seen in 5-year-olds) to have arisen as a result of early childhood caries. Arbitrarily classifying children who are one year older as not having the condition is to miss an important opportunity to further understand its occurrence and aetiology, and so we chose to include 6-year-olds in our analyses. The strengths of the study include the representative sample, a participation rate which is satisfactory by modern standards [Locker, 2000], and the size of the sample.

The 31.3% prevalence of s-ECC observed in the current study is much higher than that seen in children of an equivalent age in the UK and Australia [O'Brien, 1994; Plutzer and Spencer, 2008] but similar to that seen in at least two recent studies from the Middle East [Al-Malik et al., 2001; Sayegh et al., 2005]. In Jeddah (Saudi Arabia), the prevalence of s-ECC was around 34% [Al-Malik et al., 2001] while, in Amman (Jordan), the prevalence of s-ECC was 31% [Sayegh et al., 2005]. This may indicate common determinants of disease in countries with similar cultures.

The findings of this study showed a clear association between maternal education and s-ECC, with children of primary-educated mothers having higher s-ECC prevalence than those of university-educated mothers. This finding demonstrates the importance of social factors in the development of caries in children, and is consistent with findings from numerous other investigations in Arab countries, such as in Jordan [Hamdan and Rock, 1993; Sayegh et al., 2002; Rajab and Hamdan, 2002], Saudi Arabia [Al-Malik et al., 2001; Al-Mohammadi et al., 1997] and in other countries [Postma et al., 2008; Traebert et al., 2009]. The universality of the social gradient indicates the overriding influence of the social environment on health [Watt, 2007]. Our finding showed that children of low-income families had higher s-ECC experience than children of high-income families. Some of this difference might be attributed to the fact that children of low-income

families tended to brush their teeth less frequently than the children of high-income families. Many studies have shown that have ECC or s-ECC are more prevalent among children from low-income families [Rajab and Hamdan, 2002; Ismail et al., 2008].

Snacking between meals appears to be a common practice among Arab children, reflecting the high accessibility of these foods. A study of Saudi children aged four to six years old found that a high percentage (88.2%) regularly consumed sweet snacks [Wyne and Khan, 1995]. In line with this finding, Sayegh and co- researcher [Sayegh et al., 2002] reported that confectionery was eaten regularly by 76% of Jordanian 4-5-year-olds. Data from surveys carried out in Arab countries have shown a change in the dietary patterns of mothers and children, with a trend (following that seen elsewhere) towards the consumption of foods rich in fat, cholesterol, salt and sugar [Musaiger, 1996]. These changes are likely to have had an effect on oral health. In the UAE, for example, traditional dietary habits and practices have continued, but food and drinks typical of westernized diets are now cheap and readily available, particularly in major cities. The impact of this relatively sudden transition from the traditional way of feeding and preparing children's meals to a new style of living and eating might be another reason for ECC development in young children in the Emirates. To date, few studies have reported on the cariogenicity of human breast milk. Osman and El-Sabban (1999) studied infant feeding practices in Al-Ain (UAE), and showed that breast-feeding was practiced by less than a third of all (375) mothers, and usually discontinued after 12 months.

In the current study, children who had visited the dentist during the last year for a problem had higher prevalence of severe Early Childhood Caries than those who never visited the dentist. It is clear that these children had attended due to pain or symptoms, rather than because of any greater dental awareness of their parents. Considering the small number of restorations observed (data not presented), it appears reasonable to suggest that most instances of dental treatment that took place were tooth extractions as a result of symptomatic dental visits. The high level of untreated decay observed in the survey offers further support for this interpretation. The same observation has been noted by Wong and co-researcher [Wong et al., 2001] among 5-6-year-olds in China. Parents

may have been unaware of the need for treatment, or perhaps felt that the child was too young to attend a dental clinic, and he/she was not taken to the dental clinic until pain was experienced.

Regular asymptomatic dental visits have a cumulative effect and may also act to prevent development of dental anxiety. In this way, children learn to associate positive or neutral effects with asymptomatic dental visiting. For clinical prevention to work in practice, regular attendance by children is necessary; dentists should be adequately remunerated for undertaking this time-consuming work. Preventive interventions (such as the topical application of fluoride) are advocated for children with active caries [Fayle et al., 2001] and such non-invasive approaches should do much to build confidence in anxious children and their parents.

In the current study, the prevalence of s-ECC was higher among children from low-income families, those who had a high snack consumption level, and those who utilized dental services only when they had a problem. It is important to note that the UAE is a country with a diverse mix of nationalities, religions, languages, and origins. Caries among preschool children is determined by a complex interplay of social, familial, community, government, and work policies, and work is needed to promote changes at all of these levels. Health-promoting approaches recognize that health is linked to social and economic conditions outside the control of the individual. Oral health promotion aims to increase people's control over their own health and includes actions to tackle the social, political and environmental determinants of oral health are needed.

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Tables

Table 1 Prevalence of severe Early Childhood Caries and odds ratio (95% CI), by child and family characteristics.

	N (%)	Prevalence	Unadjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
Age						
5 years	495 (50.5)	30.1	1.00	0.444	1.00	0.895
6 years	486 (49.5)	32.1	1.11 (0.80, 1.55)		1.02 (0.76, 1.36)	
Sex						
Male	488 (49.7)	33.0	1.00	0.286	1.00	0.344
Female	493 (50.3)	29.7	0.89 (0.69, 1.16)		0.88 (0.67, 1.16)	
Mother's education						
University	253 (25.8)	27.8	1.00	0.062	1.00	0.154
High school	467 (47.6)	29.2	1.05 (0.64, 1.72)		1.00 (0.63, 1.60)	
Primary school	261 (26.6)	38.2	1.60 (0.97, 2.66)		1.43 (0.85, 2.42)	
Monthly income						
> Dhs 7000	384 (39.1)	25.9	1.00	0.020	1.00	0.058
Dhs 3001-7000	329 (33.5)	32.9	1.45 (1.05, 2.01)		1.35 (1.03, 1.87)	
Dhs 1000-3000	268 (27.4)	36.5	1.73 (1.25, 2.39)		1.53 (1.08, 2.27)	

Table 2 Prevalence of severe Early Childhood Caries and odds ratio (95% CI), by dietary factors.

	N (%)	Prevalence	Unadjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
Frequency of eating/day						
1-2 times	148 (15.3)	35.8	1.00	0.211	1.00	0.226
3-4 times	632 (65.2)	29.0	0.73 (0.44, 1.19)		0.75 (0.44, 1.26)	
5+ times	190 (19.5)	35.9	1.00 (0.59, 1.68)		1.01 (0.59, 1.77)	
Snacks between meals/day						
Once	369 (37.8)	28.4	1.00	0.139	1.00	0.168
Twice	389 (39.9)	33.1	1.20 (0.92, 1.56)		1.14 (0.86, 1.51)	
Three or more	217 (22.3)	32.3	1.25 (0.97, 1.60)		1.24 (0.99, 1.59)	
Eat/drink before bedtime						
No	569 (58.0)	30.5	1.00	0.636	1.00	0.176
Yes	412 (42.0)	32.2	1.09 (0.75, 1.55)		1.04 (0.73, 1.49)	
Frequency of drinking/day						
1-2 times	621 (63.4)	30.0	1.00	0.709	1.00	0.849
3-4 times	260 (26.6)	30.2	1.00 (0.71, 1.31)		0.95 (0.69, 1.31)	
5+ times	98 (10.0)	36.4	1.28 (0.65, 2.51)		1.15 (0.59, 2.21)	
Snack consumption level						
Low	297 (33.7)	25.7	1.00	0.002	1.00	0.003
Moderate	363 (41.2)	29.4	1.20 (0.81,1.77)		1.18 (0.78, 1.77)	
High	221 (25.1)	40.2	1.93 (1.38, 2.70)		1.84 (1.31, 2.57)	

Table 3 Prevalence of severe Early Childhood Caries and odds ratio (95% CI), by children's brushing characteristics.

	N (%)	Prevalence	Unadjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
Frequency of child's brushing						
Less than daily	265 (27.0)	38.4	1.00	0.068	1.00	0.091
Once	308 (31.4)	28.4	0.64 (0.43, 0.93)		0.64 (0.43, 0.95)	
Twice or more	407 (41.6)	28.7	0.65 (0.44, 0.94)		0.61 (0.47, 0.98)	
Who helps with brushing?						
No-one	354 (36.4)	30.5	1.00	0.081	1.00	0.221
Mother	559 (57.5)	29.8	0.96 (0.71, 1.31)		1.05 (0.81, 1.41)	
Others	60 (6.1)	43.7	1.77 (0.92, 3.38)		1.76 (0.89, 3.46)	
Does child skip brushing?						
Never	402 (41.2)	32.0	1.00	0.061	1.00	0.098
Occasionally	266 (27.2)	27.1	0.78 (0.65, 0.94)		0.81 (0.67, 0.98)	
> once/month	309 (31.6)	33.2	1.05 (0.77, 1.42)		1.09 (0.84, 1.43)	

Table 4 Prevalence of severe Early Childhood Caries and odds ratio (95% CI), by reason for dental visiting.

	N (%)	Prevalence	Unadjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
Dental visit in previous year						
Never	660 (67.5)	28.6	1.00	0.003	1.00	0.001
Check-up	68 (6.9)	15.8	0.47 (0.24, 0.90)		0.48 (0.24, 0.94)	
Problem	250 (25.6)	42.1	1.81 (1.38, 2.37)		1.92 (1.49, 2.49)	

Table 5 Multivariate model, odds ratio (95%CI) for the association between s-ECC and other variables.

		s-ECC	
	N (%)	**Adjusted odds ratio (95% CI)**	**P**
Age			
5 years	445 (50.9)	1.00	0.943
6 years	429 (49.1)	1.01 (0.71, 1.42)	
Sex			
Male	431 (49.3)	1.00	0.553
Female	443 (50.7)	0.92 (0.68, 1.23)	
Mother's education			
University	224 (25.6)	1.00	0.301
High school	419 (47.9)	0.97 (0.61, 1.52)	
Primary school	231 (26.5)	1.21 (0.79, 1.85)	
Monthly income			
> Dhs 7000	341 (39.0)	1.00	0.040
Dhs 3001-7000	297 (34.0)	1.34 (0.98, 1.86)	
Dhs 1000-3000	236 (27.0)	1.43 (1.11, 1.85)	
Snacks between			
Once	331 (37.8)	1.00	0.837
Twice	353 (40.4)	1.07 (0.81, 1.42)	
Three or more	190 (21.8)	1.03 (0.73, 1.45)	
Snack consumption			
Low	294 (33.6)	1.00	0.004
Moderate	362 (41.4)	1.19 (0.78, 1.80)	
High	218 (25.0)	1.80 (1.26, 2.58)	
Frequency of child's brushing			
Less than daily	237 (27.1)	1.00	0.275
Once	277 (31.7)	0.73 (0.50, 1.07)	
Twice or more	360 (41.2)	0.78 (0.51, 1.18)	