Dental caries experience and use of dental services among pre-school children in Ajman (UAE).

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SUMMARY

Objective: To estimate the prevalence and severity of dental caries in the primary dentition of young children in Ajman, UAE, and investigate its association with socio-demographic characteristics and use of dental services.

Methods: A cluster sampling approach was used to randomly select children aged 5 or 6 years old who were enrolled in public or private schools. Clinical examinations for caries were conducted by a single examiner using WHO criteria. Parents completed questionnaires seeking information on socioeconomic background and dental service utilization. Zero-inflated negative binomial (ZINB) regression modeling was used to identify risk markers and risk indicators for caries 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 prevalence of dental caries in 5- and 6-year-old children was 72.5% and 79.7% respectively ($P<0.01$), with mean dmfs scores of 9.2 (sd, 12.6) and 11.4 (sd, 13.3) respectively ($P<0.01$). Multivariate (ZINB) analysis indicated that children from low-income families had lower odds of being an extra zero. Males had higher average dmfs scores, as did children of mothers with lower levels of education, and Emirati children (compared to Arab/other children). Children whose last dental visit was for a check-up had considerably lower mean dmfs scores.

Conclusions: Dental caries prevalence and severity in young children in Ajman are high, and socioeconomic characteristics 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

The United Arab Emirates (UAE) lies on the eastern side of Arabia. It is bordered by the Arabian Gulf, the Gulf of Oman and Sultanate of Oman, Qatar and Saudi Arabia. The 1995 population of the UAE was estimated officially at 2.378 million residents [1]. The Emirati population represents some 25-30% of this number; with the remainder being expatriates who are living in the UAE for variable lengths of time. Children between 0 and 14 years (33.9%) and women in the childbearing age group of 15-45 years (20.6%) represent 54.5% of the total population, which emphasizes the importance of maternal and child health services. In general, dental services are spread throughout the UAE. The dental care system is well-developed and comprehensive, and has a predominantly curative emphasis. About half a million people sought dental care in 1995 [2]. There is one dentist for every 13,000 persons (on average). Local dentists have qualified abroad, as there was no dental school in the Emirates until very recently. A private dental school has recently been established by the University of Ajman. The total number of dentists registered with the Ministry of Health in the Emirate of Ajman is 10 (nine general practitioners and one prosthodontist). There is only one dental center available in Ajman.

The Emirate of Ajman was selected for this study because there was no information available on the oral health of preschool children. Only three studies of child oral health had previously been conducted in the Emirates: Al-Mughery *et al.* [3] reported from the Emirate of Abu Dhabi; Al-Hosani and Rugg-Gunn [4] reported from Abu Dhabi, Al-Ain

and the Western Region; and Naqvi *et al.* [5] focused on the Al-Ain region only. Those three studies all reported caries estimates which were relatively high by international standards. The objectives of the present study were to determine the prevalence and severity of dental caries among pre-school children in Ajman Emirate, and to investigate the association of disease with sociodemographic characteristics and dental service utilization.

METHODS

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 complex sampling scheme was used, with the school (kindergarten) selected as the primary sampling unit. 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 ethnicity, level of parental educational attainment and parental income. Information was also collected on dietary habits, children's exposure to fluoride, and their utilization of dental services. In addition to items capturing sociodemographicdata, another 18 sought information on the children’s diet, oral hygiene, oral self-care, and the use of dental services. For the child’s dietary habits, information was sought on usual eating frequency, and on the number of times the 8 most common UAE children’s snack foods were consumed. The oral hygiene information collected included the frequency of

brushing, the type of toothpaste used, and whether the child was helped with brushing. Fluoride use was also assessed (*e.g.* "has your child ever taken fluoride tablets or drops?"), as well as whether the child had received any fluoride from other sources. Parents were asked about child dental service use (*e.g.*, "has your child visited the dentist during the past 12 months?"). The questionnaires were pre-tested before use in the field, in order to examine the extent to which parents could easily understand their content.

At the field data collection stage, the questionnaire was sent to the parents, and written consent was obtained before each child was dentally 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. Children with food remnants on their teeth were asked to rinse with water before their examination. The WHO criteria [6] were used, and caries was diagnosed at the cavitation stage.

To determine the reliability of dental caries examination, the recorder was asked to arrange for one in ten children to be re-examined. This was done without the examiner's knowledge and the examination and re-examination were separated by at least one day. Re-examination of approximately 10% of the children resulted in 97 children being seen twice by the examiner. Test-retest reliability for dmfs was very high, with an intraclass correlation coefficient (ICC) of 0.99 (indicating an error variance of 1%). In addition, the main researcher and the supervisor both examined ten children; the ICC for dmfs was 1.00. The ICC was calculated using the reliability analysis command in SPSS.

At the analysis stage, each child was categorized into one of three groups according to maternal education. These were: 'low' (not able to read or write and had attended primary school only) 'middle' (had attended high school level) and 'high' (had obtained a university or college education). Children were also categorized according to monthly household income, using the three groups of low (less than 3000 Dirhams); Dhs 3.6 = US $1, middle (3001-7000 Dirhams) and high (more than 7000 Dirhams).

The information from the questionnaires and caries forms was coded and entered into a spreadsheet for analysis using SPSS (Statistical Package for the Social Sciences - Version 11.0 for Windows) and Stata (Intercooled Stata 8.0; Stata Corporation, College Station TX, USA). The level of statistical significance was set at $P < 0.05$. Because taking the complex sampling scheme [7] into account by using the "survey" procedures in Stata (and using the school as the strata variable) made no difference to the estimates, the decision was made to treat the sample as a simple random sample. Data analysis was undertaken, first, to determine dental caries prevalence (represented by the percentage of children who had one or more decayed, filled or missed surface) and severity (represented by the mean dmfs), and second, to investigate possible risk markers and indicators for caries prevalence and severity. After computing descriptive statistics, bivariate analyses used Chi-square tests (for caries prevalence) and Mann-Whitney U or Kruskal-Wallis H tests where appropriate (for caries severity). P values of less than 0.05 were considered to be statistically significant. Zero-inflated negative binomial (ZINB) regression was used to model dmfs and control for potential confounding factors. This approach was used because, unlike ordinary linear regression, the negative binomial model provides a

superior “fit” to the dmfs distribution, and it is more informative because it allows the simultaneous modeling of both the prevalence and severity of caries [8]. Variables which had shown statistically significant bivariate associations with dental caries experience were entered into the ZINB model (in Stata) for dmfs.

RESULTS

The total number of children sampled was 1297, of whom 1036 completed both the dental examination and the questionnaire by their parents, giving a participation rate of 79.9%. There were 518 males (50.0%) and 518 females (50.0%); 524 (50.6%) were 5-year-olds, and 512 (49.4%) were 6-year-olds. There were 248 (23.9%) 5-year-old and 270 (26.1%) 6-year-old males, and 276 (26.6%) 5-year-old and 242 (23.3%) 6-year-old females. Data on the distribution of participants by age, sex, parental education, monthly income and nationality are presented by age and sex in Table 1. A statistically significant association was found between maternal education and child's age, with a higher percentage of the 6-year-old children in this study having mothers with a high education level. A higher percentage of the 5-year-old children (44.8%) came from high income families.

The mean dmft was 4.4 (sd, 4.3; range 0 to 20). Data on the severity of dental caries are presented in Table 2. Overall, the average dmfs score (10.2; sd 13.0; range 0 to 85) was dominated by the decayed component, with the ds contributing 91% of the total score. Caries severity was greater among males and children of less educated mothers. Children in high-income families had the least dental caries. Emirati (local) children had higher

caries severity than the others. Children from higher-income families had a greater *fs* score, on average, while the mean number of decayed surfaces was greater among children from lower-income households and those whose mothers had had less education.

Data on the use of dental services by age, sex, maternal education, monthly income and nationality are presented in Table 3. More 6-year-old children than 5-year-olds, more children of highly educated mothers and more Arab children had visited in the previous year. More of the 6-year-olds had had to visit the dentist because of a problem. There were no significant differences by the other sociodemographic characteristics.

The ZINB model for caries prevalence is presented in Table 4. Children from low-income families had substantially lower probability of being an extra zero (that is, caries-free). Males had higher dmfs scores on average, as did children of mothers with lower levels of education, and Emirati children. Children from high-income families or those whose last dental visit was for a check-up had considerably lower dmfs scores, on average. The latter were also more likely to be an extra zero (although this just fell short of statistical significance).

DISCUSSION

This cross-sectional study has investigated the influence of socio-demographic factors on the dental caries experience of pre-school children in order to provide information which would be useful in planning for a dental preventive program. The main reason for selecting 5-year-olds was to enable comparison of UAE children dental caries status with findings previously published [3,4,5]. Although questionnaires are an accepted way of obtaining information in dental epidemiology, they had not been used widely in UAE, and never before in the Emirate of Ajman. The questions were designed in English and then translated by a linguist into Arabic and back into English again ("back translation") for checking to ensure that the meaning of the questions stayed the same. The questionnaire used in this study was based on other published questionnaires previously used for the same purpose [9,10]; it is assumed that parental responses were accurate and honestly written by parents might be questioned, as their validity and reliability were not examined; however, every effort was made to gain truthful answers. The parents were asked to respond to the best of their knowledge and were told beforehand that there was no right or wrong answer; they just had to give honest answers.

In this study, over three-quarters of the children had experienced caries. This estimate is very close to that of Al-Mughery *et al.* [3] who reported that 72% of Abu Dhabi children had experienced caries. Estimates by Al-Hossani and Rugg-Gunn [4] were higher, as they reported that 94%, 90% and 82% of Abu Dhabi, Al-Ain and Western Region children (respectively) had experienced caries, while Naqvi *et al.* [5] reported 79% among a similar

age group in Al-Ain. Comparison with recent findings from studies in countries neighboring UAE suggests that caries levels may be similar [11,12]. This estimate is considerably higher than the World Health Organization [13] target for the year 2000 for 5-year-olds (50% caries-free). In the current study, the mean dmft was 4.4, which is only slightly less than the 5.1 dmft in 5 year olds reported approximately 12 years previously [3], but somewhat lower than the 8.4, 8.6 and 5.7 dmft observed in Abu Dhabi, Al-Ain and the western region respectively among 5-year-old children [4]. Naqvi *et al.* [5] reported that 4- to 5-year-old Al-Ain children had a mean dmft of 5.8. The overall estimate of 7.1 dmft reported by Al-Hosani and Rugg-Gunn [4] is identical to the 7.1 dmft reported for 5-year-olds in Riyadh, Saudi Arabia [14]. It is worth noting that all these studies utilized the WHO system for diagnosing and recording dental caries. These Arab world estimates are much higher than those reported from eight European countries, which range from 0.8 dmft in Sweden to 3.1 dmft in Scotland [15]. It appears that, by international standards, caries prevalence is high among young Arab children.

Not surprisingly, caries experience in the current study was greater among the older children, suggesting that caries activity continues in these 5- to 6-year-old children. This is consistent with other studies conducted in various countries [16,17], and reflects the cumulative nature of caries. The observed gender difference in caries severity was in line with the findings of Al-Khateeb *et al.* [18], Al-Hosani and Rugg-Gunn [4], Maciel *et al.* [19], all of which found that, on average, girls had cleaner teeth and lower caries experience in the primary dentition. This could be related to the traditional practice of over-indulging sons in the Arabic culture, exploration of this phenomenon using non-

quantitative approaches is worthwhile. Further support comes from a study in Jeddah, Saudi Arabia, which showed that males had slightly higher dental caries scores than females [20]. A number of studies [21,22], however, have offered mixed findings in the presence of other non-biological exposure factors.

There was no existing classification of 'social class' or 'socio-economic status' in the Emirate. Thus, arbitrary classifications of children by parental education and income were made. Notwithstanding this problem, this study showed a clear relationship between maternal education and caries occurrence, with children of highly educated mothers (and high-income families) having lower levels of caries. This finding is consistent with those from numerous other investigations in industrialized countries [23,24]. In Jordan [25] and in Saudi Arabia, the same relationship between social class and caries has now been well documented [12,26].

The nationality of children was also investigated as a risk marker for caries experience. On average, non-local children had lower caries scores than the local (indigenous) children, after controlling for factors such as education and family income might be responsible. Ethnic differences in caries experience have also been reported from a wide range of settings [27,28]. The majority of the non-local children included in this study were from different Arab countries and possibly different cultural backgrounds. Clarification of this point in order to compare the influence of social factors and dietary practices among foreign workers and indigenous Emiratis would be interesting and useful. However, it is beyond the scope of this study.

In many developing countries, access to oral health services is limited, and teeth are often left untreated or are extracted because of pain or discomfort. Control of oral disease depends on many factors, one of which is the availability and accessibility of oral health care. However, the reduction of disease is only possible if services are oriented towards primary health care and prevention [29]. In the current study, children who had received dental care had greater caries experience, on average. It is probable that these children had attended due to pain or symptoms rather than to any greater dental awareness of their parents. The same observation has been reported by Wong *et al.* [30] among 5- to 6-year-old children in China. Parents may have been unaware of the need of treatment or perhaps felt that the child was too young to attend a dental clinic and was not taken to the dental clinic until pain was experienced. It has been shown that the oral habits of families are formative, since parents are role models for their children [31]. Therefore, if parents do not, or can not, attend for their own dental care, then this is likely to be the pattern for these children in the future [32].

Several studies have shown that children with caries in the primary dentition are more likely to develop caries in their permanent teeth [33,34]. Thus, it seems reasonable to presume that the most important target groups for instituting preventive dental care are infants and toddlers (and their families). The high caries prevalence and severity in young children in the Emirate of Ajman (and surrounding countries) is of great concern; the current study's mean of 9.2 dmfs at the age of 5 years is among the highest recorded in the literature. In addition, the level of disease appears to have increased in recent years [5].

Public health efforts are needed to reduce this high level of dental caries and improve the dental health of Ajmani children. While the current study's findings offer many challenges for UAE dental policy planners and health promoters, they may be useful as a platform on which to raise the profile of child oral health. It is very important to convey the message that caries in preschoolers is a health problem that warrants the attention and resources of the community.

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Table 1. Age and sex by parents' education, monthly income and nationality (percentage in brackets).

	Age		Sex	
	5 years	**6 years**	**Male**	**Female**
Father's education				
Primary school	104 (21.0)	119 (24.7)	109 (22.4)	114 (23.3)
High school	212 (42.8)	208 (43.2)	204 (42.0)	216 (44.1)
University	179 (36.2)	154 (32.0)	173 (35.6)	160 (32.7)
Mother's education				
Primary school	157 (31.3)	106 (22.2)[a]	124 (25.6)	139 (28.1)
High school	244 (48.7)	241 (50.4)	235 (48.5)	250 (50.6)
University	100 (20.0)	131 (27.4)	126 (26.0)	105 (21.3)
Monthly income				
Dhs 1000-3000	108 (21.5)	165 (33.4)[a]	136 (27.3)	137 (27.5)
Dhs 3001-7000	169 (33.7)	167 (33.8)	164 (32.9)	172 (34.5)
More than Dhs 7000	225 (44.8)	162 (32.8)	198 (39.8)	189 (38.0)
Nationality				
Emirati	367 (70.8)	334 (66.3)	360 (69.8)	341 (67.4)
Arab	110 (21.2)	114 (22.6)	102 (19.8)	122 (24.1)
Other	41 (7.9)	56 (11.1)	54 (10.5)	43 (8.5)

[a]$P<0.01$

Table 2. Mean dmfs, ds, ms and fs by age, sex, mother's education, monthly income and nationality (*sd*. in brackets)

	dmfs	ds	ms	fs
All children	10.2(13.0)	9.3 (12.1)	0.5(2.4)	0.4 (1.4)
Age				
5 years	9.2 (12.6)[a]	8.3 (11.6)[a]	0.4 (2.5)	0.4 (1.3)
6 years	11.3 (13.3)	10.3 (12.6)	0.5 (2.3)	0.5 (1.5)
Sex				
Male	11.3 (13.6)[b]	10.2 (12.7)	0.6 (2.6)	0.5 (1.5)
Female	9.3 (12.3)	8.4 (11.4)	0.4 (2.2)	0.4 (1.2)
Mother's education				
Primary school	13.2 (14.3)[a]	12.4 (13.6)[a]	0.5 (2.6)	0.3 (1.2)
High school	9.6 (12.3)	8.5 (11.2)	0.6 (2.6)	0.4 (1.3)
University	8.5 (12.3)	7.5 (11.7)	0.4 (1.9)	0.6 (1.8)
Monthly income				
Dhs 1000-3000	12.7 (13.9)[a]	11.8 (13.0)[a]	0.6 (2.3)	0.3 (1.3)[b]
Dhs 3001-7000	10.6 (14.3)	9.8 (13.6)	0.4 (1.9)	0.4 (1.3)
> Dhs 7000	8.3 (10.8)	7.2 (9.7)	0.5 (2.7)	0.6 (1.5)
Nationality				
Emirati	10.8 (13.3)[b]	9.9 (12.5)[b]	0.5 (2.5)	0.4 (1.4)
Arab	8.7 (11.8)	7.6 (10.9)	0.5 (2.2)	0.5 (1.6)
Other	9.6 (13.3)	8.9 (12.4)	0.5 (2.0)	0.2 (0.6)

[a]P<0.01
[b]P<0.05

Table 3. Dental utilization by age, sex, mother's education, monthly income and nationality (percentage in brackets).

	Visiting the dentist in previous year	Problem was the reason for dental visit
All children	332 (32.0)	260 (25.1)
Age		
5 years	163 (31.2)	109 (66.9)[a]
6 years	190 (37.4)	151 (79.5)
Sex		
Male	179 (34.8)	132 (73.7)
Female	174 (33.7)	128 (73.6)
Mother's education		
Primary school	77 (28.8)	51 (66.2)
High school	166 (34.3)	127 (76.5)
University	109 (41.4)	81 (74.3)
Monthly income		
Dhs 1000-3000	92 (33.9)	67 (72.8)
Dhs 3001-7000	113 (33.7)	85 (75.2)
> Dhs 7000	135 (34.9)	99 (73.3)
Nationality		
Emirati	223 (31.9)	166 (74.4)
Arab	96 (43.2)	70 (72.9)
Other	28 (28.9)	19 (67.9)

[a]P<0.05
[b]P<0.01

Table 4. Outcome of Zero-Inflated Negative Binomial modeling for dmfs.(brackets contain 95% confidence intervals)

	Logit	**P value**	**Probability of being an extra zero**	**Negative binomial**	**P value**	**Adjusted DMFS**
Intercept	-1.235 (-1.752, -0.718)	0.00	0.23	2.285 (2.086, 2.484)	0.00	9.83
Male	0.136 (-0.270. 0.542)	0.51	0.25	0.201 (0.055, 0.347)	0.01	12.01
Low maternal education	-0.195 (-0.721, 0.330)	0.47	0.19	0.227 (0.054, 0.400)	0.01	12.33
High maternal education	0.092 (-0.393, 0.577)	0.71	0.24	0.014 (-0.178, 0.207)	0.88	9.97
Low income family	-0.888 (-1.534, -0.242)	0.00	0.11	0.088 (-0.098, 0.274)	0.35	10.73
High income family	0.179 (-0.293, 0.651)	0.46	0.26	-0.262 (-0.442, -0.081)	0.00	7.60
Emirati nationality	-0.459 (-0.960, 0.043)	0.07	0.16	0.207 (0.024, 0.389)	0.03	12.09
Last visit was for check-up	0.609 (-0.007, 1.225)	0.05	0.35	-0.342 (-0.619, -0.065)	0.02	6.98

ZINB used to model dmfs and control for potential confounding factors