

Dental caries status of preschool children in Hong Kong

C. H. Chu,¹ D. S. H. Fung,² and E. C. M. Lo,³

Objective To describe the dental caries status of preschool children in Hong Kong and factors which affect their caries status.

Design 658 preschool children aged 4 to 6 years from six randomly selected kindergartens in Hong Kong were surveyed in December 1997. A questionnaire to investigate possible explanatory variables for caries status was completed by their parents. Dental caries was diagnosed according to the criteria recommended by the World Health Organization (1997).

Result Caries experience as measured by the mean number of decayed, missing and filled primary teeth (dmft) of the 4-, 5-, and 6-year-old children were found to be 0.9, 1.8, and 3.3 respectively. Overall, 61% of the children had a zero dmft score. Children born in Mainland China had a higher mean dmft score (4.6) than those born in Hong Kong (1.4). Statistically significant correlations were found between the children's dental caries status and their oral health practices as well as their socio-economic background. Parents' education level, dental knowledge and attitudes were also associated with the children's dental caries experience.

Conclusion In general, the caries status of Hong Kong Chinese preschool children was similar to that of children in industrialised countries and was better than that of children in the nearby areas. However, special dental programmes should be made available to children from lower socio-economic classes and new immigrants from Mainland China because they are the high risk groups for caries in Hong Kong.

Hong Kong is a metropolis located on the southern coast of China with a population of around 6.8 million. The drinking water in Hong Kong has been fluoridated since 1961 and the present concentration is 0.5 ppm. Most toothpastes available in Hong Kong are fluoridated from 1,000 to 1,500 ppm. Children's toothpastes have a fluoride concentration of 600 ppm. Mouthrinse with 0.05% sodium fluoride is available over the counter but is not popular among children. The Hong Kong Government established the School Dental Care Service in 1979 which aims at the promotion of oral health in primary school children through oral health education, prevention and curative dental treatment. Although preschool children attending kindergartens are not included in this service, an organised Preschool Oral Health Education Program has been provided by the government since 1993.

Results from oral epidemiological studies showed that the prevalence and severity of dental caries in primary school children in Hong Kong had reduced after the introduction of water fluoridation.^{1,2} Findings from a recent survey of primary school children

showed that the mean DMFT score of 12-year-olds in Hong Kong was 0.95, and 48% of them were caries free.³ However, few oral health surveys have been conducted on preschool children aged 6 years or below in Hong Kong. The first of such surveys was conducted by the World Health Organisation (WHO) in 1968.⁴ The mean dmft score of 5- to 6-year-old children was found to be 5.3. The second survey was conducted in 1991 by Wei *et al.*,⁵ and they found that the mean dmft score of 5-year-old Chinese children was 3.2. However, results of another survey conducted in 1992 by the government showed a mean dmft score of 1.8 in the 5-year-olds.⁶

In the few years just before the change of sovereignty of Hong Kong from UK to China in 1997 and also afterwards, many immigrants from Mainland China moved to Hong Kong. The current quota for immigrants from Mainland China set by the Hong Kong government is 150 persons per day, ie about 55,000 a year. A large proportion of these new immigrants are children. In addition, there has been a sharp increase in the number of marriages between Hong Kong citizens and Mainland China residents in the recent years. It is estimated that more than 60,000 children of these inter-territorial marriages live in Mainland China, and they are eligible to migrate to Hong Kong. Conceivably, the population structure in Hong Kong is changing rapidly.

A recent study conducted in the Guangdong Province,⁷ China, which is next to Hong Kong, showed that the caries experience of preschool children was very high, the mean dmfs score of 5-year-olds was 14.8. This might be related to the fact that there was no water fluoridation and the availability of fluoride supplement and fluoride toothpaste was low. It is very likely that child immigrants from China have poorer oral health status and higher prevalence of caries than that of the local Hong Kong children. Thus, update information from preschool children is required for a better understanding of the current situation and for planning community caries prevention programmes.

The present study had the following objectives:

- To describe the prevalence and severity of dental caries among Chinese preschool children in Hong Kong
- To describe the association between dental caries experience of preschool children and their place of birth, socio-economic background and oral health practices
- To correlate parental dental knowledge and attitudes with the caries status of their preschool children.

Materials and methods

In Hong Kong, children start school at age of 6 years and kindergartens provide either a 2-year or a 3-year preschool programme. Stratified random sampling was employed to select six kindergartens from a list of 731 registered kindergartens according to the proportion of kindergartens in Hong Kong's three main geographic areas, namely Hong Kong Island, Kowloon and the New Territories. All children attending the last two years of preschool programme in the selected kindergartens, mostly 4- or 5-years-old, were invited to participate in this study.

¹Part-time Lecturer, Faculty of Dentistry, The University of Hong Kong, China,

²Dental Officer, Department of Health, Hong Kong, China, ³Associate Professor, Faculty of Dentistry, The University of Hong Kong, China

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The study was carried out in December 1997. A letter was sent to the children's parents informing them of the study and to ask for their consent. The parents were also asked to complete a questionnaire specially designed for this study. The questionnaire consisted of four parts and the following information were to be collected:

- 1 The children's personal data — sex, age, place of birth and years of residence in Hong Kong
- 2 The children's socio-economic background — parents' education level and household income
- 3 Oral health practices of the children — frequency of toothbrushing, use of fluoridated toothpaste, brushing with or without adult assistance, and their dental visit pattern, and
- 4 Parent's dental knowledge and attitude. To assess the parents' dental knowledge, twenty-one multiple choice questions on the cause and prevention of dental diseases were asked. One point was given to each correct answer; and no point was given to a wrong answer or a 'don't know' answer. Thus, the dental knowledge score could range from 0 to 21. The parents were then categorised into three groups according to their dental knowledge scores — poor (scored 0–7), moderate (scored 8–14) and good (scored 15–21). Parents' attitude to dental care was assessed by asking what they would do if their child had toothache — bring the child to see a dentist, give pain-killer to the child, give herbal medicine, or other actions.

All six selected kindergartens agreed to participate in this study. A visit was paid to each kindergarten before the survey to deliver the questionnaires and to discuss the protocol with the kindergarten teachers. The teachers were responsible for the distribution and collection of the questionnaires. An oral health education session was given to the preschool children prior to the survey. The clinical examinations were carried out by three examiners using a portable intra-oral fibre-optic light, a front surface dental mirror and a WHO CPI probe. Cotton wool rolls and gauze were used for moisture control and removal of plaque on the tooth surfaces when necessary. Diagnosis of dental caries was made according to the criteria recommended by the WHO⁸ which was mainly made visually and were confirmed with a probe when necessary. Calibration exercises

were carried out on patients of a dental hospital prior to the survey in order to reduce discrepancies in caries diagnosis between examiners. Duplicate examinations were systematically carried out on one out for every ten children during the survey. The Kappa statistic was used to assess the inter-examiner reproducibility. Data analysis was performed using the software SPSS/Win7.5. *T*-test and one-way ANOVA were used to assess the statistical significance of the differences in caries status found between groups. A multivariate analysis, analysis of covariance (ANCOVA), was used to investigate the effects of the variables studied. The level of statistical significance for all tests was set at $P < 0.05$.

Results

A total of 663 children were invited to participate in this study and five parents did not give their consent. Therefore, only 658 children were examined and the response rate was 99.2%. The inter-examiner reliability in caries diagnosis among the three examiners as measured by Kappa statistics was excellent (Kappa = 0.95, 0.97, and 0.98 for pairwise assessment). The examiners were also 'blind' to the questionnaire record. The distribution of caries experience of the survey children is shown in Figure 1. The overall mean dmft score of the surveyed children was 1.6. With respect to the pattern of dental caries, the upper anterior teeth had the highest caries experience (dmft = 0.6) whereas the lower anterior teeth had the lowest (dmft = 0.1). The lower posterior teeth had a slightly higher caries experience (dmft = 0.5) than the upper posterior teeth (dmft = 0.4). Sixty-one per cent of the children were caries free and the mean dmft score of the affected children was 4.1. More than 90% of the dmft score was contributed by decayed teeth (dt), 8% was caused by filled teeth (ft) and only 1% were extracted teeth because of caries (mt).

Boys and girls had the same mean dmft score (Table 1). The mean dmft scores of age groups 4, 5 and 6 years were 0.9, 1.8 and 3.3 respectively ($P < 0.001$). There was also a decrease in the proportion of caries free children with an increase in age, from 71% in the 4-year-olds to 48% in the 6-year-olds. The dental caries experience of children born in Mainland China was three times that of children born in Hong Kong or in other countries (dmft 4.6 vs 1.4,

Table 1 Dental caries experience of preschool children according to their demographic background and oral health practices

Independent variables	Group	N (%)	Mean dmft (SD)	Significance
<i>Demographic background</i>				
Gender	Female	295 (45%)	1.6 (2.9)	Not significant
	Male	363 (55%)	1.6 (2.9)	
Age in years	4	240 (36%)	0.9 (2.0)	$P < 0.001$
	5	367 (56%)	1.8 (3.1)	
	6	51 (8%)	3.3 (4.2)	
Place of birth	Hong Kong	579 (90%)	1.4 (2.7)	$P < 0.001$
	Mainland China	39 (6%)	4.6 (4.2)	
	Others	26 (4%)	1.4 (2.8)	
<i>Oral Health Practice</i>				
Toothbrushing	Twice daily	278 (43%)	1.1 (2.3)	$P < 0.01$
	Once daily	284 (44%)	1.8 (3.1)	
	Never/Sometimes	87 (13%)	1.8 (3.0)	
Dental visit pattern	Regular	41 (6%)	0.7 (1.5)	$P < 0.001$
	Irregular	97 (15%)	3.6 (4.2)	
	Never	503 (79%)	1.2 (2.3)	
Assistance in brushing	Yes	362 (56%)	1.3 (2.6)	Not significant
	No	281 (44%)	1.7 (3.0)	
Use of other cleaning aids	Yes	89 (14%)	1.6 (2.7)	Not significant
	No	545 (86%)	1.5 (2.8)	

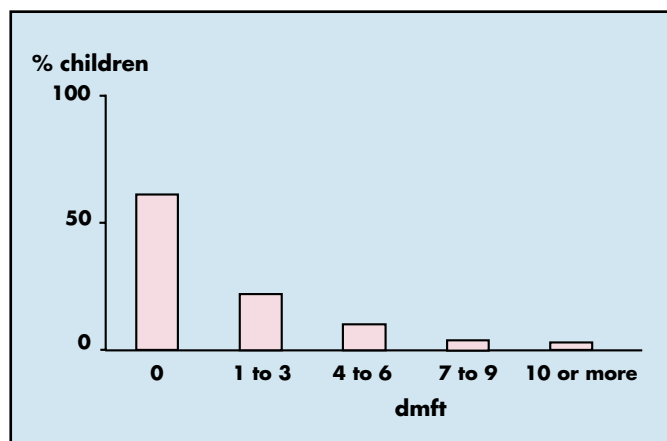


Fig. 1 Percentage distribution of preschool children in Hong Kong according to their dmft score

$P < 0.001$). Within the China-born group, no association was found between the dmft scores and the number of years they lived in Hong Kong.

It was found that the children's dental caries experience was related to some of their oral health practices. Children who brushed their teeth twice a day had a lower mean dmft score than those who brushed only once a day or less often ($P < 0.01$). Children who had made regular dental visits also had experienced less dental caries than those who had never visited a dentist before, while children who had visited dentists irregularly had the highest mean dmft score ($P < 0.001$). No statistically significant differences were found between the children's dmft scores and whether their parents help them in tooth brushing and their use of other oral hygiene aids.

The dental caries situation of the surveyed children was found to be related to their socio-economic background and their parents' dental knowledge and attitudes (Table 2). There is a clear trend of decrease in the children's dmft scores as their family's household income increases, from 2.7 in children coming from the poorest families to 0.9 in children coming from the wealthiest families ($P < 0.01$). Children whose parents had attained a higher education level also had lower dmft scores. Moreover, it was found that children whose parents had better dental knowledge had a lower caries experience.

Those children whose parents would bring them to see a dentist if they had a toothache had a lower mean dmft score than those children whose parents chose to give them painkillers or Chinese herbal medicine. These differences were statistically significant ($P < 0.005$).

Result of the multivariate analysis (ANCOVA) was shown in Table 3. Five variables remained in the final model. They were birth place, total family income, oral hygiene practice (brushing frequency), parental dental attitude (response to child's toothache) and dental visit pattern.

Discussion

A random stratified cluster sampling technique was employed in this study and a very high response rate of 99% was obtained. Although the sample size was only modest, the surveyed children should be rather representative of the preschool children in Hong Kong. Dental caries was diagnosed at the cavitation level mainly through visual inspection as recommended by the WHO.⁸ This ensures a high level of agreement between examiners but might have underestimated the number of carious teeth in the population. The questionnaire contained closed end questions which required less than 5 minutes to complete. It has been pilot tested to ensure that parents of the participants could understand the questions asked.

Most of the decayed teeth of the immigrant children, both boys and girls, were untreated. This was similar to the finding of a recent survey conducted in UK.⁹ The mean dmft score of the preschool children surveyed in this study was similar to that of UK preschool children (1.3).⁹ However, this is lower than the findings of recent surveys conducted in the more affluent parts of China such as Guangdong⁷ and Beijing,¹⁰ and in other Asian developing countries such as Thailand¹¹ and Malaysia.¹² The lower caries level among Hong Kong children is probably related to water fluoridation and the availability of different fluoride agents like fluoride toothpaste in Hong Kong. The possible reasons for the relatively high dmft found in Beijing and Thailand has been reported.^{10,11} In Beijing, reticulated water supply was not fluoridated and the accessibility to preventive and treatment services was limited. For Thai children, it was suggested that the rampant caries resulted from peri-natal malnutrition. When compared with the preschool children of western industrialised countries,¹³⁻¹⁶ Hong Kong children has similar caries experience.

In the present study, caries experience of the preschool children increased with age. This age related trend was reported in studies in

Table 2 Dental caries experience of preschool children according to their household income, parents' education level, dental knowledge and attitudes

Independent variables	Group	N (%)	Mean dmft (SD)	Significance
Monthly household income (\$HK)	< 10,000	108 (18%)	2.7 (3.7)	$P < 0.001$
	10,000-15,000	126 (21%)	1.7 (3.0)	
	15,001-20,000	75 (12%)	1.7 (2.5)	
	20,001-25,000	56 (9%)	1.2 (2.9)	
	> 25,000	248 (40%)	0.9 (2.1)	
Father's education level	Primary or below	87 (15%)	2.1 (3.1)	$P < 0.005$
	Secondary	332 (57%)	1.6 (2.8)	
	Post-secondary	166 (28%)	1.0 (2.4)	
Mother's education level	Primary or below	110 (19%)	2.1 (3.0)	$P < 0.005$
	Secondary	366 (63%)	1.4 (2.8)	
	Post-secondary	107 (18%)	0.8 (2.0)	
Parents' dental knowledge	Poor	181 (27%)	2.2 (3.5)	$P < 0.005$
	Moderate	290 (44%)	1.5 (2.8)	
	Good	187 (29%)	1.0 (2.1)	
Response to child's toothache	Visit a dentist	543 (86%)	1.3 (2.5)	$P < 0.005$
	Give pain-killer	22 (3%)	2.6 (3.3)	
	Give herbal medicine	36 (6%)	2.7 (2.8)	
	Others	29 (5%)	2.3 (4.7)	

Table 3 Relationship between caries experience of preschool children and independent variables studied (result of ANCOVA analysis)

Independent variables	Beta	SE(Beta)	P-value
<i>Birth place</i>			
Hong Kong	0.03	0.52	<0.001
China	2.12	0.68	
Others*			
<i>Response to children's toothache</i>			
Visit a dentist	-1.37	0.47	0.001
Give pain-killer	0.11	0.73	
Give herbal medicine	-0.57	0.63	
Other*			
<i>Dental visit pattern</i>			
Never	-2.86	0.29	<0.001
Regular	-2.54	0.47	
Irregular*			
<i>Tooth brushing</i>			
Never/sometimes	0.80	0.32	<0.005
Once daily	0.68	0.22	
Twice daily*			
<i>Monthly household income (HK\$)</i>			
< 10,000	1.37	0.32	0.001
10,000 – 15,000	0.53	0.28	
15,001 – 20,000	0.79	0.33	
20,001 – 25,000	0.56	0.37	
> 25,001*			

F-value = 13.64 ; df = 13, 562 ; P > 0.001 ; R² = 0.240

* Reference category

many countries¹⁷⁻¹⁹ including a recent survey of preschool children in UK.⁹ It could be explained by a number of factors which include the time span since eruption of primary teeth and the change of dietary habits as the children grow older. Prevention and simple treatment should be undertaken at an early age when intervention is most cost-effective.²⁰ A dental programme for providing preventive care and early interceptive treatment to preschool children in Hong Kong needs to be developed.

The finding that the children's caries status was related to their socio-economic background is in agreement with many overseas studies,^{12,21,22} previous surveys in Hong Kong^{5,23} and also the latest survey in UK.⁹ Our study result also supports a previous study in Sweden²⁴ which showed that toothbrushing frequency of preschool children was related to their caries status. Similar to the findings of other studies,²⁵⁻²⁶ parental dental knowledge and attitude was found to be related to the dental caries experience of preschool children. Parents with a positive dental attitude and better dental knowledge will probably build up better oral health habits in their children and look after the children's oral health. Thus, it is of great importance to involve the parents in dental health promotion programmes for preschool children.

The finding that immigrant preschool children had a higher caries level than that of the local population has been reported in many studies.²⁷⁻²⁹ The present finding that children born in Mainland China had a worse caries status than children born in Hong Kong is worth special attention. This is probably caused by the low availability of fluorides in China and that most of these children are from the lower socio-economic classes, and their parents have poor dental knowledge and attitudes. They are a high-risk group for caries and special dental programmes should be organised for them to promote their oral health. This is a pressing problem for the Hong Kong government and the dental profession as many child immigrants are moving into Hong Kong every day and it is estimated that more than 60,000 children living in Mainland China are eligible to migrate to Hong Kong.

Conclusion

In general, the caries status of Hong Kong Chinese preschool children was similar to that of children in industrialised countries and was better than that of children in the nearby areas. However, special dental programmes should be made available to children from lower socio-economic classes and new immigrants from Mainland China because they are the high risk groups for caries in Hong Kong.

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