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# Parental Oral Health Literacy of children with severe early childhood caries in Hong Kong

## ABSTRACT

**Aim** To assess the parental oral health literacy of children with severe early childhood caries.

**Methods** A total of 315 children diagnosed with severe early childhood caries, and their parents were recruited to participate in the study. A clinical examination was conducted to assess the children's oral health status. Their parents were asked to complete a Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry (HKOHLAT-P) questionnaire.

**Results** There were 311 complete responses (98.7% response rate). The mean age of children was 4.7 years (standard deviation (SD) = 0.8). The mean decayed, missing filled teeth (dmft) score was 10.2 (SD = 4.5). Most of the children had unfilled dental caries (98.7%). About 72.7% of the parents had an education level of up to secondary school. More than half (61.7%) had a monthly family income of below HKD 20,000. Parents with a lower education level and income had a significantly lower HKOHLAT-P score ( $p < 0.001$ ). Multiple regression analyses showed that a higher family income ( $p < 0.05$ ) and education level ( $p < 0.05$ ) predicted higher HKOHLAT-P scores.

**Conclusion** The parental oral health literacy of children with severe early childhood caries was associated with their socio-economic background. Oral health education should be targeted towards the lower socio-economic groups.

**Keywords** Oral health literacy; Dental caries.

## Introduction

Oral health literacy (OHL), which is a subset of health literacy, is defined as 'the degree to which individuals have the capacity to obtain, process, and understand basic oral and craniofacial health information and services needed to make appropriate health decisions' [United States Department of Health and Human Services, 2000]. There has been a growing interest and research in OHL in recent years, as OHL is closely linked with oral health and prevention. Health literacy influences health knowledge, attitudes and practices, as well as the utilisation of health services. This in turn will have an impact on health outcomes and health costs in society [Sorensen et al., 2012]. OHL has been shown to be related to oral health status, where a higher OHL results in a better oral health status [Blizniuk et al., 2015].

Dental caries in children is the most common childhood disease and affects a large proportion of children. According to the American Academy of Pediatric Dentistry definition, early childhood caries (ECC) is the presence of 1 or more decayed, missing or filled tooth surfaces (dmfs) in any primary tooth in a child younger than 6 years old. Severe early childhood caries (S-ECC) occurs when: a child less than 3 years old has any sign of smooth surface caries; a child between 3-5 years old has 1 or more cavitated, missing or filled smooth surfaces in primary maxillary anterior teeth; a child has a dmfs score of  $\geq 4$  (at age 3),  $\geq 5$  (at age 4) or  $\geq 6$  (at age 5) [American Academy of Pediatric Dentistry, 2014]. The prevalence of children with ECC ranges from 23% in the United States [Dye et al., 2015], 48.7% in Australia [Australian Institute of Health and Welfare, 2011], to 49% in the United Kingdom [Health and Social Care Information Centre, 2015]. In Hong Kong, the prevalence of children with ECC is 49% [Chu et al., 2012]. It was found that 26.3% of 5-year-olds were experiencing 81.2% of all the dental caries, with at least 17.4% having S-ECC [Department of Health, 2012]. This shows that the distribution of dental caries amongst children is uneven, with a small group of children being burdened with a high dental caries experience.

Information about children with S-ECC has been limited as studies on OHL have been conducted on adults, or on caregivers of a general sample of children. Since this group of children carries the biggest burden of dental disease, they deserve to be studied further in greater detail. The objective of this study was therefore to evaluate the parental OHL of children with S-ECC, and to identify the factors influencing their OHL.

## Materials and methods

### Ethical considerations

This study was a cross-sectional study to assess the

parental OHL of children with S-ECC. The study was approved by the Institutional Review Board of the University of Hong Kong (IRB reference number: UW 14-010). The child's accompanying parents were given information about the study, with their participation being voluntary. Written consent was obtained if they agreed to participate in the study.

### Sample size calculation

For the calculation of sample size, the estimated standard deviation (SD) for this study was derived from a previous study which had used the HKOHLAT-P [Bridges et al., 2014]. Using a SD of 6, a 2-sided confidence level of 95% and a width of 1.5 points, a sample size of around 250 patients was calculated. Assuming a 15% non-response rate, an estimate of 295 patients was required.

### Data collection

A purposive sample of children was recruited from the Prince Philip Dental Hospital, The University of Hong Kong. Children were included if they were physically healthy, between 3 to 6 years old, diagnosed with S-ECC, and accompanied by a parent who could read and write Cantonese. Children who were uncooperative, or with major systemic diseases or syndromes were excluded from the study.

Recruitment of the subjects was carried out from August 2014 to July 2015. Initial screening for children was undertaken by a Junior Hospital Dental Officer working at the Paediatric Dentistry Clinic of the Prince Philip Dental Hospital, The University of Hong Kong. Once the inclusion criteria had been met, written consent was obtained from their parents. The parents were then given 3 questionnaires to complete while the children were clinically examined.

### Clinical examination

Before the clinical examination, the child was asked whether he or she was currently experiencing any tooth-related pain. Their response would then be recorded as 'without pain', or 'with pain'.

Clinical examination was carried out by 2 trained and calibrated examiners. The dmft score was computed based on the number of sound, decayed, missing (due to caries) and filled teeth recorded according to the World Health Organization criteria for the visual assessment of dental caries [World Health Organization, 2013]. The number of sites of each tooth with dental plaque were recorded, based on the Visible Plaque Index (VPI) [Ainamo and Bay, 1975]. The VPI is the percentage of the number of sites with dental plaque divided by the total number of sites examined.

The clinical examination was repeated twice for 32 random subjects in order to measure inter- and intra-examiner reliabilities of the dmft and VPI scores.

### Questionnaires

The parents were given 3 questionnaires to complete. The first questionnaire had questions about their family's socio-demographic background.

The second questionnaire was the Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry (HKOHLAT-P), which assesses the OHL of parents. The HKOHLAT-P consists of 3 sections which tests health knowledge (Part I), numeracy (Part II), and comprehension (Part III), respectively. Each section is scored and then added up to form a total score. The HKOHLAT-P score has a range of 0 to 52, with a higher score reflecting a higher OHL. The HKOHLAT-P was developed and validated for the Chinese population in 2013 [Wong et al., 2013].

The third questionnaire was the Early Childhood Oral Health Impact Scale (ECOHS), which was translated into the Chinese language and validated in 2009 [Wong et al., 2011]. It consists of 13 questions to measure the child's oral health-related quality of life (OHRQoL). The range of the ECOHS score is 0-52, with a higher score denoting a lower OHRQoL.

### Statistical methods

Data analyses were performed using IBM SPSS Statistics for Windows, Version 23.0 (Armonk, NY: IBM Corp, USA). Frequency distribution tables and descriptive analysis were produced. The mean and standard deviation of each component of HKOHLAT were calculated for each child and parent variable. To test the differences in mean HKOHLAT scores between the various child and parent characteristics, independent samples t-tests were used for two groups, and analysis of variance (one-way ANOVA) tests for three groups.

A multiple regression analysis was carried out using a stepwise procedure according to the Akaike Information Criteria (AIC), to show only the statistically significant associations ( $p < 0.05$ ) in the final model. The analysis was performed using the stepAIC function in MASS package version 7.3-45 [Venables et al., 2002], running on R Version 3.2.3 [The R Foundation].

Intraclass correlation coefficient (ICC) was used to indicate inter- and intra-examiner reliabilities using the ICC function in psyche package version 1.5.8 [Revelle, 2015], running on R version 3.2.3 (Tables 1, 2).

## Results

A total of 315 children and their parents were recruited to participate in the study. There was a response rate of 98.7%. The 4 patients who were not included comprised of 3 who did not complete some questionnaires, and 1 patient who was too uncooperative for the clinical examination.

Both examiners had very high intra- and inter-

examiner reliabilities for the clinical examination. The ICC scores for the recording of dmft and VPI were above 0.98, for both inter-examiner and intra-examiner reliabilities. According to Fleiss [Fleiss et al., 2003], an ICC greater than 0.74 is deemed 'Excellent'

Table 1 describes the socio-demographic profile of the children and their parents. The mean age of the children was 4.7 (SD = 0.8). There was a gender distribution of 53.7% male and 46.3% female. The mean dmft score was 10.2 (SD = 4.5). Majority of the dental caries experience was due to untreated dental caries, with a prevalence of 98.7%. Only 13 children (4.2%) had missing teeth due to caries, and 31 children (10%) had filled teeth. The mean VPI was 86.9 (SD = 18.3). About three quarters of the parents (72.7%) had an education level of secondary school or less. More than half of the families (61.7%) had a monthly family income of below 20,000 HKD. About one quarter (28.9%) of the children were experiencing pain during the visit.

The mean HKOHLAT-P score was 41.5 (SD=6.9), with a range from 14 to 52. Table 2 shows the association between the various parent and child characteristics with the different components of the HKOHLAT-P. The parent's education level and monthly family income had associations with the HKOHLAT-P total score and its components. Parents with a lower education level had a significantly lower Part II score and Total score (p<0.001). Parents with a lower income had a significantly lower Part III score and Total score (p<0.001). The number of filled teeth in the child also was associated with the HKOHLAT-P Part I (p = 0.006) and Total score (p = 0.003). Parents who had children with dental restorations scored higher than parents with children who had no dental restorations.

The results from the multiple regression model in Table 3 shows that Part I (p=0.007), Part II (p<0.001) and the Total HKOHLAT-P scores (p=0.018) were higher if the parents had an education level of post-secondary or above. Parents scored higher HKOHLAT-P Part III (p<0.001) and Total scores (p=0.007) when the family monthly income was higher than HKD 20,000. There was a trend towards a higher HKOHLAT-P Part II score if the dmft score was lower, however this was not statistically significant. There was also a trend towards a higher HKOHLAT-P Part III score if the child was experiencing pain (p=0.056), and if the parent scored a lower ECOHIS score (p=0.068) (Table 3).

## Discussion

The HKOHLAT-P was developed as a tool to explore the relationship between the caregiver's OHL and their child's oral health status in a Chinese population [Wong et al., 2013]. Besides the HKOHLAT-P, the Hong Kong Rapid Estimate of Adult Literacy in Dentistry-30

Parents and child characteristics	Frequency	%
<b>Parent demographics</b>		
Relationship to the child		
Mother	242	77.8
Father	69	22.2
Education level		
Secondary or below	226	72.7
Post-secondary or above	85	27.3
Family income per month		
<HKD 20,000	192	61.7
HKD 20,000-39,999	97	31.2
≥HKD 40,000	22	7.1
<b>Child's demographics</b>		
Gender		
Male	167	53.7
Female	144	46.3
<b>Child's clinical disease status</b>		
Decayed teeth (dt)		
None	4	1.3
One or more	307	98.7
Missing teeth (mt)		
None	298	95.8
One or more	13	4.2
Filled teeth (ft)		
None	280	90.0
One or more	31	10.0
dmft		
<7	68	21.9
7-13	163	52.4
≥14	80	25.7
VPI		
<90%	120	38.6
≥90%	191	61.4
Presence of pain		
No pain	221	71.1
With pain	90	28.9
ECOHIS score		
<9	76	24.4
9-18	148	47.6
≥19	87	28.0

**TABLE 1** Parent and child characteristics in the survey of parental OHL in Hong Kong (n=311 child-parent pairs).

Parent and child characteristics	Components of HKOHLAT-P			
	Part I score	Part II score	Part III score	Total score
<b>Parent demographics</b>				
Relationship to the child <sup>a</sup>				
Mother	9.87 (2.00)	21.89 (3.68)	9.70 (3.12)	41.46 (7.06)
Father	10.14 (1.68)	21.67 (3.58)	9.77 (2.60)	41.58 (6.24)
Education level <sup>a</sup>	**	***	*	***
Secondary or below	9.75 (2.04)	21.35 (3.85)	9.46 (3.01)	40.57 (7.19)
Post-secondary or above	10.41 (1.55)	23.13 (2.71)	10.38 (2.92)	43.92 (5.28)
Family income per month <sup>a</sup>	*	**	***	***
<HKD 20,000	9.73 (2.04)	21.37 (3.83)	9.13 (3.14)	40.23 (7.26)
≥HKD 20,000	10.26 (1.71)	22.60 (3.23)	10.66 (2.52)	43.51 (5.66)
<b>Child's demographics</b>				
Gender <sup>a</sup>				
Male	9.91 (1.93)	21.73 (4.02)	9.63 (3.03)	41.27 (7.36)
Female	9.96 (1.95)	21.97 (3.19)	9.81 (2.98)	41.74 (6.29)
<b>Child's clinical disease status</b>				
Decayed teeth <sup>a</sup>				
None	8.25 (3.10)	22.00 (3.16)	11.75 (1.71)	42.00 (2.94)
One or more	9.95 (1.92)	21.84 (3.66)	9.69 (3.01)	41.48 (6.91)
Missing teeth <sup>a</sup>				
None	9.95 (1.92)	21.84 (3.70)	9.69 (3.04)	41.48 (6.96)
One or more	9.46 (2.44)	21.85 (2.44)	10.23 (2.31)	41.54 (4.63)
Filled teeth <sup>a</sup>				
None	**			**
One or more	9.87 (2.00)	21.73 (3.75)	9.64 (3.09)	41.23 (7.09)
One or more	10.52 (1.06)	22.84 (2.52)	10.42 (2.09)	43.77 (3.85)
dmft <sup>b</sup>				
<7	9.88 (1.99)	22.13 (3.05)	10.37 (2.95)	42.38 (6.09)
7-13	10.06 (1.86)	22.11 (3.38)	9.70 (2.86)	41.87 (6.36)
≥14	9.73 (2.06)	21.04 (4.50)	9.19 (3.28)	39.95 (8.23)
VPI <sup>a</sup>				
<90%	9.91 (1.94)	22.16 (3.57)	9.98 (2.98)	42.05 (6.64)
≥90%	9.95 (1.94)	21.64 (3.70)	9.54 (3.02)	41.13 (7.01)
Presence of pain <sup>a</sup>				
No pain	9.98 (1.91)	22.00 (3.47)	9.61 (3.02)	41.59 (6.73)
With pain	9.81 (2.02)	21.44 (4.08)	9.97 (2.99)	41.22 (7.25)
ECOHIS score <sup>b</sup>				
<9	9.91 (2.06)	22.07 (3.18)	9.97 (2.49)	41.95 (6.00)
9-18	9.89 (2.02)	21.69 (4.06)	9.83 (3.27)	41.41 (7.76)
≥19	10.03 (1.69)	21.90 (3.31)	9.29 (2.95)	41.22 (5.99)
a: Independent samples t-test: *p<0.05; **p<0.01; ***p<0.001. b: One-way ANOVA: *p<0.05; **p<0.01; ***p<0.001.				

**TABLE 2** Association between various parent and child characteristics and different components of HKOHLAT-P (mean, SD) (n=311 dyads).

(HKREALD-30) is also an instrument which measures OHL, and was developed and validated for the local context [Wong et al., 2012]. The HKREALD-30 is adapted from the REALD-30, a word recognition test used to assess the reading ability of the individual [Lee et al., 2007]. The REALD-30 does not test comprehension nor functional oral health literacy [Dickson-Swift et al., 2014; Parker and Jamieson, 2010]. In a previous study where both the HKREALD-30 and HKOHLAT-P

measures were used, it was found that HKOHLAT-P was a better predictor of children's oral health, as it tested the individual's comprehension skills instead of word recognition skills [Bridges et al., 2014]. The HKOHLAT-P also focuses mainly on paediatric dentistry, which is relevant to the study group of this research.

Previous studies have found a significant association between the children's dental caries status and their parent's OHL [Bridges et al., 2014; Miller et al., 2010].

Variable	Unstandardized coefficient	Standard error	p-value	
<b>HKOHLAT PART I<sup>a</sup> (adjusted R<sup>2</sup>=0.020)</b>				
Intercept	9.752	0.128	<0.001	***
Parent education level: Post-secondary or above	0.660	0.244	0.007	**
<b>HKOHLAT PART II<sup>b</sup> (adjusted R<sup>2</sup>=0.048)</b>				
Intercept	22.064	0.525	<0.001	***
Parent education level: Post-secondary or above	1.732	0.454	<0.001	***
dmft	-0.069	0.045	0.131	
<b>HKOHLAT PART III<sup>c</sup> (adjusted R<sup>2</sup>=0.069)</b>				
Intercept	9.494	0.382	<0.001	***
Family monthly income: 20,000-39,999	1.395	0.363	<0.001	***
Family monthly income: ≥40,000	2.082	0.664	0.002	**
Presence of pain: with pain	0.726	0.378	0.056	
ECOHIS score	-0.040	0.022	0.068	
<b>HKOHLAT</b>				
Intercept	39.897	0.499	<0.001	***
Parent education level: Post-secondary or above	2.201	0.929	0.018	*
Family monthly income: 20,000-39,999	2.334	0.856	0.007	**
Family monthly income: ≥40,000	3.666	1.617	0.024	*
a: Excluded variables: Relationship to the child, child's age, family monthly income, child's gender, dmft, VPI, pain for children, and ECOHIS total score.				
b: Excluded variables: Relationship to the child, child's age, family monthly income, child's gender, VPI, pain for children, and ECOHIS total score.				
c: Excluded variables: Relationship to the child, child's age, parental education level, child's gender, dmft and VPI score.				
d: Excluded variables: Relationship to the child, child's age, child's gender, dmft, VPI, and ECOHIS total score.				

**TABLE 3** Multiple regression analysis: HKOHLAT scores for the various parent and child characteristics (n=311 dyads).

Parents of children with good oral health status had higher OHL scores. In this study, the mean HKOHLAT-P (41.5) was high for its given range (0-52), and no association was found between the severity of S-ECC (dmft score) and the parental OHL. This suggests that the level of parental OHL is independent of the severity of S-ECC of their children, and that the level of OHL is dependent on other factors. In this study, the parent's education level was associated with OHL levels, which was consistent with previous studies [Burgette et al., 2016; Lee et al., 2014; Manganello, 2008]. Income levels were also found to be associated with OHL, which could be attributed to the close link between education and family income. Family income, like education, has been shown to have an impact on the severity of dental caries [Engelmann et al., 2016; Bridges et al., 2014]. This shows that OHL, just like oral health status, is closely linked to socio-economic factors. One study however, analysed the OHL of female caregivers from a low-income population, and found that caregivers with a higher OHL had children with a better oral health status, independent of covariates such as education and income [Vann et al., 2010].

A study conducted in 2012 found that the caregivers' OHL was weakly associated with their child's OHRQoL,

although there was a strong association between the child's oral health status and their OHRQoL [Divaris et al., 2012]. This is in agreement with this study's results, where there was only a weak association between the ECOHIS score and one of the HKOHLAT-P sections. Conversely, a study conducted in Hong Kong observed that the parental OHL was significantly negatively correlated with the ECOHIS score [Wong et al., 2013]. The difference in findings could be due to the former study having a higher proportion of parents with an education level below secondary school, compared to the Hong Kong study which had more parents with a post-secondary education. Parents with low literacy may underreport symptoms or quality-of-life impacts, and answer the ECOHIS questionnaire differently from parents with high literacy [Divaris et al., 2012]. Just as socio-economic factors can affect the parental OHL, they can also affect the severity of dental caries [Christensen et al., 2010; Chu et al., 2012]. Children with parents who had a lower education level and lower family income had a tendency to have more dental caries [Christensen et al., 2010].

Although Hong Kong children have access to the school dental care service when they enter primary school, this only commences when they are at the

age of 6. Preschool children do not have access to subsidised dental care, and parents will thus have to take their own initiative to bring their children to the dentist. Parents belonging to lower socio-economic classes may be reluctant to bring their preschool child to seek dental treatment due to cost concerns. They may also have a misconception that dental treatment for their child's dental problems could be delayed until primary school where treatment is covered by the School Dental Care Service. More steps could be taken to promote oral health and prevention to the public, especially to parents of lower socio-economic status. Oral health promotion materials should be easy to read and understand so that parents with low literacy levels are able to grasp the basic oral health concepts. A large emphasis on prevention should be placed so that it decreases the financial burden of dental treatment on this group of parents, and in the event where treatment is required, dental treatment should be affordable and easily accessible.

## Conclusion

The parental OHL of children with S-ECC was associated with their socio-economic background. Oral health education should be targeted towards the lower socio-economic groups to improve the parent's oral health literacy, and hopefully motivate them to look after their child's dental health. Dental care should be made more affordable for children who belong to lower socio-economic groups, and more emphasis should be placed on oral health prevention so that it decreases the financial burden on the family.

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