

Relationship between Caregivers' Oral Health Literacy and their Child's Caries Experience

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Objective: This study aimed to assess the association between caregivers' oral health literacy (OHL) and the dental caries experience of their child. **Participants:** This cross-sectional study was conducted among 300 caregiver/child dyads at a paediatric dental centre in Saudi Arabia. The OHL was assessed using an Arabic translated version of Comprehensive Measure of Oral Health Knowledge (CMOHK-A) questionnaire. Test-retest reliability and internal consistency was assessed using the appropriate statistical methods. **Main Outcome Measure:** Children's dental caries experience was assessed using the DMFT and deft index (decayed, missing/extracted, filled teeth) for permanent and primary teeth respectively. **Results:** The mean age of the caregivers and children was 37.9±7.9 years and 8.3±3.1 years respectively. Most children (87.7%) had dental caries experience (dmft > 0) and the mean DMFT/deft was 5.2±4.0. The means±standard deviations (SD) for untreated caries (DT/dt), missing/extracted teeth (MT/et) and filled teeth (FT/ft) were 2.6±2.5, 0.5±0.9 and 2.1±2.2 respectively. Multivariate linear regression models showed that caregivers' educational levels and OHL scores were associated with the child's untreated caries levels. Caregivers' gender, educational levels and their perception of the child's oral health were significant predictors for child's lifetime caries experience. Children of caregivers with low OHL had more untreated caries than children of caregivers with adequate OHL. **Conclusion:** This study found better caregiver OHL levels to be associated with lower caries experience for their child.

Keywords: Children; caries, DMFT; health education; health literacy; oral health

Introduction

An individual's oral health seeking behaviour is influenced by a number of factors, such as his/her perception about the signs and symptoms, perceived value of good oral health and the ability to understand the health care system (Lacy *et al.*, 2004). Oral health literacy (OHL) plays a central role in these relationships and has been linked with several oral health behaviours and outcomes. OHL is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions" (Institute of Medicine, 2004). The effect of health literacy on health outcomes is an emerging area of research (Dewalt *et al.*, 2004). Poor OHL has been associated with poor oral health outcomes (Blizniuk *et al.*, 2015), poor patient compliance (Baskaradoss, 2016) and poor utilization of health care services (Kranz *et al.*, 2013; Scott *et al.*, 2002). The US Surgeon General's report *Oral Health in America* stressed the importance of parental knowledge about their child's oral health (US Department of Health and Human Services 2000). Caregivers' perceptions of oral health care could influence their child's health, since children are dependent on their caregivers' for accessing care (DeWalt and Hink, 2009). The oral health of preschool children is influenced by their caregivers' oral health knowledge,

education and oral health status (Weintraub *et al.*, 2010). Several studies among young children consistently support the role played by caregivers in determining their child's health (Vann *et al.*, 2010). Bridges and colleagues (2014) found caregivers' low oral health literacy to be associated with more decayed, missing and filled teeth (DMFT) among their children. Shin and colleagues (2013) reported more need for advanced pulpal therapy among children whose caregivers had limited oral health literacy.

The prevalence of dental caries among Saudi children (6-18 years) ranges from 70-90 percent, which is higher than the global average (Al Dosari *et al.*, 2010). In children aged 6-9 years the mean decayed, missing, and filled teeth (dmft) score was 6.53±4.3 and in the permanent dentition, the mean decayed, missing and filled teeth (DMFT) score was 5.06±3.7 (Al Dosari *et al.*, 2004). A previous study among 5-12 year-old children from Riyadh, Saudi Arabia reported high levels of dental caries (mean dmft = 3.8±3.2 and mean DMFT = 2.0±1.9) in this population (Al-Banyan *et al.*, 2000). It may be hypothesized that OHL levels of caregivers' influences their children's caries experience. The present study was designed to assess the association between caregivers' OHL and the dental caries experience of their child in a selected sample of children in Riyadh, Saudi Arabia.

Methods

The Institutional Review Board (King Abdullah International Medical Research Centre) approved the study (IRBC/1650/17). It is reported according to the Strengthening the reporting of observational studies in epidemiology (STROBE) guidelines (Von Elm *et al.*, 2007).

This cross-sectional study was conducted between September and December, 2017 at the paediatric dental clinics at King Abdulaziz Medical City (KAMC) Riyadh, Saudi Arabia. No prior information is available on oral health literacy levels in this population, on which to base any sample size calculations. Assuming a conservative proportion of 50% adults to have limited oral health literacy, it was estimated that 250 patients would be required to obtain a power of 80% with a 95% confidence interval (95% CI). This was then rounded off to 300 child/parent dyads to adjust for incomplete responses. Only children less than 12 years were included. Those children requiring emergency procedures were excluded.

Data were collected from a convenience sample of child/caregiver dyads who reported to the dental centre for scheduled appointments. Self-administered questionnaires were given to those who agreed to participate and who signed the informed consent. Demographic and socioeconomic data provided by the caregivers' included age, gender, marital status, monthly income, educational level, area of living, number of children and their relationship to the child. Childrens' demographic data included gender, age, and birth order. Questions about dental history included the reason for the current dental visit, the child's attitude during dental treatment and his/her oral hygiene and sugar intake. OHL was assessed using the Comprehensive Measure of Oral Health Knowledge (CMOHK) questionnaire (Macek *et al.*, 2010). CMOHK

consists of 23 questions; ten initial basic knowledge questions, six dental caries prevention and management questions, five periodontal disease prevention and management questions and two oral cancer prevention and management questions.

The validation process of CMOHK into Arabic (CMOHK-A) was performed in four separate steps in accordance with Guillemin and colleagues (1993). As the first step, two bilingual dental students translated the original CMOHK into Arabic. This Arabic version was back translated into English by a professional bilingual translator, who was not a subject expert. In the third step, seven subject experts (two faculty member and 5 dental students) reviewed both the English and the Arabic versions and compared the Arabic with the original questionnaire to ensure semantic equivalence. The necessary changes were incorporated into the final Arabic version (CMOHK-A) which was then pilot tested.

CMOHK-A was piloted in a sub-sample of 20 adult caregivers' accompanying their child for dental treatment at KAMC. Participants' feedback indicated there were no potential conceptual problems. After a week, the same 20 caregivers were requested to complete the CMOHK-A questionnaire again to determine its test-retest reliability.

The test-retest reliability of the CMOHK-A was assessed by calculating the intra-class coefficient (ICC) from a one-way random effects model. The ICC was 0.75 ($p < 0.05$), which can be categorized as highly reliable (Bartko, 1976). Internal consistency was estimated by generating Cronbach's alpha for all 23 items. Item-scale, inter-item and item-deletion correlations were evaluated using Pearson correlation coefficients. Cronbach's alpha for CMOHK-A was 0.76, which is within acceptable limits (Table 1).

Table 1. Item wise correlation of individual items of Comprehensive Measure of Oral Health Knowledge –Arabic version

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CMOHK_Q_1	13.343	13.223	0.329	0.731
CMOHK_Q_2	13.070	13.972	0.135	0.746
CMOHK_Q_3	13.640	14.418	0.049	0.748
CMOHK_Q_4	13.173	12.967	0.406	0.725
CMOHK_Q_5	13.343	13.430	0.269	0.736
CMOHK_Q_6	12.837	14.003	0.296	0.736
CMOHK_Q_7	13.217	13.241	0.320	0.732
CMOHK_Q_8	12.830	13.861	0.390	0.732
CMOHK_Q_9	13.343	13.470	0.258	0.737
CMOHK_Q_10	13.140	12.977	0.411	0.724
CMOHK_Q_11	12.823	14.173	0.235	0.739
CMOHK_Q_12	13.173	13.147	0.353	0.729
CMOHK_Q_13	12.833	13.825	0.399	0.731
CMOHK_Q_14	12.886	13.332	0.503	0.723
CMOHK_Q_15	12.920	13.425	0.409	0.727
CMOHK_Q_16	13.063	13.431	0.300	0.733
CMOHK_Q_17	13.153	13.996	0.113	0.748
CMOHK_Q_18	13.206	13.750	0.177	0.744
CMOHK_Q_19	13.096	13.539	0.255	0.737
CMOHK_Q_20	13.220	13.102	0.360	0.729
CMOHK_Q_21	13.326	13.244	0.320	0.732
CMOHK_Q_22	13.560	13.518	0.327	0.732
CMOHK_Q_23	13.593	13.834	0.241	0.737

To determine face and content validity, questions were designed to assess participants' satisfaction, ability to understand CMOHK-A and whether they felt CMOHK-A was relevant, each answered on a Likert Scale. Participants were given space to provide any additional comments about the scale. Table 2 shows the results of the face validity and the content validity of the questionnaire. Most participants found the questionnaire to be understandable and comprehensible.

Children's caries experience was assessed by 5 paediatric dentists, using the WHO Basic Methods protocol (World Health Organization, 1997). Dental health data were expressed as decayed, missing and filled teeth (DMFT) and decayed, extracted and filled teeth (deft) for the permanent and primary dentitions respectively. The intra- and inter-examiner reliability for dental health examinations were 0.94 and 0.90 respectively.

Data Analysis

The CMOHK-A scores were normally distributed, and the mean score of 14 was used to categorize the sample into poor (≤ 14) and adequate (>14). The outcome variables were child's lifetime caries experience (dmft/DMFT) and untreated caries (DT/dt). Bivariate associations between the various independent variables with the outcome variables were analysed using independent sample t-tests and analysis of variance (ANOVA). A final forward stepwise multivariate linear regression model was built. The sociodemographic variables were included as a first step. Retaining the significant variables, the parental perception factors were added to the model. Variables that provided significant additional predictive value were retained in the model. The goodness-of-fit of the model was assessed using R-squared. The data management and analysis were carried out with SPSS 22.0 (Statistical Package for the Social Sciences for Windows; SPSS Inc., Chicago, IL, USA). A p value of <0.05 was chosen as the cut off for statistical significance.

Results

A total of 326 caregiver/child dyads participated, from which 26 incomplete questionnaires were discarded. The responses of 300 caregivers were analysed. Bivariate variations in child's caries status with respect to caregiver's characteristics are shown in Table 3. Sixty percent of respondents were women, 53.7% of the caregivers had a total monthly income more than 10,000 SAR and 56.7% had baccalaureate or higher educational level. Caregivers' mean age was 37.9 ± 7.9 years old and that of the child was 8.3 ± 3.1 years.

Most children (87.7%) had dental caries or treatment experience (dmft > 0) and the mean DMFT/deft \pm standard deviation (SD) for the sample was 5.2 ± 4.0 . The values for untreated caries (DT/dt), missing/extracted teeth (MT/et) and filled teeth (FT/ft) were 2.6 ± 2.5 , 0.5 ± 0.9 and 2.1 ± 2.2 respectively. Gender of the caregivers, education level of caregiver, and caregivers' oral health literacy scores were significantly associated with untreated caries (DT/dt) and lifetime caries and treatment experience of the child (DMFT/deft). Children accompanied by male caregivers had higher DMFT/deft and DT/dt compared with those accompanied by females ($p < 0.01$). Children of caregivers with baccalaureate degrees or more had lower DT/dt and DMFT/deft scores than those with lower levels of education ($p < 0.01$).

Most (53%) caregivers were categorized as having poor OHL. Children of caregivers with poor OHL had more untreated caries and higher lifetime caries and treatment experience than children of caregivers with adequate OHL ($p < 0.05$).

Parental perceptions of child's oral health related behaviour and child's caries status are presented in Table 4. Almost one quarter (23.7%) of the participants categorized their child's oral health as poor. Children whose parents believed that their child had poor oral health had higher mean FT/ft and DMFT/deft than the others ($p < 0.01$). There was no association between the parental assessment of the child's diet, oral hygiene habits, adequacy of dental treatment and frequency of dental visits with child caries status.

Table 2. Content and Face Validity of Comprehensive Measure of Oral Health Knowledge –Arabic version

No	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Content Validity						
1	Questions were clear and easy	75	20	0	5	0
2	Questions tested your knowledge levels in all the relevant areas of dentistry	80	5	15	0	0
3	You would like to retake the questionnaire in future to assess your change in scores received	10	30	0	60	0
4	The questionnaire lacks important questions	0	15	0	85	0
5	Any of the questions violate your privacy	0	0	0	0	100
Face Validity						
1	You would recommend this questionnaire to another volunteer	95	5	0	0	0
2	It took a lot of time and effort to fill in the questionnaire	100	0	0	0	0
3	The questions appear to encourage a specific answer	0	0	20	80	0
4	You found it difficult to answer some of the questions	90	10	0	0	0

Table 3. Bivariate variations in child's caries status with respect to caregiver's characteristics

	N (%)	DT+dt	MT+et	FT+ft	DMFT/deft
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<i>Caregiver Characteristics</i>					
<i>Age (years)</i>					
Q1: ≤ 32	75 (25.0)	2.5 (2.5)	0.5 (1.1)	1.9 (2.2)	5.0 (4.2)
Q2: 32-37	79 (26.3)	2.2 (2.2)	0.3 (0.7)	2.1 (2.1)	4.6 (3.6)
Q3: 38-43	69 (23.0)	2.7 (2.6)	0.6 (1.2)	2.2 (2.2)	5.6 (4.2)
Q4: ≥ 44	64 (21.3)	3.2 (2.8)	0.6 (0.9)	2.2 (2.1)	6.0 (3.9)
<i>Gender</i>					
Female	182 (61.0)	2.2 (2.3)**	0.3 (0.7)*	2.0 (2.2)	4.5 (3.7)**
Male	118 (39.0)	3.2 (2.7)	0.6 (1.1)	2.3 (2.3)	6.2 (4.2)
<i>Education level</i>					
Less than Bachelor	128 (42.7)	3.3 (2.6)**	0.6 (1.1)*	2.3 (2.4)	6.3 (4.3)**
Bachelor degree or higher	170 (56.7)	2.1 (2.3)	0.4 (0.8)	2.0 (2.1)	4.4 (3.7)
<i>Monthly income</i>					
Less than 10,000 SAR	133 (44.3)	2.8 (2.5)	0.5 (0.9)	2.1 (2.1)	5.3 (3.8)
More than 10,000 SAR	161 (53.7)	2.5 (2.6)	0.4 (0.9)	2.2 (2.4)	5.2 (4.2)
<i>Oral Health Literacy scores</i>					
Poor (≤14)	159 (53.0)	3.3 (2.6)**	0.56 (1.1)	1.91 (2.1)	5.7 (4.2)*
Adequate (>14)	141 (47.0)	1.84 (2.3)	0.40 (0.8)	2.4 (2.3)	4.7 (3.7)
<i>Child Characteristics</i>					
<i>Gender</i>					
Female	163 (54.3)	2.5 (2.5)	0.5 (1.0)	2.2 (2.4)	5.1 (4.3)
Male	137 (45.7)	2.8 (2.6)	0.5 (0.9)	2.0 (1.9)	5.3 (3.7)
<i>Age (years)</i>					
Q1: ≤ 6	79 (26.4)	2.4 (2.7)	0.3 (0.8)	2.6 (2.7)	5.3 (4.5)
Q2: 7-8	104 (34.6)	2.5 (2.4)	0.6 (1.1)	1.9 (1.9)	4.9 (3.6)
Q3: 9-10	52 (17.3)	3.5 (2.8)	0.5 (1.0)	2.4 (2.5)	6.4 (4.2)
Q4: 10-12	65 (21.7)	2.3 (2.2)	0.5 (0.9)	1.7 (1.7)	4.6 (3.7)

*Significant at p<0.05 level; **Significant at p<0.001 level; ---Missing values present.

Table 4. Parental Perception of child's oral health related behaviour and child's caries status

Variables	N (%)	DT+dt	MT+et	FT+ft	DMFT/deft
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<i>How would you categorize your child's dietary sugar intake?</i>					
Very frequent	79 (26.3)	2.8 (2.5)	0.5 (0.9)	2.4 (2.5)	5.7 (3.8)
Less frequent	221 (73.7)	2.5 (2.5)	0.5 (1.0)	2.0 (2.1)	5.1 (4.1)
<i>How would you categorize your child's tooth brushing habit?</i>					
Regular	94 (31.3)	2.2 (2.4)	0.5 (0.8)	2.2 (2.6)	4.8 (4.2)
Not Regular	203 (67.7)	2.7 (2.6)	0.5 (1.0)	2.1 (2.2)	5.4 (3.9)
<i>How would you categorize your child's oral health?</i>					
Poor	71 (23.7)	3.0 (2.5)	0.6 (1.2)	2.8 (2.8)**	6.4 (4.2)**
Adequate	229 (76.3)	2.5 (2.5)	0.4 (0.9)	1.9 (2.0)	4.8 (3.9)
<i>Do you think your child has received adequate dental care?</i>					
Yes	209 (69.7)	2.5 (2.4)	0.5 (1.0)	2.1 (2.2)	5.0 (3.8)
No	85 (28.3)	2.9 (2.8)	0.5 (1.0)	2.4 (2.4)	5.7 (4.5)
<i>When was your child's last dental visit?---</i>					
More than 6	99 (33.0)	2.4 (2.4)	0.5 (0.9)	2.0 (2.2)	4.8 (3.9)
Less than 6	198 (66.0)	2.7 (2.6)	0.5 (1.0)	2.2 (2.2)	5.5 (4.0)

*Significant at p<0.05 level; **Significant at p<0.001 level; Missing values present

Multivariate linear regression modelling indicated that caregivers' educational levels ($p = 0.004$) and OHL scores ($p < 0.001$) predicted the child's untreated caries levels (Table 5). Caregivers' gender, educational levels and their perception of the child's oral health were significant predictors for child's lifetime caries experience.

Discussion

In this study, several caregiver characteristics were found to be related to the caries status of their child. Caregivers' educational status, gender and perceptions of their child's oral health were associated with the child's lifetime caries experience. Children of caregivers with poor educational background and those who exhibited low OHL had higher levels of untreated dental caries.

In Saudi Arabia, the government provides all its citizens and expatriates working within the public sector with full and free access to all public health care services. Dental treatment is provided free-of-cost at all Government hospitals. The ratio of physicians' and dentists' per 10,000 populations in Saudi Arabia are 16 and 3.5 respectively (Alkhamis, 2012). Despite the huge progress that has been achieved in the health service sector, the prevalence of several oral diseases continues to be high. The caries experience among children in this study is higher than that reported in the neighbouring countries (Al-Mutawa *et al.*, 2006; Al-Otaibi *et al.*, 2012). The high caries experience recorded in the present study is similar to previous reports from Saudi Arabia (Al Dosari *et al.*, 2010), but contrasts sharply with trends in many industrialized countries (Dye *et al.*, 2010).

To the best of our knowledge, this is the first study in a Middle Eastern population to assess the relationship between caregivers' OHL levels and the child's oral health status. Macek and colleagues (2010) described a conceptual framework for the pathway between health literacy and oral health, with four components: word recognition, reading comprehension, conceptual knowledge, and communication skills. The authors also identified significant associations between word recognition,

reading comprehension and conceptual knowledge. The CMOHK assesses the oral health conceptual knowledge and has been found to be a valid instrument to measure the OHL (Macek *et al.*, 2017). An Arabic translated version of CMOHK (CMOHK-A) was used in this study. Most OHL studies have been conducted in North America and other English dominant countries. Therefore, most existing OHL measures were developed and validated in English. This work helps validate the instrument in this population and therefore addresses the important issue of cross-cultural applicability of OHL instruments. Two of the most popular OHL instruments - the Rapid Estimate of Adult Literacy in Dentistry (REALD) (Lee *et al.*, 2007) and the Test of Functional Health Literacy in Adults (TOFHLA) (Gong *et al.*, 2007) measure word recognition and reading comprehension respectively. CMOHK was reported to be consistently and significantly associated with both word recognition and reading comprehension and also supports the contention that conceptual knowledge is a construct of health literacy (Macek *et al.*, 2017). The major advantage of CMOHK over other OHL instruments, is its ability to be translated and be used in a cross-cultural setting. Translating REALD or TOFHLA would result in loss of their validity. This is especially true in the case of TOFHLA, which includes components taken from Medicaid application forms. While relevant for United States residents, this section is irrelevant for others and therefore limits the ability to use TOFHLA in a cross-cultural setting (Nguyen *et al.*, 2015). However, CMOHK is aimed at measuring a person's level of understanding of health-related information or oral health conceptual knowledge. The 23 items in the CMOHK can be effectively translated into any language while maintaining their validity. This makes it an ideal instrument for cross-cultural OHL research. Bi-lingual investigators ensured that the language and content of the translated version matches with the English version. In addition, face and content validity were confirmed. The criterion validity of the CMOHK-A could not be tested due to the lack of an appropriate Arabic OHL instrument for comparison.

Table 5. Regression analysis for lifetime caries experience and untreated caries

Dependent Variable	Independent Variables	Un-standardized Coefficients		
		B	Std. Error	P value
DMFT/def [§]	Education (<Baccalaureate / ≥ Baccalaureate)	-1.42	0.48	0.003
	Gender of caregiver (Female/Male)	1.75	0.48	<0.001
	Perceived child's oral health (Poor/Adequate)	-1.59	0.55	0.004
DT/dt ^{§§}	Oral Health Literacy score (Poor/Adequate)	-1.20	0.31	<0.001
	Education (<Baccalaureate / ≥ Baccalaureate)	-0.90	0.31	0.004

[§] R-squared value = 11.3%; ^{§§} R-squared value = 10.3%

Caregivers' assessments of their child's oral health matched well with their children's clinically determined caries status. Children categorised as having poor oral health by their caregivers had significantly more filled teeth and higher caries and treatment experience. This finding contrasts with that reported by Divaris and colleagues (2012), who found poor correlations between caregivers' assessments and the child's clinical needs. A possible explanation for this difference could relate to the treatment history. In this sample, the children of parents who categorized their child's health as poor, had more filled teeth. Also, Divaris and colleagues (2012) conducted their study among caregivers with children who were less than two years old. Parents of very young children may over-estimate the oral health status of their child. As the child grows older the parents become more aware of the child's oral health symptoms such as pain while eating or bleeding while brushing. This would improve the caregiver's assessment of the child's oral health. Most caregivers in this study believed that their child received adequate dental care and most children had had dental visits within the previous six months. This demonstrates good dental care-seeking behaviour in this population. This could be due to this hospital-based sample and hence the health-seeking behaviour of this population could be better than the general population.

Caregivers' education level was inversely associated with both the child's caries experience as well as the number of untreated carious teeth. It is well known that caries in children and adolescents is more common in socioeconomically deprived populations and those with lower levels of parental education (Polk *et al.*, 2010). A previous study showed poor adherence with recalls among socioeconomically disadvantaged caregivers' (Wang *et al.*, 2010). It might be impossible to change or modify a caregivers' sociodemographic characteristics, therefore, dental professionals working with paediatric populations could recognize and appreciate the key role played by the caregivers' in determining their child's oral health.

Caution should be exercised in extrapolating the findings of this study to the general population, especially since a non-probability sampling technique was employed. A larger multi-centre study at the community level would improve external validity. It is still unclear in the field of oral health literacy research, whether word recognition, reading comprehension and conceptual knowledge are truly interchangeable. More work is needed to further explore these interactions, and to explore the different aspects of OHL.

Conclusion

This study found better caregiver OHL to be associated with lower levels of untreated dental caries for their child. Caregivers' educational background, gender and their perception about the child's oral health were other factors that were related to the child's caries experience. CMOHK-A was found to be a valid, reliable, and culturally acceptable measure for assessing the OHL in an Arabic speaking population.

Conflict of Interest

None

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