Published in final edited form as:

Community Dent Oral Epidemiol. 2017 August ; 45(4): 323–329. doi:10.1111/cdoe.12294.

Oral Health Conceptual Knowledge and Its Relationships with Oral Health Outcomes: Findings from a Multi-Site Health Literacy Study

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Abstract

Objectives—In 2010, a health literacy instrument designed to measure oral health conceptual knowledge was introduced. This developmental work was limited in that it included a relatively small and homogeneous study population and few oral health measures against which to test concurrent validity. The purpose of the present investigation is to expand upon the earlier work by utilizing a larger study sample and additional outcome variables.

Methods—Data for this report came from the Multi-site Oral Health Literacy Research Study (MOHLRS), a large, cross-sectional survey conducted at two university-based dental clinics in the United States. MOHLRS included multiple assessments administered during face-to-face interviews. Conceptual knowledge was measured with the Comprehensive Measure of Oral Health Knowledge (CMOHK). Questions about self-efficacy, utilization, and dental beliefs and attitudes were also asked. Covariates included recruitment site, age, gender, race/ethnicity, education level, and languages spoken.

Results—Overall, 18% of 909 adult participants exhibited “low” conceptual knowledge. CMOHK scores were significantly associated with three health literacy instruments, the REALM, Short-TOFHLA, and confidence filling out forms. In both bivariate and multivariable analyses, CMOHK scores were also significantly associated with dental beliefs and attitudes and self-efficacy to prevent both dental caries and periodontal disease. CMOHK scores were not associated with utilization, measured either as having a dental visit or a dental cleaning in the last year.

Conclusions—The present investigation provides additional support for the CMOHK’s validity. Researchers are encouraged to incorporate oral health conceptual knowledge into their theoretical frameworks, especially as it relates to beliefs and self-efficacy.

INTRODUCTION

According to Sørensen and colleagues, health literacy is, “linked to literacy and entails people’s knowledge, motivation and competencies to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course”¹. Recent data from the European Health Literacy Survey^{2, 3} showed that 12% of participants from eight representative European Union nations had “inadequate” general health literacy (scores of 0–25 out of 50) and 35% had “problematic” (scores of 26–33 out of 50) general health literacy. These data revealed that limited health literacy skills were related to poor self-rated health status and higher health system costs, independent of social status or national origin.

Although much has been published about the relationships between health literacy and health outcomes during the last few decades^{4–6}, the field has received some criticism. The most common measures of health literacy have traditionally focused on a relatively narrow range of skills^{7, 8}, namely reading and, to a lesser extent, the ability to use mathematics in health contexts (also known as numeracy). Given that typical healthcare encounters may require patients to have advanced reading skills, the heavy reliance on reading measures in health literacy research has ignored the fact that information may come to individuals from a variety of sources; written material being only one of them. For example, knowledge of health-related issues may come from audiovisual media, one’s interpersonal experiences with the healthcare system, or interactions with friends and family, to name a few.

In 2010, Macek and colleagues hypothesized that conceptual knowledge provided a more suitable means of assessing how well an individual might understand, appraise, and apply health information⁹, than did reading comprehension, word recognition, or numeracy. Focusing on the relationship between health literacy and oral health, they developed a survey to measure oral health conceptual knowledge, called the *Comprehensive Measure of Oral Health Knowledge* (CMOHK)⁹. The resulting CMOHK instrument consisted of questions that measured general oral health knowledge, as well as specific knowledge of oral disease prevention and management. Though promising, the initial developmental work was somewhat limited in that it employed a relatively small and homogeneous study population. In addition, the early work included only one oral health outcome measure, dental utilization, against which to assess concurrent (criterion) validity.

The purpose of the present investigation is to expand on the initial developmental work by testing the validity of the CMOHK using a larger, more diverse study sample, and by including additional outcome measures. The intention is ultimately to compare and contrast the use of the CMOHK versus other measurement tools in oral health literacy research.

METHODS

Data for this analysis came from a large, cross-sectional investigation of oral health literacy conducted in the United States, called the *Multi-site Oral Health Literacy Research Study*, or MOHLRS. Participants, with documented informed consent, were recruited from initial-care

seeking dental patients who presented to two university-based dental clinics in California and Maryland, between 2011 and 2014. The MOHLRS survey included multiple assessments administered during a single, face-to-face interview that lasted approximately 40 minutes. A detailed description of the MOHLRS project is available elsewhere¹⁰.

The MOHLRS sample¹⁰ included 922 English-speaking adults, 456 recruited in Maryland and 466 in Southern California. Most (44%) of the participants were 45–64 years of age and approximately half were male. The distribution of race/ethnicity reflected the multi-site nature of the project – 38% were non-Hispanic white, 36% were non-Hispanic black, 11% were other races, and 14% were Hispanic. Almost 33% of the sample included adults with no more than a high school education and 61% earned less than \$44,000 annually. Most (66%) spoke English exclusively and more than one-third of the remainder did not speak English as a child. Only 38% reported having any form of dental insurance. The reader should note that the present investigation included only 909 of the 922 participants because 13 individuals left three or more of the oral health conceptual knowledge questions unanswered.

Oral health conceptual knowledge was assessed by the CMOHK instrument. The CMOHK included 23 sets of multiple-choice questions and accompanying response choices that were read aloud to participants. Each correctly answered question yielded 1 point. The total number of correct responses was divided into four categories approximating quartiles (*low*, *middle-low*, *middle-high*, and *high*), representing different levels of oral health conceptual knowledge and corresponding to the somewhat negatively-skewed distribution of values (skewness score = -0.67).

The primary outcome measures for the present investigation included dental utilization (two versions), self-efficacy (two versions), and dental beliefs and attitudes. The dental utilization items included two separate questions, each adapted from items used in national surveys of the U.S. population¹¹. The question assessing whether the participant had a dental visit in the last year came from an item that asked, “About how long has it been since you last saw a dentist for any reason?” The question assessing dental cleanings in the last year came from an item that asked, “When was the last time you saw a dentist or dental hygienist to have your teeth cleaned?”

The two self-efficacy items included a brief introductory statement, followed by the question. The first item read, “Some people are sure they can do what is needed to prevent tooth decay. Other people are not sure. How sure are you that you can prevent tooth decay?” The second item read, “Some people are sure they can do what is needed to prevent gum disease. Other people are not sure. How sure are you that you can prevent gum disease?” Both items were scored on a 4-category Likert scale, ranging from “very sure” to “very unsure”. A dichotomous variable was created for each questions (“low” and “high”), using the cut-point between “sure” and “unsure” response categories.

The dental beliefs and attitudes items included nine questions adopted from the Florida Dental Care Study¹²; two questions concerning attitudes about cost were not used. The items asked participants to provide their opinions about a variety of topics, including dentists, self-

care practices, and oral health determinism. The questions were scored on a 5-category Likert scale, ranging from “strongly agree” to “strongly disagree” (scoring for selected questions was reversed for consistency). Scores for all nine items were summed and the resulting total was divided into two categories (“low” and “high”), based on the median.

Three existing health literacy measures were included in this investigation as a way of assessing the construct validity of the CMOHK instrument. The first measure was developed by Chew and colleagues¹³. It measured confidence filling out health forms, and was based on a 5-category Likert scale. For this investigation, scores were grouped into a dichotomous variable, combining “extremely” and “quite a bit” in the “high” category, and “somewhat”, “a little bit”, and “not at all” in the “low” category. The second widely-used health literacy measure was the *Rapid Estimate of Adult Literacy in Medicine* (REALM), developed by Davis and colleagues¹⁴. The REALM assessed a participant’s ability to recognize medical words of varying complexity based on correct pronunciation. Our scoring categories followed those that were originally proposed by the REALM developers (0–18, 19–44, 45–60, and 61–66). The third health literacy measure was the abbreviated version of the *Test of Functional Health Literacy in Adults* (Short-TOFHLA). Developed by Baker and colleagues¹⁵, this 36-item, reading comprehension instrument assessed a participant’s ability to use the context of medical text to select missing words from a corresponding list; a format referred to as the cloze procedure¹⁶. Our scoring categories also followed those that were originally proposed.

We used the IVEware software program (Version 0.2; University of Michigan, 2012) to impute a limited number (<4%) of missing values in the dataset, using the sequential regression multivariate imputation method¹⁷ in a cyclic process, with 25 imputations and 125 iterations. There were no missing values for the CMOHK. We then used the SAS statistical software program for Windows (Version 9.3; SAS Institute, Inc., 2002–2012) to conduct all bivariate and multivariable analyses. Covariates included recruitment site, age, sex, race/ethnicity, education level, and languages spoken, a composite variable describing whether multiple languages were spoken at the time of the interview and what language was spoken as a child.

Study methods were reviewed and approved as representing minimal risk by institutional review boards at The University of Maryland, Baltimore; The University of Baltimore; and The University of California, Los Angeles.

RESULTS

The CMOHK instrument contained four unique domains: general oral health knowledge, knowledge of dental caries prevention and management, knowledge of periodontal disease prevention and management, and knowledge of oral cancer prevention and management. In general, MOHLRS participants exhibited the highest level of understanding for the six items that comprised the *knowledge of dental caries prevention and management* domain (86.8% correct, range 75.9% to 96.5%). By comparison, participants had the lowest level of understanding for the two questions that comprised the *knowledge of oral cancer prevention and management* area (64.5% correct, range 57.4% to 71.6%). Understanding in the *general*

oral health knowledge domain (10 items) (74.5% correct, range 41.5% to 98.6%) and the *knowledge of periodontal disease prevention and management* domain (5 items) (72.5%, range 63.7% to 77.8%) were somewhere in the middle.

Table 1 shows the distribution of CMOHK scores by selected sociodemographic characteristics. Overall, about 18% of the sample exhibited the lowest level of knowledge and 19% exhibited the highest level. CMOHK scores significantly varied across all of the sociodemographic variables except gender (chi-square test = 0.14), including recruitment site (chi-square $p=0.04$), race/ethnicity ($p<0.01$), education level ($p<0.01$), and languages spoken ($p<0.01$). The relationship between CMOHK scores and age just missed being statistically significant ($p=0.054$). Participants recruited in Maryland, Hispanics, persons with less than a high school education, and those who spoke a language other than English as a child tended to have the lowest levels of knowledge. Non-Hispanic whites, college graduates, as well as those who spoke multiple languages at the time of the survey and who spoke English as a child had the highest knowledge scores.

Table 2 shows that CMOHK scores were significantly associated with the three established health literacy measures. Study participants with low conceptual knowledge scores were more likely to have less confidence filling out health forms ($p<0.01$), as well as lower scores for word recognition (REALM) ($p<0.01$) and reading comprehension (Short-TOFHLA) ($p<0.01$).

There was no significant relationship between conceptual knowledge and two different forms of dental service utilization (Table 3). CMOHK scores were neither associated with having had a dental visit in the last year ($p=0.26$) nor with having had a dental cleaning in the last year ($p=0.64$).

By contrast, CMOHK scores were significantly associated with self-efficacy for knowing how to prevent dental disease, as well as with dental beliefs and attitudes (Table 4). Study participants with low conceptual knowledge scores had the lowest levels of self-efficacy for knowing how to prevent dental caries (26.2%; $p<0.01$) and periodontal disease (35.6%; $p<0.01$). Those with low CMOHK scores also had the lowest beliefs and attitudes concerning dentistry and oral health care (80.0%; $p<0.01$).

Table 5 shows multiple logistic regression analyses for the five oral health outcome measures, respectively, controlling for relevant covariates (Models A–E). Consistent with the bivariate findings, CMOHK scores were not significantly associated with the adjusted odds of having had a dental visit in the last year or with having had a dental cleaning in the last year. Those with low CMOHK scores were 2.3 times as likely to have low self-efficacy for knowing how to prevent dental caries as were the reference group. Participants with low and middle-low CMOHK scores were 3.2 and 1.9 times as likely, respectively, to have low self-efficacy for knowing how to prevent periodontal disease as the reference. In addition, those with low and middle-low conceptual knowledge scores were 4.4 and 2.9 times as likely, respectively, to have low dental beliefs and attitudes as were the reference “high” conceptual knowledge group.

DISCUSSION

When the CMOHK was initially developed, data were gathered from a relatively small sample (n=100) of adults from Baltimore who were primarily African American⁹. The present investigation builds upon this earlier work by including a larger, more diverse sample of more than 900 individuals. A previously published report¹⁰ showed that the MOHLRS sample included a broader cross-section of age, gender, race/ethnicity, and sociodemographic groups than were included in the original, developmental work. For example, only 6% of the original sample was a race other than African American and only 1% was Hispanic. The MOHLRS sample was 38% non-Hispanic white, 36% non-Hispanic black, and 14% Hispanic. The MOHLRS sample was also more geographically diverse, including residents from Maryland, Delaware, Pennsylvania, California, and the District of Columbia.

A second objective of the larger sample was to confirm/refute the previously reported relationships between the CMOHK and three other health literacy instruments. In the original study, the CMOHK was compared against two accepted health literacy instruments (the REALM and Short-TOFHLA) and one oral health outcome measure, dental utilization. In that original work, the CMOHK was found to be significantly associated with the REALM but not with the Short-TOFHLA. Macek and his colleagues reported being somewhat surprised by the inconsistency⁹ given that these two health literacy instruments are so widely (and interchangeably) used to test health literacy levels in the literature. Because of these inconsistent results, they considered that perhaps the REALM and Short-TOFHLA were measuring unique attributes.

In the present investigation, by contrast, the associations between the CMOHK and the REALM and Short-TOFHLA were both statistically significant. The finding that oral health conceptual knowledge was consistently and significantly associated with both word recognition and reading comprehension supports the contention that conceptual knowledge is, indeed, a construct of health literacy, as initially proposed by the Institute of Medicine¹⁸ in its landmark publication, *Health Literacy: A Prescription to End Confusion*. Inconsistencies in the findings between the developmental work and the present study likely resulted from differences in statistical power.

Of note, the previously reported developmental work included only one oral health variable, dental utilization, by which to test the concurrent (criterion) validity of the CMOHK. The original findings suggested that oral health conceptual knowledge was not significantly related to dental utilization. The present investigation re-analyzed the association between the CMOHK and dental utilization but, this time, included two separate aspects of utilization – one regarding any type of dental care visit and the other regarding a visit specifically for a dental cleaning. Despite having a more diverse sample and more statistical power, the present investigation, again, found no association between conceptual knowledge and dental utilization. We hypothesized that oral health conceptual knowledge direct results from interacting with dentists and/or dental hygienists. We also hypothesized that individuals with higher levels of oral health conceptual knowledge might be more likely to visit a dentist/dental hygienist because they would be expected to have a correspondingly higher

appreciation for the importance of oral health. The findings from the present investigation call these hypotheses into question.

A few explanations might be offered for this non-association. For instance, one year might be too short of a period to detect differences in dental utilization patterns across groups. A national survey in the United States¹⁹ estimated that up to 57% of working-age adults do not have an annual dental visit. Among poor groups, the percentage increases to 77%. It is conceivable that a conceptual knowledge variable would have established differences during a longer period of 2 years or more. Another possible explanation is that there truly is a relationship between oral health literacy and utilization but it is an indirect relationship, manifesting through mediators pathways. For example, low scores on the CMOHK could have been associated with visits to other, non-dental healthcare providers who were willing to treat oral health problems. The literature has shown that low-income populations sometimes seek oral health care from emergency departments, physicians, or pharmacists, especially when the needs are acute in nature^{20, 21}. The literature also documents that some adults avoid the healthcare system, altogether, relying on home remedies and prayer, for example²². The final potential explanation is that there was no relationship between conceptual knowledge and dental visits. This explanation implies that having conceptual knowledge is only one of many factors leading an individual to visit a dentist. This explanation also implies that individuals may be obtaining oral health conceptual knowledge outside of the dental environment. There is some support for these possibilities in the literature, as other studies have reported no association between health literacy and dental visits, as well^{23, 24}. The reader should also note that although dental insurance status is a strong predictor of dental utilization, its inclusion in the multiple logistic regression analyses (data not shown) did not alter the non-significant associations between CMOHK scores and the two utilization questions.

Beyond the REALM and Short-TOFHLA, the present investigation also showed that the CMOHK was significantly associated with another health literacy indicator, namely confidence filling out forms. Completing forms in a healthcare setting is challenging on a number of levels, including being able to recognize words and read sentences but also recalling details from the past and writing one's answers/thoughts in a coherent way. The finding that oral health conceptual knowledge was also related to this functional skill set provided additional evidence that the CMOHK is a valid measure of health literacy.

The question remains, however, whether these four health literacy measures can be both highly related to one another yet still measure different attributes, as was originally posited by Macek and colleagues in their developmental work⁹. In other words, it is still not clear for the field of oral health literacy if word recognition, reading comprehension, confidence filling out forms and conceptual knowledge are truly interchangeable. Future research is needed to clarify the relationships of these measurement instruments.

Bivariate and multivariable analyses showed that conceptual knowledge was significantly associated with self-efficacy to prevent dental caries and periodontal disease, even after controlling for relevant covariates. In a comprehensive description of the Health Belief Model and its evolution over time, Glanz and colleagues argued that behaviors (*e.g.*, oral

health self-care, avoidance of risky practices such as smoking, *etc.*) were guided by individual beliefs and self-efficacy²⁵. They also hypothesized that the relationship between beliefs and actions could be modified by a number of sociodemographic factors, such as age, gender, ethnicity, and knowledge. Given that the present investigation showed that oral health conceptual knowledge, dental beliefs and attitudes, and self-efficacy were significantly related to one another, even after controlling for potential confounders, this investigation provides additional support for the validity of the CMOHK as an oral health literacy measure.

Despite the notable improvements of this report over the original, developmental work, the present investigation had limitations. First, the present study was cross-sectional. Any conclusions regarding the relationships between conceptual knowledge and the various oral health outcomes included in this investigation cannot be thought of as reflecting causation. In addition, the findings of this investigation may not have been generalizable to the general population or to individuals who did not seek treatment from a university-based dental clinic. Finally, the CMOHK covered a finite range of conceptual knowledge topics. It is possible that other types of conceptual knowledge, such as familiarity with the healthcare system, payment options, and recommended self-care behaviors could have been associated with the oral health outcomes in complementary or opposing ways.

Although questions about the relationship between conceptual knowledge and dental utilization remain, the significant relationships between the CMOHK and several other oral health outcomes confirms that the CMOHK's concurrent (criterion) validity is good, at least as it relates to oral health-related beliefs and attitudes, and self-efficacy to prevent/manage oral diseases. Consistent with the IOM's framework¹⁸, oral health conceptual knowledge appears to be an important component of health literacy. As such, the CMOHK provides an additional tool for assessing the relationship health literacy and oral health in an arena that is dominated by word recognition and reading comprehension measures^{26, 27}. Results from the present investigation lend credence to the CMOHK's use in future studies of oral health literacy.

Acknowledgments

This project was funded by the National Institute of Dental and Craniofacial Research, National Institutes of Health (R01 DE020858). The authors are grateful to Maria Rosa Watson, Jennifer Holtzman, Bonnie Braun, Linda Aldoory, Diana Messadi, Jessica Richards, P. Ann Cotten, James Bradley, Laurie-Ann Sayles, Kristi Grimes, Lynette Dozier, Leonard Cohen, Susan Coller, Solace Ehioghae, Kathleen Ford, MaryAnn Schneiderman, Sue Tatterson, Folasayo Adunola, Marla Yee, Jie Ge, Jimin Kim, and Danielle Motley for their valuable contributions to this project.

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Table 1

Frequency (and percentage in parentheses) of oral health conceptual knowledge, by selected characteristics (n=909)

Characteristic	Level of oral health conceptual knowledge			
	Low	Middle-Low	Middle-High	High
Overall	160 (17.6)	247 (27.2)	327 (36.0)	175 (19.2)
Recruitment site				
Maryland	85 (19.1)	124 (27.9)	140 (31.6)	95 (21.4)
California	75 (16.1)	123 (26.5)	187 (40.2)	80 (17.2)
Age				
18–24 years	16 (22.2)	23 (32.0)	25 (34.7)	8 (11.1)
25–44 years	60 (18.7)	92 (28.6)	118 (36.8)	51 (15.9)
45–64 years	66 (16.7)	105 (26.5)	130 (32.8)	95 (24.0)
65 years or greater	18 (15.0)	27 (22.5)	54 (45.0)	21 (17.5)
Gender				
Male	82 (18.7)	125 (28.4)	162 (36.8)	71 (16.1)
Female	78 (16.6)	122 (26.0)	165 (35.2)	104 (22.2)
Race/ethnicity				
Non-Hispanic white	34 (9.8)	77 (22.2)	140 (40.3)	96 (27.7)
Non-Hispanic black	70 (21.1)	104 (31.3)	112 (33.7)	46 (13.9)
Non-Hispanic Asian	9 (23.1)	11 (28.2)	14 (35.9)	5 (12.8)
Non-Hispanic other	15 (22.4)	18 (26.9)	21 (31.3)	13 (19.4)
Hispanic	32 (25.8)	37 (29.8)	40 (32.3)	15 (12.1)
Education level				
Less than 12 years	28 (37.8)	23 (31.1)	13 (17.6)	10 (13.5)
12 years of GED	56 (24.3)	80 (34.8)	68 (29.6)	26 (11.3)
Some college	41 (14.7)	73 (26.3)	103 (37.1)	61 (21.9)
College graduate	35 (10.7)	71 (21.7)	143 (43.7)	78 (23.9)
Multiple languages spoken now/Languages spoken as a child				
No/English only	92 (15.4)	158 (26.4)	213 (35.6)	135 (22.6)
Yes/English only	16 (14.7)	26 (23.9)	49 (44.9)	18 (16.5)
Yes/English and other	17 (20.0)	22 (25.9)	36 (42.3)	10 (11.8)
Yes/Other than English	35 (29.9)	41 (35.0)	29 (24.8)	12 (10.3)

Note: Statistically significant χ^2 test associations ($p < 0.05$) listed in **bold**

Association between level of oral health conceptual knowledge and three health literacy measures (frequencies and percentages, in parentheses, listed in each table cell) (n=909)

Table 2

Level of oral health conceptual knowledge	Confidence filling out forms		REALM score		Short-TOFHLA score	
	Low [*]	High [†]	0–60 [‡]	61–66	0–22 [¶]	23–36
Low	42 (26.2)	118 (73.8)	87 (54.4)	73 (45.6)	32 (20.0)	128 (80.0)
Medium-low	34 (13.8)	213 (86.2)	64 (25.9)	183 (74.1)	13 (5.3)	234 (94.7)
Medium-high	24 (7.3)	303 (92.7)	34 (10.4)	293 (89.6)	9 (2.7)	318 (97.3)
High	14 (8.0)	161 (92.0)	6 (3.4)	169 (96.6)	2 (1.1)	173 (98.9)

Note: Statistically significant χ^2 test associations ($p < 0.01$) listed in **bold**

* Low = “Somewhat”, “A little bit”, and “Not at all”

[†] High = “Quite a bit” and “Extremely”

[‡] Three lowest categories of REALM scores combined due to small cell size

[¶] Two lowest categories of Short-TOFHLA scores combined due to small cell size

Table 3

Association between level of oral health conceptual knowledge and visits in the last year for dental care and a dental cleaning (frequencies and percentages, in parentheses, listed in each table cell) (n=909)

Level of oral health conceptual knowledge	Dental care visit in last year		Dental cleaning in last year	
	No	Yes	No	Yes
Low	84 (52.5)	76 (47.5)	109 (68.1)	51 (31.9)
Middle-low	120 (48.6)	127 (51.4)	171 (69.2)	76 (30.8)
Middle-high	172 (52.6)	155 (47.4)	229 (70.0)	98 (30.0)
High	77 (44.0)	98 (56.0)	113 (64.6)	62 (35.4)

Association between level of oral health conceptual knowledge and self-efficacy for knowing how to prevent dental caries and periodontal disease, and dental beliefs and attitudes (frequencies and percentages, in parentheses, listed in each table cell) (n=909)

Table 4

Level of oral health conceptual knowledge	Self-efficacy for knowing how to prevent...					
	Dental beliefs and attitudes		Dental caries		Periodontal disease	
	Low	High	Low	High	Low	High
Low	42 (26.2)	118 (73.8)	57 (35.6)	103 (64.4)	128 (80.0)	32 (20.0)
Middle-low	44 (17.8)	203 (82.2)	61 (24.7)	186 (75.3)	176 (71.3)	71 (28.7)
Middle-high	56 (17.1)	271 (82.8)	66 (20.2)	261 (79.8)	155 (47.4)	172 (52.6)
High	21 (12.0)	154 (88.0)	26 (14.9)	149 (85.1)	77 (44.0)	98 (56.0)

Note: Statistically significant χ^2 test associations ($p < 0.01$) listed in **bold**

Table 5

Adjusted* odds of several oral health outcome measures across different levels of oral health conceptual knowledge (adjusted odds ratios and 95% confidence intervals, in parentheses, listed in each table cell) (n=909)

Level of oral health conceptual knowledge	Model A	Model B	Model C	Model D	Model E
Low	1.37 (0.86–2.22)	1.14 (0.69–1.90)	2.32 (1.23–4.39)	3.19 (1.78–5.74)	4.37 (2.55–7.49)
Middle-low	1.15 (0.75–1.76)	1.21 (0.77–1.89)	1.58 (0.87–2.87)	1.95 (1.31–3.38)	2.90 (1.86–4.50)
Middle-high	1.35 (0.92–2.00)	1.31 (0.87–1.98)	1.57 (0.89–2.77)	1.48 (0.87–2.51)	1.22 (0.82–1.81)
High (reference)	1.0	1.0	1.0	1.0	1.0

Model A = Adjusted* odds of having no dental visit in the last year

Model B = Adjusted* odds of having no dental cleaning in the last year

Model C = Adjusted* odds of having low self-efficacy for knowing how to prevent dental caries

Model D = Adjusted* odds of having low self-efficacy for knowing how to prevent periodontal disease

Model E = Adjusted* odds of having low dental beliefs and attitudes

* Adjusted for recruitment site, age, gender, race/ethnicity, education level, and multiple languages spoken currently/as a child
 Note: Statistically significant Wald χ^2 test associations ($p < 0.05$) listed in **bold**