# Scientific Article

# Beyond Word Recognition: Understanding Pediatric Oral Health Literacy

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**Abstract:** **Purpose:** Parental oral health literacy is proposed to be an indicator of children's oral health. The purpose of this study was to test if word recognition, commonly used to assess health literacy, is an adequate measure of pediatric oral health literacy. This study evaluated 3 aspects of oral health literacy and parent-reported child oral health. **Methods:** A 3-part pediatric oral health literacy inventory was created to assess parents' word recognition, vocabulary knowledge, and comprehension of 35 terms used in pediatric dentistry. The inventory was administered to 45 English-speaking parents of children enrolled in Head Start. **Results:** Parents' ability to read dental terms was not associated with vocabulary knowledge ($r=0.29$, $P<.06$) or comprehension ($r=0.28$, $P>.06$) of the terms. Vocabulary knowledge was strongly associated with comprehension ($r=0.80$, $P<.001$). Parent-reported child oral health status was not associated with word recognition, vocabulary knowledge, or comprehension; however parents reporting either excellent or fair/poor ratings had higher scores on all components of the inventory. **Conclusions:** Word recognition is an inadequate indicator of comprehension of pediatric oral health concepts; pediatric oral health literacy is a multifaceted construct. Parents with adequate reading ability may have difficulty understanding oral health information. (Pediatr Dent 2011;33:420-5)   Received January 16, 2010   /   Last Revision May 7, 2010   /   Accepted May 17, 2010

KEYWORDS: LITERACY, PUBLIC HEALTH, PREVENTIVE DENTISTRY, HEALTH SERVICES, MEDICOLEGAL ISSUES

The ability to read, understand, and use health information is a specialized form of literacy termed "health literacy."[1] As many as 14% of American adults lack basic health literacy; an additional 22% function only at a basic level of health literacy.[2] Low health literacy is associated with less frequent preventive care, unhealthy behaviors and incorrect health beliefs, and poorer health outcomes.[3-6] Most health literacy studies have used reading ability as a proxy for this complex construct. One of the most common instruments used to screen for health literacy, the Rapid Estimate of Adult Literacy in Medicine (REALM), relies solely on an individual's ability to read terms aloud.[7] REALM does not test for word comprehension or the ability to apply information conveyed by specific terms. Studies have demonstrated significant associations between REALM scores and an individual's knowledge about adult health issues but less clear associations with health behaviors and health status.[6,8-10]

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There have been relatively few health literacy studies specific to pediatric concerns. Those that exist yield conflicting results, possibly due to the use of different instruments to assess health literacy or due to the complexity of the underlying relationship between parental literacy and child health outcomes.[6,11,12] Although logical, it is unclear to what extent and in what manner parental health literacy influences or reflects parenting beliefs and behaviors and, in turn, how it affects children's overall health.

Oral health literacy has been defined by the American Dental Association as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate oral health decisions."[13] Three instruments have been developed to estimate adults' oral health literacy: the Rapid Estimate of Adult Literacy in Dentistry-99 (REALD-99), its abbreviated version, the Rapid Estimate of Adult Literacy in Dentistry-30 (REALD-30), and the Test of Functional Health Literacy in Dentistry (TOFHLiD).[14-16] Higher scores on the REALD-99 and TOFHLiD have been shown to be correlated with self-reported oral health-related quality of life, but neither assessment was found to correlate with parent or child oral health status. Conversely, adults who scored in the lowest tertile of the REALD-30 were more likely to report fair or poor oral health status and to have incorrect oral health knowledge.[17] Although both the REALD and the TOFHLiD were initially tested on a population of parents of pediatric dental patients, there have been no studies specifically intended to ascertain parents' pediatric oral health literacy.

Lower oral health literacy may impair a parent's ability to act on behalf of their child's oral health needs. In partial support of this proposition is a study by Schroth and Moffett, who reported that low maternal education was associated with early childhood caries; however, this study did not include measures of mother's literacy or oral health literacy.[18]

The purpose of this present study was to evaluate the measurement of parents' oral health literacy by evaluating the relationship between 3 different components of pediatric oral health literacy and parent-reported child oral health status. To do so, we created a 3-part Oral Health Literacy Inventory for Parents (**OH-LIP**) that assessed: word recognition; vocabulary knowledge; and comprehension of 35 pediatric oral health terms. We hypothesized that:

1. Word recognition of pediatric oral health terms is weakly correlated with parents' vocabulary knowledge and comprehension of these terms and therefore, overestimates oral health literacy.

2. Parental comprehension of oral health terms is positively associated with the parent-reported oral health status of the child.

## Methods

The study setting was 2 Head Start programs in western Washington State with centers located primarily in nonfluoridated municipalities. Federally funded educational programs include Early Head Start for low-income infants and Head Start for preschool-age children. Study participants were parents of children enrolled in either program. Children who were no longer in Head Start or over 6-years-old or whose parents were not verbally fluent in English were excluded. Head Start staff and teachers informed parents about the study and referred interested parents to the principal investigator (**PI**). Study procedures were described in writing and verbally by the PI to potential participants, after which informed consents were obtained. Participants were given a gift card for participating. The Institutional Review Board of the University of Washington, Seattle, Wash, approved the study methods. Based on prior power calculations that assumed a correlation of 0.4 or greater between subsets of OH-LIP scores, a sample size of 45 subjects had 80% power to demonstrate a statistically significant nonzero correlation between OH-LIP scores based a 2-sided test of a Pearson's correlation coefficient and a 0.05 significance level.

The OH-LIP evaluates 3 components or oral health literacy: (1) word recognition; (2) vocabulary knowledge; and (3) comprehension. The OH-LIP is composed of a list of 35 pediatric oral health-related words and terms. The items included words from the REALD terms from a research instrument called *Things to Know about Baby Teeth*[19] as well as words and phrases commonly used with parents suggested by pediatric dental faculty and residents.

To assess word recognition (OH-LIP part 1), parents were asked to read the list of 35 terms; the procedure was similar to the method used with the REALM and REALD. The list was then read aloud and parents were asked to give a verbal definition of each term (OH-LIP part 2). To determine oral health comprehension (OH-LIP part 3), parents were read brief pas-

sages from oral health education brochures. Each of the 35 passages contained one of the OH-LIP terms. Following each passage, parents were asked a question to evaluate their understanding of the information, including their ability to act on it correctly. For example, for the item primary teeth, parents were asked first to read the term aloud (part 1). Then, parents were asked, "What does the term primary teeth mean to you?" (part 2). In part 3, parents were read the sentence "Your child's primary teeth come in about 6 months after birth" and asked "Why are they called primary teeth?"

The OH-LIP was administered as part of a 35-minute interview that included assessments of child oral health status and family demographics. Each set of measures is described in detail below. The order of administration was: OH-LIP parts 1, 2, and 3, child oral health status, and demographics. Interviews were conducted by the principal investigator in private areas at the Head Start program sites and were audiotaped to facilitate scoring responses to the OH-LIP. The 3 questions about children's oral health status were taken from the National Survey of Children's Health (**NSCH**) 2003-2004: parent's perception of the child's oral health status; current treatment needs; and the date of the child's last dental visit.[20] Demographic questions asked about race, ethnicity, income, gender, marital status, educational level, number of children, and age of the study child. Clinical examinations of the children were not conducted because it was not feasible to do so at the Head Start sites and because estimates of caries activity without the benefit of radiographs are unreliable.

Talekar and colleagues, however, reported that parents are able to provide a reasonably accurate assessment of their child's oral health status, so parental report using validated questions from the NSCH was used as a proxy for child oral health status.[21] Fluoride exposure was also not estimated due to the difficulty and unreliability of estimating fluoride exposure from multiple sources, including, possibly, pediatrician's offices, dental offices, daily tooth-brushing, municipal water fluoridation, and any halo effect. Most of the children, however, resided in nonfluoridated areas. Head Start is required to help parents obtain dental screenings and necessary services within 90 days of a child's enrollment in Head Start, so by the time of the study, most children had completed at least 1 dental screening. Children in Head Start perform daily supervised tooth-brushing with fluoridated toothpaste under the guidance of Head Start teachers after eating.

The audio records were reviewed off-site after completing the parent interview. OH-LIP part 1 (word recognition) responses were scored as either correct (1) or incorrect (0) based on the parent's pronunciation. The pronunciation standard was the Random House Unabridged Dictionary.[22] This is the same criterion used with the REALD and REALM instruments. Parents had the choice to skip any item by saying, "pass" (coded as incorrect). An overall word recognition score was obtained by computing the mean item score multiplied by 100, giving a possible range of 0 to 100 points.

Scoring criteria for OH-LIP part 2 (vocabulary knowledge) and part 3 (comprehension) were developed based on the responses of the first 16 parents enrolled in the study. A panel consisting of the study authors reviewed transcripts of

all audio records. The panel established scoring criteria illustrated with examples of responses which were correct (1 point), partially correct (0.5 points), or incorrect (0 points) for each item. Total scores for parts 2 and 3 were obtained by computing the mean item score multiplied by 100, giving a possible range of 0 to 100 points for OH-LIP parts 2 and 3.

Internal consistency was ascertained using Cronbach's alpha, which was: 0.93 for OH-LIP 1 (word recognition scores); 0.87 for OH-LIP 2 (vocabulary knowledge scores); and 0.86 for OH-LIP 3 (comprehension scores), indicating excellent internal consistency. Intra-rater reliability was calculated based on 23 audio recordings for OH-LIP 1 and a random selection of 20 interviews for OH-LIP parts 2 and 3. The intraclass correlation coefficient was: 0.98 for OH-LIP 1; 0.94 for OH-LIP 2; and 0.95 for OH-LIP 3. Most individual items had excellent intra-rater agreement ($\kappa$>0.75). Only 4 items had a kappa statistic lower than 0.40, indicating poor agreement. These items were: tooth and filling in OH-LIP 2 and erupt and sealant in OH-LIP 3.

We determined correlation between OH-LIP 1, 2, and 3 using the Spearman rank correlation coefficient. We used the Kruskal-Wallis test to assess associations between each component of the OH-LIP, parent-reported child oral health status, and parental education. Parent-reported child oral health scores in "fair" and "poor" categories were combined to form 1 category due to the small number of parents who reported these categories.

## Results

Demographic information describing the 45 study parents is shown in Table 1. Most were females and Caucasian. As expected given the study population, most were from low-income families.

For the group as a whole, OH-LIP 1 scores for the 35 items were high. Most (78% or more) read each word correctly (Table 2). In contrast, OH-LIP 2 scores revealed numerous instances of incomplete or incorrect understanding. Almost half of the terms were scored as incorrect or partially incorrect for the majority of participants. Only 1 of the 35 terms, permanent teeth, was scored as fully correct for 75% or more of parents. Interestingly, 10 parents confused primary teeth with permanent teeth initially and realized their error when the term permanent teeth was read to them during part 2. The term erupt received the greatest number of fully incorrect responses (80%); many parents described erupt as referring to an explosion or infection. The term general anesthesia was described as a locally acting anesthetic by almost half of the parents. One parent defined it as "...something that's given in a doctor's office, and it's not...doesn't put you to sleep; it just numbs the general area."

The term most frequently scored as incorrect in OH-LIP part 3, was decay (48%). This item was presented to parents in the following passage: "Tooth decay in primary teeth often means there will be tooth decay in permanent teeth." Parents were asked: "How might this be true?" Many parents did not appear to understand the statement. Parents who answered the question partially correctly often proposed that decay would travel "through the root" to get to the permanent tooth. A second term that revealed common misunderstanding was

fluoride varnish. Fifteen parents were unsure what fluoride varnish referred to, and some confused fluoride varnish with fluoride drops or tablets prescribed for home use. Finally, although most parents (82%) understood the term pea-sized amount of toothpaste to indicate a small amount of toothpaste, 4 parents did not. One parent indicated several inches as a "pea-sized" amount of toothpaste.

Associations between OH-LIP 1 and 2 scores and parental education were not statistically significant. There was a significant association between OH-LIP 3 and parental education and a trend of increasing OH-LIP scores with higher education. (Table 3) Associations between OH-LIP 1, 2, or 3 scores and parent-report of child oral health status did not reach statistical significance; however parents who reported either "excellent" or "fair or poor" oral health status had higher scores on all 3 components of the OH-LIP than did parents who reported their children were in "good" or "very good" oral health status (Table 4).

## Discussion

Word recognition is a commonly used method to screen for oral health literacy. While poor word recognition is likely to identify individuals with low health literacy, the converse

### Table 1. DEMOGRAPHIC CHARACTERISTICS

| | Characteristic | No. of subjects (%) N=45 |
|---|---|---|
| Parent's gender | Male | 4 (9) |
| | Female | 41 (91) |
| Hispanic | Yes | 10 (22) |
| | No | 35 (78) |
| Parent's ethnicity | Caucasian | 35 (78)* |
| | American Indian or Alaskan Native | 2 (4)* |
| | Native Hawaiian or Pacific Islander | 1 (2)* |
| | Asian or Asian American | 1 (2)* |
| | Other | 7 (16)* |
| Primary language | English | 38 (84)* |
| | Other | 10 (22)* |
| Income | <$10,000 | 16 (36) |
| | $10,000-$39,000 | 24 (53) |
| | $40,000-$69,000 | 2 (4) |
| Education | <9th grade | 3 (7) |
| | Some high school | 9 (20) |
| | High school diploma or GED | 10 (22) |
| | Some college | 15 (44) |
| | College degree | 5 (11) |

\* Numbers add up to >100% due to subjects' ability to select multiple categories.

is not necessarily so. Our results support the hypothesis that word recognition overestimates a parent's oral health literacy. We found only weak and nonsignificant correlations ($r<.30$) between parents' ability to correctly read and define oral health terms and between word recognition of oral health terms and their deeper comprehension. This lack of association is evidence that the ability to read and pronounce words correctly does not imply an understanding of the underlying concepts or of oral health recommendations.

Parents who reported their child's oral health status as "excellent" and as "fair or poor" had higher scores on all 3 components of the OH-LIP than did parents who reported their child's oral health status as "very good" or "good" oral health status. This finding is counterintuitive. Although it did not reach statistical significance, the fact that it held for all 3 components of the OH-LIP suggests further research is warranted.

Pediatric oral health literacy can be both a goal of health promotion and a pre-existing characteristic of parents.[23] Likewise, the relationship between a parent's oral health literacy and a child's oral health is subject to multiple influences and may be bidirectional. That is, children of parents with high oral health literacy may be in better health because their parents are better able to follow professional recommendations, obtain oral health care when indicated, and develop healthy at-home hygiene and diet practices. Paradoxically, parents of children with significant dental needs and extensive experience with dental treatment may increase their oral health literacy

| Table 2. ORAL HEALTH LITERACY INVENTORY FOR PARENTS (OH-LIP) PERCENTAGE OF CORRECT RESPONSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| | OH-LIP 1: Word recognition | OH-LIP 2: Vocabulary knowledge | | | OH-LIP 3: Comprehension | | |
| Item | Correct (%) | Fully correct | Partially correct | Incorrect | Fully correct | Partially correct | Incorrect |
| Brush | 100 | 33 | 62 | 5 | 47 | 51 | 2 |
| Floss | 100 | 38 | 56 | 7 | 40 | 27 | 33 |
| Germs | 100 | 33 | 47 | 20 | 67 | 24 | 9 |
| Bottle | 100 | 62 | 22 | 16 | 82 | 9 | 9 |
| Check-up | 100 | 20 | 67 | 13 | 67 | 31 | 2 |
| Pea-sized amount of toothpaste | 100 | 73 | 20 | 7 | 82 | - | 18 |
| Tooth | 98 | 13 | 67 | 20 | 11 | 67 | 22 |
| Filling | 98 | 46 | 50 | 5 | 53 | 42 | 4 |
| Acid | 98 | 27 | 44 | 29 | 68 | 7 | 25 |
| Tartar | 98 | 5 | 57 | 39 | 18 | 59 | 23 |
| Silver cap | 96 | 18 | 52 | 30 | 16 | 67 | 18 |
| Decay | 96 | 13 | 73 | 13 | 23 | 30 | 48 |
| Primary teeth | 96 | 49 | 5 | 44 | 69 | 11 | 20 |
| Cavities | 96 | 9 | 80 | 10 | 82 | 7 | 11 |
| Saliva | 96 | 20 | 71 | 9 | 30 | 32 | 39 |
| Sealant | 96 | 11 | 51 | 38 | 98 | 2 | - |
| Permanent teeth | 96 | 80 | 11 | 9 | 21 | 46 | 34 |
| Infection | 96 | 18 | 64 | 18 | 66 | 16 | 18 |
| Inflammation | 96 | 9 | 75 | 16 | 57 | 25 | 18 |
| Bacteria | 96 | 16 | 76 | 9 | 44 | 22 | 33 |
| Pediatric dentist | 96 | 18 | 73 | 9 | 38 | 56 | 7 |
| Snacks | 93 | 34 | 64 | 2 | 66 | 7 | 27 |
| Fluoride varnish | 93 | 9 | 38 | 53 | 13 | 53 | 33 |
| Numb | 91 | 9 | 89 | 2 | 29 | 51 | 20 |
| Hidden sugars | 91 | 53 | 20 | 27 | 40 | 29 | 31 |
| Discoloration | 91 | 51 | 30 | 19 | 69 | 24 | 7 |
| Plaque | 91 | 16 | 52 | 38 | 18 | 61 | 21 |
| Extraction | 91 | 67 | 22 | 11 | 33 | 49 | 19 |
| Teething | 89 | 74 | 12 | 14 | 80 | 7 | 13 |
| Gingivitis | 89 | 18 | 49 | 33 | 59 | 7 | 34 |
| Enamel | 87 | 25 | 48 | 27 | 56 | 36 | 9 |
| Abscess | 87 | 38 | 38 | 24 | 53 | 36 | 11 |
| Erupt | 82 | 11 | 9 | 80 | 73 | 16 | 11 |
| General anesthesia | 82 | 13 | 38 | 49 | 9 | 66 | 25 |
| Regularly | 78 | 71 | 21 | 9 | 73 | 13 | 13 |

as a consequence of interactions with dental professionals. The results of this study, in which parents with higher oral health comprehension rated their children as being at either end of the dental health spectrum, suggest pediatric oral health literacy is a complex construct that likely both affects and is affected by experiences with the dental health care system. Our findings identify this system as a potential point of oral health education intervention for parents, as parents can learn by experiences in the dental health care system and by interactions with dental health care providers.

Several limitations exist with the design and conduct of the study. Two limitations pertain to the composition of the study sample. The use of a small convenience sample of Head Start parents limits generalization to the broader population of low-income parents. It is possible the parents in this study may have had more knowledge of oral health than other low-income parents because of their participation in Head Start. Head Start's federal mandate to help parents obtain dental care for their children and program-specific oral health activities for children and parents may have created greater pediatric oral health knowledge; if so, our findings would over-estimate the oral health literacy of low-income parents of preschool aged children. Second, the restricted range in parental education of this sample, may have limited the ability to demonstrate statistically significant associations among the study constructs. A larger study is needed to test the extent to which low pediatric oral health literacy is associated with or independent of parental education.

Three limitations pertain to study measures. First, we did not use an objective test of fluency; all parents self reported fluency in English and were able to converse adequately in English with the examiner, and most parents scored well on OH-LIP part 1—the test of word recognition. Second, a proxy measure (parental report) was used to determine children's oral health status rather than a clinical examination; this choice was due primarily to constraints of place and funding. Talekar and colleagues reported that parents are able to assess their children's oral health and treatment needs accurately, so this may not be a significant limitation.[20] Finally, caries is a multifactorial disease, and we did not evaluate all variables that can contribute to caries, such as an objective evaluation of oral hygiene or caries activity, fluoride exposure, or exposure to fermentable carbohydrates. The primary purpose of this study, however, was to more fully characterize parental oral health literacy and identify areas where serious misunderstandings can occur even when reading ability is adequate.

This study is a preliminary study of parental oral health literacy; future studies should evaluate the instrument for external validity. Despite these limitations, this study demonstrates that relying on parents' reading ability, either formally or informally, as a proxy for oral health literacy may significantly overestimate a parent's understanding of: child oral health; proper oral hygiene and dietary practices; information and instructions received in the dental health care setting such as preventive oral health information; informed consent for procedures including general anesthesia; and postsurgical in-

structions. Oral health literacy is a construct that extends far beyond basic reading ability and, as such, there is great potential for parents to not understand communication in the pediatric dental care setting, despite having the ability to read words and terms correctly. This study's results have implications both for primary dental care providers and for oral health literacy researchers.

| Table 3. | PARENTAL EDUCATION AND ORAL HEALTH LITERACY INVENTORY FOR PARENTS (OH-LIP) SCORE | | | | | |
|---|---|---|---|---|---|
| **OH-LIP** | **Parental education** | **N** | **Mean±(SD)** | **Min, max** | **P-value*** |
| 1: Word recognition | <high school | 13 | 88±19 | 29, 100 | .06 |
| | High school or GED | 12 | 96±9 | 71, 100 | |
| | Some college | 20 | 96±10 | 54, 100 | |
| 2: Vocabulary knowledge | <high school | 13 | 50±14 | 23, 71 | .10 |
| | High school or GED | 12 | 54±13 | 38, 79 | |
| | Some college | 20 | 59±16 | 23, 79 | |
| 3: Comprehension | <high school | 13 | 59±14 | 29, 81 | >.04† |
| | High school or GED | 12 | 64±17 | 39, 89 | |
| | Some college | 20 | 71±11 | 39, 86 | |

\* Kruskal-Wallis test of significance used.                    † Denotes significant P-value.

| Table 4. | ORAL HEALTH LITERACY INVENTORY FOR PARENTS (OH-LIP) SCORES AND CHILD'S REPORTED ORAL HEALTH | | |
|---|---|---|---|
| | **N** | **Mean±(SD)** | **P-value*** |
| **OH-LIP 1** | | | .12 |
| Excellent | 14 | 98±4 | |
| Very good | 10 | 95±9 | |
| Good | 14 | 87±21 | |
| Fair/poor | 7 | 99±2 | |
| **OHLIP 2** | | | .12 |
| Excellent | 14 | 61±5 | |
| Very good | 10 | 55±14 | |
| Good | 14 | 47±16 | |
| Fair/poor | 7 | 58±7 | |
| **OHLIP 3** | | | .15 |
| Excellent | 14 | 71±3 | |
| Very good | 10 | 63±15 | |
| Good | 14 | 59±17 | |
| Fair/poor | 7 | 73±6 | |

\* Kruskal-Wallis test for statistical significance; no significant P-values are present.

## Conclusions

Based on this study's results, the following conclusions can be made:

1. Word recognition, a well-accepted method of screening for patient health literacy, overestimates oral health literacy.
2. Parents of young children may have substantial and serious misunderstandings of pediatric oral health terms and instructions.
3. Oral health providers should use simple language and seek to improve comprehension by the use of visual aids and verbal communication and techniques such as questioning parents to confirm understanding of instructions and encouraging parental questions.
4. Oral health literacy can be improved at a population level by developing oral health informational tools with an emphasis on improving understanding of commonly used and commonly misunderstood pediatric oral health terms.
5. Misunderstandings can have serious medical or legal implications especially when involving medications or treatment procedures that are irreversible or have associated risks such as general anesthesia.

## Acknowledgments

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