Screening for oral health literacy in an urban dental clinic

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Abstract

Objective: Studies show that the average person fails to understand and use health care related materials to their full potential. The goal of this study was to evaluate a health literacy instrument based on the Rapid Estimate of Adult Literacy in Medicine (REALM) that incorporates dental and medical terms into one 84-item Rapid Estimate of Adult Literacy in Medicine and Dentistry (REALM-D) measure and determine its association with patient characteristics of a culturally diverse dental clinic population.
Methods: An 84-item dental/medical health literacy word list and a 48-item health beliefs and attitudes survey was provided to a sample of 200 adult patients seeking treatment for the first time at an oral diagnosis clinic located in a large urban medical center in Los Angeles, California.
Results: Of the total sample, 154 participants read all of list 1 correctly, 141 read list 2 correctly, and only 38 read list 3 correctly. Nonwhite participants had significantly lower REALM-D scores at each level of difficulty as well as the total scale score compared to white participants. Participants who reported English as not their main language had significantly lower REALM-D scores. REALM-D scores also varied significantly by level of education among participants where as level of education increased, oral health literacy increased. At a bivariate level, race, education, and English as a main language remain predictive of health literacy in a regression model. An interaction between education and English as a main language was significant.
Conclusions: The REALM-D is an effective instrument for use by medical and dental clinicians in detecting differences among people of different backgrounds and for whom English was not their primary language.

Introduction

Low health literacy, one's limited capacity to obtain, comprehend and act on health information, is described as "the silent health epidemic" (1). Regarding postoperative instructions, Atchison and colleagues found that patients recall and comprehend little, sometimes only 50 percent of what they are told by doctors (2). Inappropriate use of health care services is seen among persons with low literacy in high hospitalization rates (3), high emergency room use (4,5), and underuse of preventive health services (6,7).

Health literacy was conceptualized by the American Medical Association in 1999 as "a constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment" (8). Since then, a number of instruments have been developed to measure various aspects of this construct. One of the most widely used measures is the Rapid Estimate of Adult Literacy in Medicine (REALM), a 66-item word recognition screening instrument designed to assess an adult's ability to read common medical words and lay terms for body parts and illnesses (9). One reason why the REALM has been used in many different clinical settings is that it is quick and easy to administer and score, and requires minimal training to use. A trade-off for a user-friendly instrument is that it only measures sight-reading ability and word recognition and not comprehension.

As progress is made toward developing health literacy instruments that are effective and efficient for use by medical and dental clinicians, three significant issues emerge: a) it is

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imperative that patients have the potential to understand materials regarding their medical history, treatment plans, and postoperative care plans; b) lengthy evaluation tools are not functional in clinical settings; and c) tools must assess fluency in field-specific terminology (10).

Measurement tools to assess oral health literacy are currently being developed, some based on the REALM. Lee and colleagues developed the Rapid Estimate of Adult Literacy in Dentistry (REALD)-30 dental word recognition instrument, consisting of 30 dental terms and arranged like the REALM in order of difficulty (11). Building on this measure, and hoping to produce a measure with better predictive validity, Richman and colleagues (12) developed and evaluated a 99-item REALD. Results indicated that since both measures were reliable, the added time to administered the 99-item measures outweighed its increased predictive validity (as shown in the ability to predict self-perceived oral), making the 30-item measure more user-friendly in a clinical setting. Jones and colleagues (13) used the 30-item REALD in a study to examine the association of knowledge, dental care visits, and oral health status with oral health literacy and concluded that dental knowledge is a strong predictor of low oral health literacy.

The purpose of this study is to evaluate a measurement instrument based on the REALM that incorporates dental and medical terms into one 84-item Rapid Estimate of Adult Literacy in Medicine and Dentistry (REALM-D) measure and determine its association with patient characteristics of a culturally diverse dental clinic population.

Methods

Using the 66-word REALM as a starting point, the first step in designing a dental/medical health literacy screening instrument was to see which of the original 66 words overlap with dental terminology. In a 3-month period of time prior to the start of the study, we assembled a convenience sample of 28 people, including University of California, Los Angeles (UCLA) dental students and new UCLA dental clinic patients (12 males and 16 females). The average age of the group was 41, with ages ranging from 19 to 87 years. The racial/ethnic make up of the group was 12 non-Hispanic whites, nine Asian/Pacific Islanders, four Hispanic, and three African-Americans. Each person was shown the list of REALM terms and asked to circle those words that they had heard when visiting a dental office or thought were related to dentistry. Of the original REALM terms, nine were identified as dental related (*nerves, germs, disease, infection, emergency, medication, irritation, antibiotics*, and *diagnosis*) suggesting extant overlap in terminology between dental and medical terminology.

Individuals in the group were then asked to list 5 to 10 dental specific words they thought were missing from the list. A total of 72 different dental-related terms were identified. The most frequently listed words included teeth, gums, pain, root canal, cavity, floss, brushing, bridge, crown, anesthetic, fluoride, abscess, denture, extraction, hygiene, insurance, and enamel. Other words listed less frequently included suction, blood, Novocain, pliers, gauze, braces, veneers, molars, periodontics, orthodontics, and bacteria. From this list, a selection of words mentioned most frequently were categorized into one of three word lists depending on pronunciation difficulty and number of syllables. Eighteen of the most frequently identified dental words were selected and six words were integrated according to level of difficulty into each of the three lists ranging from one-syllable words in list 1 to difficult, three-syllable words in list 3 (see Figure 1), bringing the total to 28 words per list for the REALM-D. Teeth and pain were located at the beginning of list one, while caries and abscess were located at the end. Likewise, extraction and bacteria were located at the beginning of list 3 and gingivitis and periodontitis were located at the end.

REALM-D Instrument (6 dental terms per column)		
List 1	**List 2**	**List 3**
Fat	Fatigue	Allergic
Flu	Pelvic	Menstrual
Pill	Jaundice	Testicle
Teeth	**Dentures**	**Extraction**
Dose	Infection	Colitis
Eye	Exercise	Emergency
Stress	Behavior	Medication
Pain	**Hygiene**	**Amalgam**
Smear	Prescription	Occupation
Nerves	Notify	Sexually
Germs	Gallbladder	Alcoholism
Tongue	**Root Canal**	**Bacteria**
Meals	Calories	Irritation
Disease	Depression	Constipation
Cancer	Miscarriage	Gonorrhea
Caries	**Insurance**	**Gingivitis**
Caffeine	Pregnancy	Inflammatory
Attack	Arthritis	Diabetes
Kidney	Nutrition	Hepatitis
Brushing	**Calculus**	**Anesthetic**
Hormones	Menopause	Antibiotics
Herpes	Appendix	Diagnosis
Seizure	Abnormal	Potassium
Abscess	**Toothache**	**Periodontitis**
Bowel	Syphilis	Anemia
Asthma	Hemorrhoids	Obesity
Rectal	Nausea	Osteoporosis
Incest	Directed	Impetigo

Figure 1 REALM-D added dental terms by list [terms in boldface type are dental terms added to original Rapid Estimate of Adult Literacy in Medicine (REALM)].

Subject recruitment

This 84-item dental/medical health literacy word list was provided to a sample of 200 adult patients seeking treatment for the first time at the UCLA School of Dentistry Oral Diagnosis Clinic between January 2005 and June 2006 following approval of the study protocol by the UCLA institutional review board. Potential participants were screened by the clinic coordinator based on information from the patient's completed intake form which included a medical history to

screen out people who had great difficulty communicating in English and were unable to consent to the study. People were chosen for inclusion in the study using the criteria of being at least 18 years of age, without cognitive, vision or hearing impairment, and having either limited or no difficulty understanding the intake questions posed to the patient by the coordinator in English. Each eligible participant was given a letter describing the study, emphasizing the voluntary confidential nature of the research, and the subject's ability to withdraw at any time, and inviting them to participate. This letter was read to the patient while they followed with their own copy in hand. Comprehension of the information was done by asking the subject to reiterate the procedures included in the study. Following informed consent, participants were administered the 84-item REALM-D and a 48-item survey instrument on health beliefs, attitudes, and knowledge. Each patient received $5.00 after completing the initial survey and another $5.00 after completing a follow-up survey.

The protocol for administration and scoring of the original instrument was retained. Each of the 200 study participants was given a laminated copy of the REALM-D by the interviewer and asked to read each word aloud. If the subject could not read a word, he/she was instructed to say "blank" and move to the next word. Over the course of the study, five interviewers were trained by the coinvestigator on how to administer and score the REALM-D instrument. Calibration was done by having two interviewers complete and score a sample REALM-D instrument as the coinvestigator listened for accurate phonetic pronunciation. Interviewers were given the original REALM-coding rubric and instructed to score accordingly, use the following marking system; a correctly pronounced word received a plus (+), a mispronounced word received check (√), and a word not attempted received a minus (−). Words pronounced correctly received a score of 1 by the interviewer, and mispronounced or not attempted words received a score of 0.

Patient health beliefs and attitudes questionnaire

Paper copies of a 48-item health beliefs and attitudes survey were attached to a clip board for the interviewer to administer to the study subject. Due to the link between low health literacy and an inability or inaccuracy in completing self-administered paper surveys (14), each interviewer was instructed to read the questions and point to the item so the participant could follow along and respond aloud. Possible responses included Likert scale, ranging from 0 (*never*) to 4 (*always*), *yes/no*, *true/false*, and *pick all that apply*. Categories of questions included patient health education assessment (UCLA clinic survey), health values, beliefs and attitudes (15), and health locus of control (16).

Reliability/validity

Reliability tests were conducted on each list and the total 84 items using Cronbach's alpha. The total 84-item instrument showed good reliability (alpha = 0.958) and each of the three lists also showed good reliability with Cronbach's alpha scores of 0.900, 0.915, and 0.893, respectively.

To test for validity, Pearson's and Spearman's correlations were used along with Mann–Whitney, and Kruskal–Wallis *t*-tests. Using SPSS version 16 (17), raw scores for each of the 200 subjects who completed the REALM-D were computed and correlation coefficients were generated. Criterion validity of the REALM-D was assessed in terms of its correlation with the 66-item REALM ($r = 0.99$), as well as between the REALM-D and two single-item indicators of health literacy: *how often the participant needed help reading medical forms* and *how confident the patient was in filling out medical forms, and* patient sociodemographics.

The REALM-D was administered with the initial survey and again at a follow-up visit for 80 participants between 6 and 9 months later to determine the test-retest validity. A high correlation was found between initial and follow-up total scores ($r = 0.95$) as well as between each list (L1 = 0.93, L2 = 0.95, L3 = 0.87).

Results

Study participant were fairly representative of the clinic population which draws a variety of people from the greater Los Angeles area. Over half of the sample (57 percent) were male and over half (57 percent) were white. The other half of the sample was made up of a variety of ethnic groups including Hispanic (19 percent), African-American (11 percent), Asian/Pacific Islander (9 percent), American Indian (2 percent), and those who self-identified as "other" (1 percent). Most of the sample had 4 years of college education (57 percent) with 15 percent reporting 5 or more years of college; however, 28 percent of the sample reported less than or equal to a high school education. Also representative of the dental clinic population, 20 percent of the sample reported English as not their main language. While this is representative of the UCLA dental clinic, it is underrepresentative of Los Angeles County where, according to 2000 Census data, 54 percent of household report a language other than English spoken at home. The majority of the sample (72 percent) paid for their dental care through private funds compared to 28 percent who paid through some source of public insurance.

The new 84-item REALM-D discriminated between easy and hard medical/dental terms as indicated by the number of participants who missed words in each list. Of the total sample of 200, 154 participants read all of list 1 correctly, 141 read list 2 correctly, and only 38 read list 3 correctly. Eight items were mispronounced by at least 10 percent of the

Table 1 Comparison of Sample Characteristics Associated with REALM-D Scores

Variables	REALM-D List 1		REALM-D List 2		REALM-D List 3		REALM-D Total (84 items)	
Pearson's *r* correlation	*r* (*P*-value)		*r* (*P*-value)		*r* (*P*-value)		*r* (*P*-value)	
Age Mean (SD) = 48.6 (16.93)	0.079 (0.266)		0.055 (0.438)		0.036 (0.613)		0.057 (0.420)	
Self-reported health Mean (SD) = 3.2 (0.64)	0.001 (0.993)		0.093 (0.218)		0.100 (0.186)		0.078 (0.303)	
t-test or ANOVA	Mean (SD)	*P*-value	Mean (SD)	*P*-value	Mean (SD)	*P*-value	Mean (SD)	*P*-value
Gender								
Male (*n* = 113)	27.2 (2.3)	0.916	27.0 (3.1)	0.928	24.6 (4.3)	0.896	78.8 (9.1)	0.903
Female (*n* = 87)	27.0 (2.4)		26.7 (2.9)		24.6 (4.1)		78.6 (8.7)	
Race								
White (*n* = 115)	27.6 (1.4)	0.016	27.5 (1.5)	0.000	25.4 (2.9)	0.003	80.5 (5.3)	0.002
Nonwhite (*n* = 85)	26.7 (3.1)		26.0 (4.0)		23.5 (5.3)		76.2 (11.8)	
Education								
≤High school (*n* = 55)	26.5 (3.9)	0.020	26.0 (4.1)	0.020	23.0 (5.4)	0.002	75.6 (12.8)	0.005
College (*n* = 115)	27.5 (1.3)		27.1 (2.6)		25.0 (3.6)		79.5 (6.9)	
Postcollege (*n* = 30)	27.8 (0.8)		27.5 (1.3)		26.0 (2.7)		81.2 (4.6)	
English as main language								
No (*n* = 40)	25.8 (4.3)	0.010	25.0 (4.2)	0.000	22.6 (4.8)	0.003	73.4 (12.8)	0.002
Yes (*n* = 160)	27.6 (1.3)		27.3 (2.4)		25.1 (3.9)		80.1 (7.1)	
Payment type								
Insurance (*n* = 56)	27.2 (2.6)	0.246	26.8 (3.3)	0.665	24.5 (4.5)	0.579	78.5 (9.8)	0.484
Self-pay (*n* = 144)	27.5 (1.3)		27.0 (2.1)		24.8 (3.2)		79.3 (5.9)	

ANOVA, analysis of variance; REALM, Rapid Estimate of Adult Literacy in Medicine; SD, standard deviation.

sample: *anemia, colitis, amalgam, anesthetic, periodontitis, jaundice, osteoporosis*, and *gingivitis*. Only one term (*eye*) was pronounced correctly by all participants.

Among the sample of 200 dental clinic patients, a number of patient characteristics are associated with oral health literacy as measured by the 84-item REALM-D (Table 1). Nonwhite participants had significantly lower REALM-D scores at each level of difficulty as well as the total scale score compared to white participants ($P \leq 0.002$). The greatest difference in scores was between the most difficult word list, where nonwhites missed on average two more words than whites (23.5 versus 25.4, $P = 0.003$) and the largest standard deviation was observed.

Participants who reported English as their main language also had significantly higher REALM-D scores than those participants whose main language was other than English. As with race, this was consistent across all three word lists as well as the total scale score with the biggest difference between scores on the most difficult word list where those whose primary language was not English missed on average 2.5 more words than their counterparts (22.6 versus 25.1, $P = 0.003$).

REALM-D scores also varied significantly by level of education among participants where as level of education increased, oral health literacy increased. Those who completed up to 12 years of education had consistently lower REALM-D scores across each list and total score. Those with 16 years or more of college education had close-to-perfect scores on list 1 and list 2 and missed on average three fewer list 3 terms than those with 12 or fewer years of education. No significant association with age, gender, self-reported general health or payment type (insurance or self-pay) was observed.

An individual's ability to read and complete medical forms and to access health information is considered a health literacy skill that facilitates navigation of the health system and decision making regarding disease prevention and management (18,19). Table 2 presents items in which participant's reported such skills by their REALM-D scores. Participants who reported always being confident filling out medical forms by themselves had significantly higher REALM-D scores across each list and total score. Similarly, participants who reported never needing someone to help them read hospital materials had significantly higher REALM-D scores for the more difficult word lists (list 2 and list 3) and total score. In terms of where participants seek health information, those with higher oral health literacy reported that they got their health information from the Internet significantly more frequently than those with lower oral health literacy. No differences were found between the groups with respect to their use of TV or newspaper as sources of health information;

Table 2 Health Information Seeking Associated with Dental/Medical Health Literacy

	REALM-D List 1		REALM-D List 2		REALM-D List 3		REALM-D Total (84 items)	
Variables	Mean (SD) Mean (SD)	*P*-value	Mean (SD) Mean (SD)	*P*-value	Mean (SD) Mean (SD)	*P*-value	Mean (SD) Mean (SD)	*P*-value
Confident filling out forms								
No	26.6 (3.6)	0.029	26.2 (3.5)	0.037	23.4 (4.5)	0.004	76.1 (11.1)	0.012
Yes	27.6 (1.3)*		27.2 (2.7)*		25.2 (3.9)		80.0 (7.3)*	
Need help reading forms								
No	26.9 (2.7)	0.147	25.8 (4.3)	0.008	23.2 (5.5)	0.013	75.9 (11.8)	0.015
Yes	27.4 (2.2)		27.3 (2.1)**		25.2 (3.3)*		79.9 (7.0)*	
Get health information via . . .								
TV								
No	27.3 (2.2)	0.796	27.0 (2.5)	0.524	24.6 (4.1)	0.947	78.9 (8.2)	0.747
Yes	27.2 (2.5)		26.7 (3.5)		24.6 (4.3)		78.5 (9.7)	
Newspaper								
No	27.1 (2.8)	0.355	26.7 (3.4)	0.181	24.3 (4.5)	0.175	78.1 (10.0)	0.197
Yes	27.5 (1.2)		27.2 (2.1)		25.1 (3.5)		79.8 (6.3)	
Magazines								
No	27.0 (2.9)	0.092	26.5 (3.6)	0.031	24.2 (4.7)	0.079	77.7 (10.6)	0.044
Yes	27.5 (1.2)		27.3 (1.8)*		25.2 (3.4)		80.1 (5.8)*	
Internet								
No	26.8 (3.1)	0.004	26.3 (3.9)	0.009	23.8 (5.0)	0.007	76.9 (11.2)	0.004
Yes	27.7 (0.9)*		27.4 (1.6)**		25.4 (3.0)**		80.5 (5.1)**	

* $P < 0.05$; ** $P < 0.01$.

REALM, Rapid Estimate of Adult Literacy in Medicine; SD, standard deviation.

however, a trend was found among higher oral health literacy and use of magazines as a source of health information.

Table 3 presents a multivariate regression model predicting REALM-D scores. Among the variables that were associated with health literacy at a bivariate level, race, education, and English as a main language remain predictive of health literacy. A trend ($P = 0.063$) is noted for reporting confidence in filling out medical forms. To further assess the association between health literacy and confidence in filling out forms, a separate regression analysis predicting confidence filling out medical forms using race, gender, and education level as covariates (data not shown) and health literacy (REALM-D score) as a predictor was conducted. We found health literacy to be the only significant predictor [$b = 0.50$, standard error (SE) = 0.21, $P = 0.02$] of confidence filling out medical forms.

Of special note, the interaction between education and English as a main language was significant in the multiple regression. The effect of education on REALM-D score is stronger among participants who do not report English as their main language. The effect of education level among

Table 3 Multivariate Multiple Regression Predicting 84-Item Total REALM-D Score

Variables	Standardized coefficients (SE)	Unstandardized coefficients (SE)	*P*-value
Male (versus female)	0.046 (1.34)	0.867 (1.34)	0.518
Age	0.018 (0.042)	0.010 (0.042)	0.810
Whites (versus all others)	0.155 (1.38)	2.936 (1.38)	0.035
Education	0.517 (0.503)	1.829 (0.503)	0.000
English as main language (versus not main)	1.04 (8.40)	23.812 (8.40)	0.005
Self-reported health	0.042 (1.081)	0.612 (1.081)	0.572
Regular follow-up dental visit (versus no follow-up)	0.053 (1.423)	1.065 (1.423)	0.455
Need help reading hospital forms	0.090 (1.483)	1.833 (1.483)	0.218
Confident filling out medical forms	0.139 (1.452)	2.714 (1.452)	0.063
Interaction term (education & English as main language)	–0.947 (0.574)	–1.385 (0.574)	0.017
Constant (intercept)	–	40.621 (8.399)	0.000

Adjusted R^2 (18.7 percent); the model is significant at 0.000.

participants who do not report English as their main language is much greater in terms of improving their health literacy; however, this effect disappears when high levels of education are reached (after 17 years), suggesting a threshold effect.

Discussion

This study presents a modified REALM health literacy measure, the REALM-D, which incorporates dental terminology. The study protocol required sufficient English expertise to comprehend an English informed consent and responses to a dentist screening exam. As a result, the study sample was better able to read words written in English, underrepresenting a segment of our clinic population most at risk for low health literacy, at least in English. Despite this selection bias, 20 percent of the sample reported a primary language other than English, representative of the demographics of the UCLA dental clinic, which serves an extremely diverse urban population. Furthermore, the resulting validity measures demonstrated that the REALM-D was valid for use in detecting differences among people of different backgrounds, nonwhites, people for whom English was not their primary language, and people of lower education levels. Interesting also was the interaction of education on literacy among people whose primary language was not English. This measure demonstrated that increased education, up to a Masters level, was a predictor of the REALM-D score for those for whom English was not their main language. However, the fact that health literacy was the only significant covariate predicting confidence filling out medical forms confirms the notion that health literacy captures something more than simply education level or English proficiency.

REALM-D scores did not differ by age in our sample which corroborates finding by Barber and colleagues who suggest that older people have more exposure and opportunity to become familiar with health-related terms, therefore are able to pronounce words correctly (20).

As suggested by Jones and colleagues (13), mispronunciation of dental terms may affect a patient's ability to communicate verbally about an oral health issue. Thus, the study suggests that the REALM-D could serve as a screener for poor patient-provider communication in addition to screening for low health literacy, especially among those who report English as not their main language.

One of the more interesting finding from this study is the association between higher health literacy scores and the ways in which people access health information. Use of the Internet to get health information was found to be associated with higher health literacy. This is informative to both health educators and clinicians in several ways. We are entering a major shift in the way we think about health literacy with new options for broadening the body of health information through the Internet. Studies show that online sites are important sources of health care information and health literacy is necessary for full utilization of online resources (21).

Some of the original REALM terms were viewed by subjects as "dental" terms. Added dental terms, such as "anesthesia," "abscess," "hygiene," and "extraction" are also applicable to other surgical fields. This reinforces the benefit of a combined medical-dental, or health literacy measure so that all health care providers involved with a patient seeking treatment at a large medical complex can have access to a universal measure of health literacy which becomes part of the patient's profile as he/she navigates the health system. From a clinical standpoint, allowing multiple providers to utilize the instrument saves time and resources. Furthermore, patients seeking dental care at a dental school clinic often have complicated oral health problems that may overlap with other health care needs. A criticism of existing health literacy measures is that they focus on terms found only in medical/dental clinic settings and do not include terms that capture other domains of the health care experience (19). The REALM-D, developed for this study, includes medical, behavioral, or psychosocial terms, and even payment terms (i.e. insurance, depression, alcoholism, exercise), thus providing a broad spectrum of terminology that captures a wide range of the health care experience for diverse dental clinic patients.

As with the original instrument upon which it was based, the REALM-D is strictly a screening tool to identify inadequate medical and dental word recognition. It does not assess a patient's ability to understand the meaning of a medical or dental term. Baker (14) suggests that health literacy is a complicated construct, consisting of an individual's capacity to communicate and function within the health system demands, requiring a comprehensive assessment of the full range of literacy skills. However, for low health literate patients seeking treatment in large one-stop clinics designed to address not only oral health, but a variety of physical health needs, being able to accurately screen for health literacy and address health instruction accordingly may contribute to better adherence to recommendations and better follow-up care.

Successful utilization of this type of screening tool in large hospital-based dental clinics calls for an efficient, easy-to-use instrument. Future work with this screening measure entails addressing redundancy as evidenced by the high reliability score (Cronbach's alpha = 0.958), and developing a shorter version with the same ability to identify patients who may need extra help with health instruction material and informed consent documents.

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