Scientific Article

An Evaluation of Pediatric Dental Patient Education Materials Using Contemporary Health Literacy Measures

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Abstract

Purpose: The purpose of this study was to determine the appropriateness of nationally available dental information materials according to the suitability assessment of materials (SAM) method.

Methods: Clinically related, professionally produced patient dental health education materials (N=22) provided by the American Academy of Pediatric Dentistry (AAPD) were evaluated using the SAM method that had previously been judged valid and reliable. A rater was trained by an experienced health literacy evaluator to establish validity. The rater then rated all materials for 5 categories of assessment (content, literacy demand, graphics, layout and typography, and learning stimulation/motivation) and an overall assessment, and repeated 5 materials to establish intrarater reliability.

Results: When compared to the experienced rater, the validity was κ=0.43. The reliability was established for all ratings as κ=0.52. The consistently weakest categories were content, graphics, and learning stimulation, while reading level as part of literacy demand was often not suitable. The overall suitability of the AAPD materials was generally classified as superior.

Conclusions: Reliable and valid evaluation of available dental patient information materials can be accomplished. The materials were largely superior. There is great variability within the categories of evaluation. The categories of content, graphics, and learning stimulation require attention and could raise the overall quality of the materials. (Pediatr Dent 2005;27:409-413)

KEYWORDS: HEALTH LITERACY, READING ABILITY, HEALTH EDUCATION, SUITABILITY ASSESSMENT OF MATERIALS (SAM), READABILITY, LITERACY

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In current health care practice, health care providers rely heavily on written information to communicate health information with their patients. The written information includes health history, informed consent, instructions for health prevention and maintenance, instructions for taking prescription medications, and informational brochures. Research indicates that much of this information is not well understood by the majority of patients. Approximately 40 to 44 million Americans are considered to be functionally illiterate, according to the Ad Hoc Committee on Health Literacy (AHCHL).[1] This means that they do not have the ability to read, write, speak, and act on information to function appropriately or effectively in society. An additional 50 million are only marginally literate.[1] Combined, this represents roughly half of the US population. The average reading level in the United States is at the eighth- to ninth-grade level, and 1 in 5 people are at a fifth-grade reading level or below.[2] Although there have been recent dramatic demographic changes, the majority of the illiterate are white, native-born Americans.

Health literacy, specifically, is defined as the ability to read, understand, act on health care information, and perform basic reading and numerical tasks required to function in the health care environment.[1] Research shows that low-literate individuals with inadequate functional health literacy have more self-reported poor health and are more likely to be hospitalized.[3,4] Patients may not be able to understand physicians' instructions, their diagnosis, or even

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Factor to be rated	Score*	Comments
1. Content		
(a) Purpose is evident		
(b) Content about behaviors		
(c) Scope is limited		
(d) Summary or review included		
2. Literacy demand		
(a) Reading grade level		
(b) Writing style, active voice		
(c) Vocabulary uses common words		
(d) Context is given first		
(e) Learning aids via "road signs"		
3. Graphics		
(a) Cover graphic shows purpose		
(b) Type of graphics		
(c) Relevance of illustrations		
(d) List, tables, etc. explained		
(e) Captions used for graphics		
4. Layout and typography		
(a) Layout factors		
(b) Typography		
(c) Subheads ("chunking") used		
5. Learning stimulation, motivation		
(a) Interaction used		
(b) Behaviors are modeled and specific		
(c) Motivation-self efficacy		
Total SAM score:		
Total possible score:,	Percent score:%	

Figure 1. Suitability assessment of materials (SAM) evaluation form (adapted from Doak, Doak, and Root, 1996).[2] This evaluation form demonstrates the categories and factors (subcategories) of evaluation that contribute to the final score as a percentage of the total possible points. The Fry readability score[9] comprises the reading grade level (item 2a in the form).

*2 points=superior rating; 1 point=adequate rating; 0 points=not suitable rating; N/A=the factor does not apply to this material. Total possible score does not include any factors with N/A. Percent score is total SAM/total possible.

how to complete a health history form. In a study conducted in 2 urban hospitals with 2,659 patients, researchers found that 42% were unable to understand directions for taking medication on an empty stomach, 26% were unable to understand information about their next appointment, and 60% could not understand a standard informed consent document.[5]

In dentistry, the state of affairs is not as developed or delineated. Limited research is available in dentistry regarding dental health literacy and its effects on dental health and dental health behaviors, but many of the circumstances are similar to medicine. One of the goals of dental practice is to inform patients regarding the treatment practices and the associated procedures available to them. In many instances and in an effort to be efficient, this information is provided by auxiliary staff or through printed media. These media are either produced by the practitioner or purchased through professional associations. According to the American Dental Association (ADA), the production and sales of dental practice information media is a multimillion dollar annual industry.[6] Unfortunately, the quality of these materials, whether purchased or produced by practitioners, is often inconsistent or inadequate to provide useful information to the patients that they can understand and use.

A survey by Alexander of 24 dental education materials published and widely distributed by various dental associations showed that the reading levels of many were far beyond the reading ability of the intended audience.[7] Using the Flesch-Kincaid readability analysis, Alexander found that 10 of 24 brochures were written at a high school reading level and 1 at a college level. Furthermore, the analysis found 79 instances where medical/dental jargon or long, difficult words were used in the material. Such words may be unfamiliar and intimidating for the general audience.

Chung et al[8] examined 19 printed oral cancer educational materials and found that, while most of the materials presented accurate and comprehensive information about cancer prevention and early detection, they were written at reading levels too high for many people to understand. Ranging from the 6th to 13th grade using the Simplified Measure of Gobbledygook (SMOG) readability formula, only 5 were determined to be at a sixth- or seventh-grade reading level.

It is clear that available materials may not serve the educational purposes they are envisioned to support. Many patients or parents receiving such materials are overwhelmed with the volume of information encoded in technical jargon and complicated pictures that are too difficult for the general public to understand. The first step in addressing the problem is to evaluate the suitability of education materials and then make recommendations to increase their effectiveness on the audience.

When dealing with the dental health and care of children, the audience is the parent serving as a proxy for the

child. It is important for parents to be well informed prior to consenting for dental procedures, and communication with the parent must be clear. Orthodontic and pediatric dentistry materials most often fit this critical niche of dental educational materials for parents.

The purpose of this study was to determine the appropriateness of nationally available dental information materials from the American Academy of Pediatric Dentistry (AAPD).

Methods

Clinically related, professionally produced patient dental health education materials on a wide range of topics (N=22) provided by the AAPD were evaluated using the SAM (suitability assessment of materials) tool that has previously been judged valid and reliable.[2] This tool, which incorporates the Fry readability formula (FRF),[9] has been used in diverse health literacy investigations such as consumer drug product information[10] and specific illness patient education materials.[11] A rater was trained by an experienced health literacy evaluator to establish the ratings' validity. The training was a 3-step process:

1. familiarize the rater to the evaluation criteria;
2. evaluate and score materials independently and then together with the experienced evaluator;
3. discuss the results.

After establishing validity, the rater independently evaluated all materials for 5 categories of assessment: (1) content; (2) literacy demand; (3) graphics; (4) layout and typography; (5) learning stimulation/motivation; and (6) an overall assessment. The categories and their factors are shown in Figure 1. As recommended in the SAM tool, the FRF was used to determine the reading grade level (a factor under the literacy demand category) of the material being evaluated.[9] Three 100-word passages were selected from the beginning, middle, and end of the material, as recommended by the FRF technique. Next, the syllables and sentences were counted. Best attempts were made to use passages that contained full sentences. An average was determined, and the intersection of the 2 points (number of sentences and number of syllables) in the graph indicated grade level. Fry readability scores were grouped as "superior" if the FRF score was fifth-grade level or lower, "adequate" if the score was sixth-, seventh-, or eighth-grade level, or "not suitable" if ninth-grade level and above.

The intrarater reliability was established by repeating evaluation of 5 of these materials. The validity agreement with the experienced rater and intrarater agreement was calculated using the kappa statistic, including 95% confidence intervals (CI). The mean, standard deviation, and range for performance on the 5 dimensions and the overall assessment were calculated as a percentage of the total possible points for each category. According to the analysis, an overall rating of the material was categorized as: (1) "superior"=70% to 100% score; (2) "adequate"=40% to 69% score; and (3) "unsatisfactory"=0% to 39% score. These nominal categorizations were tabulated.

Results

The validity for these ratings, when compared to the experienced rater, was κ=0.42 (95% CI=0.31; 0.54). The intrarater reliability was established for all ratings at κ=0.54 (95% CI=0.38; 0.70). The mean, standard deviation, and range of each category and the overall results are shown in Table 1. To demonstrate the scope of the findings, the scores for the maximum, minimum, and mean total score materials were also included. Although the FRF was considered under SAM literacy demand, it is interesting to note that 9 of the materials were in the "adequate" category, while the other 13 were above the ninth-grade reading level and in the "not suitable" category (Table 2). Overall, all materials were judged as either "superior" or "adequate," with 73% in the "superior" category.

Discussion

The rater was trained to a "fair to good" or "moderate" level of agreement with the expert evaluator according to the kappa statistic. Similarly, the intrarater reliability was also moderate at 0.54. Although not excellent agreement on either account, the literature clearly indicates that 0.40 to 0.75 is moderate agreement, according to Landis and Koch,[12] Fleiss,[13] and Rosner.[14] When placed in the context of the rigors of the kappa statistic and its guidelines, this study should be considered valid and reliable. Further, this study's kappa values compare favorably with other health literacy studies, with κ=0.2 to 1.0 using the SAM tool.[15]

Table 1. Descriptive Statistics for AAPD Educational Materials Evaluation

Category	Percentage possible points		Illustrative scores		
	Mean±SD	Range	Max "Diet and snacks"	Mean "Microabrasion"	Min "Calming the anxious child"
Content	57±6.3	70-50	70	60	50
Literacy demand	73±14.5	90-50	90	50	60
Graphics	61±25.3	88-13	75	75	25
Layout	96±8.0	100-75	83	100	100
Learning stimulation	64±15.7	83-25	83	50	50
Overall	74±7.2	85-59	85	74	59

These studies also reference Landis and Koch's[12] evaluation of kappa values. All kappa values in this study were statistically greater than 0 ($P<.05$), indicating significant agreement beyond chance.

Health literacy is defined by the ability to read, understand, and act on health care information.[1] The SAM tool allows material to be evaluated reliably for all 3 of these criteria. These selected materials demonstrated largely superior overall ratings, but the categories for classification are broadly defined, with as much as 30% point ranges. This leads to great amounts of variability in acceptable quality (a percentage point range of 40% to 100%, resulting in a favorable rating). There was also great variability, as noted by the range of results in each category being up to nearly 75 percentage points.

Interestingly and fortunately, the literacy demand of these materials—which consists of: (1) reading level; (2) writing style; (3) vocabulary; (4) content; and (5) learning aids—scored reasonably well in spite of a higher-than-ideal reading level. This is a category that often has numerous violations of the standards. Those common mistakes were avoided. On the other hand, the data demonstrate the lowest ratings consistently were for content, graphics, and learning stimulation. Content can be remedied by limiting the scope of the subject matter with a clearly stated purpose and information that is presented in a behavior-oriented context rather than presenting informational statements or facts.

Table 2. AAPD Materials With Their Overall SAM Score (as Percentage), Rating, and the Reading Grade Level as Determined With the Fry Readability Formula

Title	Score (%)	Overall suitability rating	Reading grade level
Diet and snacking	85	Superior	Adequate
Conscious sedation	69	Adequate	Not suitable
Thumb, finger and pacifier habits	75	Superior	Adequate
Enamel fluorosis	83	Superior	Adequate
Preventive diet	70	Superior	Not suitable
Pediatric dentist	70	Superior	Not suitable
Early orthodontic care	76	Superior	Not suitable
Mouth protectors	84	Superior	Adequate
Nitrous oxide	68	Adequate	Not suitable
Sealants	79	Superior	Adequate
Calming the anxious child	59	Adequate	Not suitable
Enamel microabrasion	74	Superior	Not suitable
Esthetic dentistry	74	Superior	Not suitable
Space maintenance	71	Superior	Adequate
Tooth-colored fillings	80	Superior	Adequate
Dental care for your baby	81	Superior	Adequate
Regular dental visits	83	Superior	Not suitable
Dental care for your special child	68	Adequate	Not suitable
Emergency care	83	Superior	Adequate
X-ray use and safety	72	Superior	Not suitable
Malocclusion	69	Adequate	Not suitable
General anesthesia	63	Adequate	Not suitable

Graphics and the material's overall readability can be improved by:

1. tying the appropriate images to the subject matter;
2. focusing images that can produce a more reader-friendly and potentially more cost-effective educational tool;
3. captioning images to guide the reader;
4. using nonglossy paper;
5. increasing font size.

Learning stimulation can be enhanced by:

1. limiting the material's scope;
2. using common words with fewer syllables;
3. facilitating interaction using checklists, a self-quiz, or question-and-answer materials;
4. including summaries in a behavior-oriented format.

Often, these types of materials are written by the content expert who is the practitioner and then further developed and formatted by media specialists. This leads to excellent quality images and overall general appeal when the brochure is purchased by the practitioner and displayed in the practitioner's office. When there is little connection between the images and the message, however, effectiveness is highly variable. The content staff and production staff must converge to consistently develop quality materials. Similarly, when practitioners produce these types of materials, they must attend to the same standards and rigors as used in this study if they expect their materials to meet the objectives of truly informing the patient and parent.

Conclusions

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

1. It is possible to demonstrate modestly reliable and valid methods for evaluating patient dental education materials in the context of health literacy.
2. The materials produced by the American Academy of Pediatric Dentistry largely fall in the "superior" range for overall quality.
3. There is great variability within the categories of evaluation. Content, graphics, and learning stimulation require greater attention and could raise the overall quality of the materials.

References

1. American Medical Association. Ad Hoc Committee on Health Literacy. Health literacy: Report of the council on Scientific Affairs. JAMA 1999;281: 552-557.
2. Doak CC, Doak LG, Root JH. *Teaching Patients With Low Literacy Skills*. Philadelphia, Pa: JB Lippincott Company; 1996.
3. Baker DW, Parker RM, Williams MV, Clark WS, Nurss J. The relationship of patient reading ability to self-reported health and use of health services. Am J Public Health 1997;87:1027-1030.
4. Baker DW, Gazmararian JA, Williams MV, Scott T, Parker RM, Green D, Ren J, Peel J. Functional health literacy and the risk of hospital admission among Medicare managed care enrollees. Am J Public Health 2002;92:1278-1283.
5. Williams MV, Parker RM, Baker DW, Parikh NS, Pitkin K, Coates WC, Nurss JR. Inadequate functional health literacy among patients at two public hospitals. JAMA 1995;274:1677-1682.
6. American Dental Association. *Report 2 of The Board of Trustees to the House of Delegates: ADA Operating Account Financial Affairs and Recommended Budget Fiscal Year 2005*. Chicago, Ill: August, 2004.
7. Alexander RE. Readability of published dental education materials. J Am Dent Assoc 2000;131:937-942.
8. Chung V, Horowitz AM, Canto MT, Siriphant P. Oral cancer educational materials for the general public: 1998. J Public Health Dent 2000;60:49-52.
9. Fry E. Fry's readability graph: Clarifications, validity, and extension to level 17. J Read 1977;21:242-252.
10. Kaphingst KA, Rudd RE, DeJong W, Daltroy LH. Literacy demands of product information intended to supplement television direct-to-consumer prescription drug advertisements. Patient Educ Couns 2004; 55:293-300.
11. Weintraub D, Maliski SL, Fink A, Choe S, Litwin MS. Suitability of prostate cancer education materials: Applying a standardized assessment tool to currently available materials. Patient Educ Couns 2004;55:275-280.
12. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33: 159-174.
13. Fleiss JL. *Statistical Methods for Rates and Proportions*. 2nd ed. New York, NY: John Wiley and Sons; 1981: 216-218.
14. Rosner B. *Fundamentals of Biostatistics*. 5th ed. Pacific Grove, Calif: Duxbury; 2000:410.
15. Rees CE, Ford JE, Sheard CE. Patient information leaflets for prostate cancer: Which leaftlets should health care professionals recommend? Patient Educ Couns 2003;49:263-272.

Abstract of the Scientific Literature

Intraoral Acid Production Associated With Eating Whole or Pulped Raw Fruits

The aim of this article was to determine: (1) the clearance from the mouth of whole or pulped fruits; and (2) the production of acids after the consumption of these fruits. Raw and pulped intact fruits (banana, pineapple, apple, orange, and pear) were given to a group of volunteers. The volunteers chewed and retained the fruits in the mouth for 1 minute, and then saliva samples were taken at 1, 5, 15, 30, and 60 minutes after swallowing the fruit. The salivary samples were analyzed for: (1) content of glucose, sucrose, and fructose; and (2) concentration of acetic, formic lactic, succinic, citric, and malic acid. It was found that sugars were rapidly cleared from the mouth (5 minutes) and that the major bacterially produced acids were lactic and succinic, which reached maximum concentration at 5 minutes. No significant differences in the levels of sugars or acids were observed within a fruit. This in vitro study suggests that whole or pulped raw fruits have an acidogenic potential.

Comments: Fruits can have an acidogenic potential, as is demonstrated in this in vitro study. We should encourage our patients to be careful in their dietary habits, including the amount and frequency of ingestion of whole and pulped raw fruits. JLC

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Beighton D, Braisfold SR, Gilbert SC, Clark DT, Rao S, Wilkins JC, Tarelli E, Homer KA. Intraoral acid production associated with eating whole or pulped raw fruits. Caries Res 2004;38:341-349.

27 references