Scientific Article

Readability of the American Academy of Pediatric Dentistry Patient Education Materials

Homa Amini, DDS, MPH, MS[1] • Paul S. Casamassimo, DDS, MS[2] • Hsuan L. Lin, DDS[3] • John R. Hayes, PhD[4]

Abstract: ***Purpose:*** *The purpose of this study was to assess the readability of the American Academy of Pediatric Dentistry's (AAPD) patient education brochures and compare their readability level with that recommended by health education experts.* ***Methods:*** *Readability for the 25 AAPD brochures was assessed using the: (1) Flesch-Kincaid formula; (2) Gunning Fog formula; and (3) Flesch reading ease formula. The results were compared to the reading level recommended by the experts.* ***Results:*** *Mean readability for all 25 brochures was: (a) 9.1(±1.8 SD) using the Flesch-Kincaid formula; (b) 9.2 (±1.5 SD) with the Gunning Fog formula; and (c) 53.0 (±12.2 SD) with the Flesch reading ease formula. Using the Flesch-Kincaid and Gunning Fog formulas, 88% and 92% of the AAPD patient education materials were written above the recommended sixth-grade reading level, respectively.* ***Conclusions:*** *Overall, American Academy of Pediatric Dentistry patient education materials were difficult to read and written above the recommended level for the general public using accepted measures. Readability formulas may be used as a guide to help improve the reading ease of health education materials.* *(Pediatr Dent 2007;29:431-5) Received August 21, 2006 / Revision Accepted January 2, 2007.*

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Although financial, cultural, behavioral and biological factors are among the major determinants of oral health, literacy skills are hypothesized to contribute to oral health outcomes. Oral health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions." To promote oral health and deal with disease, one must be able to comprehend, decipher, and act on health information communicated verbally or in written form.[1] The "Healthy People 2010" objectives urge all health professionals to provide improved, accurate, and understandable information to patients.[2]

Many oral health care providers rely on written materials to explain or reinforce health messages to their patients. Research suggests that written information accompanying oral teaching should enhance the understanding of complex topics, and experts suggest ending patient education sessions by providing written take-home information.[3] These materials are, however: (1) oftendense; (2) unnecessarily technical; and (3) written at a grade level too high for most patients to understand.[1]

Readability is a concept closely linked to health literacy and is defined as "the ease with which a person can read and understand written materials."[4] A recent report by the Institute of Medicine revealed that about half the adult US population, or as many as 90 million adults, cannot benefit from the available health care system due to difficulty with reading and understanding health information encountered in daily life.[1]

Many studies have looked at readability of printed health information. D'Alessandro et al assessed the readability of pediatric patient education materials on the World Wide Web and concluded that the majority were not written at an appropriate reading level for the average adult.[5] Wallace and Lennon assessed the readability of American Academy of Family Physicians patient education materials on the Web and found that 75% were written above the average reading level of adult Americans.[6] Mead et al evaluated the readability of American Cancer Society patient education literature and found 55% written for individuals with grade 12 or higher reading skills.[7] Freda et al reported an improvement in the readability of the American College of Obstetricians and Gynecologists patient education brochures over the past 10 years. Most pamphlets, however, were still written at a higher readability level than recommended for the average adult.[3] They also evaluated the readability of American Academy of

[1]*Dr. Amini is associate professor and Director, Pediatric Dental Residency Program and* [2]*Dr. Casamassimo is professor and Chair, both in Section of Pediatric Dentistry, College of Dentistry, Ohio State University, Columbus, Ohio;* [3]*Dr. Lin is general dentist in private practice in Cleveland, Ohio;* [4]*Dr. Hayes is biostatistician at Columbus Children's Hospital Research Institute, Columbus , Ohio. Correspond with Dr. Amini at aminih@chi.osu.edu*

Pediatrics patient education material and found at least half written at higher-than-suitable readability levels for the general public.[4]

In dentistry, only a few studies have looked at the readability of patient education materials. Alexander reviewed 24 dental education materials from several resources and concluded that reading levels ranged from the third to twenty-third grade, with 42% written at higher-than-acceptable readability levels for most patients. Many publications contained jargon vocabulary, and the specialty publications were written at or near college levels.[8] Bakdash et al assessed the readability of periodontal health education literature and found those reading at the 10th- and sixth-grade level would only understand 35% and 15% of the printed materials, respectively.[9] Harwood and Harrison evaluated the readability of the American Association of Orthodontists published patient information leaflets and reported that 100% of the leaflets were "fairly difficult" to "difficult" to read.[10] Chung et al assessed the readability of oral cancer education materials and reported that a majority was written at above the average reading level for the general public.[11]

The average reading skills of American adults is approximately at the eighth-grade level. Some experts suggest that all patient education materials should be written at the sixth- to eighth-grade level.[3,4] In the United States, 1 in 5 adults reads at the fifth-grade level or below.[3] The 1998 National Literacy Work Group on Literacy and Health recommended that patient education materials should be written at or below the sixth-grade level, since data suggest reading levels are, on average, 3 to 5 years lower than the education level.[12,13]

Readability of written materials can be measured by mathematical formulas, which determine grade level based on such elements as: (1) vocabulary; (2) number of syllables in words; and (3) sentence length.[4] There are numerous readability formulas developed to assist in matching text and a person's reading ability. Three popular formulas used routinely to assess patient education materials are:

1. The Flesch-Kinkaid (**F-K**) formula assigns a grade level based on the average number of words per sentence and the average number of syllables per word. It is reported to be used by the US government to evaluate the readability of military training manuals containing technical language. Below a sixth-grade level indicates a simple document, and above the ninth-grade level is considered difficult for the average adult.[3,4]
2. The Flesch reading ease (**FRE**) formula assigns a score from 0 to 100 based on sentence length and polysyllabic words with a lower score indicating more difficulty in reading than a higher score. A score of 70 or above is considered "easy" and written at the grade school level; a score of 60 to 70 is considered "standard" and written at approximately the high school level, and a score of 60 or below is considered "difficult."[5]
3. The Gunning Fog (**GF**) formula (taking the "fog" out of reading) evaluates readability based on the number of words, polysyllabic words, and sentences and assigns a grade level assuming that multisyllabic words are harder to read.[3] As with F-K, a GF level below the sixth grade corresponds to an easy text.

So far, only 1 study has evaluated the appropriateness of pediatric dental education materials. Kang et al studied the appropriateness of the American Academy of Pediatric Dentistry (**AAPD**) educational materials using the suitability assessment of materials (**SAM**) method, which incorporates into an overall assessment: (1) content; (2) literacy demand; (3) graphics; (4) layout; (5) typography; and (6) learning stimulation/motivation. They concluded that materials produced by the AAPD were largely superior and "interestingly and fortunately, the literacy demand of these materials scored reasonably well in spite of a higher-than-ideal reading level."[14]

Although attributes such as attractive layout, graphics, accurate content, and learning stimulation are important parts of comprehension of educational materials, they have little bearing if the words cannot be read and understood.[4] Since the SAM method considers multiple factors in its assessment, the suitability of the materials may be overestimated while the readability is poor. Hoffmann et al suggest that materials be evaluated using both a readability formula and a broader instrument such as SAM.[15]

The purpose of this study was to assess the readability of the AAPD's patient education materials using the F-K, FRE, and GF readability formulas and compare their readability levels with that recommended by health education experts.

Methods

In this institutionally approved study, 25 English language AAPD educational brochures covering a range of dental topics (eg, diet, sedation, fluoride, nitrous oxide, sealants, and general anesthesia) were downloaded from the AAPD Web site (www.aapd.org) in February 2006.[16] Calculation of readability and grade level for each brochure was done by copying the document's title and entire text into readability calculators (to automatically calculate the scores) by one investigator. Since the literature recommends using multiple formulas to assess readability, the F-K, FRE, and GF formulas (most frequently seen in the health education literature) were used in this study.[17,18] The documents' FRE and F-K reading levels were generated using built-in software in Microsoft 2000 (Microsoft Corp, Redmond, Wash), and the GF grade level was determined by using the Text Content Analysis Tool.[19] Each brochure was tested twice for accuracy of scoring by each formula.

The Statistical Package for the Social Sciences (SPSS+) for Windows version 11.0 (SPSS, Inc, Chicago, Ill) was used for all statistical analyses.[20] Mean readability levels were calculated by F-K and FG formulae and compared to the reading level of seventh grade. The seventh grade was chosen as the upper limit of readability since most experts recommend readability at or below the sixth grade.[3,6,12,13] Mean FRE scores were compared to the recommended score level of 70. Mean readability scores were compared using the independent t-test. A *P*-value <.05 was considered significant. The scores for each brochure were ranked based on each readability formula to give the best- and worst-performing brochures.

Results

All 3 readability formulas found mean readability levels above the recommended level, suggesting overall that the materials were difficult to read. The overall means and standard deviations for the F-K grade level was 9.1+1.8 (range=6.1-12) and for the GF grade level was 9.2+1.5 (range=5.8-11.9). The calculated means were compared to the seventh-grade level, and the comparison found the brochures were significantly more difficult than the recommended sixth-grade level (F-K: t=5.8, *P*<.001; FG: t=7.2, *P*<.001). The overall mean score for the FRE was 53.0+12.2 (range=24.7-73.2), which was significantly more difficult (lower score indicates more difficulty) than the recommended score level of 70 (t=-6.96, *P*<.001).

Table 1 provides the readability levels by formula and topic of brochure. Although there was some variability in the grade levels based on the readability formula used for the same brochures, there was no significant difference between the means of the F-K grade level and GF grade level. Since each readability formula uses slightly different mathematical methods to calculate readability level, it is not unusual to see different grade levels reported for the same material.[5] Using the F-K and G-F formulae, 88% and 92% of

Table 1. READABILITY LEVELS FOR THE AMERICAN ACADEMY OF PEDIATRIC DENTISTRY BROCHURES

Brochure title	Flesch-Kincaid grade level	Gunning Fog grade level	Flesch reading ease score
Diet and Snacking	6.1 *	7.6 †	73.2 §
Emergency Dental Care	6.2 *	6.8 *	69.9 §
Dental Care for Your Baby	6.4 *	5.8 *	68.7 _
Space Maintenance	7.0 †	8.3 †	66.6 _
Mouth Protectors	7.3 †	8.9 †	65.0 _
To My Teenage Patient	7.4 †	7.5 †	64.6 _
Thumb, Finger, and Pacifier Habits	7.7 †	8.0 †	66.9 _
Sealants	7.8 †	9.0 ‡	61.4 _
Enamel Fluorosis	8.0 †	7.9 †	60.4 _
Tooth-colored Fillings	8.2 †	8.1 †	58.7 ¶
Preventive Dentistry	9.1 ‡	9.9 ‡	52.8 ¶
X-ray Use and Safety	9.2 ‡	10.4 ‡	51.5 ¶
Esthetic Dentistry	9.3 ‡	8.4 †	49.4 ¶
Regular Dental Visits	9.4 ‡	9.7 ‡	51.6 ¶
Early Orthodontic Care	9.7 ‡	9.0 ‡	49.1 ¶
Managed Dental Care Programs	10.0 ‡	10.4 ‡	52.9 ¶
Nitrous Oxide	10.0 ‡	8.7 †	45.3 ¶
Enamel Microabrasion	10.4 ‡	9.7 ‡	43.1 ¶
Fluoride	10.6 ‡	10.5 ‡	43.9 ¶
Calming the Anxious Child	10.9 ‡	10.1 ‡	42.0 ¶
Dental Care for Special Child	11.0 ‡	10.4 ‡	40.1 ¶
The Pediatric Dentist	11.0 ‡	11.3 ‡	44.1 ¶
Conscious Sedation	11.2 ‡	10.9 ‡	41.0 ¶
General Anesthesia	12.0 ‡	11.3 ‡	24.7 ¶
What Malocclusion?	12.0 ‡	11.9 ‡	37.1 ¶

* ≤ Sixth grade = easy
† Seventh and eighth grade = standard
‡ ≥ Ninth grade = difficult
§ ≥ 70 = easy
_ 60 - 70 = standard
¶ ≤ 60 = difficult

the AAPD patient education materials were written above the recommended sixth-grade reading level, respectively.

Discussion

Studies show that individuals with limited literacy skills have: (1)a higher rate of hospitalization; (2) a lower utilization of preventive services; (3) less knowledge of their health status and treatment regimens; (4) higher rate of chronic diseases; and (5) higher health care costs.

A mismatch between the literacy levels of the intended audience and the materials that have been created for that audience is also reported.[21-23] The results of this study suggest that most of the AAPD patient education brochures are written at a higher readability level than recommended for most adults. This has significant clinical implications, since pediatric dentists utilize written materials to educate adults (primary care givers) about their children's oral health needs.[22] Some topic areas that covered basic preventive and therapeutic interventions that would apply to most patients, such as fluoride, were rated as difficult to read. There are also ethical and medicolegal implications when such materials are used to explain treatment modalities to obtain informed consent. For example, "general anesthesia" and "conscious sedation" brochures, 2 of the most commonly used management techniques in pediatric dentistry, were written at a very difficult level and not easily understood by the average adult.

It is estimated that 80% of tooth decay is concentrated in 20% of the population and that individuals with lower income and education levels are more at risk of developing the disease. Many of these individuals often have limited literacy skills and are not able to read and understand patient education materials. Professional organizations that print health education brochures should make sure that their materials can be read by the widest audience possible and must continuously assess the materials they develop.[3] It is recommended that the readability levels be noted on the patient education materials so that professionals know if the material is suitable for their targeted population.[4,5] Difficult-to-read patient education materials are not suitable for safety net dental clinics or private offices that care for low-income families with limited literacy skills.

While readability is only 1 variable in measuring the appropriateness of written materials, it is one of the most important. This study concluded that the majority of the AAPD patient education materials were not written at an appropriate reading level for the general public. In contrast, Kang et al concluded that AAPD materials (22 items evaluated) were largely superior utilizing the SAM tool which considers other factors such as content, graphics, layout, and typography in addition to the readability. Utilizing the Fry readability formula in the SAM tool, Kang et al showed that almost 60% of the materials were in the "not suitable" category and written above the ninth-grade reading level. Despite the readability assessment, however, 73% and 27% of the materials were judged to be "superior" and "adequate," respectively.[14] Estey et al studied health education materials developed at different reading levels and found that only 33% of the patients could understand the materials when written at the ninth-grade level. This percentage increased to 77% when materials were prepared at the fifth-grade level.[24] Other research suggests that even those with higher literacy skills and advanced degrees favor receiving health education materials that are straightforward and easy to comprehend.[6]

There are more than 50 published readability formulas that can help to evaluate how easily a document can be read and understood.[10] There are limitations with readability formulas, however, as they generally measure very low-level aspects of the text (word or sentence length). Counting words and syllables and assigning a grade level are most likely not sufficient to determine how readable text is. McCray cited a study in which text readability reduced by 6 grade levels showed no increase in comprehension by the subjects. Simplifying a text based on a readability formula can lead to problems in comprehension, as phrases may be omitted—thus increasing the comprehension burden. There is also a liability concern among health professionals that simplifying materials might prevent accurate and full disclosure of information.[23] Medical terminologies that are hard to understand might be scored as easy by the readability formulas if they are short words, leading to an underestimation of readability level.[5]

In many health texts, implicit assumptions underlie the concepts being discussed, which also may prevent comprehension; for example, a text talking about risks and benefits of a procedure assumes that the reader has a basic understanding of the concept of risk. Better methods for evaluating and making sure the comprehensibility of health texts are clearly required. Since readability assessments do not consider the patient's prior knowledge and motivation, it is recommended that characteristics of the consumer should be considered when developing the materials.[8,23]

According to the US Surgeon General Richard Carmona, "the evidence indicates that health literacy may be both a cause of and contributor to health disparities. We need to present health information in ways that people of all races and ethnicities, all walks of life, and all regions of this country will understand and, more important, use."[25] Organizations such as the AAPD can take the lead in identifying best practices for educating parents with low literacy skills and develop quality standards for written material.

Conclusion

Overall, the American Academy of Pediatric Dentistry's patient education materials were difficult to read and written above the recommended sixth-grade reading level.

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