The Readability of Pediatric Dentistry Patient Education Materials

BY

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THESIS

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This thesis is dedicated to my husband, Jay,

and our baby, who cooperated in not coming early.
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<tr>
<td>AAPD</td>
<td>American Academy of Pediatric Dentistry</td>
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<td>AAP</td>
<td>American Academy of Pediatrics</td>
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<td>ADA</td>
<td>American Dental Association</td>
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<td>FKGL</td>
<td>Flesch-Kinkade Grade Level</td>
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<td>Flesch Reading Ease</td>
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<td>GF</td>
<td>Gunning-Fog</td>
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<td>MeSH</td>
<td>Medical Subject Headings</td>
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<td>SAM</td>
<td>Suitability Assessment of Materials</td>
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<td>SMOG</td>
<td>Simple Measure of Gobbledygook</td>
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<tr>
<td>UIC</td>
<td>University of Illinois at Chicago</td>
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SUMMARY

Pediatric dentists often use written materials, such as brochures, to help supplement, strengthen and support educating the caregivers of their patients. However, the brochures given to the caregivers are often written at a higher reading level than their literacy level. The objective of this study was to investigate whether pediatric dental education materials, written at lower reading levels, will be better understood by their intended audience than those written at a higher reading level.

This randomized control trial, conducted at the University of Illinois at Chicago (UIC), involved having English speaking adults read an educational brochure and answer questions. The topic of the brochure, “Sealants,” was chosen because the original version, published by the American Academy of Pediatric Dentistry (AAPD), was written at a moderate reading level. The subject matter was applicable to a large audience, as sealants may be placed on most patients, pediatric or adult. There were two versions of the brochure, an original and a version rewritten at a lower reading level. They were randomly assigned to participants. After reading a brochure, participants were asked to answer a questionnaire. The participants were asked questions regarding understanding of the presented material, self-reported evaluation of the brochure, non-identifying demographic information and previous dental experience.

Data analysis revealed no significant differences in understanding scores between the participants who read the rewritten and original versions of the brochure. However, when the mediator variable of education level of the participants was factored in, significance was shown. As the education level of the participant’s increased, the number
of correct answers also increased. The mediating factors of ethnicity, the relationship to the child accompanied, the age of the child accompanied, previous experience taking a child to the dentist, and personal experience with sealants had no statistical effect. Furthermore, participants’ self-reported evaluation of the brochure did not differ by reading the original or rewritten version.

It appears that a relatively high education level of participants may have reduced the variation of response to the differing reading levels of the two brochures, and thus, it is still not clear if altering written materials to a lower reading level may be an effective way to improve understanding for patients and caregivers who have low literacy levels.

Many factors influence the effectiveness of educating patients through written materials. Prior research has shown that measuring and altering readability with the use of readability formulas may be valuable in making educational materials more understandable, and therefore, more effective. However, reducing reading levels with the use of readability formulas alone may not be as fruitful as advocates have previously suggested.
1. INTRODUCTION

1.1 Background

Text based education materials, such as brochures, are a significant tool for pediatric dentists. The dentist may be focused on the treatment and behavior management of the patient and have limited time to devote to extensive education of the caregiver (35). To supplement and reinforce the spoken word, dentists use written materials to educate the caregivers regarding treatment. Many varieties of written materials are available through dental organizations such as the American Academy of Pediatric Dentistry (AAPD) and the American Dental Association (ADA.) Corporations also publish brochures for dentists to distribute to patients and caregivers. Many of these brochures are written at a grade level that is too high for the intended audience (2, 17, 20).

Literacy statistics for the adult population of the United States vary among published reports, however, most experts agree there is a problem. As much as half of the adult population may be considered functionally illiterate, meaning their reading skills are not sufficient for requirements of adult living (7, 24). Much of the prior research is focused on materials written in English and regarding English speakers (2, 17, 20). Our study also focused on English speaking participants as the brochure was written in English and the readability tests employed were designed for the English language. We
must note, however, that language may also be a barrier to health literacy and, consequently, health care. The 2010 Census, reported Hispanics comprised 16% of the U.S. population, up from 13% in 2000 (X1). The Spanish-speaking population must not be overlooked, however due to the logistics of our study (readability measurement instruments, site, sample, language ability of the researchers) we were constrained to an English language brochure and English speaking participants.

The intersection of reading ability and health literacy is elemental to the objectives of this research. Health literacy is defined as “the ability to read, understand, [and] act on health care information and perform basic reading and numerical tasks required to function in the health care environment” (28). Educational brochures presented by dentists to their patients can help promote health literacy and ultimately lead to better health (10). However, the reading ability of the patients must be considered for the written material to be understood.

Readability tests are used to determine the reading level of a written document by analyzing the complexity of the words and sentences indicating the ease or difficulty of reading. There are eight common readability tests or formulas: the Automated Readability Index, Coleman-Liau, Flesch Reading Ease, Flesch-Kincaid Grade Level, Fry Readability Formula, Gunning Fog Index, Health Information Readability Analyzer, SAM (Suitability Assessment of Materials) and SMOG (5, 6, 8, 11, 14, 20, 22, 31). Studies using these formulas have yielded valuable insights indicating the need to more closely evaluate the materials given to patients. The Joint Commission on the Accreditation of Healthcare Organizations requires that information is presented in an understandable manner and that patients are taught in a way that is consistent with their
abilities (29). By using one or more well-established formulas to determine the grade level of patient education literature, and comparing the grade level to the experts’ recommendations, oral health care professionals may be able to better develop materials suitable for patient audiences. Many of these formulas are available as computer programs. With the aid of such programs, the educational materials distributed by pediatric dentists can be and have been evaluated for ease of reading. The three formulas commonly used in healthcare settings — the Flesch Reading Ease, Flesch-Kincaid Grade Level, and Gunning Fog Index — were employed in developing the brochures used in this research project.

Readability tests were used to measure the reading level of the brochures, and the measurement of participants’ understanding of the brochures was determined using an objective test and a subjective report. The objective test questioned the participants’ knowledge of the material; the subjective report inquired about the participants’ self-reported evaluation of the readability. Our findings have shown that a tool to solely improve readability may not significantly increase the understanding of written educational materials in pediatric dentistry.
1.2 **Purpose**

The purpose of this study was to determine if pediatric dental education materials written at lower reading levels will be better understood by their intended audience than those written at a higher reading level.

1.3 **Hypotheses:**

1: There is no significant difference in caregiver understanding of pediatric dentistry patient education material between a brochure revised to conform with a lower grade level readability score and the original version that has a higher grade level readability score.

2: A caregiver’s evaluation of the readability of the brochure is not associated with which version of the brochure was read.
2. REVIEW OF THE LITERATURE

2.1 Introduction

The focus of this literature review is research relevant to the readability of pediatric dentistry patient education material. To meaningfully discuss patient education materials, we must examine the population for which materials are written and the present state of oral health literacy in the United States. The United States Department of Health and Human Services in the report, Healthy People 2010, and the ADA have defined oral health literacy 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” (25, 27). To fully understand what is meant by readability, the terminology and methods of analyzing the difficulty of a piece of text must be reviewed. After discussing the general principles of readability and oral health literacy, the existing literature on readability specific to pediatric dentistry patient education materials will be reviewed.

2.2 Methods of Review

To find scholarship relevant to this study, the databases PubMed, Cochrane, and Google Scholar, were searched with a variety of combinations of search terms. The following search terms were used in different combinations: comprehension [MeSH], dentistry [MeSH], educational status [MeSH], health [MeSH], literature [MeSH], literacy, oral health, pamphlets [MeSH], parents [MeSH], patient education, patient information, pediatrics [MeSH], readability,
readability level, readability formula, and readability tests. The MeSH term “Comprehension” was synonymous with the term “Understanding.” The search was limited to English language. The results were numerous and varied greatly for the different combinations. The combinations and results were as follows:

- Educational status/Pediatrics/Parents: 185
- Readability/Patient Education: 837
- Comprehension/Dentistry: 87
- Pamphlets/Comprehension: 78
- Readability/Printed Patient Education: 42
- Pamphlets/Oral Health: 19
- Readability/Dentistry/Patient Education: 15
- Pamphlets/Pediatric Dentistry: 8
- Pediatric Dentistry/Comprehension: 7
- Comprehension/Dentistry/Pamphlets: 2

In total, there were 557 different articles. The inclusion criteria were patient education materials, health literacy, and pediatric dentistry. From the searches, a review of the abstracts showed a number of common themes not relevant to the topic. A set of exclusion criteria narrowed the search. Excluded articles were those pertaining to informed consent and health questionnaires, dental students and dental schools; cleft lip and cleft palate; and adult surgeries. After the exclusions, nineteen articles had relevance to the topic. From the relevant articles, the references, citations and bibliographies were searched to extrapolate more literature. Twenty-two full articles were read. Useful information was extracted from each and they are listed under “Cited Literature.” Of the
twenty-two papers, three were specific to the readability of pediatric dentistry education materials.

2.3 Health Literacy

Health literacy is defined as “the ability to read, understand, [and] act on health care information and perform basic reading and numerical tasks required to function in the health care environment” (20). Health literacy requires the ability of an individual to obtain, process and understand health information and use it to act upon and make appropriate health decisions (18, 27, 28). Oral health literacy is health literacy in facets of oral health. In medicine, an individual’s health literacy level has been shown to have an impact on their health and health care (18). Poor health literacy has been associated with “poorer perceptions of health, less utilization of services (particularly those related to disease prevention), and poorer understanding of verbal and written instructions for self-care” (18). While there is insufficient data to determine if the same relationship exists in dentistry, oral health literacy, like general health literacy, is thought to be an important predictor of an individual’s health status (28). Richman, Huebner, Leggott, Mouradian and Mancl asserted in their 2011 study of oral health literacy, “Lower oral health literacy may impair a parent’s ability to act on behalf of their child’s oral health needs” (26).
Prevention is fundamental to good oral health. In 2006, Jackson evaluated parental health literacy and children’s dental health. The study suggested that the “keystone” to intervention with patients who are at the highest risk for early childhood caries is “timely delivery of educational information to parents” (18). Wallace and Lennon surveyed a random sample of 1605 non-retired members of American Academy of Pediatrics (AAP) in 2004 and found that, “the most frequently cited barrier to effective communication during an office visit was limited time to discuss information” (35). Therefore, the time spent in the healthcare setting is often supplemented with written education materials.

In dentistry, the written materials used to reinforce messages to caregivers and patients are often brochures, pamphlets and handouts. According to Harwood and Harrison, who investigated the readability of orthodontic education materials, “People only retain about 20% of what they hear, but this may increase by up to 50% if there is an additional visual or written input” (16). In some healthcare settings, the use of printed material may be the primary mode of educating patients (29). Consequently, the reading ability of patients and caregivers, and the readability of patient education materials both have strong implications for oral health literacy and oral health outcomes.
2.5 Adult Literacy in the United States

There are conflicting statistics on adult literacy in the United States, but most experts agree that literacy levels are shockingly low. In a 1994 national survey, Davis, Mayeau, Fredrickson, Bocchini, Jackson, and Murphy found the prevalence of illiteracy to range “from 13% of American adults who are severely illiterate (reading less than a fourth grade level) to 55% who have marginal reading skills insufficient for meeting specific requirements of adult living” (7). In 2005, McCray analyzed the National Adult Literacy Survey (NALS), which assessed the literacy of more than 26,000 adults in the United States. The survey divided literacy into five levels. From that survey, McCray found 22 to 23% of the adult population, representing 40 to 44 million adults, performed at the lowest level, and another 25 to 28%, representing about 50 million adults, fell into the second lowest level. People in the two lowest levels were more likely to have a lower socioeconomic status. Results of the NALS showed more than half of the U.S. population to be “functionally illiterate” (24). In 2000, Alexander reported that up to twenty percent of Americans have difficulty reading. He estimated that “13 percent of the population read at less than a fourth-grade level, and 55 percent of the population reportedly lack the reading skills necessary to function normally as adults in our society” (3). In 2006, Jackson found most parents of pediatric dentistry patients had a seventh to ninth-grade reading level (18). The medical community suggests that physicians can assume that almost twenty-five percent of their patients have limited literacy and can only read at or below the fifth grade level (35). In addition, research has found that the reading comprehension level of U.S. adults tends to be several years below their self-reported
highest education level (24). Sheih and Hosei found the comprehension level four years below, while Sabharwal et al. and Jackson found it five grades lower (28,18,30). Regardless of the reported literacy level, up to forty percent of Americans have a difficult time understanding common patient education materials (27).

The increasing diversity of the U.S. population must be noted. There is a growing population of non-English and limited-English speakers, many of whom are Hispanic. The Hispanic population accounted for over half the growth of the total population in the United States between 2000 and 2010 (8). Garcia, Cadoret and Henshaw stated in their 2008 report on the relationship between oral health and multi-cultural issues, that a significant challenge for dentist-patient communication may be with the growing Spanish speaking population of Americans (12). Spanish versions of the brochures provided may be an essential tool to help the communication for non-Spanish speaking dental personnel. In describing their findings on parental predictors of low health literacy, Yin, Johnson, and Mendelsohn, found that “Parents with less than a high school education had >8 times the odds of being categorized as having low health literacy… [and] parents who stated that they understood English ‘not well’/‘not at all’ had >18 times the odds of being categorized as having basic or below-basic health literacy” (37). Limited English may be a compounding factor in the problems of adult literacy in English, and must, at minimum, be noted in any discussion of readability. However, the limited scope of this study did not allow us to analyze differences among participants with varying levels of English language proficiency nor to include a parallel analysis with Spanish language brochures.

People with reading difficulties often disregard written information and ask fewer questions; however, when asked, they will describe themselves as literate (3). In
healthcare settings, patients may act embarrassed, not ask for help, and find ways to mask their limited abilities (24). Therefore, it may be especially difficult for healthcare providers to determine the literacy status of an individual patient.

2.6 Readability

Readability is a concept closely linked to oral health literacy because of the heavy reliance of text in patient education materials. Readability is defined as the ease with which written materials can be read and understood, and is usually expressed as a grade level (10, 21). Understanding of the written materials is vital to the patient’s ability to use the information to benefit their health. The objectives outlined in Healthy People 2010 prompt all health professionals “to provide improved, accurate, and understandable information to patients” (33). Understandability of health information is thought to be determined, in part, by its readability. Readability must be congruent with the patient’s or caregiver’s reading ability, and therefore, their ability to understand the material. In both the medical and dental realms, although an individual may be able to read and apply information with familiar content, they may have a very difficult time interpreting and applying information that has unfamiliar concepts or vocabulary, which happens often in health care settings (13). In 2006, Jackson found, “while not as extensive as the medical literature, the dental literature indicates that the reading level of many educational materials commonly used by dentists requires a high level of literacy” (18).

Formulas to analyze readability are an important guide for health care professionals (7). Many of the formulas are based on the length of the text units (i.e.,
words sentences and paragraphs) (21). The readability tests are mainly suitable for “English speaking populations and are inappropriate for assessing the health literacy level of Spanish speakers” (23.) Those most commonly used in health literature are the Flesch-Kinkaid Grade Level (FKGL), the Flesch Reading Ease (FRE), the Simple Measure of Gobbledygook (SMOG), and the Gunning Fog (GF) (2,7,10,21).

The Flesch-Kinkaid Grade Level (FKGL), developed in the 1940’s, measures the average paragraph length in number of words, sentence length in number of words and the average word length in number of syllables (18, 35). FKGL gives a score to the material in a grade level interpreted as the number of years of education needed to understand a given text (7). A higher FKGL of a text determines the material to be more difficult to read and comprehend, therefore, requiring more advanced reading skills than would be needed for a text with a lower FKGL (28). FKGL defines texts written below the sixth-grade level as easy to read and above the ninth-grade level as difficult to read (2). Because the formula uses words per paragraph, it is appropriate for text arranged in paragraph form and not in list form. According to FGKL, a paragraph is defined as at least thirty-five words. According to analysis by Sabharwal, Badarudeen, and Unes, FKGL has been “extensively validated and researched,” and has demonstrated “a very high inter-observer reliability” (28).

The Flesch Reading Ease (FRE) does not define a grade level but rather gives the text a score of 1 to 100 based on average sentence length in number of words and average number of syllables per word (9). By definition, a text with a lower FRE score is usually harder to read than one with a higher score (16). A score below 60 is considered difficult, a score between 60 and 70 is standard, and a score above 70 is considered easy (2).
The Simple Measure of Gobbledygook (SMOG) formula was developed in 1969 by McLaughlin (25). According to Kim et al., it is often used to measure the readability of health information (21). SMOG measures only the number of syllables in each word in the document; and it is typically reserved for short documents (5, 9).

Gunning-Fog index (GF) converts sentence length and percentage of polysyllabic words into a score of readability (21). It uses the sentences per paragraph, number of words, and syllables per word, and assigns a grade level (2). The GF formula “requires that 75% of persons reading at a given grade level be able to comprehend the text” (7). When using the GF to interpret readability, texts that are written below the sixth-grade level are considered easy to read (2).

Although these formulas are widely accepted to determine the readability of health literature, they have limitations. One criticism of the formulas is that counting words and syllables may not be sufficient to assess readability, because context and familiarity with vocabulary also matters (19). Kandula and Zeng-Treitler, for instance, found FKGL to be inadequate for estimating the difficulty of some types of health texts, because “a piece of text with short sentences yet low cohesion between sentences can be less understandable than one that has longer sentences and high cohesion” (19). Furthermore, research conducted by Amini et al. suggested that, “simplifying a text based on a readability formula can lead to problems in comprehension, as phrases may be omitted - thus increasing the comprehension burden.” Amini et al. referred to patient understanding as “comprehension.” In our study, we refer to the patients’ understanding to remain consistent with the definitions of oral health literacy and readability, as well as the recommendations to provide “understandable” material (10, 20, 21, 29, 33). Amini et
al. also found that medical jargon, which may be comprised of few syllables and short words, may lead to a miscalculation using tests that overestimate the actual readability, and that unexplained assumptions about the concepts discussed in the materials, with which the reader may not be familiar, may also hinder understanding (2). Similarly, dentistry has a distinct vocabulary with specific meanings that may not be familiar to the layperson. This vocabulary may change the readability level of a text (16). In a study by Freda concerning the AAP patient education brochures, “SMOG formula routinely assessed the brochures two to three grade levels higher than did the Flesch-Kincaid formula” (10). The algorithms used to assess grade level differ between the two formulas, and unfortunately, there is no gold standard against which the formulas can be compared to determine which is more accurate (2). Simplifying materials may also have legal and ethical implications if it reduces the accuracy and completeness of information about potential treatment benefits and risks (24).

Despite these limitations, the readability formulas have yielded valuable insights concerning the need to more closely evaluate the materials given to patients. The Joint Commission on the Accreditation of Healthcare Organizations requires that information be presented in an understandable manner. It also requires that “patients be taught in a manner that is consistent with their abilities and learning styles” (29). By using formulas to determine the grade level, and comparing the grade level to expert’s recommendations, many patient educators hope that materials can be developed to be more suitable for their audiences.

Just as estimates of adult literacy levels vary, so too do recommendations for the appropriate reading level of patient education materials for the U.S. population. The
recommended grade level varies from fifth grade to eighth grade. The arguments for each are valid, because defining the appropriate level for an entire population has proven difficult. Amini et al. reported, “In the United States, 1 in 5 adults reads at the fifth-grade level or below” (2). Sabharwal et al. found 40 million people in the adult US population have literacy skills equal to or less than the fifth-grade level and another 50 million people have reading skills between the sixth- and eighth-grade levels. They report that the average reading level is the eighth grade (28). Other literacy specialists recommend that patient education materials should be written no higher than a sixth-grade reading level to be readable by the greatest number of patients (35). In 2007, Sand-Jecklin also found a standard guideline from healthcare organizations, such as the National Institutes of Health, the National Work Group on Cancer and Health, and the American Medical Association, that readability of patient education materials should be no higher than the sixth grade level (29). Shieh and Hosei report that printed materials at the fifth grade level are considered superior; materials written at the 6th to 8th grade level are deemed adequate; and those written at or above the 9th grade level are judged to be not suitable for most of the population (30). Alexander found the seventh to ninth grade level was “recommended in the medical literature” (3). Interestingly, Harwood et al. explained that, “studies show that highly educated people do not mind if instructional material is oversimplified for them” (16). Thus there appears to be little risk in assuming a low level of literacy, and, it may be deduced from the literature, that materials should be written at or below the fifth grade level to ensure that the majority of people can comprehend the information.
2.7 Readability of Pediatric Dentistry Patient Education Materials

A connection has been found between parental health literacy and children’s dental health, in that “parental education was one of the primary factors for caries prediction in primary teeth” (18). Studies performed in the medical community regarding education materials for the caregivers of pediatric patients are plentiful. In 2009, Abrams, Klass and Dreyer wrote a “recommendation for action” that all AAP patient and family educational materials use “plain language” or have a plain-language version. They found that, “even those with excellent literacy skills who are usually proficient in health literacy can sometimes find the medical environment difficult to navigate and report episodic problems in understanding health related information” (1). The review by Davis et al. of AAP materials in 1994 found an incompatibility between the grade level of written materials and the reading level of parents, and emphasized that most parents cannot be expected to read materials written at the high school level (7). In pediatric dentistry, very few studies have reviewed printed patient education materials for their readability. According to Davis et al., “children’s healthcare will be compromised if physicians incorrectly assume that all parents can read and understand health-related materials” (7).

According to the ADA, the production and sales of dental brochures is a multimillion-dollar annual industry (20). Recently, three articles have been published regarding the readability of pediatric dentistry patient education materials. In 2005, Kang, Fields, Cornett, and Beck wrote, “An evaluation of pediatric dental patient education materials using contemporary health literacy measures”; in 2006, Hendrickson, Huebner

The purpose of the three studies was similar: to evaluate the readability, content and appropriateness of patient education materials in pediatric dentistry. All three research teams evaluated printed materials available to pediatric dentists, but the methods used by the three teams of researchers varied (2, 17, 20). Kang et al. used the SAM (Suitability Assessment of Materials) method to evaluate 22 patient dental health education materials provided by the AAPD (20). Hendrickson et al. evaluated the readability of 27 pediatric oral health brochures from commercial, government, industry, and private non-profit sources using FKGL, FRE, and the SMOG. They also analyzed the brochures for thoroughness, textual framework, and terminology (17). Amini et al. tested the readability of 25 AAPD brochures using FKGL, GF, and FRE (2).

The SAM method used by Kang et al. analyzed the materials in five categories of assessment: content, literacy demands, graphics, layout and typography, and learning stimulation and motivation. The SAM method incorporates the Fry readability formula, which deems the materials as superior if they are fifth-grade level or lower, adequate if written between the sixth to eighth-grade level, and not suitable if written above the ninth-grade level. Kang’s team found that, “Nine of the materials were in the ‘adequate’ category, while the other thirteen were above the ninth-grade reading level and in the ‘not suitable’ category.” The authors looked at other aspects of the literacy demand, including
reading level, writing style, vocabulary, content and learning aids. They found the overall literacy demands to be acceptable, “in spite of higher-than-ideal reading levels” (20).

Hendrickson et al. used an analysis based on format, including physical attributes, intended audience, instructional graphics, bulleted text, and thoroughness. The topics covered included baby gum care, infant dental visit, tooth brushing, toothpaste amount, flossing, fluoride, training cups, sealants, and avulsed teeth. Readability was analyzed using FKGL, FRE, SMOG, and analysis of “professional jargon.” They defined “professional jargon” as “the total number of complex terms used within the dental profession.” Concerning readability, the authors found the twenty-seven publications had grade levels that ranged from second- to ninth-grade according to the FKGL. The SMOG formula gave results two to three grade levels higher. “On average, the government publications had significantly lower readability demands than either commercial or industry sources.” Many publications were deemed adequate in terms of low literacy demands, but offered only limited information. The publications that provided an adequate amount of information required higher reading skills and were deemed too difficult for most of the population to understand (17).

Amini et al. found the mean readability of the brochures to be similar using the FKGL and GF formulas, and determined that “88% and 92% of the AAPD patient education materials were written above the recommended sixth-grade reading level, respectively” (2).

The three studies came to similar conclusions regarding readability. Hendrickson et al. concluded that, of the sample of 27 publications evaluated, those that were readable did not offer sufficient information and those that offered comprehensive information
were not at an appropriate reading level for most American adults (17). Kang et al. concluded that, “The materials produced by the American Academy of Pediatric Dentistry largely fall into the ‘superior’ range for overall quality,” however, the readability of the materials “required greater attention” (20). Amini et al found that educational materials are often dense, technical and written at a grade level too high for most people to understand. They concluded that the mean reading level as measured by all three tests was above that recommended and that all of the materials were difficult to read, and that, “the majority of AAPD patient education materials were not written at an appropriate reading level for the general public” (2)

All three studies emphasized the necessity of understandable written information and the possible consequences of readability problems (2, 17, 20). Kang et al. recommended, “In order to help parents understand the value of early dental care and home oral hygiene, educational messages must be easy to understand and relevant.” They also asserted that low literacy leads to more expensive care, more emergency visits, and higher hospitalization rates (20). Hendrickson et al, suggested concise and consistent materials, “are a simple way to bridge the communication gap between provider, parent, and pediatric patient.” They stated, “Dentists can chose better suited materials for their patient population based upon the parameters of usability, i.e., readability and content, and can use this and other readability papers to select publications that yield favorable grade levels” (17). Considerations of readability and content can serve as the basis for dentists to choose materials to distribute to their patients.

Educational materials must be understandable to be effective. Therefore, pediatric dentists must take into consideration the readability of the materials they
provide, and the literacy level of the caregivers to whom they are providing the materials. The medical community has many published studies and reports on the effectiveness of the written information they provide to their patients. Pediatric dentistry needs to follow their lead and develop more effective communication by providing materials to their patients and caregivers that can be easily understood.
3. METHODS

3.1 Site

This study was conducted at University of Illinois at Chicago in the Pediatric Medicine Outpatient Center Clinic.

3.1 Sample Selection

English-speaking adults aged 18 and over, accompanying patients of University of Illinois at Chicago Pediatric Medicine Outpatient Center Clinic, were recruited to participate in the study. A cover letter was provided explaining the study. Agreeing to participate in the study after having read the cover letter served as consent (Appendix A). Persons who did not speak English were excluded. Dental professionals, for whom the subject matter in the brochures and surveys would be too familiar, were excluded. However, no one was identified as a dental professional.

3.2 Study Design

The study was a randomized control trial of two versions of a brochure given to participants to read, followed by a questionnaire. Materials consisted of a cover letter, brochure and questionnaire. An introduction and verbal explanation were given the participants before reading the materials. The verbal explanation first asked if the participants spoke English. It was explained that the research involved having participants read the brochure, answer questions regarding the brochure and non-identifying questions about themselves and the children they were accompanying.
Participants were reassured that their participation was voluntary and they could refuse without negative consequences regarding their healthcare at the site. Randomization of the brochure group was accomplished by a coin toss. If the coin landed heads up, they were given the original brochure; if it landed tails up, they were given the rewritten brochure. When the participants had completed reading the cover letter and brochure, they were given the questionnaire. The brochure was returned before completing the questionnaire so the participants could not refer to it while answering the questions.

A total of 78 questionnaires were collected. The surveys were collected from October 2011 until December 2011.

Approval of the study was obtained from the University of Illinois at Chicago Institutional Review Board, protocol # 2011-0835 (Appendix B)

3.3 Brochure

Two brochures were included in the study; each participant read only one brochure. One was the original version of an American Academy of Pediatric Dentistry patient education brochure entitled “Sealants.” (Appendix C). The brochure was obtained with permission from the AAPD (Appendix F). The second was the American Academy of Pediatric Dentistry patient education brochure entitled “Sealants” with the text rewritten to a lower grade level (Appendix D).

Three readability formulas were employed to change the grade level of the rewritten brochure to a more readable level: Flesch-Kinkaid Grade Level (FKGL), Gunning-Fog Index (GF) and Flesch Reading Ease (FRE). The text was altered using the following criteria: sentence length was reduced in number of words, word length was
reduced in number of syllables, and percentage of polysyllabic words was reduced. Words that were considered necessary technical jargon were defined within the brochure to enhance understanding.

The text of the brochure was altered, but not the design or graphics. Each brochure was scanned into Adobe Photoshop®. The brochures were printed in color on stock paper so they appeared identical in quality.

The brochure “Sealants” was chosen because the original readability level was above the fifth grade reading level suggested by the literature review as most appropriate. The subject is applicable to the general population and the intention of the brochure is to educate the reader, providing general knowledge about sealants. The original brochure received moderately high scores on all three scales: grade 7.8 on the Flesh-Kinkade Grade Level, a score of 61.4 on the Flesch Reading Ease, and a grade 9.0 on the Gunning Fog Index. The rewritten brochure received a grade level of 3.2 according to Flesh-Kinkade Grade Level, a score of 86.2 on the Flesch Reading Ease, and a Gunning Fog Index reading level of grade 5.4.

The brochures were randomly distributed to the participants. The goal was to have an equal number of participants reading the original brochure and the rewritten brochure. Participants who read the original brochure were the control group; participants who read the altered brochure were the experimental group.

3.4 Survey Tools

The survey (Appendix E) consisted of four sections. The first section contained questions regarding information contained in the brochures. The questions were a test of
understanding of the information. The understanding test was developed using the guidelines developed by Brookhart in *The Art and Science of Classroom Assessment: The Missing Part of Pedagogy* (4). Participants were scored on the understanding section, one point per question for a possible total score of five points. The second section contained information regarding the participants’ self-reported evaluation of the brochure’s understandability and readability. The third section requested non-identifying demographic information. One flaw in the study design was in question #11, which asked about the age of the child the participant accompanied (Appendix E.) The age-range choices given to the participants overlapped. The fourth section contained questions regarding previous dental experience and knowledge. Answers to the second, third and fourth sections were included as potential confounding variables for analysis and used to demonstrate a random selection of participants.

3.5 **Statistical Analysis**

Data was entered in SPSS 19.0 for Windows® (MicroSoft Office, 2003) SP3. The data was entered according to the encoding scheme described in Appendix F. Hypotheses were tested according to Table I.

First, the demographic variables were compared by Brochure Group, Original or Rewritten, to insure the randomization was effective. Chi Square analyses were used for categorical variables and Mann Whitney U analyses were used for ordinal variables. Next, the hypotheses were tested by comparing the groups on Understanding and Evaluation Scores. The variable “Understanding Score” was determined by awarding one point per correct answer for a possible total score of five points for questions #1-5, the
knowledge test questions. The variable “Evaluation Score” was determined by one point per affirmative answer in questions #6 and #7 and up to 3 points for affirmative answer in question #8, for a total of five points. (Appendix F: Data Encoding Scheme.) Then the potential mediating variables were tested to determine if they influenced Understanding. Those variables with an association with Understanding were then regressed along with Group membership on Understanding. If Group remained significant, it was interpreted as contradicting Null Hypothesis 1.
### Table I

**ANALYSIS VARIABLES**

<table>
<thead>
<tr>
<th>Null Hypothesis 1</th>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Mediators</th>
<th>Statistical Analysis Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brochure Group</td>
<td>Understanding Score *</td>
<td>Education</td>
<td>Education</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-original version</td>
<td>Ethnicity</td>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-rewritten version</td>
<td>Relationship to the child being accompanied</td>
<td>Relationship to the child being accompanied</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ages of the child being accompanied</td>
<td>Ages of the child being accompanied</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Previous experience with sealants</td>
<td>Previous experience with sealants</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Previously taken a child to the dentist</td>
<td>Previously taken a child to the dentist</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Null Hypothesis 2</th>
<th>Brochure Group Evaluation Score**</th>
<th>none</th>
<th>1. T-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>-original version</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-rewritten version</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The variable “Understanding Score” was determined by awarding one point per correct answer for a possible total score of five points for questions #1-5. (Appendix F: Data Encoding Scheme)

** The variable “Evaluation Score” was determined by one point per affirmative answer in questions #6 and #7 and up to 3 points for affirmative answer in question #8, for a total of five points. (Appendix F: Data Encoding Scheme)

*** Linear Regression Analysis was used by regressing education as a mediating variable and Group on the dependent variable Understanding Score. No other measures obtained were mediators of Understanding Score.
4. RESULTS

4.1 Number of Participants and Response Rates

A total of 89 people were approached to participate in the study. Nine people refused to participate. Two who read the brochure declined answering, both because their children’s names were called for an appointment. Seventy-eight completed questionnaires were obtained. Forty-two participants (54%) read the original brochure; and 36 participants (46%) read the rewritten brochure. Everyone who began the questionnaire completed it. A power analysis was completed verifying there was enough power to detect a difference of one item (power = 1.0) between the two groups.

4.2 Descriptive Characteristics of Participants

The descriptive characteristics of the participants are listed in Table II. The highest proportion of participants was African American. All participants had at least some high school education. The majority of participants were mothers of the children they accompanied. The demographic characteristics between the two groups were statistically equivalent, demonstrating adequate randomization.
Table II
DESCRIPTIVE CHARACTERISTICS OF PARTICIPANTS

<table>
<thead>
<tr>
<th></th>
<th>Original Brochure</th>
<th>Rewritten Brochure</th>
<th>Total Number</th>
<th>Percentage of all participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Ethnicity *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>26%</td>
<td>28%</td>
<td>22</td>
<td>27%</td>
</tr>
<tr>
<td>African American</td>
<td>48%</td>
<td>44%</td>
<td>36</td>
<td>46%</td>
</tr>
<tr>
<td>Latino</td>
<td>19%</td>
<td>25%</td>
<td>17</td>
<td>22%</td>
</tr>
<tr>
<td>Other Ethnicity</td>
<td>7%</td>
<td>3%</td>
<td>4</td>
<td>5%</td>
</tr>
<tr>
<td>**Relationship to child *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>55%</td>
<td>56%</td>
<td>43</td>
<td>55%</td>
</tr>
<tr>
<td>Other relationship</td>
<td>45%</td>
<td>44%</td>
<td>16</td>
<td>45%</td>
</tr>
<tr>
<td>**Highest education **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No High School</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Some High School</td>
<td>10%</td>
<td>14%</td>
<td>9</td>
<td>12%</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>24%</td>
<td>6%</td>
<td>12</td>
<td>15%</td>
</tr>
<tr>
<td>Some College</td>
<td>41%</td>
<td>50%</td>
<td>35</td>
<td>45%</td>
</tr>
<tr>
<td>College Graduate</td>
<td>26%</td>
<td>31%</td>
<td>22</td>
<td>28%</td>
</tr>
<tr>
<td>**Age of child being accompanied **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child 0-12 months old</td>
<td>22%</td>
<td>28%</td>
<td>19</td>
<td>24%</td>
</tr>
<tr>
<td>Child 1-3 years old</td>
<td>14%</td>
<td>17%</td>
<td>12</td>
<td>15%</td>
</tr>
<tr>
<td>Child 4-6 years old</td>
<td>22%</td>
<td>14%</td>
<td>14</td>
<td>18%</td>
</tr>
<tr>
<td>Child 6-12 years old</td>
<td>24%</td>
<td>25%</td>
<td>19</td>
<td>25%</td>
</tr>
<tr>
<td>Child 12 years or older</td>
<td>19%</td>
<td>17%</td>
<td>14</td>
<td>18%</td>
</tr>
</tbody>
</table>

* Ethnicity and relationship to child were compared with Chi Square

** Age of child being accompanied and Education were compared by Mann-Whitney U.

There was no significant difference noted between the two groups. Mann-Whitney, p>0.5. Chi square, p=1.0
4.3 Null Hypothesis 1

There is no significant difference in caregiver understanding of pediatric dentistry patient education material between a brochure revised to conform with a lower grade level readability score and the original version that has a higher grade level readability score.

The mean Understanding Score was determined by the number of correct answers to the knowledge test questions in the survey, with a total of five possible points. Analysis revealed no statistical difference in the mean understanding score between the two groups (Table II), T(76df)= 1.2, p > 0.05.

Table III
EFFECT OF IMPROVED READABILITY ON A “SEALANTS” BROCHURE ON PARTICIPANTS’ UNDERSTANDING SCORES

<table>
<thead>
<tr>
<th></th>
<th>Original Brochure</th>
<th>Rewritten Brochure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Median</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.7</td>
<td>0.7</td>
</tr>
</tbody>
</table>

5 points were possible. T-test was non-significant.
n= 42 for original brochure and 36 for rewritten

We further investigated Null Hypothesis 1 by examining the effect of all possible mediating variables on Understanding: participants’ ethnicities, education levels, relationships to the child being accompanied, ages of the child being accompanied,
previous personal experience with sealants, and whether they had previously taken a child to the dentist. The ages of the child being accompanied was regressed first by the categories on the survey. We then collapsed the ages into three groups, infants (from newborn to 3 years old), children (from 4 to 12 years old), and adolescents (over 12 years old) and performed another linear regression analysis. In both analyses, the age of the child being accompanied was not significantly related to the Understanding Scores. We assumed that a higher level of education would improve Understanding Scores in both groups, and were interested in whether it affected understanding differently depending on the brochure. We regressed the mediator Education and the independent variable Brochure Group on the dependent variable Understanding Score. Results are shown in Table IV. Education was significantly related to Understanding, but the Readability of the brochure was not related to Understanding after Education was taken into account. The overall regression model was significant (ANOVA [F(2,75)=8.2], p<.001).

<table>
<thead>
<tr>
<th></th>
<th>Standardized Beta</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Brochure Group</td>
<td>0.1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

n=78
4.4 Null Hypothesis 2

The caregiver's evaluation of the readability of the brochure is not associated with which brochure was read.

The mean evaluation score was determined by one point per affirmative answer in questions #6 and #7 and up to 3 points for affirmative answer to question #8, for a total of five points. Analysis revealed no statistical difference between the groups’ Evaluation Scores, $T(76df)= 0.7, p > 0.05$.

<table>
<thead>
<tr>
<th></th>
<th>Mean Evaluation Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>4.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Rewritten</td>
<td>4.9</td>
<td>0.4</td>
</tr>
</tbody>
</table>

5 points were possible. T-Test was non-significant. 
n= 42 for original brochure and 36 for rewritten
4.5 Summary of Results

Written materials can help pediatric dentists educate the caregivers of their patients and ultimately lead to better patient health (10). However, given low national literacy rates, brochures may not be effective if their intended audience cannot read and understand them. The purpose of this study was to determine if pediatric dental education materials that are written at lower reading levels would be better understood by their intended audience than those written at a higher reading level.

Null Hypothesis 1 sought to determine if pediatric dental education materials written at lower reading levels would be better understood by their intended audience than those written at a higher reading level. There was no difference between the Understanding Scores of the two Brochure groups. Therefore, Null Hypothesis 1 could not be rejected. Changing the readability from the seventh-grade level to the third-grade level did not make a statistically significant difference in understanding for this sample.

Even though no correlation was found between Brochure Group and Understanding, several other variables were analyzed to see if they might have an impact on Understanding: participants’ ethnicities, participants’ education levels, relationships to the child being accompanied, ages of the child being accompanied, previous personal experience with sealants, and whether they had previously taken a child to the dentist. Of these variables, only Education had a significant association with Understanding. Participants with higher levels of education also had higher Understanding Scores than those with lower levels of education, regardless of Brochure Group.
We did not find a significant association between any other variable and Understanding. Even participants who had answered “yes” to having had personal experience with sealants did not have an increased Understanding Score compared with those who did not have experience with sealants. Likewise, those who knew about sealants prior to reading the brochure did not have a higher Understanding Score.

Null Hypothesis 2, that the caregiver’s Evaluation Score is not associated with the Brochure Group, could not be rejected. Regardless of which brochure participants read, they overwhelmingly found it well written and with comprehensible vocabulary.
5. DISCUSSION

This study was a randomized control trial comparing pediatric caregivers’ understanding of two versions of a pediatric dentistry patient education brochure. The sample size of 78 participants achieved sufficient power for the statistics employed and the two groups were equivalent on all descriptive characteristics, verifying that the participants were randomly assigned.

Prior research suggests that this particular sample did not represent the general population of healthcare patients in the United States. According to a 2011 study involving the population at UIC Pediatric Outpatient Care Clinic, more than 80% of the caregivers reported their primary method of payment to be via Medicaid (15). Medicaid services people and families with low incomes. McCray found that people with low socio-economic status and low incomes were more likely to not read well (24). Therefore, we found it surprising that the education level of the participants was higher than the averages for the U.S. population cited in the literature review. The medical community suggests that physicians can assume that almost twenty-five percent of their patients have limited literacy and can read only at or below the fifth grade level (35). Yet, all participants had at least some high school education. Consequently, it may have been warranted to purposefully select a sample that reflected a population with lower literacy levels or lower educational levels.

Conversely, the brochure was chosen because it scored in the moderate range for difficulty of reading: seventh-grade level according to FKGL and the ninth-grade level according to GF. This moderate level may have been too low a grade level to be
challenging for the majority of this particular sample. Measurable literacy levels are often several years below that of the highest grade completed. In this study, all participants reported a minimum of some high school education, which would be equal to or higher than the readability of the original brochure, since the highest grade level measured by the formulas was the ninth grade (24). The FKGL for the original brochure was slightly above the seventh grade, which was lower than the lowest education level for all participants. Given participants’ relatively high education levels, it is not surprising that all participants had high Understanding scores. Therefore, it may also have been merited to choose original text written at a much higher reading level. Our findings are consistent with other studies that have suggested that those with high education and literacy levels do not mind if information is written more simply, as exemplified by the participants’ high Evaluation Scores (14).

The brochure was also chosen because its purpose was general education of the reader about sealants. Seventy-five percent of the participants in this study reported that they did not know about sealants before reading the brochure, therefore, an unintended benefit of this study was educating those who did not previously know about sealants. In light of their high scores on the knowledge test, the goal of the brochure, to educate the reader, was successful. However, the lack of correlation between Brochure Understanding and Readability Levels, suggest that understanding text is more complex than literacy level alone, and it is not clear that using a readability formula to change the grade level of a text will make it more understandable to patients or caregivers.
5.1 Limitations

One limitation of the study may have been surveying a sample at a single site, the University of Illinois at Chicago. A larger and more diverse study could have broadened the data collection to capture the socioeconomic and educational diversity of the U.S. population. By focusing on the English language, our study did not take into account the portion of the population that does not speak English. Alternatively, we could have focused on a non-randomized sample with a lower average education level and lower mean literacy levels. In addition, the relatively small sample size in this study may have limited the ability to document significant relationships that may exist among variables due to the small frequencies in some groups. For instance, the sample was too small to determine if the rewritten brochure was more helpful to participants with the lowest education level.

Testing methods may not have been effective for this sample. More difficult understanding questions and original readability may have been needed to show significant improvements in understanding from a rewritten brochure. Likewise, the brochure may have been too short and simple. The original brochure was only seven paragraphs long, which did not allow for a lengthy test of understanding. Therefore, a longer brochure may have yielded a wider range of scores, and greater variation in the sampling might have made it possible to detect a difference between the two groups. Both the text passage and the test of understanding were too brief to rule out the possible confounds of prior knowledge and guessing based on common sense. A more effective means of testing understanding may have been to wait a period of time to see if the
participants retained the knowledge, as rote memorization is likely to fade more rapidly than conceptual understanding. However, this method would have been difficult logistically as the participants do not come to the doctor’s office at regular intervals.

An additional issue is that brochures vary in their intended goals, so it may be difficult to make a generalization about how to make them more effective. Not all brochures are intended to increase knowledge of the reader. For instance, a brochure describing tooth brushing technique may have the goal of changing habits. Therefore, a test of understanding would not be the most effective means of determining if the goal of the brochure had been achieved. For a brochure on brushing techniques, a plaque index might have been an appropriate test for effectiveness.

According to prior literature (2, 3, 16, 28, 29, 30, 35) the recommended readability level is at or below the fifth-grade level. However, that standard may be lower than necessary for UIC’s patient population, as the ninth grade level of the brochure appeared to be adequate for understanding. Due to time constraints, we determined to use only one brochure to evaluate understanding. However, were multiple brochures at different reading levels employed, any outcomes may have been more reliable and representative of patient education brochures in general.
5.2 Significance and Implications

This study has shown that a tool to solely improve readability may not significantly increase the effectiveness of written educational materials in pediatric dentistry. Improving comprehension is a complex issue, which may not be resolved with one method. The patient population and audience for the brochures, the goal of the written materials, and the methods of determining understanding are important factors that must be considered. According to previous studies, establishing simple guidelines for appropriate sentence length, word length and percentage of polysyllabic words can help oral healthcare providers to develop more understandable patient education materials if the other factors are also addressed.

We hope that our study can generate momentum for future studies to determine the best methods to make patient education materials more understandable. Communication with patients and caregivers is an essential part of pediatric dentistry. If pediatric dentists continue to use written materials to educate patients and caregivers, they should be aware of the limitations of those materials.
6. CONCLUSIONS

The purpose of this study was to determine if pediatric dental education materials that are written at lower reading levels would be better understood by their intended audience than those written at a higher reading level.

The primary findings of this study of English-speaking participants’ ability to understand dental education brochures written at differing reading levels are as follows:

- There is no significant difference between caregiver’s understanding of pediatric dentistry patient education materials revised to conform with a lower grade level readability score as compared with original versions that have higher grade level readability scores.
- Having a positive self-reported Evaluation of the brochure was not associated with the reading level of the brochure.
- Caregivers’ Understanding score was positively associated with their level of education.

Because the null hypotheses were supported, we can infer that changing readability alone may not be effective in improving the understandability of written materials. Changing text through readability formulas changes the grade level of written materials. In our study, the audience was more educated than anticipated, and therefore, reducing the grade level was not effective in improving understandability, as indicated by the finding that Understanding Scores remained uniformly high.
CITED LITERATURE


CITED LITERATURE (continued)


APPENDICES
APPENDIX A: Cover Letter

Readability of Pediatric Dentistry Patient Education Materials

Study Title: Readability of Pediatric Dentistry Patient Education Materials
PI: Julie M Rudgers Croft, DDS

Dear Respondent,

I am inviting you to participate in a research project to study the readability of pediatric dentistry patient education materials. This research project is not funded. Along with this letter is a brochure for you to read followed by a short list of questions that ask about the brochure. I am asking you to look over the brochure and answer the questionnaire. It should take you about 10 minutes to complete. You must be 18 years of age to participate.

The purpose of this project is to determine if the brochure is written at an appropriate reading level. Through your participation I hope to understand if there is a better way to write patient education materials. I hope that the results of the survey will be useful for developing educational materials and I hope to share my results by publishing them in a scientific journal.

There are no risks to participation in this survey. Your responses will not be identified with you personally. I will not collect any information that will identify you, and you will not be asked to put your name on the questionnaire.

I hope you will take the time to read the brochures and complete the questionnaire. Your participation is voluntary and there is no penalty if you do not participate. Regardless of whether you choose to participate, please let me know if you would like a summary of my findings. To receive a summary, you may contact me at the email address listed at the bottom of this page.

If you have any questions or concerns about completing the questionnaire or about being in this study, you may contact me at jrudge2@uic.edu. You may also contact my research advisor at ipunwani@uic.edu. This project has been approved by the Institutional Review Board (IRB) at University of Illinois at Chicago.

If you have any questions about your rights as a research study participant, you may contact the chair of the IRB through the Compliance Office at 312-996-1711 or at www.research.uic.edu/protocolreview/irb.
APPENDIX A: Cover Letter ( Continued )

You must be at least 18 years old in order to participate.
If you agree to participate, you may keep this form and complete the survey.
If you wish, you may stop at any time.
You do not have to place your name on the survey.

Sincerely,
Julie Rudgers Croft, DDS
Jrudge2@uic.edu
APPENDIX B: IRB Approval # 2011-0835

Exemption Granted

October 6, 2011
Julie Rudgers Croft, DDS
Pediatric Dentistry
801 S Paulina St
M/C 850
Chicago, IL 60612
Phone: (312) 996-2242 / Fax: (312) 413-8006

RE: Research Protocol # 2011-0835

“The Readability of Pediatric Dentistry Patient Education Brochures”

Dear Dr. Rudgers Croft:

Your Claim of Exemption was reviewed on October 6, 2011 and it was determined that your research protocol meets the criteria for exemption as defined in the U. S. Department of Health and Human Services Regulations for the Protection of Human Subjects [(45 CFR 46.101(b)]. You may now begin your research.

Please note the following regarding your research:

Exemption Period: October 6, 2011 – October 5, 2014

Sponsor(s): None

Performance Site(s): UIC

Subject Population: Adults (18 years and older) only

Number of Subjects: 330 Total

The specific exemption category under 45 CFR 46.101(b) is:

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:

(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects’ responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.
APPENDIX B: IRB Approval # 2011-0835 (continued)

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities for the ethical conduct of the research under state law and UIC policy. Please be aware of the following UIC policies and responsibilities for investigators:

1. **Amendments** You are responsible for reporting any amendments to your research protocol that may affect the determination of the exemption and may result in your research no longer being eligible for the exemption that has been granted.

2. **Record Keeping** You are responsible for maintaining a copy all research related records in a secure location in the event future verification is necessary, at a minimum these documents include: the research protocol, the claim of exemption application, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to subjects, or any other pertinent documents.

3. **Final Report** When you have completed work on your research protocol, you should submit a final report to the Office for Protection of Research Subjects (OPRS).

4. **Information for Human Subjects** UIC Policy requires investigators to provide information about the research protocol to subjects and to obtain their permission prior to their participating in the research. The information about the research protocol should be presented to subjects in writing or orally from a written script. When appropriate, the following information must be provided to all research subjects participating in exempt studies:

   a. The researchers affiliation; UIC, JBVMAC or other institutions,
   b. The purpose of the research,
   c. The extent of the subject’s involvement and an explanation of the procedures to be followed,
d. Whether the information being collected will be used for any purposes other than the proposed research,

e. A description of the procedures to protect the privacy of subjects and the confidentiality of the research information and data,
   • f. Description of any reasonable foreseeable risks,

g. Description of anticipated benefit,

h. A statement that participation is voluntary and subjects can refuse to participate or can stop at any time,

i. A statement that the researcher is available to answer any questions that the subject may have and which includes the name and phone number of the investigator(s).

j. A statement that the UIC IRB/OPRS or JBVMAC Patient Advocate Office is available if there are questions about subject’s rights, which includes the appropriate phone numbers.

Please be sure to:

☐ Use your research protocol number (listed above) on any documents or correspondence with the IRB concerning your research protocol.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact me at (312) 355-1404 or the OPRS office at (312) 996-1711. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

☐ Sincerely,
   Sheilah R. Graham, BS

☐ IRB Coordinator, IRB # 2

☐ Office for the Protection of Research Subjects

cc: Indru C. Punwani, Pediatric Dentistry, M/C 850
   Charlotte Briggs, Faculty Sponsor, Pediatric Dentistry, M/C 850
APPENDIX C: Original Brochure

What are sealants?
Sealants protect the grooved and pitted surfaces of the teeth, especially the chewing surfaces of back teeth where most cavities in children are found. Made of clear or shaded plastic, sealants are applied to the teeth to help keep them cavity-free.

What is the treatment like?
The application of a sealant is quick and comfortable. It takes only one visit. The tooth is first cleaned. It is then conditioned and dried. The sealant is then flowed onto the grooves of the tooth and allowed to harden or hardened with a special light. Your child will be able to eat right after the appointment.

How do sealants work?
Even if your child brushes and flosses carefully, it is difficult—sometimes impossible—to clean the tiny grooves and pits on certain teeth. Food and bacteria build up in these crevices, placing your child in danger of tooth decay. Sealants “seal out” food and plaque, thus reducing the risk of decay.

How long do sealants last?
Research shows that sealants can last for many years if properly cared for. Therefore, your child will be protected throughout the most cavity-prone years. If your child has good oral hygiene and avoids biting hard objects, sealants will last longer. Your pediatric dentist will check the sealants during routine dental visits and recommend re-application or repair when necessary.

How much does it cost?
The treatment is very affordable, especially in view of the valuable decay protection it offers your child. Most dental insurance companies cover sealants. Some companies, however, have age and specific tooth limitations. Check with your benefits provider about your child’s coverage and talk to your pediatric dentist about the exact cost of sealants for your child.

Which teeth should be sealed?
The natural flow of saliva usually keeps the smooth surfaces of teeth clean but does not wash out the grooves and fissures. So the teeth most at risk of decay—and therefore, most in need of sealants—are the six-year and twelve-year molars. Many times the permanent premolars and primary molars will also benefit from sealant coverage. Any tooth, however, with grooves or pits may benefit from the protection of sealants. Talk to your pediatric dentist, as each child’s situation is unique.

If my child has sealants, are brushing and flossing still important?
Absolutely! Sealants are only one step in the plan to keep your child cavity-free for a lifetime. Brushing, flossing, balanced nutrition, limited snacking, and regular dental visits are still essential to a bright, healthy smile.

Before sealant is applied. After sealant is applied.
APPENDIX D: Rewritten Brochure

What are sealants?
Cavities are tooth decay. Most cavities in children are found on the back teeth. There are grooves and pits on the surface of the back teeth where cavities live. Sealants cover the grooves and pits on the teeth. They are made of clear or colored plastic. They are placed on teeth to help stop cavities.

How do sealants work?
Placing sealants is fast and painless. It takes only one visit. First, the tooth is cleaned. Second, it is conditioned and dried. Then, the sealant is then flowed onto the grooves of the tooth. It gets hard on its own or with a special light. Your child will be able to eat right away.

How long do sealants last?
Research shows that sealants can last for many years. But, to last they must be taken care of. Most cavities form in childhood. Sealants will help protect your child for those years. Sealants will last longer if your child brushes and flosses well. Biting hard objects can damage sealants. Your dentist will check the sealants during check-ups. It may be needed to repair or re-apply the sealants.

What is the treatment like?
Decay can form even if your child brushes and flosses carefully. It is very hard to clean the tiny grooves and pits on certain teeth. Food and germs build up in these gaps. The build up can cause decay. Sealants "seal out" food and germs. They cut down the risk of cavities.

How much does it cost?
The treatment is low-cost in view of protecting from cavities. Most dental insurance pays for sealants. Some companies have limits on the age and the tooth. Check with your insurance if your child is covered. Talk to your dentist about the cost of sealants.

Which teeth should be sealed?
Saliva can help keep the smooth parts of teeth clean. The grooves and pits are not washed out with spit. So the teeth in the back, the adult molars, are the most at risk for decay. The premolars, between the front and back teeth, also have grooves. Sealants can also help protect the adult premolars and the baby molars. Sealants may protect any tooth with grooves or pits. Talk to your dentist, as every child is different.

If my child has sealants, are brushing and flossing still important?
YES!
Sealants are only one step that keeps your child cavity-free for life. Many things are important for a bright healthy smile. Your child must brush and floss very well. They must have good eating habits and limited snacking. They must also have regular dental visits.
APPENDIX E.: Questionnaire

1. How do sealants work?
   ○ They protect the surface of the teeth
   ○ They add substances, like Fluoride, to block the bacteria.
   ○ They kill the germs that make cavities.

2. How long do sealants last?
   ○ Forever.
   ○ 10 years.
   ○ It depends on how well they are taken care of.
   ○ They last until the next visit when they are reapplied.

3. What is sealant treatment like?
   ○ It takes three visits.
   ○ The sealant is flowed into the grooves and hardens.
   ○ The tooth is drilled out and the sealant is put on.
   ○ The child cannot eat for 2 hours.

4. What teeth will benefit from sealants?
   ○ Any teeth with grooves.
   ○ Front teeth.
   ○ Molars or back teeth only.
   ○ Only baby teeth.

5. After sealants, what does the child need to do?
   ○ Only brush at night.
   ○ Brush and floss normally.
   ○ Brush with a very hard toothbrush.
   ○ Brush only the sides of the teeth.

6. Do you feel like this brochure was well-written?
   ○ Yes
   ○ No
APPENDIX E.: Questionnaire (continued)

7. Do you understand all of this brochure?
   ○ Yes
   ○ No

8. Were you able to understand the language and words used in this brochure?
   ○ Yes, all of the words
   ○ Yes, most of the words
   ○ Somewhat, some of the words were difficult
   ○ No, the words were difficult to understand

9. Your relationship to the patient:
   ○ Mother
   ○ Father
   ○ Grandparent
   ○ Legal Guardian
   ○ Other

10. Your ethnicity (please check all that apply):
    ○ Caucasian
    ○ Latino
    ○ African American
    ○ Asian
    ○ Other

11. The age of the child you are with
    ○ Newborn to 12 months
    ○ 1 to 3 years old
    ○ 4 to 6 years old
    ○ 6 to 12 years old
    ○ Older than 12 years
APPENDIX E: Questionnaire (continued)

12. Your Highest Level of Education:
   ○ No High School
   ○ Some High School
   ○ High School Graduate
   ○ Some College
   ○ College Graduate

13. Have you ever taken a child to the dentist?
    ○ Yes
    ○ No

14. Did you have sealants placed?
    ○ Yes
    ○ No

15. Did you know about sealants before reading this brochure?
    ○ Yes
    ○ No
APPENDIX F: Data Encoding Scheme

1. How do sealants work?
   ○ They protect the surface of the teeth. = 0
   ○ They add substances, like Fluoride, to block the bacteria. = 1
   ○ They kill the germs that make cavities. = 0

2. How long do sealants last?
   ○ Forever. = 0
   ○ 10 years. = 0
   ○ It depends on how well they are taken care of. = 1
   ○ They last until the next visit when they are reapplied. = 0

3. What is sealant treatment like?
   ○ It takes three visits. = 0
   ○ The sealant is flowed into the grooves and hardens. = 1
   ○ The tooth is drilled out and the sealant is put on. = 0
   ○ The child cannot eat for 2 hours. = 0

4. What teeth will benefit from sealants?
   ○ Any teeth with grooves. = 1
   ○ Front teeth. = 0
   ○ Molars or back teeth only. = 0
   ○ Only baby teeth. = 0

5. After sealants, what does the child need to do?
   ○ Only brush at night. = 0
   ○ Brush and floss normally. = 1
   ○ Brush with a very hard toothbrush. = 0
   ○ Brush only the sides of the teeth. = 0

6. Do you feel like this brochure was well-written?
   ○ Yes = 1
   ○ No = 0
APPENDIX F: Data Encoding Scheme (continued)

7. Do you understand all of this brochure?
   ○ Yes =1
   ○ No =0

8. Were you able to understand the language and words used in this brochure?
   ○ Yes, all of the words =3
   ○ Yes, most of the words =2
   ○ Somewhat, some of the words were difficult =1
   ○ No, the words were difficult to understand =0

9. Your relationship to the patient:
   ○ Mother =1
   ○ Father =2
   ○ Grandparent = 3
   ○ Legal Guardian = 4
   ○ Other = 0

10. Your ethnicity (please check all that apply):
    ○ Caucasian =0
    ○ Latino =1
    ○ African American = 2
    ○ Asian =3
    ○ Other =4

11. The age of the child you are with
    ○ Newborn to 12 months =0
    ○ 1 to 3 years old =1
    ○ 4 to 6 years old =2
    ○ 6 to 12 years old =3
    ○ Older than 12 years =4
APPENDIX F: Data Encoding Scheme (continued)

12. Your Highest Level of Education:
   - No High School = 0
   - Some High School = 1
   - High School Graduate = 2
   - Some College = 3
   - College Graduate = 4

13. Have you ever taken a child to the dentist?
   - Yes = 1
   - No = 0

14. Did you have sealants placed?
   - Yes = 1
   - No = 0

15. Did you know about sealants before reading this brochure?
   - Yes = 1
   - No = 0
APPENDIX G: PERMISSION TO REPRINT COPYRIGHT MATERIAL

University of Illinois at Chicago
Department of Pediatric Dentistry

January 10, 2012

American Academy of Pediatric Dentistry
211 East Chicago Avenue, Suite 1700
Chicago, IL 60611-2637
(312) 337-2169

I am writing to request permission to use the following material from your publication ("Sealants" brochure, 2009) in my thesis. This material will appear as originally published and in a version with the readability of the text altered. Unless you request otherwise, I will use the conventional style of the Graduate College of the University of Illinois at Chicago as acknowledgement.

A copy of this letter is included for your records. Thank you for your kind consideration of this request.

Sincerely,

Julie M Rudgers Croft, DDS
c/o UIC COD
Department of Pediatric Dentistry
M/C 850
Chicago, IL 60612

The above request is approved.

Approved by: [Signature] Date: 1/17/2012
VITA/CV

Name: Julie Rudgers Croft, DDS

EDUCATION

University of Illinois at Chicago, Chicago, IL, College of Dentistry, 2010-present
  Pediatric Dentistry Residency, certificate to be conferred 7/2012

University of Illinois at Chicago, Chicago, IL, College of Dentistry, 2006-2010
  Doctor of Dental Surgery

Loyola University, Chicago, IL, Continuing Education, 2006-2010
  Courses: prerequisite courses for dental school

Columbia College, Chicago, IL, Continuing Education, 1998-1999
  Courses: Photography and Graphic Design

San Diego City College, San Diego, CA, Continuing Education, 2002
  Courses: Graphic Design

DePaul University, Chicago, IL, Bachelor of Arts Degree, 1995-1998
  Majors: English and Sculpture

University of Akron, Akron, OH, Post Secondary, 1994-1995
  Courses: Post-secondary, completing high school and college courses

PROFESSIONAL ORGANIZATIONS

2006-present American Academy of Pediatric Dentistry
2006-present Illinois Society of Pediatric Dentists
2006-present American Dental Association
2006-present Illinois Academy of General Dentistry
2006-present American Association of Women Dentists
2006-present Chicago Dental Society
2006-2010 American Student Dental Association
2007-2010 Delta Sigma Delta Dental Fraternity
2008-2010 American Association of Public Health Dentistry
2009-2010 North American Scholar Consortium: Honor Society
WORK EXPERIENCE

March 2011-present  Glen Ellyn Pediatric Dentistry
2004- 2006  The Art of Dental Care: Dr. Emmanuel Paguio, DDS
2003- 2004  Jordan Tilden, DDS, PC
2001- 2003  Freelance Graphic Designer
1998- 2001  The Chicago Reader: Graphic Designer

AWARDS

2011  Literature Review Award
UIC College of Dentistry Clinic and Research Day, 2011

2010  Nobel BioCare Award for Implant Dentistry

SPECIAL EXPERIENCES

June 2009-present  Clinical Instructor, UIC Predoctoral Pediatric Dentistry Clinic
2009 -2010  Clinical rotation: Pilot Program “2x2” UIC College of Dentistry
2009 -2010  Volunteer Goldie’s Place
2007  Volunteered at elementary schools providing dental education
2005 - 2009  Volunteer Chicago Midwinter Meeting
2007 - 2009  Volunteer with “Give Kids A Smile Day” and “Healthy Smiles”
2009  Volunteer Chicago Boys and Girls Club

ADVANCED / CONTINUING EDUCATION

2008- 2009  AIMMC Hospital Dentistry Rotation: pilot program
June 2009  Honors Pediatric Dentistry Course
PRESENTATIONS

Winter 2011  
**Poster Presentation:** UIC College of Dentistry Clinic and Research Day  

**Topic:** The Readability of Pediatric Patient Education Materials.

Spring 2011  
**Poster Presentation:** AAPD Research Poster Competition  
AAPD 64th Annual Session, New York, NY  

**Topic:** The Readability of Pediatric Patient Education Materials.

Winter 2012  
**Poster Presentation:** UIC College of Dentistry Clinic and Research Day  

**Topic:** Ankylosis of Primary Teeth: A Case Report