



Education in pathology

An online readability analysis of pathology-related patient education articles: an opportunity for pathologists to educate patients[☆]



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Summary Information for patients regarding their clinical conditions and treatment options is widely available online. The American Medical Association and National Institutes of Health recommend that online patient-oriented materials be written at no higher than a seventh-grade reading level to ensure full comprehension by the average American. This study sought to determine whether online patient-oriented materials explaining common pathology procedures are written at appropriate reading levels. Ten pathology procedures that patients would likely research were queried into Google search, and plain text from the first 10 Web sites containing patient education materials for each procedure was analyzed using 10 validated readability scales. We determined mean reading levels of materials grouped by readability scale, procedure, and Web site domain, the overall average reading level of all resources, and popular Web site domains. One hundred Web sites were accessed; one was omitted for short length (<100 words). The average reading grade level of the 99 materials, none of which met national health literacy guidelines (range, 7.3–17.4), was 10.9. Twenty-nine articles (29%) required a high school education for full comprehension, and 4 (4%) required an undergraduate college education. Most frequently accessed Web site domains included medlineplus.gov, webmd.com (both accessed 7 times), and labtestsonline.org (accessed 6 times). Average reading levels of the 11 most commonly accessed Web sites ranged from 8.25 (patient.info) to 12.25 (mayoclinic.org). Readability levels of most online pathology-related patient education materials exceeded those recommended by national health literacy guidelines. These patient education materials should be revised to help patients fully understand them.

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1. Introduction

Most American adults today use the Internet as an important resource for health care information. Previous research has shown that close to 80% of Internet users access the Web to educate themselves about disease information and treatment options [1]. In addition, 70% of American adults who reported that they obtained health care information online also stated that it influenced how they sought treatment of illnesses [2]. However, patient education material on the Web can only benefit patients if they are able to fully comprehend the information presented. This is under the thematic umbrella of health literacy, which is defined by the American Medical Association (AMA) as a patient's ability to read and understand health care information, as well as to make effective health care decisions [3]. Numerous studies have established that poor health literacy is well correlated with adverse health outcomes [4-7].

An important marker of health literacy is reading level. Readability is a quantitative metric that is well correlated with reading level and can be used to assess the ease of reading and understanding a text [8]. The AMA and the National Institutes of Health (NIH) have provided national guidelines recommending that online patient-oriented educational material be written at no higher than a seventh-grade reading level to meet the health literacy competency of the average American and ensure patient comprehension [3,9]. However, prior studies assessing the readability levels of online patient education materials in various fields of medicine, including surgery [10], radiation oncology [11,12], radiology [13,14], and dermatology [15], have shown that such materials are written at too difficult a level.

Previous assessments of the readability of pathology patient education materials have been limited [16,17]. However, with the introduction of the Affordable Care Act, patients are now able to access with greater ease more of their personal medical reports than ever before. As the number of patients reading their reports and seeking information regarding unfamiliar terms increase, it is essential that pathology-related online education material be written at adequate reading levels.

The purpose of this study was to determine the readability level of Internet-based patient educational materials explaining common pathology procedures. This is the first study of publicly accessible online pathology patient education information using multiple readability measurement techniques.

2. Materials and methods

Ten common pathology-related terms and procedures for which patients would likely research were queried on www.google.com. The 10 phrases were *Fine Needle Aspiration (FNA)*, *Bone Marrow Biopsy*, *Temporal Artery Biopsy (TAB)*, *Fluorescent In Situ Hybridization (FISH)*, *Blood Typing*, *Complete Blood Count*, *Coombs Test*, *Core Needle*

Biopsy, *C-Reactive Protein*, and *Tumor Staging*. For each search criterion, the first 10 Web sites containing health education materials directed for patients were collected, for a total of 100 articles. Advertisements on the top of each Google search were ignored.

Each of the 100 articles was downloaded and transferred into plain text in Microsoft Word (Microsoft, Redmond, WA). Any text or items unrelated to patient education, such as copyright notices, author information, acknowledgements, hyperlinks, advertisements, images or figures, captions, multimedia, and references, were removed. The clean-text articles were then analyzed with Readability Studio platform (Oleander Software, Vandalia, OH) [18]. Ten validated readability assessment scales widely accepted in similar assessments of the readability of text in the medical literature were used to evaluate these articles. The readability scales included Fry Readability [19], Raygor Readability Estimate [20], New Fog Count [21], Coleman-Liau Index [22], New Dale-Chall [23], FORCAST formula [24], Gunning Fox Index [25], Simple Measure of Gobbledygook [26], Flesch-Kincaid Grade Level [21], and Flesch Reading Ease [27]. The Flesch Reading Ease scale, with scores ranging from 0 to 100, evaluated readability through syllable count per 100 words and average sentence length in words, with a higher score indicative of easier reading. Flesch Reading Scores ranging from 0 to 30 are interpreted as "very difficult" to read, 30 to 50 as "difficult," 50 to 60 as "fairly difficult," 60 to 70 as "standard," 70 to 80 as "fairly easy," 80 to 90 as "easy," and 90 to 100 as "very easy" [27].

Mean reading levels of the materials were determined and grouped by readability scale, by term, and by Web site domain from which they were extracted. Each scale evaluated the readability of selected articles by evaluating such factors as word complexity, number of syllables per word, and sentence length. The Fry Readability scale assessed the mean number of sentences and syllables per 100 words [19]. The Raygor Readability Estimate calculated a reading grade level based on average number of sentences and long words (words having >6 letters) per every 100 words [20]. The New Fog Count assessed readability by evaluating the number of complex words, or words having greater than 3 syllables; the number of easy words, or words having less than 3 syllables; and the number of sentences [21]. The New Fog Count addressed a potential overestimation of readability by not counting each clause as a full sentence. The Coleman-Liau Index assessed readability by looking at the average number of words per sentence and word complexities as determined by character count [22].

The New Dale-Chall scale compared text to a previously established database of 3000 common words understood by the average fourth-grade student and assessed readability based on sentence length and frequency of unfamiliar words [23]. The FORCAST formula examined a 150-word text sample from each article and assessed the number of single-syllable words to evaluate readability [24]. The Gunning Fox Index looked at the average sentence length and complex words, defined as words having more than 3 syllables, to assess readability [25]. The Simple Measure of Gobbledygook

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