Readability Assessment of Internet-Based Consumer Health Information

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BACKGROUND: A substantial amount of consumer health-related information is available on the Internet. Studies suggest that consumer comprehension may be compromised if content exceeds a 7th-grade reading level, which is the average American reading level identified by the United States Department of Health and Human Services (USDHHS). OBJECTIVE: To determine the readability of Internet-based consumer health information offered by organizations that represent the top 5 medical-related causes of death in America. We hypothesized that the average readability (reading grade level) of Internet-based consumer health information on heart disease, cancer, stroke, chronic obstructive pulmonary disease, and diabetes would exceed the USDHHS recommended reading level. METHODS: From the Web sites of the American Heart Association, American Cancer Society, American Lung Association, American Diabetes Association, and American Stroke Association we randomly gathered 100 consumer-health-information articles. We assessed each article with 3 readability-assessment tools: SMOG (Simple Measure of Gobbledygook), Gunning FOG (Frequency of Gobbledygook), and Flesch-Kincaid Grade Level. We also categorized the articles per the USDHHS readability categories: easy to read (below 6th-grade level), average difficulty (7th to 9th grade level), and difficult (above 9th-grade level). RESULTS: Most of the articles exceeded the 7th-grade reading level and were in the USDHHS "difficult" category. The mean ± SD readability score ranges were: SMOG 11.80 ± 2.44 to 14.40 ± 1.47, Flesch-Kincaid 9.85 ± 2.25 to 11.55 ± 0.76, and Gunning FOG 13.10 ± 3.42 to 16.05 ± 2.31. The articles from the American Lung Association had the lowest reading-level scores with each of the readability-assessment tools. CONCLUSIONS: Our findings support that Web-based medical information intended for consumer use is written above USDHHS recommended reading levels. Compliance with these recommendations may increase the likelihood of consumer comprehension. *Key words: consumer, information, health literacy, Internet, health information, education-level.* [Respir Care 2008;53(10):1310–1315.

Introduction

An abundance of health-related information is available on the Internet. In 2006, 98 million Americans accessed the Internet to find health-care information.[1] The general public often refers to the Internet for information to confirm or broaden their understanding of disease processes and conditions, and to research treatment opinions that influence health-care decisions. A qualitative study[2] by researchers at the University of Washington analyzed what people were searching for when they accessed the Internet for health-care information. The top 5 reasons individuals searched the Internet for health-care information were to find information about a condition, a treatment, or symptoms, or advice about symptoms or treatment. That study also found that 79% of the time the patient accessed the Internet, and 11% of the time a friend or a relative was

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doing the research.[2] Although many Internet resources can be beneficial, they are advantageous only if the consumer is capable of comprehending them.

The term "health literacy," as described by the Joint Commission (formerly the Joint Commission on Accreditation of Health Care Organizations), refers to "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."[3] Reading level is an important component of health literacy. The most recent large-scale national assessment of the average reading level among Americans was performed by the National Center for Education Statistics in 2003. It found that the typical American reads between a 7th and 8th grade level.[4] The United States Department of Health and Human Services (USDHHS) resolved that material is considered "easy to read" only if written below a 6th-grade level. Material between the 7th and 9th grade levels is viewed as "average difficulty," and material above the 9th-grade level is regarded as "difficult."[5]

Three of the most commonly used reading-level assessment tools are the SMOG (Simple Measure of Gobbledygook), the Gunning FOG (Frequency of Gobbledygook), and the Flesch-Kincaid Grade Level.

The SMOG formula, which is the tool of choice according to the American Cancer Institute, assesses an article by counting off 10 consecutive sentences near the beginning, middle, and end of the article. If the article contains less than 30 sentences, then the entire article is evaluated. Next, the number of polysyllabic words (ie, $\geq$ 3 syllables) is tallied. The results are then analyzed with a formula to establish the article's reading grade level.[6] Essentially, the more polysyllabic words, the higher the SMOG score.

The Flesch-Kincaid Grade Level formula considers the average number of words per sentence as well as the average number of syllables per word.[6] This formula is incorporated in some word-processing programs (eg, Word, Microsoft, Redmond, Washington). The Flesch-Kincaid formula has the limitation that the highest level it assesses is grade 12.0, so articles above the 12th-grade level are assessed as lower than they actually are.

The Gunning FOG formula calculates the reading level based on the average number of words per sentence and the percentage of polysyllabic words.[7] The Gunning FOG and Flesch-Kincaid have been the most commonly used tools since the 1940s.[8]

The purpose of the present study was to analyze the reading level of publicly accessible Internet-based health-information articles from the associations that represent the 5 leading causes of health-related death in America: heart disease, cancer, stroke, chronic obstructive pulmonary disease (COPD), and diabetes. We hypothesized that the articles' average reading level would exceed the 7th-grade level.

Table 1. Sources of Articles Analyzed for This Study.

Organization	Web Site
American Heart Association	http://www.americanheart.org
American Cancer Society	http://www.cancer.org
American Stroke Association	http://www.strokeassociation.org
American Lung Association	http://www.lungusa.org (COPD center)
American Diabetes Association	http://www.diabetes.org

COPD = chronic obstructive pulmonary disease

Methods

We randomly selected articles from the consumer-oriented Web pages of the associations that, at the time, represented the top 5 health-related causes of death, per an October 2006 report from the National Center for Health Statistics (Table 1).[9] To ensure the articles from the American Lung Association were specific to COPD, we selected the articles from the "COPD Center" page of that Web site. We gathered a convenience sample of 20 articles from each association's Web site, from lists of consumer-oriented articles. Specifically, at each Web site, without reading the article titles, one of the authors (TMW) randomly selected 20 articles from the site's list of publicly available articles by placing the pointer on random articles and downloading them. We then categorized the articles into 5 domains:

- General information: symptoms, causes, myths and misconceptions, effects
- Definition and description of the condition and its subtypes
- Diagnosis/screening: invasive and noninvasive tests to diagnose the disease
- Treatments and adverse effects
- Risk factors and prevention

The articles were not prescreened for a particular domain, but categorized for subanalysis after the random selection.

We then assessed the articles' reading levels with the SMOG, Flesch-Kincaid Grade Level, and Gunning FOG formulas. We printed the articles to facilitate the SMOG and Gunning FOG assessment. The SMOG method requires selecting 10 consecutive sentences near the beginning, middle, and end of each article. If the article contained less than 30 sentences, then the entire article was

Table 2. Readability Scores by Disease Category.

		Readability Score (mean ± SD)*		
Disease	*n*	SMOG	Flesch-Kincaid	Gunning FOG
Heart disease	20	12.50 ± 1.88	10.05 ± 2.24	13.10 ± 3.42
Cancer	20	12.65 ± 2.08	10.45 ± 1.43	13.50 ± 3.05
Stroke	20	13.95 ± 1.61	11.20 ± 1.11	15.75 ± 2.95
COPD	20	11.80 ± 2.44	9.85 ± 2.25	13.95 ± 4.30
Diabetes	20	14.40 ± 1.47	11.55 ± 0.76	16.05 ± 2.31

* All differences significant at $p < .001$
SMOG = Simple Measure of Gobbledygook
FOG = Frequency of Gobbledygook
COPD = chronic obstructive pulmonary disease

Table 3. Readability Scores by USDHHS Readability Category

	Recorded Grade Level			USDHHS Readability Category (*n*)		
	Highest	Lowest	Mean	Easy	Average	Difficult
SMOG	18	7	13	0	4	96
Flesch-Kincaid*	12	4	11	3	22	75
Gunning FOG	22†	5	14	1	4	95

* Grade 12.0 is the highest score in the Flesch-Kincaid system. 46 of the 100 articles were at or above grade 12.0.
† 22 corresponds to 6 years of post-baccalaureate education
USDHHS = United States Department of Health and Human Services
SMOG = Simple Measure of Gobbledygook
FOG = Frequency of Gobbledygook

evaluated via hand-count. We then used the following equation to obtain the SMOG score:[6]

$$\sqrt{\left(\frac{\text{Total Number of Polysyllabic Words}}{\text{Total Number of Sentences}}\right)\left(\text{Number of Sentences Short of 30}\right)} + \left(\text{Total Number of Polysyllabic Words}\right) + 3$$

We also hand-calculated the Gunning FOG score, with the equation:

[(number of words/number of sentences) + number of polysyllabic words] × 0.4

We then opened the articles in Microsoft Word to obtain the Flesch-Kincaid score. The formula used by Microsoft Word for analysis by the Flesch-Kincaid method was verified with the online help function in the word processing program. The Flesch-Kincaid formula is:

(0.39 × average sentence length) + (11.8 × average syllables per word) – 15.59

In Microsoft Word, the "Spelling and Grammar" function includes an option to show Flesch-Kincaid Grade Level score at the conclusion of the spell-check process. We also hand-calculated the Flesch-Kincaid score of 5 randomly selected articles, to verify agreement between hand-calculation and the calculation by Microsoft Word.

We categorized the reading-level data in accordance with the USDHHS standards and analyzed the data with statistics software (SPSS 9.0, SPSS, Chicago, Illinois). The mean ± SD scores were analyzed with Student's *t* test. Spearman's rho was used to assess correlations between the readability-assessment tools. The 5 content domains were also assessed for mean readability score.

Table 4. Readability Scores by Content Domain

Content Domain	*n*	Readability Score (mean ± SD)*		
		SMOG	Flesch-Kincaid	Gunning FOG
Definition	22	13.0 ± 2.2	10.8 ± 1.4	15.0 ± 3.5
Treatment	25	13.4 ± 2.2	11.3 ± 2.2	15.5 ± 3.6
Risk factors/prevention	21	12.8 ± 2.0	10.5 ± 1.5	13.9 ± 2.8
Diagnosis/screening	14	14.2 ± 1.4	11.1 ± 1.2	15.5 ± 2.5
General information	18	12.2 ± 2.5	10.1 ± 2.5	12.4 ± 3.7

* All differences significant at $p < .001$
SMOG = Simple Measure of Gobbledygook
FOG = Frequency of Gobbledygook

Results

Table 2 shows the mean readability scores. The articles from the American Lung Association had the lowest reading level as analyzed by all tools. A low score within the range of 6th to 9th grade is desirable and recommended by the USDHHS. Table 3 categorizes the articles into the USDHHS difficulty levels. Table 4 shows the subanalysis of the readability scores, performed after separating the articles into the 5 domains. The highest grade level of any article was 22 (ie, 6 years schooling beyond college graduation), which was found with Gunning FOG. The lowest score was 5th grade, also found with Gunning FOG.

The articles on diagnosis had the highest mean readability score and were all in the USDHHS "difficult" category. The general-information articles had the lowest mean readability score, but were nevertheless in the USDHHS "difficult" category. Although the mean scores differed, there was a strong correlation between the readability scores from each assessment tool ($r > 0.72$, $P < .001$).

Discussion

The Internet is a key resource for consumers seeking health information.[10] Individuals may search the Internet for health information before consulting professionals, so it is important for consumer health-related materials to be written at a comprehensible level. One of the main reasons that individuals search the Internet is to find information that they are uncomfortable discussing. The Internet anonymously provides information on sensitive health issues such as herpes, human papilloma virus, depression, bipolar disorder, anorexia, diverticulitis, genital warts, yeast infection, constipation, and urinary tract infection.[11] Consumers can research topics on the Internet without fear of criticism or ridicule. We targeted the Web sites of the associations that represent the 5 leading health-related causes of death because studies have demonstrated that the 5 leading causes of death have a continued profound impact on the health of our nation. Although the death rates from heart disease, cancer, and stroke have declined, they still remain among the leading causes of death in the United States. Morbidity and mortality from COPD and diabetes are on the rise.[12] Since the absolute number of deaths from these conditions continues to increase, it is imperative that patients completely comprehend information on the details of the specific condition and the risks and benefits of the treatment options. When health-related Internet articles are written at the USDHHS "difficult" level, many readers in the general public may misinterpret or fail to comprehend crucial information.

Comprehension of basic health information defines health literacy. Basic health information includes a wide range of material, from specific instructions on medication administration or therapies to general information about a specific disease or disease prevention. Consumers with lower reading skills are more likely to suffer from poor health due to lack of understanding of written instructions, such as instructions about dosage or about seeking emergency or additional care if symptoms worsen.

Studies have shown that those who suffer from low health literacy are not limited to minorities or underprivileged populations. Rather, individuals of all ages, races, incomes, and education levels are challenged by health illiteracy. A study by the Partnership for Clear Health Communication found that of all such characteristics (age, race, income, education level), age is the strongest predictor of literacy and therefore of health status. The study found an inverse relationship between age and reading skill level. Approximately 40% of the tested population ages 19–40 years read below a basic reading skill level, compared to those over the 65 years old, in whom 61% read below a basic reading skill level.[13] That study emphasizes that Americans tend to read at least 3 grades lower than their education level.

Additional findings from the Partnership for Clear Health Communication study suggest that 90 million Americans have low health literacy, and that the average person with

low health literacy spends $7,500 more per year in health expenses than does the average person with higher health literacy.[13] The American Medical Association stated that in the United States we spend enormous financial resources on medical complications. Data suggest that financial resources amounting to 4 times the allowable amount were allocated for care for avoidable or preventable medical complications,[14] which equates to $50–73 billion per year in unnecessary doctor visits and hospital in-patient days.[13] From these statistics alone it is apparent how relevant health literacy is in today's society. Spending unnecessary money on health-care can put an immense burden on a family's savings and also add to the national debt if the patient or family is incapable of paying the medical expenses.

Compounding this problem is the fact that many patients may be confused about discharge instructions on routine care or medication administration but embarrassed or intimidated to ask for the needed clarification, which compromises the ability to adhere to therapy. This problem may be exacerbated by a physician's misperception of a patient's health literacy. Physicians tend to overestimate their patients' health literacy. In one survey of 115 physicians, only 17.4% of patients were perceived to have low literacy,[15] but the National Assessment of Adult Literacy found that 47–51% of Americans have low literacy, and above age 80, 89% are health-illiterate.[15] Overestimation of a patient's literacy may influence a physician's choice of words or medical terms and cause him or her to exceed the patient's ability to comprehend the advice or instructions. This may ultimately increase unnecessary medical expenses, because of preventable errors and misconceptions. If information provided to patients through verbal communication, pamphlets, and Internet resources were provided at a comprehensible level (below 7th grade), several benefits to the public could be realized, beginning with improved outcomes. Easily understood information could enhance the patient's ability to optimize his or her plan of care, and improve disease management. An enhancement in self-esteem and confidence in the ability to self-manage the disease process also may be realized when the patient understands the information provided.

The intent of the present study was to determine whether the readability of articles provided to the public through the Internet are written at a level at which the average American can comprehend. Comparison of the mean readability scores of the Web-based medical information with USDHHS standards by multiple t-tests yielded statistically significant results, $p < .001$. All of the consumer intended medical information we accessed on the Internet was written above the recommended 6th grade level.

More than three quarters of the articles had a reading level at or above the "difficult" rating. Many of the articles had readability equivalent to the college freshman or sophomore level. Though the articles ranged from easy to far beyond difficult, the mean score of the 100 articles was 8 grade levels above the USDHHS readability recommendation. It was encouraging to find that the American Lung Association's articles had the lowest overall mean score. However, across all domains the readability scores of the pulmonary material were well above the USDHHS recommended level.

Limitations

An inherent weakness in our study design is that the sample of articles was a convenience sample, though we attempted to emulate simple random sampling. Although from the list, every article was given an equal chance of being selected, selection bias was still possible. To eliminate the probability of selection bias and for the sake of reproducibility, we could have selected articles with a random-number generator or table. We did not access bilingual Web sites nor address the impact of such sites on consumers for whom English is a second language. This may be a topic worth further investigation.

Limitations were also inherent in the readability-assessment tools. The Flesch-Kincaid formula has an upper score limit of grade 12.0, so we would expect the mean score to be lower than that from the SMOG and Gunning FOG, which have higher upper limits. Forty-six of the 100 articles had a Flesch-Kincaid score of 12.0, which could have yielded falsely low readability scores and/or mean score. However, the strong correlation between these 3 readability-assessment tools suggested that the probability of that phenomenon is low.

In our subanalysis of the 5 domains, the diagnosis/screening articles had the highest mean readability score, and general-information articles had scored. This may be inherent to the limited use of complex medical terms in literature that does not provide specific information about a disease process. It would be more common to use complex medical terms in material related to a specific diagnosis. Thus, it is important to consider that the general-information articles still exceeded the USDHHS readability recommendation.

Though there are health-literacy-assessment tools (eg, Rapid Estimate of Adult Literacy in Medicine, and the Test of Functional Health Literacy in Adults), these tools are not preferential or beneficial in determining readability scores for large populations. They are not designed to assess a volume of written material such as Internet articles. They are designed to be administered on an individual basis. A one-on-one evaluation by a health-care professional is required to determine the patient's medical reading capability. In addition, these tests assess only whether the patient can read medical words, not whether they understand the words, which is the most important part of health literacy.

Medical words are compilations of multiple roots, prefixes, and suffixes, and many are among the longest in the English language. However, it may be possible and worthwhile to explain procedures, symptoms, and other basic health information without complex medical terminology. It may be difficult for practitioners to communicate health-related information at a low literacy level. This endeavor requires planning, implementation, and evaluation. An outline is an exceptional tool for authors of consumer health information. Just like an artist first applies broad strokes and then fine details to a painting, the outline serves as the conceptual framework on which the health-related information is built. The Web site http://www.plainlanguage.gov provides an exceptional resource for writers. It has tools and tips for writing in "plain language" and links to additional resources and tools.

The use of illustrations, pictures, and/or simple drawings is an effective alternative to the use of complex words or terms. Illustrations or pictures may also be useful in explaining a technique or self-care procedure to a patient. Key messages can be communicated in a manner that is not demeaning to individuals with low-health literacy.[16] As providers develop consumer health materials, readability-assessment tools such as Gunning FOG, SMOG, or Flesch-Kincaid may assist them to edit the writing down to the appropriate reading level. This step provides a quality check to ensure that patient-education materials meet the USDHHS reading-level recommendation.

Conclusions

Although the Internet is a popular way to acquire health-related information, many consumers may not understand the materials they find because the reading level is too high. The literature indicates and the USDHHS recommends that consumer medical information be written at the 6th-grade reading level. Illustrations and drawings can help overcome low-literacy barriers and assist with the communication of self-care techniques and procedures.

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