

How Readable Is BPH Treatment Information on the Internet? Assessing Barriers to Literacy in Prostate Health

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Abstract

Information about benign prostatic hyperplasia (BPH) has become increasingly accessible on the Internet. Though the ability to find such material is encouraging, its readability and impact on informing patient decision making are not known. To evaluate the readability of Internet-based information about BPH in the context of website ownership and Health on the Net certification, three search engines were queried daily for 1 month with BPH-related keywords. Website ownership data and Health on the Net certification status were verified. Three readability analyses were performed: SMOG test, Dale–Chall readability formula, and Fry readability graph. An adjusted SMOG calculation was performed to reduce overestimation from medical jargon. After a total of 270 searches, 52 websites met inclusion criteria. Mean SMOG grade was 10.6 ($SD = 1.4$) and 10.2 after adjustment. Mean Dale–Chall score was 9.1 ($SD = 0.6$), or Grades 13 to 15. Mean Fry graph coordinates (173 syllables, 5.1 sentences) corresponded to Grade 15. Seven sites (13%) were at or below the average adult reading level based on SMOG; none of the sites qualified based on the other tests. Readability was significantly poorer for academic versus commercial sites and for Health on the Net-certified versus noncertified sites. In conclusion, online information about BPH treatment markedly exceeds the reading comprehension of most U.S. adults. Websites maintained by academic institutions and certified by the Health on the Net standard have more difficult readability. Efforts to improve literacy with respect to urological health should target content readability independent of reliability.

Keywords

benign prostatic hyperplasia, Internet, health literacy, readability, consumer health information

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Introduction

Benign prostatic hyperplasia (BPH) is a prevalent condition affecting the quality of life of millions of adult men (Wei, Calhoun, & Jacobsen, 2008). A clinical entity distinct from prostate cancer, BPH involves nonmalignant growth of the prostate that can nonetheless have significant impact on urinary function as well as adverse psychosocial and lifestyle consequences. Contemporary therapy for BPH ranges from conservative to invasive, including behavioral modification, several classes of medications indicated for prostatic enlargement, and transurethral surgical removal of obstructive prostatic tissue (Roehrborn, 2011). Choosing from among these interventions is preference sensitive, and shared decisions between patients and clinicians can be made based on validated measures of symptom severity (e.g., the International Prostate Symptom Score), medication tolerability, and surgical suitability (McVary et al., 2011).

To learn about their disease and weigh treatment strategies, many patients seek health information on the Internet. Online sources of health content are now widely accessible, with Internet use for such purposes growing steadily over the past decade. The 2013 Health Information National Trends Survey demonstrated that three out of four U.S. adults routinely use the Internet to seek health advice (National Cancer Institute, 2013). Furthermore, age-related gaps in Internet access appear to be closing. Recent evidence suggests that Internet use among older adults has steadily increased since 2002 to

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nearly half of adults 65 years of age and older in 2010 (Greysen, Chin Garcia, Sudore, Cenzer, & Covinsky, 2014). Finally, socioeconomic status does not necessarily preclude Internet use for health information seeking. Low-income individuals are accessing the Internet specifically for urological health information (Levy, Ajayi, Kwan, & Saigal, 2014), and reliance on the Internet may positively predict health decision making, such as prostate-screening behaviors (Song, Cramer, & McRoy, 2015).

Despite easier accessibility, comprehension is a concern for Internet users with average or lower literacy. The most recent National Assessment of Adult Literacy demonstrated that the average U.S. adult comprehends written information at an eighth-grade reading level, and as few as 12% possess the health literacy skills needed for some types of health care decision making (U.S. Department of Education & National Center for Education Statistics, 2006). Definitions of literacy have evolved from the basic skills of reading and writing to comprehensive constructs based on individuals' use and understanding of information specific to their culture and community (I. S. Kickbusch, 2001). Functional conceptions of literacy may include computer literacy and media literacy. Health literacy, as well as eHealth for digital and electronic forms of communication, involves a related though distinct set of ideas surrounding the use and understanding of information needed to engage in health care decisions and settings. Thus, being able to access and read information about health topics on the Internet may be a challenge for some adults that is importantly separate from interpreting and applying this information to decisions about disease awareness and symptom management (I. Kickbusch & Ratzan, 2001).

The capacity to read urological information on the Internet may be particularly difficult for patients. For instance, a study of patient education materials about urological cancers from consumer health websites showed that the average reading grade level was 11.7 (Pruthi et al., 2015). Socioeconomically disadvantaged patients may be disproportionately affected, as poor baseline understanding of commonly used vocabulary about prostate health can delay help seeking and limit shared decision making (Wang et al., 2013).

Given its prevalence and functional impact on quality of life, BPH may be one of the most queried urological conditions on the Internet, but the readability of online information about BPH is not well characterized. It is also unclear whether websites that are sponsored by for-profit or nonprofit entities, or those that contain reliable, high-quality health information, can be comprehended by average-literacy patients. Prior work on the sponsorship and "Health of the Net" certification of BPH websites demonstrated that the majority of the top 20 ranked

websites most frequently encountered in Internet queries were sponsored by commercial entities and not certified by the Health on the Net standard (Koo & Yap, 2016). The Health on the Net certification is administered by the Health on the Net Foundation, an international, nonprofit, nongovernmental organization founded in 1995 and accredited by the Economic and Social Council of the United Nations. Its purpose is to guide the ethical provision of reliable health information to the public. The Health on the Net standard represents eight principles of reliable health content (authority, complementarity, confidentiality, attribution, justifiability, transparency of authorship, transparency of sponsorship, and honesty in advertising and editorial policy). Although this certification is a common measure of quality and reliability, it may not represent appropriate readability.

This study seeks to determine the readability of information about BPH treatment on the Internet and to evaluate whether website sponsorship and Health on the Net certification are associated with readability.

Method

The study design was based on prior studies of urological health information on the Internet (Ellimoottil, Polcari, Kadlec, & Gupta, 2012; Koo & Yap, 2016; Oberlin, Masson, & Brannigan, 2015; Traver, Passman, LeRoy, Passmore, & Assimos, 2009). Three search engines accounting for 96% of U.S. Internet search traffic (Google, Bing, and Yahoo!; comScore, 2013) were queried with the keywords, "benign prostatic hyperplasia," "prostate enlargement," and "BPH." All searches were performed in a cookie-free, cache-cleared manner from the same Internet Protocol address to minimize algorithmic variations in search results due to geography. Searches were conducted daily for 30 consecutive days to account for day-to-day variation in the order of results. For each daily query, the first 100 nonsponsored, English-language websites were reviewed for textual discussion of BPH treatment. Sites that contained this discussion were included in the sample for analysis.

For each site, ownership data were identified. Ownership categories were chosen based on previous work (Redmond et al., 2015; Traver et al., 2009). Commercial ownership was defined as "dot-com" sites owned by commercial or for-profit entities, excluding clinical practices. Health on the Net certification for each site was cross-referenced with the Health on the Net Foundation website (www.hon.ch). The first 30 sentences of the text on each site discussing BPH treatment were recorded for readability analysis. If the text about treatment did not contain 30 sentences, then the remaining text discussing other aspects of BPH was included to reach the total.

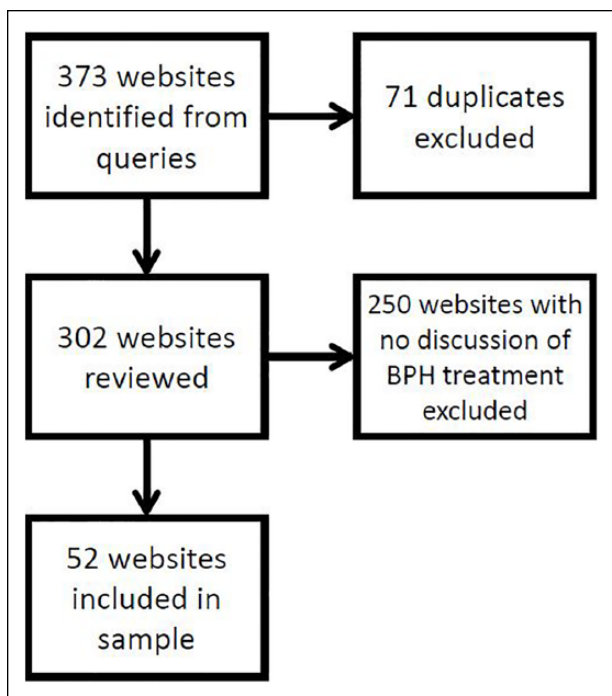


Figure 1. PRISMA diagram for sample selection.
 Note. PRISMA = Preferred Reporting Items for Systematic reviews and Meta-Analysis; BPH = benign prostatic hyperplasia.

Three readability analyses were performed: SMOG grade, Dale–Chall readability formula, and Fry readability graph. The SMOG grade is based on the number of sentences and the number of polysyllabic (three or more syllables) words in the text (McLaughlin, 1969). An adjusted calculation was also performed in which the search terms were counted only once to reduce potential overestimation of the SMOG grade. The Dale–Chall formula is based on the average sentence length (number of words divided by number of sentences) and the percentage of words in the text not found on the Dale–Chall list of 3,000 words familiar to fourth-grade readers (Chall & Dale, 1995). The Fry readability formula plots the average number of sentences and syllables per 100 words on a standardized Fry graph with corresponding reading levels (Fry, 1977). Descriptive statistics were performed. Readability comparisons between ownership types and between Health on the Net-certified versus noncertified sites were performed using the Mann–Whitney *U* test.

Results

From a total of 270 searches, 373 sites were identified and 302 unique sites reviewed after eliminating duplicates (Figure 1). The majority of these sites were not primarily about BPH or did not specifically address treatment

options. Following review, 52 sites were included in the sample for readability analysis.

The sites are summarized in Table 1. Commercial ownership was the most common type, accounting for 35% of the sample. Other ownership types included academic practices and teaching hospitals; nonacademic or private practices; nonprofit entities such as the Urology Care Foundation; and government organizations, including the U.S. National Institutes of Health and the National Library of Medicine. The majority of sites (73%) had not been certified by the Health on the Net standard. Among the sites that were certified, ownership categories were generally representative of the overall sample, with a larger proportion of commercially sponsored sites: seven were commercial, two were academic, two were nonprofit, and two were government sponsored.

Table 1 summarizes the SMOG and Dale–Chall readability tests. Mean SMOG readability for all sites was 10.6 (range: 6.9–14.0, *SD* = 1.4), corresponding to a 10th-grade reading level. Based on the SMOG test, only seven sites (13%) were written at or below the average U.S. adult's eighth-grade reading level, and none was at or below the sixth-grade level recommended for low-literacy readers (see the appendix). In the adjusted calculation, the polysyllabic search terms were counted once instead of every instance in the text; mean adjusted SMOG readability was 10.2 (range: 6.8–13.2, *SD* = 1.3). The number of sites at or below the eighth-grade level was unchanged.

Mean Dale–Chall readability for all sites was 9.1 (range: 7.7–10.6, *SD* = 0.6), corresponding to Grades 13 to 15 reading level. Based on the Dale–Chall test, no sites were at or below the eighth-grade level.

Websites were stratified by ownership and Health on the Net certification (Table 1). Mean SMOG readability was significantly more difficult for academic sites compared with commercial sites (11.0 vs. 10.2, *p* = .03). This difference persisted in the adjusted SMOG calculation (10.8 vs. 10.1, *p* = .03). Other ownership types were excluded due to small group sizes. Sites that had been certified by the Health on the Net standard had significantly higher SMOG readability compared with noncertified sites (10.8 vs. 10.0, *p* = .04), but this difference did not reach significance in the adjusted calculation (10.4 vs. 9.9, *p* = .08). Comparisons of Dale–Chall reading grade between these groups were nonsignificant.

Based on the Fry readability formula, the mean coordinates for all sites (173 syllables, 5.1 sentences) represented a Grade 15 reading level. Four sites had coordinates outside the plot (not shown), exceeding a Grade 17 reading level. Websites were then stratified by type (Figure 2) and Health on the Net certification (Figure 3). All sites fell on the side of the sentence–syllable curve corresponding

Table I. Readability Characteristics of Websites Presenting BPH Treatment Information.

	N = 52	%	SMOG mean/ reading grade	Adjusted SMOG mean/reading grade	Dale–Chall mean (reading grade)
Website ownership					
Commercial	18	34.7	10.2	10.1	9.0 (13-15)
Academic	15	28.8	11.0	10.8	9.3 (13-15)
Private practice	7	13.5	10.4	10.2	9.0 (13-15)
Nonprofit/NGO	6	11.5	10.6	10.0	9.3 (13-15)
Government	2	3.8	11.0	10.9	8.9 (11-12)
Other	4	7.7	10.9	10.7	9.3 (13-15)
Health on the Net certification					
Certified	14	26.9	10.8	10.4	9.2 (13-15)
Noncertified	38	73.1	10.0	9.9	9.0 (13-15)

Note. BPH = benign prostatic hyperplasia; NGO = nongovernmental organization. Mean SMOG score is equivalent to reading grade.

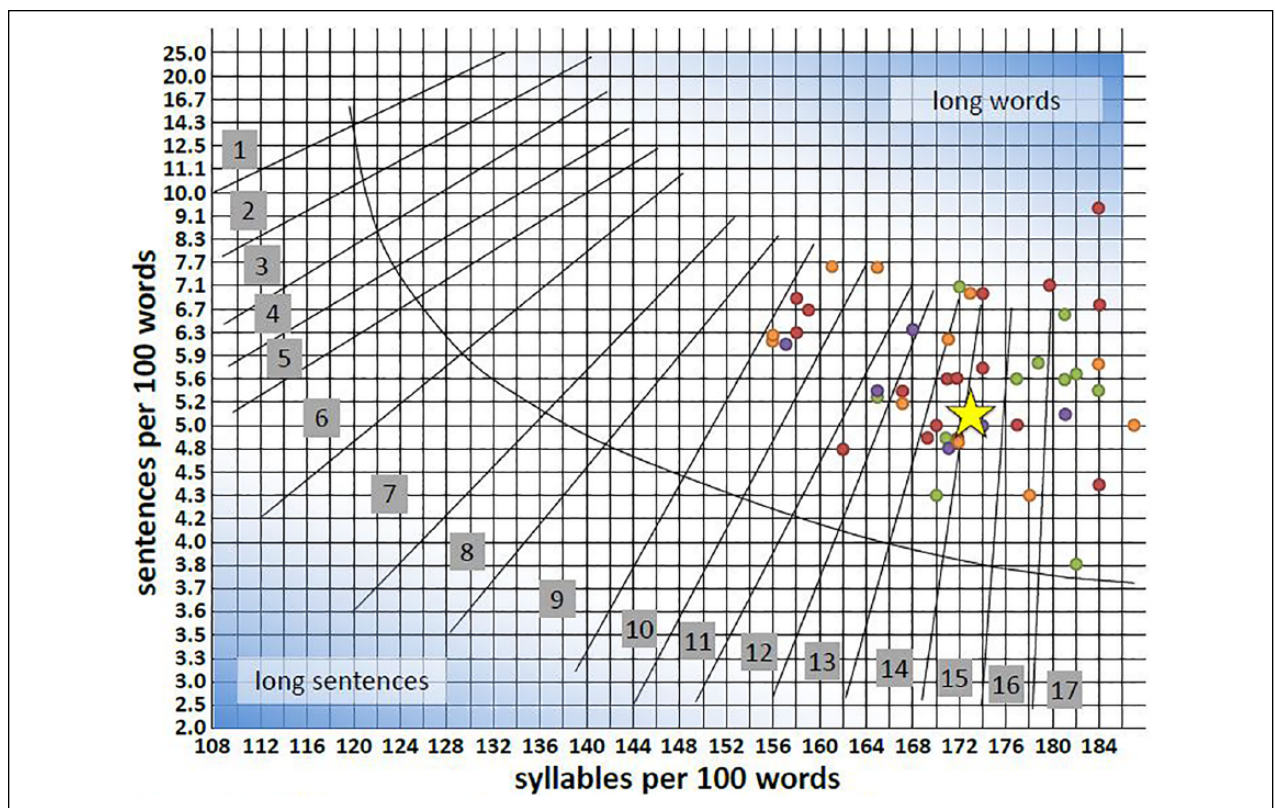


Figure 2. Fry readability graph of websites discussing BPH treatment by site ownership.

Note. BPH = benign prostatic hyperplasia. Star represents mean coordinates for all sites. Boxed numbers indicate corresponding reading grade level. Color code: Red, commercial; Green, academic; Purple, private practice; Orange, other.

to longer, more complex words. Based on the Fry graph, no sites were at or below the eighth-grade reading level.

Discussion

Increasing Internet accessibility has facilitated the dispersion of health information and the concept of eHealth at

the intersection of health information, electronic media, and medical decision making (Norman & Skinner, 2006). Ease of accessibility, however, is not the only consideration in efforts to improve literacy with respect to urological health. For a common condition like BPH, patients’ comprehension of material they find on the Internet may be critical to help seeking, informed

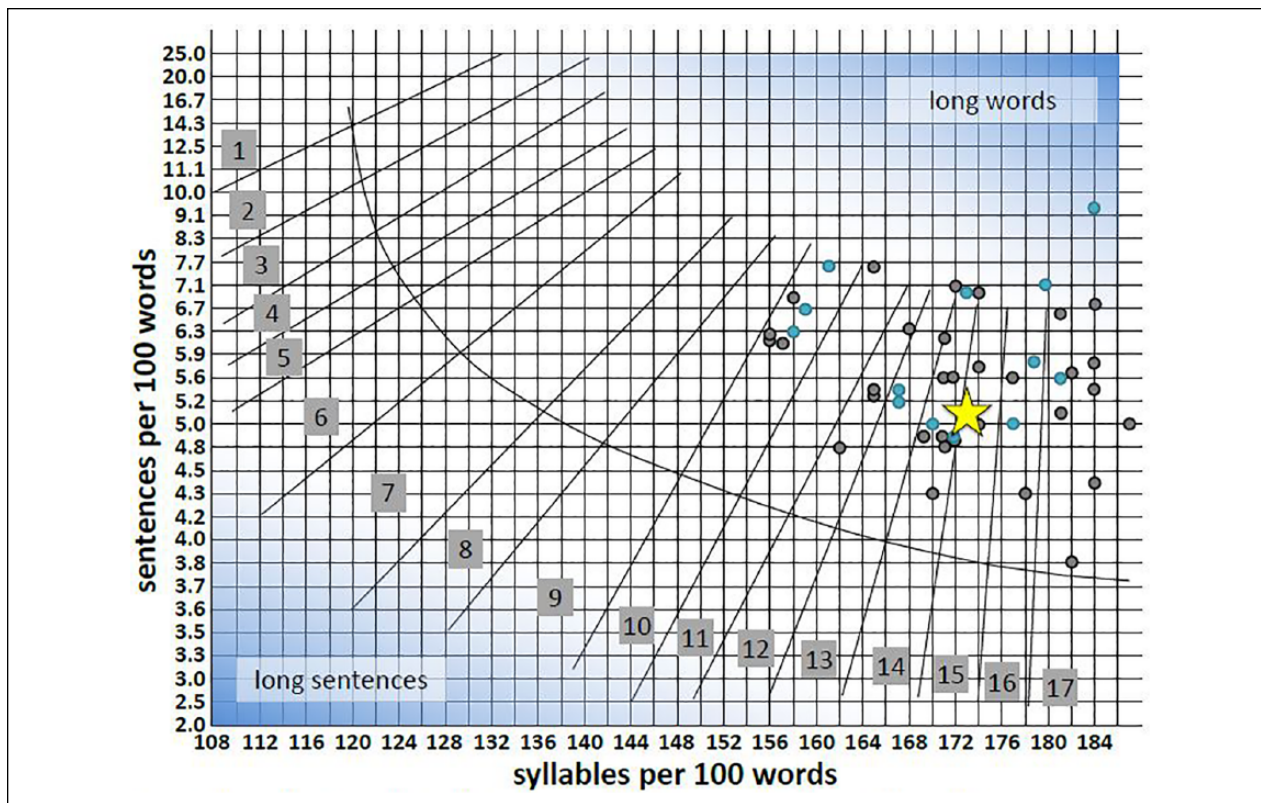


Figure 3. Fry readability graph of websites discussing BPH treatment by Health on the Net certification status. Note. BPH = benign prostatic hyperplasia. Star represents mean coordinates for all sites. Boxed numbers indicate corresponding reading grade level. Color code: Blue, certified; Black, not certified.

decision making, and adherence to therapy. To the authors’ best knowledge, this is the first study to analyze the readability of information about BPH treatment on the Internet and contextualize the findings based on indicators of sponsorship and reliability.

Previous studies of literacy in urology have relied primarily on the Flesch–Kincaid test to evaluate reading grade level (Bergman, Gore, Singer, Anger, & Litwin, 2010; Ellimoottil et al., 2012; Mossanen et al., 2014). This measure can be performed using tools included in widely available commercial word-processing software. However, the Flesch–Kincaid test’s reliability in evaluating health-education materials has been questioned, with the SMOG test being favored as a preferred literacy test (Fitzsimmons, Michael, Hulley, & Scott, 2010). Thus, the SMOG test was employed as a more reliable measure of readability in the analysis. There have also been concerns about the accuracy of single-instrument evaluation (Friedman & Hoffman-Goetz, 2006), so the present analysis was based on three diverse tests incorporating various measures of word complexity, word and sentence length, and low-literacy word comprehension.

The primary finding was that across all tests, the information was near-universally too difficult for the average U.S.

adult to understand. There was some variability in the calculated mean reading level among the three tests, ranging between the 10th and 17th grades (Table 1 and Figure 2), while results using the same test were more consistent. At the upper extremes of the reading-grade spectrum, these tests are less reliable in measuring the true grade level required to understand the text. Nonetheless, the overall finding demonstrates that the information most commonly encountered by patients is likely to exceed their reading comprehension, which in turn jeopardizes their ability to make decisions based on the data, such as when and how to seek care.

Medical jargon tends to include higher frequencies of complex words, which can artificially augment a calculated reading grade. Because the SMOG grade is based on every instance of a polysyllabic word, an adjusted calculation was performed to reduce overestimation. If the higher reading grade were a consequence of the frequent appearance of words like “prostatic” and “hyperplasia,” then by counting these words only once, the adjusted SMOG grade would be expected to be lower. Instead, while a modest decrease was observed from 10.6 versus 10.2 after adjustment (Table 1), it neither changed the overall reading grade nor the number of sites meeting the eighth-grade literacy threshold.

This suggests that a commonly used strategy of substituting jargon with simpler terms (e.g., “enlarged prostate” instead of “benign prostatic hyperplasia”) to improve readability may have modest impact. The findings support and extend prior work on urological pathology reports which had a high school reading level despite replacement of complex terminology with simpler alternatives (Mossanen et al., 2014). Thus, in addition to simplifying words and sentences, improving readability may require other strategies such as revising page design, shortening key ideas, and supplementing text with illustrations and videos for low-literacy readers.

A novel aspect of this study was the incorporation of website sponsorship data and Health on the Net certification status in the evaluation of readability. Notably, commercial sponsorship did not have a dramatic impact on mean reading grade levels (Table 1 and Figure 2). These data parallel findings from urological patient educational materials from academic institutions in the Northeastern United States (Colaco, Svider, Agarwal, Eloy, & Jackson, 2013) and general cancer information from nongovernmental sites (Pruthi et al., 2015). Interestingly, academic sites clustered at the 12th-grade level on the Fry graph and had poorer SMOG readability than commercial sites even after adjustment. One explanation could be that commercial sites have a business interest in engaging and retaining site visitors and thus may be more invested in ensuring ease of readability.

On the other hand, a study of prostate cancer sites showed that a variety of ownership types, including commercial, academic, and government sites, had similarly low Flesch–Kincaid reading grades (Ellimoottil et al., 2012), suggesting that ownership type may not be a reliable predictor of readability. In addition, an analysis of patient information about prostate biopsy identified no difference in Flesch–Kincaid readability based on site sponsorship (Redmond et al., 2015). Taken together, the findings support two recommendations for directing patients to online health information. First, while academic sites are often thought to be the most trustworthy and accurate, most patients will struggle with comprehension. Second, sites sponsored by commercial or non-profit entities should not be dismissed outright, as they may be more readable, but their content should be vetted as with other patient education materials.

Although most of the websites in the present study were not certified by the Health on the Net standard, there was only a small difference in SMOG readability between certified and noncertified sites, which became nonsignificant in the adjusted calculation (Table 1). Both groups had similar Dale–Chall readability and clustered in the same region of the Fry graph (Figure 3). The Health on the Net standard does not specifically address reader comprehension, and other tools that have been developed

to assess the quality of online health information, such as the DISCERN Instrument (Charnock, Shepperd, Needham, & Gann, 1999; DISCERN Project, 2015), also lack readability metrics. Although Health on the Net certification is commonly thought of as a marker of trustworthy content, the findings of this study suggest that readability should be considered independent of reliability to best address comprehension and content quality.

Despite robust studies linking low health literacy with disease-specific and all-cause morbidity and mortality for numerous conditions (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Peterson et al., 2011; Schillinger et al., 2002), most websites about BPH and other urological diseases remain too challenging for many patients. Although the literature on evidence-based interventions to improve eHealth literacy is limited (Car, Lang, Colledge, Ung, & Majeed, 2011), several strategies may help overcome these barriers. First, urological providers can set an example by ensuring that the information for patients on their websites is not only accurate and reliable but also readable. The U.S. Institute of Medicine’s 2009 recommendations on eHealth (Institute of Medicine Roundtable on Health Literacy, 2009) and the guidelines developed for U.S. government websites to comply with the Plain Writing Act of 2010 (www.plainlanguage.gov) are useful starting points.

Second, providers should periodically refamiliarize themselves with the landscape of urological information online to see what patients may be reading and what advice is being offered in online sources. L. G. Doak, Doak, and Meade (1996) have suggested that for low-literacy cancer patients, improving readability alone may not enhance comprehension unless the messages are relevant to patients. Thus, even for benign conditions like BPH, clinicians can check that online material is meaningful to its audience and should verify patients’ comprehension using feedback and recall techniques (C. C. Doak, Doak, Friedell, & Meade, 1998).

Third, providers can incorporate appropriate Internet sources into routine counseling so that patients have guidance about where to look for more information. These strategies are not language specific and may have particular relevance for prostate health information on the Internet because discrepancies in information quality appear to persist in non-English-language websites, as well; one recent study of English, French, German, and Spanish websites about BPH demonstrated lower rates of Health on the Net accreditation among non-English sources (Chen et al., 2014).

Several limitations of this study should be noted. The study did not assess the accuracy of the content, only readability. Metrics of online information quality do not routinely account for readability, and vice versa; more unified tools that assess both parameters are needed.

Also, the query terms reflect BPH as a diagnostic entity instead of its symptoms. Patients who search based on symptoms, however, are likely to encounter similar websites, so as a representation of online information about BPH, the findings in this study should be generalizable. This also applies to potential variation in search results from patients' Internet Protocol geography; although the queries in this study were conducted from a single address, the results are likely to parallel what most searchers would find online. Finally, patients may look for health information on the Internet in ways other than search engines, such as patient portals or online forums. The majority of contemporary users seeking health information, however, do start with a simple search (Fox & Duggan, 2013), akin to the sampling technique used in this study.

Conclusions

The majority of online information about BPH treatment is written at a reading level that markedly exceeds the reading ability of most U.S. adults. No websites met criteria for comprehension by low-literacy readers. Academic websites had significantly more difficult readability compared with commercially sponsored websites, even after adjustment for medical jargon. The majority of websites were not certified by the Health of the Net standard for high-quality health information, but certification did not improve overall readability. As BPH is one of the most prevalent and treatable urological conditions, clinicians, as well as providers of Internet-based content, should account for readability in addition to reliability of online health information to facilitate greater patient comprehension and informed decision making.

Appendix

Websites at or Below the Eighth-Grade SMOG Reading Level.

Website	Ownership type	SMOG grade
Emedtv.com	Commercial	6.9
FamilyDoctor.org	Nonprofit/NGO	7.8
UnderstandBPH.com	Commercial	8.3
UrologyHealth.org	Nonprofit/NGO	8.4
Healthline.com	Commercial	8.4
WebMD.com	Commercial	8.8
JohnMuirHealth.com	Private practice	8.9

Note. BPH = benign prostatic hyperplasia; NGO = nongovernmental organization.

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