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1   Title: Readability Assessment of Online Peripheral Artery Disease Education Materials

2   **R2WC: 317/2133**

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13   Concept and design: All authors; Acquisition of data: TA, SH, ML; Statistical analysis: KT

14   Interpretation of data: All authors; Drafting of manuscript: TA, SH, ML; Critical revision of the

15   article for important intellectual content: All authors; Supervision: JU

16   Presentations: This study was accepted as a poster presentation at the 2022 Vascular Annual

17   Meeting to be presented on June 17. 2022.

18

19   **ABSTRACT**

20   **Objective:**

21   Online resources can be a valuable source of information for patients and have been shown to

22   result in more inquiry during medical office visits, following physician medical recommendation

23   more closely, and making self-directed lifestyle changes. The accessibility to these resources is

1   limited by the readability level of the article and the literacy level of the population. Peripheral

2   artery disease (PAD) is estimated to affect between 8 and 12 million people in the United States

3   with greater disease severity among under insured or un-insured populations. As PAD continues

4   to increase in prevalence, it is imperative that patients have access to comprehensible patient-

5   centered health information. This study aims to evaluate the readability of online PAD patient

6   education materials.

7   **Methods:**

8   The search engine Google was utilized to collect the first 25 patient-accessible online articles

9   pertaining to the search term "peripheral artery disease." Articles were then categorized by

10 source type: hospital, professional society, or other. Readability was measured using the

11 following tests: Automated Readability Index (ARI), Coleman-Liau Index, (CLI) Flesch-Kincaid

12 Grade Level (FKGL), Gunning Fog, Linsear Write Formula, and the SMOG Index. Statistical

13 analyses were performed using Statistical Analysis Software (SAS), with p-values <0.05 being

14 statistically significant.

15 **Results:**

16 Twenty-five articles were categorized by source and statistically analyzed. The average

17 readability of PAD patient education materials was 10.8 and significantly above the AMA, NIH,

18 and USDHHS recommended reading level of 6th grade. Readability scores among source

19 categories were not significantly different.

20 **Conclusions:**

21 Commonly available online PAD resources are written at a grade level above that currently

22 recommended by medical societies. Hospitals, professional societies, and other stakeholders in

23 PAD patient education should take into consideration the readability of their materials to make

1 medicine more accessible. Readable articles may combat historic, and structural racism often

2 found in our health care system that marginalizes those with lower health literacy. It is

3 imperative to develop patient education at an appropriate level to enrich patient autonomy.

4

5 Keywords: readability, patient education material, health literacy, peripheral artery disease, PAD

6

10

12

13 **INTRODUCTION**

14 The internet serves an important resource for health-related patient information. According to the

15 2019 Health Information National Trends Survey (HINTS), 72.7% of respondents first looked

16 for medical or health topics on the internet[1]. Furthermore, 93% of American adults use the

17 internet, and it is estimated that this number will continue to rise[2]. Online resources can be a

18 valuable source of information for patients and have been shown to result in more inquiry during

19 medical office visits, following physician recommendations more closely, and making self-

20 directed lifestyle changes[3]. Although online patient education is an important source of

21 information, the accessibility to these resources is limited by the readability of the article and the

22 literacy level of the population.

23

1   Readability is defined as the ease with which a reader can understand a piece of text. In the

2   United States, the average adult reads at a seventh to eighth-grade level. Moreover; 43 million

3   U.S. adults possess low literacy skills and 8.4 million are functionally illiterate, meaning lacking

4   the reading or writing skills necessary for daily living and most jobs[4]. The American Medical

5   Association recommends that the readability for online materials should be at or below the sixth-

6   grade level, and ideally at the third- to fifth-grade level for practices with a high proportion of

7   patients with lower literacy[5].

8

9   Peripheral artery disease (PAD), a progressive circulatory disorder characterized by systemic

10   atherosclerotic changes leading to impaired perfusion, is estimated to affect 200 million

11   worldwide and between 8 million to 12 million individuals in the United States[6,7]. Though the

12   spectrum of PAD may be broadly categorized into patients who experience chronic limb

13   threatening ischemia (CLTI) or intermittent claudication, the clinical outcomes of CLTI are

14   disproportionally borne by Black and Hispanic communities. The progressive nature of PAD in

15   conjunction with uncontrolled medical conditions (hypertension, hyperlipidemia, diabetes

16   mellitus, etc.), and poor access to preventative medical care may precipitate CLTI and limb

17   amputations leading to diminished physical function and quality of life. A recent study showed

18   that among hospitalized patients with CLTI, Black and Hispanic patients had an elevated risk of

19   major amputation[8]. PAD prevalence increases with age and risk factors such as smoking and

20   diabetes, although U.S. rates are two to three times higher for older Black individuals when

21   compared to non-Hispanic White individuals[9]. Despite the widespread prevalence of PAD, it

22   continues to be underdiagnosed due to a lack of awareness by both patients and healthcare

23   institutions, indicating a need for improved access to quality patient education materials[10,11].

1

2   Studies assessing the readability of online medical education materials for thyroid surgery,

3   lymphedema, and neurosurgery found that the average resource reading level is greater than the

4   recommended sixth-grade level by the American Medical Association (AMA), National Institute

5   of Health, and US Department of Health and Human Services[12–14]. In this study, we utilize

6   readability tests to assess various online peripheral artery disease resources and their associated

7   patient education materials.

8

9   **METHODS**

10   This study was determined to be Institutional Review Board (IRB) exempt determined by the

11   UCLA IRB prior to the commencement of any research.

12

13   **Data Collection**

14   Online patient education materials were accessed by performing an Internet search using the key

15   phrase "peripheral artery disease" on the search engine Google (Google LLC, Mountain View,

16   California) on September 8, 2021. Google was utilized as the only search engine because it

17   comprises 88.3% of the market share for searches[15]. The first 25 search results with patient

18   information related to peripheral artery disease, peripheral arterial disease, and PAD were

19   included and all articles consisted of at least 100 words. Additionally, we performed an Internet

20   search using "peripheral arterial disease" and "PAD." The search was performed in private

21   browsing mode with account, tracking, and location settings disabled. Articles were excluded if

22   the information was published in a non-English language, sponsored search advertisement,

23   subscription-based, clinician-focused, or originated outside of the U.S. There were a total of 26

1   articles excluded, including duplicate websites (n=4), origin outside the U.S. (n=3), invalid text

2   (n=8), and clinician focused (n=11, of these subscription-based was n=5).

3

4   The article text was copied and pasted into individual Microsoft Word documents as plain text

5   format to avoid HTML tags. Text unrelated to the topic was removed, including web page

6   navigation, copyright notice, disclaimers, date stamps, author information, hyperlinks, and

7   source information. All tables, images, and website uniform resource locators were removed.

8   Embedded punctuation, including decimals, colons, semicolons, parenthesis, and dashes within

9   sentences were removed. Furthermore, bullet points and associated text, when not in sentence

10   form, were removed.

11

12   **Readability Analysis**

13   All 25 articles were individually analyzed for their readability. Readability analysis was

14   performed using six readability indices, including the Automated Readability Index (ARI),

15   Coleman-Liau Index (CLI), Flesch-Kincaid Grade Level (FKGL), Gunning Fog Index (GFI),

16   Linear Write Formula (LWF), and the Simple Measure of Gobbledygook (SMOG) Index using

17   an online readability calculator[1617]. These metrics employ formulas assessing sentence length,

18   word complexity, and syllable counts to evaluate for readability. All readability indices utilize

19   numerical U.S. grade school level as the result, corresponding to the grade level one must have

20   completed to understand a specific text. Increasing numerical value of grade level indicates that

21   the text is more difficult to read. Utilizing the averages of ARI, CLI, FKGL, GFI, LFW, and

22   SMOG scores determined the average grade level of the websites. Furthermore, article sources

23   were categorized into hospital, professional society, and other[13]. "Hospitals" were defined as

1   institutions that provide medical and surgical care to patients, primarily as inpatients.

2   "Professional societies" were defined as organizations focused on the advancement of a

3   particular profession or interest. "Other" included information from websites that did not fit in

4   the previous two categories, including clinical practices, health information websites, etc.

5

6   **Statistical Analysis**

7   The mean values, standardized deviation (SD), and 95% confidence interval (CI) of all six

8   indices were calculated with p-values <0.05 being statistically significant. A one-way T-test was

9   utilized to compare the average readability value to the sixth grade reading level[12,13]. Kruskal-

10   Wallis, a non-parametric test, was applied to determine variations in readability within our three

11   categories. Statistical analyses were performed using Statistical Analysis Software (SAS) version

12   9.4 (SAS Institute Inc., Cary, NC, USA).

13

14   **RESULTS**

15   The top 25 patient education sites from a Google search for "peripheral artery disease" that met

16   the inclusion criteria are located in **Table 1**, with associated readability scores and source

17   category. Utilizing the terms "peripheral arterial disease" and "PAD," 9 of the top 10 results

18   were the same, with minimal variation in the remaining articles. The average U.S. grade school

19   level for all education material analyzed was 10.8, with a range from 9.6 to 13, and all six mean

20   readability indices were higher than the AMA recommended reading level of sixth-grade as

21   shown in **Table 2** (p < 0.0001). The median readability scores for each test were ARI (9.9), CLI

22   (11.0), FK (10.0), GFI (13.3), LWF (10.9), and SMOG (9.7). WebMD was found to have the

23   lowest readability scores across all indices at ARI (5.9), CLI (7), FK (6), GFI (8.9), LWF (7.4),

1 and SMOG (6.4). The highest readability score in each index was ARI (pennmedicine.org, 15.3),

2 CLI (medicine net.com and pennmedicine.org, 14), FK (medicinenet.com, 13.9), GFI

3 (medicinenet.com, 17.7), LWF (pennmedicine.org, 16.4), and SMOG (pennmedicine.org, 12.9).

4 The websites pennmedicine.org and medicinenet.com were found to have the highest readability

5 scores in multiple categories. Additionally, there were no statistically significant differences in

6 readability levels observed between the following categories: hospital, professional society, and

7 other **(Table 2)**.

8

9 **DISCUSSION**

10 Since 1990, global PAD prevalence and deaths due to PAD have increased annually, and PAD

11 prevalence doubles each decade of life across ethnic groups[9,18]. As the U.S. population continues

12 to age and diversify, it is critical that PAD patient education materials are written at a grade level

13 accessible to all patients. Increased internet utilization coupled with readily accessible

14 information has the potential to improve PAD understanding contingent upon the material being

15 readable. Our study revealed that online patient education materials for peripheral artery disease

16 were not tailored to the appropriate reading levels to allow patients with low literacy to actively

17 engage in shared decision making, which has been previously found to improve patient

18 satisfaction and clinical outcomes[19].

19

20 Health literacy, as defined by the National Library of Medicine, is "the degree to which

21 individuals have the capacity to obtain, process, and understand basic health information and

22 services needed to make appropriate health decisions."[20] This form of literacy not only involves

23 reading skills measured by grade level comparisons, but also incorporates speech, cultural

factors, and conceptual knowledge regarding health. Health literacy has been found to mediate

the relationship between socioeconomic status (SES) and health disparities[21]. Low SES has been

consistently linked to health disparities resulting in poor health outcomes[22–24]. Prior research

examining the association between SES and PAD found that low SES was a strong predictor of

PAD hospitalizations due decreased access to healthcare and increased traditional cardiovascular

disease (CVD) risk factors. The risk of PAD hospitalizations was double in groups with low

household income and low educational attainment[25]. Additionally, areas with higher area

deprivation indexes (ADI) describing neighborhood socioeconomic deprivation had a two-fold

increase in the likelihood of PAD hospitalization[26]. To effectively combat health disparities seen

with PAD, health literacy should be improved in conjunction with expanded access to healthcare

and increased opportunities to ascend the SES ladder in marginalized communities. Increasing

accessibility of online patient education materials for PAD by making the reading level at or

below the 6th grade level may minimize the negative associations between SES and PAD

outcomes by augmenting this component of health literacy.

Structural racism has been well defined as a determinant of health[27,28]. The effects of structural

racism encompass disparate access to formal education and health education resulting in

decreased health literacy levels in vulnerable populations. In 2020, the American Heart

Association released a presidential advisory acknowledging structural racism as a fundamental

cause of health disparities in CVD and declared its support of antiracist policies to improve the

health of historically marginalized communities[29]. A study from the National Assessment of

Adult Literacy (NAAL) found that although Hispanic adults represented twelve percent of the

NAAL population, they accounted for thirty-nine percent of adults with Below Basic prose

1   literacy[30]. Black adults represented twelve percent and White adults represented seventy percent

2   of NAAL population, however twenty percent of Black adults had Below Basic prose literacy

3   compared to thirty-seven percent of White adults[31]. Two-thirds of adults with low level of

4   English literacy are born in the United States[32]. Furthermore, there is a call to improve health

5   literacy in U.S. immigrant adolescents[33]. Due to inequitable education access, Black, Hispanic,

6   and immigrant populations have lower health literacy levels, indicating that these populations

7   may also have a disparate understanding of education materials that are above the 6th grade

8   reading level, as found in this study.

9

10   Current online PAD education materials do not meet national recommendations that promote the

11   development of readable resources suitable for individuals with limited literacy. This study

12   further highlights the discrepancy between the reading level of the U.S. population and

13   readability of health information available online. Inaccessible online materials may act as

14   another social determinant of health for adverse events related to the management of PAD in

15   Black, Brown, and immigrant communities, further contributing to the health disparities

16   prevalent in these communities. Our findings are a call to develop online patient education

17   materials that are accessible to the U.S. population and to revise current guidelines that are above

18   a 6th grade reading level.

19

20   There are several limitations present in this study. Readability indices utilize elements such as

21   sentence length and syllable count but do not take vocabulary, content, or culture into

22   consideration to determine comprehension. Furthermore, when preparing the articles for

23   analysis, substantial text that may have influenced readability was removed if it was not in

1 sentence form to prevent miscalculations. We only evaluated the first 25 search results with

2 patient education materials pertaining to PAD. Previous research has demonstrated that 3% of

3 the population goes beyond 10 search results when conducting a web-based search[34]. We chose

4 the top 25 articles to ensure the greatest number of potential websites were included, though the

5 articles identified beyond the top 10 were likely of lower yield. Lastly, we did not assess

6 associated multimedia content such as videos and infographics that can further contribute to

7 patient comprehension.

8

9 **CONCLUSION**

10 This study demonstrated that available online patient education material for peripheral artery

11 disease were written well-above the recommended sixth-grade reading level. Future studies

12 should examine comprehensibility of all PAD materials including non-textual elements such as

13 graphs, videos, and images. Steps should be taken to screen for the readability level of current

14 and future patient resources to ensure and maintain accessibility for patients of varied literacy.

15 To prevent further widening of health disparities related to literacy, interprofessional

16 collaboration among healthcare professionals, researchers, and community stakeholders should

17 prioritize the development of patient education materials at appropriate reading levels before

18 disseminating to the public.

19

20 **References**

21 1.   The most recent time you looked for information about health or medical topics, where

22   did you go first? | HINTS. Accessed November 15, 2021. https://hints.cancer.gov/view-

23   questions-topics/question-details.aspx?PK_Cycle=10&qid=688

2. Demographics of Internet and Home Broadband Usage in the United States | Pew Research Center. Accessed November 15, 2021. https://www.pewresearch.org/internet/fact-sheet/internet-broadband/

3. Iverson SA, Howard KB, Penney BK. Impact of internet use on health-related behaviors and the patient-physician relationship: a survey-based study and review. *J Am Osteopath Assoc*. 2008;108(12):699-711.

4. Mamedova S, Pawlowski E. *Adult Literacy in the United States*.; 2019.

5. Weiss BD. *Health Literacy and Patient Safety: Help Patients Understand: Manual for Clinicians*.; 2007.

6. Shu J, Santulli G. Update on peripheral artery disease: Epidemiology and evidence-based facts. *Atherosclerosis*. 2018;275:379-381. doi:10.1016/j.atherosclerosis.2018.05.033

7. Levy PJ. Epidemiology and pathophysiology of peripheral arterial disease. *Clinical Cornerstone*. 2002;4(5):1-13. doi:10.1016/S1098-3597(02)90012-8

8. Chen L, Zhang D, Shi L, Kalbaugh CA. Disparities in Peripheral Artery Disease Hospitalizations Identified Among Understudied Race-Ethnicity Groups. *Frontiers in Cardiovascular Medicine*. 2021;8. doi:10.3389/fcvm.2021.692236

9. Allison MA, Ho E, Denenberg JO, et al. Ethnic-Specific Prevalence of Peripheral Arterial Disease in the United States. *American Journal of Preventive Medicine*. 2007;32(4):328-333. doi:10.1016/j.amepre.2006.12.010

10. Hirsch AT. Peripheral Arterial Disease Detection, Awareness, and Treatment in Primary Care. *JAMA*. 2001;286(11):1317. doi:10.1001/jama.286.11.1317

11. Criqui MH, Matsushita K, Aboyans V, et al. Lower Extremity Peripheral Artery Disease: Contemporary Epidemiology, Management Gaps, and Future Directions: A Scientific

Statement From the American Heart Association. *Circulation*. 2021;144(9).

doi:10.1161/CIR.0000000000001005

12. Seth AK, Vargas CR, Chuang DJ, Lee BT. Readability Assessment of Patient Information

about Lymphedema and Its Treatment. *Plastic and Reconstructive Surgery*.

2016;137(2):287e-295e. doi:10.1097/01.prs.0000475747.95096.ab

13. Patel CR, Cherla D v., Sanghvi S, Baredes S, Eloy JA. Readability assessment of online

thyroid surgery patient education materials. *Head & Neck*. Published online 2012:n/a-n/a.

doi:10.1002/hed.23157

14. Schmitt PJ, Prestigiacomo CJ. Readability of Neurosurgery-Related Patient Education

Materials Provided by the American Association of Neurological Surgeons and the

National Library of Medicine and National Institutes of Health. *World Neurosurgery*.

2013;80(5):e33-e39. doi:10.1016/j.wneu.2011.09.007

15. Search Engine Market Share United States Of America | Statcounter Global Stats.

Accessed April 29, 2022. https://gs.statcounter.com/search-engine-market-

share/all/united-states-of-america/2021

16. AUTOMATIC READABILITY CHECKER, a Free Readability Formula Consensus

Calculator. Accessed September 7, 2021. https://readabilityformulas.com/free-readability-

formula-tests.php

17. Grose EM, Holmes CP, Aravinthan KA, Wu V, Lee JM. Readability and quality

assessment of internet-based patient education materials related to nasal septoplasty.

Journal of Otolaryngology - Head and Neck Surgery. 2021;50(1). doi:10.1186/s40463-

021-00507-z

18. Roth GA, Mensah GA, Johnson CO, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019. *J Am Coll Cardiol*. 2020;76(25):2982-3021. doi:10.1016/j.jacc.2020.11.010

19. Ashraf AA, Colakoglu S, Nguyen JT, et al. Patient involvement in the decision-making process improves satisfaction and quality of life in postmastectomy breast reconstruction. *Journal of Surgical Research*. 2013;184(1):665-670. doi:10.1016/j.jss.2013.04.057

20. Nielsen-Bohlman L, Panzer AM, Kindig DA, eds. *Health Literacy: A Prescription to End Confusion*. National Academies Press; 2004. doi:10.17226/10883

21. Stormacq C, van den Broucke S, Wosinski J. Does health literacy mediate the relationship between socioeconomic status and health disparities? Integrative review. *Health Promotion International*. 2019;34(5):e1-e17. doi:10.1093/heapro/day062

22. Matetic A, Bharadwaj A, Mohamed MO, et al. Socioeconomic Status and Differences in the Management and Outcomes of 6.6 Million US Patients With Acute Myocardial Infarction. *The American Journal of Cardiology*. 2020;129:10-18. doi:10.1016/j.amjcard.2020.05.025

23. Carden A, Blum K, Arbaugh CJ, Trickey A, Eisenberg D. Low socioeconomic status is associated with lower weight-loss outcomes 10-years after Roux-en-Y gastric bypass. *Surgical Endoscopy*. 2019;33(2):454-459. doi:10.1007/s00464-018-6318-6

24. al Adas Z, Nypaver TJ, Shepard AD, et al. Survival after abdominal aortic aneurysm repair is affected by socioeconomic status. *Journal of Vascular Surgery*. 2019;69(5):1437-1443. doi:10.1016/j.jvs.2018.07.084

25. Vart P, Coresh J, Kwak L, Ballew SH, Heiss G, Matsushita K. Socioeconomic Status and Incidence of Hospitalization With Lower- Extremity Peripheral Artery Disease:

Atherosclerosis Risk in Communities Study. *J Am Heart Assoc*. 2017;6(8).

doi:10.1161/JAHA.116.004995

26. Maroko AR, Doan TM, Arno PS, Hubel M, Yi S, Viola D. Integrating Social

Determinants of Health With Treatment and Prevention: A New Tool to Assess Local

Area Deprivation. *Preventing Chronic Disease*. 2016;13:160221.

doi:10.5888/pcd13.160221

27. Paradies Y, Ben J, Denson N, et al. Racism as a Determinant of Health: A Systematic

Review and Meta-Analysis. *PLoS One*. 2015;10(9):e0138511.

doi:10.1371/journal.pone.0138511

28. Beech BM, Ford C, Thorpe RJ, Bruce MA, Norris KC. Poverty, Racism, and the Public

Health Crisis in America. *Front Public Health*. 2021;9:699049.

doi:10.3389/fpubh.2021.699049

29. Churchwell K, Elkind MSV, Benjamin RM, et al. Call to Action: Structural Racism as a

Fundamental Driver of Health Disparities: A Presidential Advisory From the American

Heart Association. *Circulation*. 2020;142(24). doi:10.1161/CIR.0000000000000936

30. Kutner M, Greenberg E, Baer J. *A First Look at the Literacy of America's Adults in the

21st Century*.; 2006. http://books.nap.edu/

31. National Assessment of Adult Literacy (NAAL) - Demographics - Overall. Accessed

January 3, 2022. https://nces.ed.gov/naal/kf_demographics.asp

32. Organisation for Economic Co-operation and Development. *OECD Skills Outlook 2013 :

First Results from the Survey of Adult Skills.*

1   33.   Santos MG, Gorukanti AL, Jurkunas LM, Handley MA. The Health Literacy of U.S.

2   Immigrant Adolescents: A Neglected Research Priority in a Changing World. *Int J*

3   *Environ Res Public Health*. 2018;15(10). doi:10.3390/ijerph15102108

4   34.   Google Click-Through Rates (CTR) By Ranking Position [2020] | Ignite Visibility.

5   Accessed June 12, 2022. https://ignitevisibility.com/google-ctr-by-ranking-position/

6

Website	Organization	Category	GFOG	FKGL	CL	SMOG	AR	LWF
abbott.com	Abbott	Other	10.2	7.5	8	7.7	6.5	7.8
cardiosmart.org	American College of Cardiology	Professional Society	10.1	7.5	9	7.4	7.4	8.3
cdc.gov	Center for Disease Control	Professional Society	13.7	11.3	9	10.1	11.3	14
clevelandclinic.org	Cleveland Clinic	Hospital	12.5	9.6	11	9.1	9.7	10.9
cvmus.com	Center for Vascular Medicine	Other	13.9	11	11	10.3	11.1	12.3
dukehealth.org	Duke Health	Hospital	14.4	10.5	12	10.4	11.2	12.1
health.harvard.edu	Harvard Health Publishing	Hospital	12.1	10.1	10	9	10.5	12.1
health.ucdavis.edu	UC Davis Health Vascular Center	Hospital	13.3	9.9	11	9.7	9.5	10.5
healthline.com	Healthline	Other	10.4	8.1	10	8.1	8.3	8.8
heart.org	American Heart Society	Professional Society	12.4	9.5	11	9.1	9.6	9.4
hopkinsmedicine.org	Johns Hopkins Medicine	Hospital	11.8	8.8	11	8.7	9.1	9.1
inova.org	INOVA Heart and Vascular Institute	Hospital	14.3	11.4	13	10.9	12	12.2
mayoclinic.org	Mayo Clinic	Hospital	13.8	10.7	12	10	10.7	11.6
medicalnewstoday.com	Medical News Today	Other	14.2	12.5	12	11.4	12.3	13.3
medicinenet.com	Medicine Net	Other	17.7	13.9	14	12.8	13.9	15
medlineplus.gov	National Library of Medicine	Other	10.7	8.4	10	7.8	8.5	8.7
nhlbi.nih.gov	National Heart, Lung, and Blood Institute	Professional Society	12.1	9.2	10	8.9	9.4	10.8
pennmedicine.org	Penn Medicine	Hospital	17.3	13.8	14	12.9	15.3	16.4
radiologyinfo.org	RadiologyInfo.org	Other	15.3	12.4	13	11.2	11.9	12.1
stanfordhealthcare.org	Stanford Health Care	Hospital	14.4	11.2	12	10.5	11.8	12.9
surgery.ucsf.edu	UCSF Department of Surgery	Hospital	10.5	8	10	7.8	8.1	8.1
vascular.org	Society for Vascular Surgery	Professional Society	13.4	10	11	9.7	9.6	10.9
vascularcures.org	Vascular Cures	Other	12.7	9.9	12	9.5	9.9	9.4
verywellhealth.com	Verywell Health	Other	14.8	11.5	11	10.8	11.5	13.5
webmd.com	WebMD	Other	8.9	6	7	6.4	5.9	7.4

Table 1. Website Sources, Categories, and Readability Score by Indices.
Abbreviations: GFOG, Gunning Fog; FKGL, Flesch-Kincaid Grade Level ; CL, Coleman-Liau Index; SMOG, Simple Measure of Gobbledygook; AR, Automated Readability Index; LWF, Linsear Write Formula.

Table 2: Readability scores compared to suggested 6th grade reading level, Comparison of mean readability scores between various sources.

Readability Measurement	Readability Score [a]	Comparision to 6th-Grade Reading Level (p-value)[b]	Hospital (n=10)[a]	Other (n=10) [a]	Professional Society (n=5) [a]	p-value[b]
ARI	10.2 (2.2)	<0.0001	10.8 (2.0)	10.0 (2.6)	9.5 (1.4)	0.51
CLI	11.0 (1.7)	<0.0001	11.6 (1.3)	10.8 (2.1)	10.0 (1.0)	0.22
FK	10.1 (2.0)	<0.0001	10.4 (1.6)	10.1 (2.6)	9.5 (1.4)	0.72
GFI	13.0 (2.2)	<0.0001	13.4 (1.9)	12.9 (2.8)	12.3 (1.4)	0.66
LWF	11.1 (2.4)	<0.0001	11.6 (2.3)	10.8 (2.7)	10.7 (2.1)	0.72
SMOG	9.6 (1.6)	<0.0001	9.9 (1.4)	9.6 (2.0)	9.0 (1.0)	0.64

[a] **Mean (SD)**
[b] Ps <.05 were considered statistically significant; ARI=Automated Readability Index; CLI=Coleman-Liau Index; FK=Flesch-Kincaid Grade Level; GFI=Gunning Fog Index, LWF=Linsear Write Formula; SMOG=Simple Measure of Gobbledygook