

Readability of Sports Medicine–Related Patient Education Materials From the American Academy of Orthopaedic Surgeons and the American Orthopaedic Society for Sports Medicine

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Abstract

Although studies have revealed high readability levels of orthopedic patient education materials, no study has evaluated sports medicine–related patient education materials.

We conducted a study to assess the readability of sports medicine–related patient education materials from the American Academy of Orthopaedic Surgeons (AAOS) and the American Orthopaedic Society for Sports Medicine (AOSSM). All sports medicine patient education articles available online in 2012 from the AAOS and the AOSSM, including the Stop Sports Injuries Campaign (STOP), were identified, and their readability was assessed with the Flesch-Kinkaid (FK) readability test.

Mean overall FK grade level of the 170 articles reviewed (104 from AAOS, 36 from AOSSM, 30 from STOP) was 10.2. Mean FK levels for the 3 sources were 9.5 (AAOS), 11.0 (AOSSM), and 11.5 (STOP) ($P = .16$). Fifteen (8.8%) of the 170 articles had a readability level at or below eighth grade (average reading level of US adults); only 2 (1.2%) of the 170 articles were at or below the recommended sixth-grade level. The majority of sports medicine–related patient education materials from AAOS and AOSSM had reading levels higher than recommended, indicating that the majority of the patient population may find it difficult to comprehend these articles.

As patients increasingly turn to the Internet for information about their orthopedic conditions and treatments,¹⁻⁵ and as orthopedic surgeons increasingly use online resources to communicate with patients,⁶⁻⁸ the importance of ensuring the quality of patient education materials is greater than ever. Previous reports have found orthopedic patient education materials on the Internet to be excessively long⁹ and to have information that is often misleading or inaccurate.⁹⁻¹¹ Furthermore, numerous studies have demonstrated that online orthopedic surgery patient education materials often have poor readability, defined as the reading comprehension level a person must have to understand written materials as determined by systematic formulae.^{2,12,13} Many health care organizations have called for patient education materials to be written at or below the sixth-grade level.^{1,2} However, the vast majority of orthopedic patient education materials are written at a level higher than sixth to eighth grade^{1,2,12,14-16}—a worrisome trend given that the average US adult reads at an eighth-grade level.²

Patient education materials for foot and ankle surgery,¹⁵ arthroplasty,¹⁴ pediatric orthopedics,² spine surgery,¹⁶ hand surgery,¹⁷ and orthopedics as a whole⁵ have been assessed for readability, but no similar study has been performed for sports medicine. We conducted a study to assess the readability of sports medicine–related patient education materials available online from the American Academy of Orthopaedic Surgeons (AAOS) and the American Orthopaedic Society for Sports Medicine (AOSSM). Our hypothesis was that the average readability of AAOS and AOSSM sports medicine–related patient education materials would be above the sixth-grade level.

Materials and Methods

As this study did not involve human subjects, institutional review board approval was not required.

Data Collection

We reviewed all the sports medicine–related articles available in December 2012 from the online patient education library.

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ies of AAOS (www.orthoinfo.org/menus/sports.cfm), AOSSM (www.sportsmed.org/Patient/Sports_Tips/AOSSM_Sports_Tips_Sheets), and the AOSSM-sponsored Stop Sports Injuries Campaign (STOP) (www.stopssportsinjuries.org). Articles were excluded if they were presented primarily as pictures, lists, or tables and/or if they were written in a language other than English.⁶

All articles meeting the inclusion criteria were copied² as individual Microsoft Word files (Microsoft, Redmond, Washington) and saved in plain text format to remove hidden formatting (eg, HTML tags) that might affect readability. Follow-up editing was then performed. Editing consisted of deleting information unrelated to the article topic (eg, copyright notice, author information) and deleting all numbers, decimals, para-

Table I. Mean Readability Levels of Sports Medicine–Related Patient Education Articles

Flesch-Kincaid Grade Level	Overall	AAOS	AOSSM	STOP	P
Mean	10.2	9.5	11.0	11.5	.16
Range	5.2-12	5.2-12	6.4-12	9.5-12	

Abbreviations: AAOS, American Academy of Orthopaedic Surgeons; AOSSM, American Orthopaedic Society for Sports Medicine; STOP, Stop Sports Injuries Campaign.

Table II. Sports Medicine–Related Patient Education Articles Written at Acceptable Readability Levels

Article	Flesch-Kincaid Score
“Flexibility for young athletes”	5.2
“Warm up and cool down”	6
“Tennis court safety”	6.4
“Ankle sprain” ^a	6.4
“Exercise in children”	7.1
“Steroids”	7.1
“Golf injury prevention”	7.2
“Meniscal tear”	7.4
“Helmets”	7.5
“Seniors starting exercise”	7.5
“Horseback riding injury prevention”	7.7
“Muscle cramp”	7.8
“Hip strain”	8
“Safe running”	8
“Swimming injury prevention”	8

^aFrom American Orthopaedic Society for Sports Medicine; all other articles from American Academy of Orthopaedic Surgeons.

graph breaks, bullets, colons, semicolons, abbreviations, and dashes within sentences.^{2,18,19}

One of us used Microsoft Word 2011 to assess the Flesch-Kincaid (FK) grade level for each article. The FK formula must be manually enabled in Word by going to Tools > Options > Spelling and Grammar and then choosing “Show readability statistics.”² The Spelling and Grammar tool automatically calculates the readability score after checking a document’s spelling and grammar. The FK grade level is calculated using the formula^{2,17} (0.39 × average number of words per sentence) + (11.8 × average number of syllables per word) – 15.59. The FK readability formula has been well established and substantiated as a reliable measure of readability in several studies in the orthopedic literature.^{1,2,5,14-17}

Statistical Analysis

Means and ranges were calculated for the FK grade levels. Mean FK grade levels were compared between the different patient education material sources using an analysis of variance with statistical significance set at P < .05. Intraclass correlation coefficient (ICC) calculations were used to assess the intraobserver and interobserver reliabilities of the FK grading. To assess intraobserver reliability, we had the same author who assessed the FK scores reassess the readability levels of 15 randomly selected articles 1 week after the initial assessment.² To assess interobserver reliability, we had a different, blinded author (who did not originally assess the FK scores) independently assess the readability levels of 30 randomly selected articles.⁵ ICC scores of 0 to 0.24 corresponded to poor correlation; 0.25 to 0.49, low correlation; 0.50 to 0.69, fair correlation; 0.70 to 0.89, good correlation; and 0.90 to 1.0, excellent correlation.² Statistical analyses were performed using MedCalc for Windows 12.4.0.0 (MedCalc Software, Mariakerke, Belgium), and statistical significance was set at P < .05.

Results

Of the 170 articles that met the inclusion criteria and that were reviewed by the 2 independent observers, 104 were from AAOS, 36 were from AOSSM, and 30 were from STOP. Mean overall FK grade level was 10.2 (range, 5.2 to 12). Mean FK levels were 9.5 (range, 5.2 to 12) for AAOS articles, 11.0 (range, 6.4 to 12) for AOSSM articles, and 11.5 (range, 9.5 to 12) for STOP articles; the difference was not statistically significant (P = .16) (Table I). Only 15 (8.8%) of the 170 articles had a readability level at or below eighth grade. Only 2 (1.2%) of the 170 articles were at or below sixth-grade level (Figure); all but 1 of these were AAOS articles (Table II).

Intraobserver reliability and interobserver reliability of FK grade assessment were both excellent, with ICC values of 0.97 and 0.96, respectively.

Discussion

With the Internet providing readily accessible information, many health care organizations have begun offering online educational articles pertinent to their practice and their patient population’s disease processes. As the primary goal of patient

education materials is to deliver clear and understandable information to patients and health care providers, health literacy has emerged as an important topic in orthopedic surgery and medicine as a whole. Health literacy is our ability to synthesize language and numerical skills to function in the health care environment and comprehend information about our own health care.²⁰ Functional literacy is reading ability at fifth-grade level or below, and marginal literacy is reading ability between sixth- and eighth-grade levels.²¹ According to a nationwide survey, about 20% of all US adults read at a level below fifth grade.²² Further complicating the issue is that patients' reading levels do not always fully correlate with their highest completed grades and are often below that of their stated years of education.^{23,24} Beyond compromising a patient's comprehension of his or her disease, poor health literacy (vs adequate health literacy) has been shown to result in increased mortality, decreased treatment adherence, and worse overall health status.^{2,25,26}

Previous reports have found that online patient education materials in nonorthopedic specialties are written at a level far too high for the average US adult to comprehend.²⁷⁻³⁰ Given the average reading ability of US adults, the National Institutes of Health has recommended that patient education materials be written between sixth- and seventh-grade reading levels.^{2,3,19} Although several studies within the orthopedic literature have demonstrated the existence of unacceptably high readability levels for patient education materials,^{2,3,5,14,15,21,31} no similar study has been performed for sports medicine. The present study showed that the vast majority of sports medicine-related patient education materials available online from AAOS, AOSSM, and STOP are written above the reading level of the average American. These trends are consistent with those noted in the studies assessing orthopedic patient education materials and in studies in other medical specialties.²⁷⁻³² Such a consistent trend suggests that the majority of health education material geared toward patients, offered online by health care providers, may not be fully comprehended by the general patient population.

One possible explanation for the consistently high readability levels of orthopedic surgery online patient education materials is that medical terminology is inherently complex. Some words used in the orthopedic literature have multiple syllables and can elevate the FK reading level unnecessarily. Replacing complex words with simpler ones may help improve readability, but this is not a comprehensive solution. For example, it is not possible to replace certain words or phrases, such as *anterior cruciate ligament*, with simpler terms. Other possible solutions aimed at improving readability include incorporating more tables and pictures in the text to help convey the same message more clearly.¹⁴ The saying "A picture is worth a thousand words" may be appropriate here, as a figure or table can often replace an entire paragraph yet communicate the same message. It should be noted that this strategy may improve the overall comprehensibility of patient education materials but would not alter the FK readability score. Another recommendation is to keep sentences short and concise and have each convey a single, distinct message.²⁴ Focusing on short, pithy

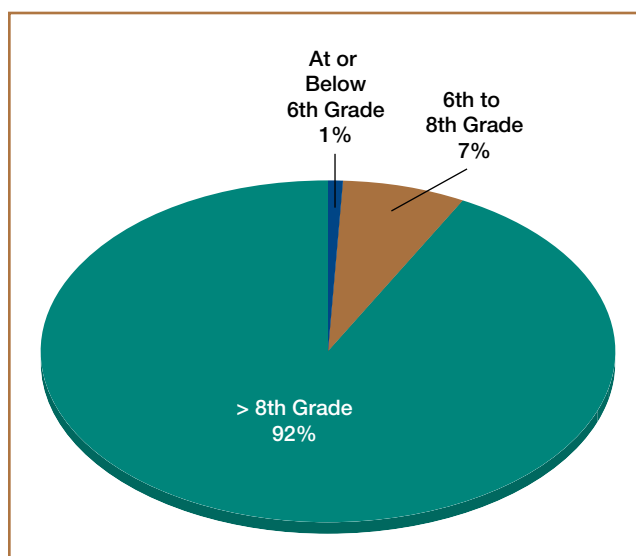


Figure. Distribution of readability levels of sports medicine-related patient education materials.

sentences means that fewer words and syllables will naturally be used, allowing for a more readable text.

Despite the present finding that most sports medicine patient education articles have a readability level higher than recommended, some articles were in fact written at an adequate readability level. Although not common, articles written at or below the eighth-grade reading level represent an encouraging example of patient education materials written at an appropriate level for patients. Striving to improve the readability of patient education materials will serve patients well, as these articles can help fortify patients' knowledge of their own pathologies²⁴ and perhaps even their clinical outcomes.^{2,20,25,26}

This study had several limitations. First, the FK readability formula does not take into account that some words of few syllables, such as *physis* and *colon* (which lower readability scores), can have complex underlying meanings (which impair text comprehensibility), thereby falsely lowering a reading level and underestimating text complexity.³³ Second, the formula also does not take into account pictures and tables, which can help simplify textual content and improve comprehensibility.³⁴ Third, this study did not assess all online sports medicine-related patient education materials but instead assessed those provided by the foremost authorities on sports medicine; other easily accessible online materials may have readability levels different from what we have reported here. Fourth, this study did not assess the actual reading level of the target population of sports medicine patients. This may be irrelevant, though, as these online patient education materials are offered in the public domain without a specific target population.⁵

Conclusion

Given the rising trend in patients accessing health care education online, it is crucial that information be provided in a comprehensive yet easily read format. The present study showed

that sports medicine–related patient education materials available online may be too difficult for the average patient to comprehend. Nevertheless, some articles are written at appropriate levels and can serve as a model for future patient education materials. Overall, this study illustrates the potential difficulties patients may have in comprehending information in patient education materials related to sports medicine. Future efforts should be aimed at improving the readability of sports medicine–related patient education materials. By recognizing the issue and working to improve the readability of sports medicine–related patient education materials, we will help our patients get “back in the game” both physically and mentally.

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References

1. Badarudeen S, Sabharwal S. Assessing readability of patient education materials: current role in orthopaedics. *Clin Orthop.* 2010;468(10):2572-2580.
2. Badarudeen S, Sabharwal S. Readability of patient education materials from the American Academy of Orthopaedic Surgeons and Pediatric Orthopaedic Society of North America web sites. *J Bone Joint Surg Am.* 2008;90(1):199-204.
3. Beall MS 3rd, Golladay GJ, Greenfield MLVH, Hensinger RN, Biermann JS. Use of the Internet by pediatric orthopaedic outpatients. *J Pediatr Orthop.* 2002;22(2):261-264.
4. Krempec J, Hall J, Biermann JS. Internet use by patients in orthopaedic surgery. *Iowa Orthop J.* 2003;23:80-82.
5. Sabharwal S, Badarudeen S, Unes Kunju S. Readability of online patient education materials from the AAOS web site. *Clin Orthop.* 2008;466(5):1245-1250.
6. Hoffmann T, Russell T. Pre-admission orthopaedic occupational therapy home visits conducted using the Internet. *J Telemed Telecare.* 2008;14(2):83-87.
7. Lifchez SD, McKee DM, Raven RB 3rd, Shafritz AB, Tueting JL. Guidelines for ethical and professional use of social media in a hand surgery practice. *J Hand Surg Am.* 2012;37(12):2636-2641.
8. Saleh J, Robinson BS, Kugler NW, Illingworth KD, Patel P, Saleh KJ. Effect of social media in health care and orthopedic surgery. *Orthopedics.* 2012;35(4):294-297.
9. Aslam N, Bowyer D, Wainwright A, Theologis T, Benson M. Evaluation of Internet use by paediatric orthopaedic outpatients and the quality of information available. *J Pediatr Orthop B.* 2005;14(2):129-133.
10. Beredjikian PK, Bozentka DJ, Steinberg DR, Bernstein J. Evaluating the source and content of orthopaedic information on the Internet. The case of carpal tunnel syndrome. *J Bone Joint Surg Am.* 2000;82(11):1540-1543.
11. Greene DL, Appel AJ, Reinert SE, Palumbo MA. Lumbar disc herniation: evaluation of information on the Internet. *Spine.* 2005;30(7):826-829.
12. Mathur S, Shanti N, Brkaric M, et al. Surfing for scoliosis: the quality of information available on the Internet. *Spine.* 2005;30(23):2695-2700.
13. Albright J, De Guzman C, Acebo P, Paiva D, Faulkner M, Swanson J. Readability of patient education materials: implications for clinical practice. *Appl Nurs Res.* 1996;9(3):139-143.
14. Polishchuk DL, Hashem J, Sabharwal S. Readability of online patient education materials on adult reconstruction web sites. *J Arthroplasty.* 2012;27(5):716-719.
15. Bluman EM, Foley RP, Chiodo CP. Readability of the patient education section of the AOFAS website. *Foot Ankle Int.* 2009;30(4):287-291.
16. Vives M, Young L, Sabharwal S. Readability of spine-related patient education materials from subspecialty organization and spine practitioner websites. *Spine.* 2009;34(25):2826-2831.
17. Wang SW, Capo JT, Orillaza N. Readability and comprehensibility of patient education material in hand-related web sites. *J Hand Surg Am.* 2009;34(7):1308-1315.
18. Fleisch RF. *How to Write Plain English: A Book for Lawyers and Consumers.* New York, NY: Harper & Row; 1979.
19. Friedman DB, Hoffman-Goetz L. A systematic review of readability and comprehension instruments used for print and web-based cancer information. *Health Educ Behav.* 2006;33(3):352-373.
20. Al Sayah F, Majumdar SR, Williams B, Robertson S, Johnson JA. Health literacy and health outcomes in diabetes: a systematic review. *J Gen Intern Med.* 2013;28(3):444-552.
21. McCray AT. Promoting health literacy. *J Am Med Inform Assoc.* 2005;12(2):152-163.
22. National Center for Education Statistics. *A First Look at the Literacy of America's Adults in the 21st Century.* Washington, DC: US Dept of Education; 2006:28.
23. French KS, Larrabee JH. Relationships among educational material readability, client literacy, perceived beneficence, and perceived quality. *J Nurs Care Qual.* 1999;13(6):68-82.
24. Jackson RH, Davis TC, Bairnsfather LE, George RB, Crouch MA, Gault H. Patient reading ability: an overlooked problem in health care. *South Med J.* 1991;84(10):1172-1175.
25. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med.* 2011;155(2):97-107.
26. Peterson PN, Shetterly SM, Clarke CL, et al. Health literacy and outcomes among patients with heart failure. *JAMA.* 2011;305(16):1695-1701.
27. D'Alessandro DM, Kingsley P, Johnson-West J. The readability of pediatric patient education materials on the World Wide Web. *Arch Pediatr Adolesc Med.* 2001;155(7):807-812.
28. Eloy JA, Li S, Kasabwala K, et al. Readability assessment of patient education materials on major otolaryngology association websites. *Otolaryngol Head Neck Surg.* 2012;147(5):848-854.
29. Misra P, Agarwal N, Kasabwala K, Hansberry DR, Setzen M, Eloy JA. Readability analysis of healthcare-oriented education resources from the American Academy of Facial Plastic and Reconstructive Surgery. *Laryngoscope.* 2013;123(1):90-96.
30. Wilson M. Readability and patient education materials used for low-income populations. *Clin Nurse Spec.* 2009;23(1):33-40.
31. Meade CD, Diekmann J, Thornhill DG. Readability of American Cancer Society patient education literature. *Oncol Nurs Forum.* 1992;19(1):51-55.
32. Berland GK, Elliott MN, Morales LS, et al. Health information on the Internet: accessibility, quality, and readability in English and Spanish. *JAMA.* 2001;285(20):2612-2621.
33. Graber MA, Roller CM, Kaeble B. Readability levels of patient education material on the World Wide Web. *J Fam Pract.* 1999;48(1):58-61.
34. Cotugna N, Vickery CE, Carpenter-Haeefele KM. Evaluation of literacy level of patient education pages in health-related journals. *J Community Health.* 2005;30(3):213-219.

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