

The readability and credibility analysis of online education materials for kidney transplantation

Saeideh Valizadeh-Haghi¹, Shahabedin Rahmatizadeh^{2*}, Sasan Adibi³, Amirreza Kalantari¹

¹Department of Medical Library and Information Sciences, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

²Department of Health Information Technology and Management, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³Honorary Research Fellow, Deakin University, Australia

Article Info

Article type:

Research

Article History:

Received: 2023-05-15

Accepted: 2023-07-13

Published: 2023-07-22

* Corresponding author:

Shahabedin Rahmatizadeh

Department of Health Information
Technology and Management,
School of Allied Medical Sciences,
Shahid Beheshti University of
Medical Sciences, Tehran, Iran

Email:

shahab.rahmatizadeh@gmail.com

Keywords:

Readability

Credibility

Patient Portals

Self-Care

Patient Education

Health Information

ABSTRACT

Introduction: The growing use of online information influences people's healthcare decision making in terms of treatment or consulting a doctor. The readability of a website is a factor that influences the correct understanding of its content. Regarding that there is little information about the readability as well as the credibility of health websites in the field of kidney transplantation, the present study assesses the readability and trustworthiness of websites in this topic.

Material and Methods: Google, Yahoo, and Bing search engines were used to search for "Kidney Transplantation" and "Renal Transplantation.". Four readability scales were applied to assess the readability of the first 30 results of each search engine. The HONcode toolbar was applied to recognize credible websites. The relationship between HONcode verification and website position on the search results pages was explored. Furthermore, the difference between the readability scores and website position on the search results pages was tested. The readability difference between search result pages was also examined.

Results: According to the results, the assessed websites are suitable for students or high school graduates. Furthermore, the association between the average readability of websites and website position on the search results pages was significant (p -value<0.05). A significant association between HONcode-verified sites and website position on the search results pages was also revealed (p -value=0.011).

Conclusion: The readability of kidney transplantation websites is far above the recommended level. Therefore, health organizations must consider readability while designing their websites.

Cite this paper as:

Valizadeh-Haghi S, Rahmatizadeh S, Adibi S, Kalantari A. The readability and credibility analysis of online education materials for kidney transplantation. *Front Health Inform.* 2023; 12: 147. DOI: [10.30699/fhi.v12i0.446](https://doi.org/10.30699/fhi.v12i0.446)

INTRODUCTION

Chronic kidney disease (CKD) is a significant public health challenge throughout the world. The prevalence of this disease is estimated to grow by 11% to 13% [1]. This disease causes the kidneys to lose their function over time. The destructive, progressive, and primarily asymptomatic nature of the disease, leading to the End-Stage Renal Disease (ESRD) and its association with cardiovascular disease, as well as the high costs of care and treatment, have made it a global health threat [2]. Approximately 2% to 3% of the health budget of

developed countries is annually spent on ESRD treatment [3]. In the case of ESRD, kidney transplantation is regarded as the most cost-effective treatment [4]. Patients need reliable information for kidney transplantation and receive relevant information, such as pre- and post-surgery care, appropriate conditions of recipient and donor, diet, and side effects of immunosuppressive medications. The provision of such information can increase patients' life expectancy and quality of life and reduce the cost of medical care [5].

The Internet is considered as a source of access to

health information in various fields of medicine [6]. The Internet is often the first-place people seek information about their disease, treatment methods, diet, fitness, and medications [7]. The use of this information continues even after receiving advice from experts [8, 9]. The trust in online health information has raised concerns because a significant percentage of people (86%) believe that web-based health information is trustworthy and high-quality [10]. However, according to various research findings, health websites have a low level of credibility, and the information contained in these websites cannot be trusted [11-13].

However, even if the content of a website is reliable, a factor influencing the correct use of information on websites is the ability of the reader to understand the contents. In another word, the capability of people to apply health information correctly is dependent on their skills to realize and comprehend this information [7]. In this regard, the readability of the text is one of the influential factors in the level of correct understanding of the content by readers. Readability is a scale of how comprehensible a text is, as well as how easily the text can be read and understood. A legible text is a text that the reader can read and understand its meaning easily [14]. Officials such as the American Medical Association (AMA) and the National Institutes of Health (NIH) recommend that health information resources should not exceed the level of sixth-grade literacy in terms of readability [15] and should be written at a level understood by an 11-year-old [16]. Besides, the text should not contain complex medical terms [17]. Despite these recommendations, studies on the readability of health websites on various topics show that the content is higher than the recommended level and is not easily understood by community members [18, 19].

The use of the Internet to obtain information about CKD, as well as hemodialysis as a treatment method, has been the most used technology in CKD patients [20]. Online health information is becoming increasingly popular, and this information impacts people's decisions to choose treatment and decision to consult a doctor [9]. Alternatively, there is little information about the level of readability, as well as the credibility of health websites in the field of kidney transplantation. Therefore, the present study evaluates the readability and validity of health-related websites in the field of kidney transplantation.

MATERIAL AND METHODS

Website selection and categorization

We investigated the readability of websites containing information on kidney transplantation. Given that medical terms are usually confusing for

patients [21], the plain terms that lay people likely use were selected using the CDC Plain Language Thesaurus [21]. Given that search engines are the first tools that people use to search for information on the Internet [22], so, to simulate the real-world search environment, the most popular search engines, Google, Yahoo, and Bing, were used to search for the keywords "Kidney Transplantation" and "Renal Transplantation" [23, 24], using Google Chrome browser on March 2022. The cookies, cached images, and browser history were deleted before performing the search process. Given that most people (90%) only read the first three pages of search engine results [25], and the default setting of search engines is to yield 10 results on each page, the first 30 websites returned by each search engine for each of the two keywords were studied, resulting in a total of 180 websites (90 results for each keyword). In the first step, websites including irrelevant, non-English-language websites, marketing websites, duplicate websites, scientific and professional journal websites (including guidelines, course descriptions, seminars, etc.), and non-accessible links were excluded from the study. Three screeners (SV, AK, and SR) were involved in this process and reached consensus on the inclusion of the retrieved websites.

After removing 107 websites, 73 unique websites remained for evaluation (Fig 1). Afterwards, the unique websites were classified into four categories based on their declaration of affiliation: Commercial, Governmental, Organization, and Educational.

Readability assessment tools:

The free web-based readability assessment tool accessible through www.readabilityformulas.com was used to gather data on the readability of the selected webpages [26]. This online tool calculates the readability of English content based on various indicators and has been used in several studies to measure and evaluate health-related websites' readability [19, 27].

Four readability scales, including Flesch-Kincaid (FKGL), Flesch Reading Ease Score (FRE), the Simple Measure of Gobbledygook (SMOG), and Gunning Fog, were applied to measure the readability of websites. Each of the mentioned tools assesses the level of readability in different ways and has been used in various studies [19, 20]. Also, the NIH recommended FKGL, Gunning Fog, and SMOG scales to measure the readability of health information [28].

The Flesch Reading Ease tool generates a score between 0 and 100, where a higher score indicates better readability. As a general rule, content with a score of 90-100 can be understood by an individual with a fifth-grade literacy level. Content with a readability score of 60-70 is understandable for 8th- and 9th-grade students. Also, people with an academic degree can understand content with a

readability score between 0 and 30. The Gunning Fog Scale gives content scores of 5, 10, 15, and 20, indicating that five is readable, ten is hard to read, 15 is difficult to read, and 20 is very difficult to read.

The SMOG and FKGL tools estimate the level of education of an individual who needs to comprehend written content. For instance, a score of 7.4 shows that the text can be read and comprehended by a 7th grader.

Credibility assessment tool:

There are several guidelines for measuring the credibility of health-related websites, one of which is the HONcode (The Health on the Net Foundation Code of Conduct) guideline [29]. This guideline was created by the Health on the Net Foundation and is the oldest and most broadly used ethical instrument to appraise the credibility of health-related websites and has been used in multiple studies [11, 19, 30]. The HON, which holds an official relationship with the World Health Organization verifies the credibility of the websites at the request of the host institution. The HONcode comprises eight principles including authority, complementarity, privacy, attribution, justifiability, transparency, financial disclosure, and advertising policy.

If a website meets all eight criteria, permission to use the HON logo on that website will be granted. Accordingly, it will be determined that the website has been approved and is a trustworthy source of medical information. HON has provided a toolbar extension for internet browsers including Chrome and Firefox that can be used to recognize HON-approved websites and is available through its official website [31]. This toolbar has been applied in several studies and is valid [11, 19]. In this study, this toolbar was used to detect credible websites.

Analysis

In this study, it was assumed that the readability of HONcode-verified websites was better than non-verified websites. An independent t-test was used to test this hypothesis. Additionally, using analysis of variance (ANOVA), the difference in readability scores in various categories of websites was assessed. It was also assumed that websites on the first page of search results read better than websites on the second and third pages. ANOVA was used to test this hypothesis. Another hypothesis of this study was that most HON-verified websites are on the first pages retrieved from search engines. A Chi-square test was used to investigate this issue. To analyze the results, SPSS software version 18 was applied.

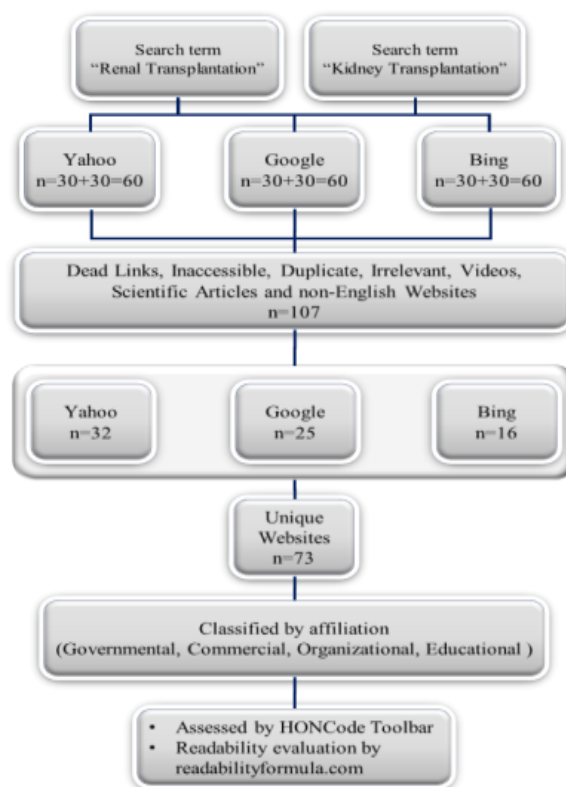


Fig 1: Diagram of the Internet search process.

RESULTS

Seventy-three websites related to kidney transplant disease retrieved from the three search engines Google, Yahoo, and Bing were evaluated. The status of the studied websites in terms of being verified by HONcode is shown in Table 1. The findings revealed that only 32 out of 73 websites were HONcode verified. Also, among the various pages of search results, the first page's results compared to the second and third pages included a more significant number of verified HONcode websites (67%) (Table 1).

Table 1: HONcode-verified websites by search engines and search results page number

Pages Search engine		Frequency	HONcode Verified n (%)	Total (%)
Page 1	Google	8	6 (75%)	18 (67%)
	Yahoo	11	7 (64%)	
	Bing	8	5 (63%)	
Page 2	Google	8	2 (25%)	6 (30%)
	Yahoo	9	3 (33%)	
	Bing	3	1 (33%)	
Page 3	Google	9	4 (44%)	8 (31%)
	Yahoo	12	3 (25%)	
	Bing	5	1 (20%)	
Total	Google	25	12(34%)	73 (100%)
	Yahoo	32	13(44%)	
	Bing	16	7(22%)	

The percentage of retrieved websites based on domain type is presented in Fig 1. Findings showed that most retrieved websites (49%) were organizational, and only 12% were academic (Fig 2).

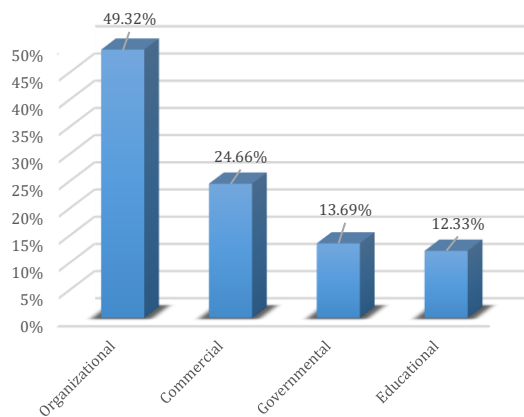


Fig 2: Websites evaluated by domain category

The difference between HONcode-Verified and non-verified websites based on different pages of the search results is shown in Table 2. According to the Chi-square test, there is a significant relationship between HONcode-verified sites and their presence on pages 1, 2, and 3 of search engines $X^2 (2, N = 73) = 9.074, p\text{-value} = .011$ (Table 2). The results obtained based on the Bonferroni and Hochberg correction showed a significant difference between the first and second pages and the first and third pages ($p\text{-value} < .05$). However, there was no significant difference between the second and third pages ($p\text{-value} > .05$). Moreover, the results showed no significant difference in the number of HONcode-Verified websites retrieved from Google, Yahoo, and Bing search engines $X^2 (2, N = 73) = 0.310, p\text{-value} = .856$. Additionally, according to the results of Chi-square test, there is a significant relationship between HONcode-verified and websites' category $X^2 (3, N = 73) = 11.03, p\text{-value} < .001$ (Table 2). Based on the results obtained from Bonferroni and

Hochberg correction, the number of HONcode-verified websites in the Commercial category is significantly more than Organizational and Educational ($P\text{-value} < .05$). On the other hand, the number of HONcode-verified websites is significantly higher in the Governmental category than Educational ($P\text{-value} < .05$).

The mean and standard deviation of the readability score of the retrieved websites by search engines are presented in Table 3. According to ANOVA, there was no statistically significant difference between the mean scores of website readability among search engines ($P\text{-value} > .05$).

The mean and standard deviation of the readability score of the studied websites by the domain of websites are presented in Table 4. The results of one-way ANOVA showed that the mean readability scores (FRE, FKGL, and SMOG) of websites were not statistically significant between different domains (Table 4).

The standard deviation and mean of readability score of the examined websites by page number search results are reported in Table 5. The one-way ANOVA results showed statistically significant differences in the readability scores (FRE and FKGL) of websites between different pages (Table 5). Therefore, the Scheffe post hoc test was used to determine readability differences between search result pages, and the results presented that the average readability score of websites retrieved on the first page was significantly higher than the third page ($P\text{-value} < .05$). In addition, although the average readability scores of the first pages of the websites were better than the second pages and the second pages were better than the third pages, these differences were not statistically significant ($P\text{-value} > .05$).

The independent t-test indicated that the readability of HONcode-verified websites was significantly better than non-verified (Table 6).

Table 2: Differences in HONcode-verified and non-verified websites based on search results attributes

Variables		HONcode Verified		X^2	df	P-value
		No (n=41)	Yes (n=32)			
Search Results	Page1	9	18	9.074	2	0.011
	Page2	14	6			
	Page3	18	8			
Category	Commercial	4	14	18.719 ^a	3	<0.001 ^a
	Organizational	24	12			
	Educational	9	0			
	Governmental	4	6			
Search Engines	Google	13	12	0.310	2	0.856
	Yahoo	19	13			
	Bing	9	7			

a) Fisher's exact test

Table 3: Readability score of the studied websites by search engines

Readability formula	Mean (SD)				Grade	P-value
	Google	Bing	Yahoo	Total		
FRE	50.38 (16.181)	50.70 (14.865)	49.99 (13.875)	50.28 (14.706)	Fairly Difficult	0.987
Gunning Fog	12.47 (3.206)	12.60 (2.888)	12.60 (2.571)	12.55 (2.831)	Difficult	0.984
FKGL	10.76 (2.935)	10.81 (2.780)	11.00 (2.706)	10.87 (2.765)	11th grade	0.946
SMOG	9.40 (2.513)	9.45 (2.272)	9.48 (2.265)	9.42 (2.322)	9th grade	0.974

Table 4: Readability score of the studied websites by domain

Readability formula	Mean (SD)				F	P-value
	Educational	Commercial	Organization	Governmental		
FRE	37.68 (8.62) (Difficult)	51.83 (18.35) (Fairly Difficult)	49.54 (12.29) (Fairly Difficult)	61.50 (11.59) (Easy)	4.93	0.004
Gunning Fog	14.07 (1.037) (Difficult)	12.45 (3.674) (Difficult)	12.56 (2.54) (Difficult)	11.38 (2.936) (Difficult)	1.48	0.228
FKGL	12.98 (1.171) (College)	10.41 (3.373) (10th grade)	10.98 (2.407) (11th grade)	9.44 (2.947) (9th grade)	3.08	0.033
SMOG	11.26 (1.262) (11th grade)	9.15 (2.770) (9th grade)	9.42 (2.094) (9th grade)	8.26 (2.268) (8th grade)	3.04	0.034

* Parenthetical items refer to general assessments, age levels, or US-equivalent grade levels.

Table 5: Readability scores of the studied by page number

Readability formula	Mean (SD)			F	P-value
	Page 1	Page 2	Page 3		
FRE	55.70 (13.194) (Fairly Difficult)	50.91 (12.304) (Fairly Difficult)	44.17 (15.995) (Difficult)	4.497	0.015
Gunning Fog	11.95 (2.604) (Difficult)	12.23 (2.395) (Difficult)	13.43 (3.221) (Difficult)	2.066	0.134
FKGL	9.98 (2.643) (10th grade)	10.77 (2.341) (11th grade)	11.88 (2.943) (12th grade)	3.367	0.040
SMOG	8.83 (2.121) (9th grade)	9.08 (1.910) (9th grade)	10.30 (2.611) (11th grade)	3.114	0.051

Table 6: Readability scores of studied websites based on HONcode certification

Readability formula	Mean (SD)		t	P-value
	HON Verified	Not HON Verified		
FRE	55.831 (15.454) (Fairly Difficult)	45.956 (12.664) (Difficult)	3.001	0.004
Gunning Fog	11.606 (2.836) (Difficult)	13.302 (2.626) (Difficult)	-2.644	0.010
FKGL	9.753 (2.863) (10th grade)	11.756 (2.368) (12th grade)	-3.271	0.002
SMOG	8.569 (2.227) (9th grade)	10.098 (2.194) (10th grade)	-2.934	0.004

DISCUSSION

Health-related information is widely available on the Internet. The prevalence of ESRD and the patient's long-term need for up-to-date information as well as the knowledge of how to perform a kidney transplant,

strengthen the need for patients to use websites in this area. Studies show that a low level of literacy is an independent factor affecting the level of health and well-being of individuals [32]. Using simple language in the content of websites is one of the ways to understand information better [33]. Readability plays an important role in health literacy and self-

care, therefore, the present study investigated the readability and credibility of kidney transplant websites retrieved through the common search engine, including Google, Yahoo, and Bing.

The present study results revealed that the average readability level of online information on kidney transplant is higher than the recommended level and is suitable for college students or 12th grader students. However, the websites are recommended to be readable for an 11-year-old or individuals with a sixth-grade elementary literacy [16]. The findings of the present study are consistent with studies on other health topics [19, 34, 35].

In the current study, the readability of websites was examined based on the domain of websites. Governmental websites were predicted to be more understandable than others because they generally intend to teach laypeople [36]. However, the findings of the current study showed that the readability level of the studied websites in all domains, including governmental websites, is higher than the recommended level. While in some surveys, the results have demonstrated that government websites are more understandable than other types of websites [37]. Hence, people who intend to read the information on kidney transplant on governmental websites will come across websites which are difficult to read and may cause them to misinterpret the information. This lack of understanding of information may result in anxiety or making an inappropriate health decision.

When searching for health content, most individuals read the results on the first page of the search results [38, 39]. Therefore, in this study, the first page results were expected to be more readable than the rest of the pages. However, the findings did not show a statistical difference between the mean readability scores of the search engine results pages. Moreover, there was no relationship between the position of search results in public search engines as well as their readability. In a study on the readability of COVID-19 websites [19], as well as the readability of pediatric emergency related complaints websites, no connection was observed between the readability of websites and their ranking [40]. Accordingly, in addition to the efforts of various organizations to improve the ranking of their websites in the results of public search engines, they should also pay special consideration to the readability of their websites so that lay people adequately understand the content presented.

In the present study, the connection between the readability of websites and their trustworthiness based on HON seal presence was also examined. The HON-approved websites were significantly more readable than the non-verified websites. Therefore, it seems that referring people to trustworthy websites may lead to access to more comprehensible

information and better health decisions. In the study of prostate disease-related websites, credible websites also had better readability than other websites [41]. Hence, more research is needed in this area. So, it is recommended that health care providers guide kidney donors as well as transplant recipients to use the information available on reputable websites. Therefore, in this way, they help individuals comprehend information and increase the health literacy of these patients and make better health decisions.

CONCLUSION

Less than half of the kidney transplantation-related websites were formally approved by HONcode. Also, the readability level of the mentioned websites is far above the officials' recommendation. Therefore, patients who search for online information on kidney transplantation cannot understand or apply the provided information properly which may lead to risky health decision-making. So, it is suggested that health organizations and online health information providers examine their websites in terms of readability and provide information in a comprehensible way to the whole community. This may improve the health literacy of the community. Furthermore, it may lead to better disease management and consequently reduces destructive physical and economic complications.

Limitations

This study includes some limitations. The search was carried out using three search engines including Yahoo, Google, and Bing, thus, different results may be retrieved by searching in other search engines. Also, due to the dynamism of websites, searching at different periods may produce diverse results. Additionally, the search results may have been influenced by the location from which they were retrieved (Tehran, Iran).

AUTHOR'S CONTRIBUTION

SV arranged the concept and methods and was the major contributor to writing the manuscript text. SR analyzed and interpreted the data and contributed to writing the manuscript. SA contributed to writing and editing the final manuscript. AK gathered the data and contributed to writing the draft manuscript.

All authors contributed to the literature review, design, data collection and analysis, drafting the manuscript, read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

FINANCIAL DISCLOSURE

This research was supported by the School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran [Project NO. 12733]. The funding supported the expenditures of the evaluation process.

ETHICS APPROVAL

This research includes no human subjects and has been approved by the ethics committee of Shahid Beheshti University of Medical Sciences (ethics code: IR.SBMU.RETECH.REC.1396.1168).

AVAILABILITY OF DATA

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

REFERENCES

- Hill NR, Fatoba ST, Oke JL, Hirst JA, O'callaghan CA, Lasserson DS, et al. Global prevalence of chronic kidney disease: A systematic review and meta-analysis. *PLoS One*. 2016; 11(7): e0158765. PMID: 27383068 DOI: 10.1371/journal.pone.0158765 [[PubMed](#)]
- Collins AJ, Foley RN, Chavers B, Gilbertson D, Herzog C, Johansen K, et al. U.S. renal data system, USRDS 2013 annual data report: Atlas of chronic kidney disease and end-stage renal disease in the United States. *Am J Kidney Dis*. 2012; 59(Suppl 1): A7. PMID: 22177944 DOI: 10.1053/j.ajkd.2011.11.015 [[PubMed](#)]
- Gao GG, McCullough JS, Agarwal R, Jha AK. A changing landscape of physician quality reporting: Analysis of patients' online ratings of their physicians over a 5-year period. *J Med Internet Res*. 2012; 14: e38. PMID: 22366336 DOI: 10.2196/jmir.2003 [[PubMed](#)]
- McDonald SP, Russ GR. Survival of recipients of cadaveric kidney transplants compared with those receiving dialysis treatment in Australia and New Zealand, 1991–2001. *Nephrol Dial Transplant*. 2002; 17(12): 2212–9. PMID: 12454235 DOI: 10.1093/ndt/17.12.2212 [[PubMed](#)]
- Stevenson JK, Campbell ZC, Webster AC, Chow CK, Tong A, Craig JC, et al. eHealth interventions for people with chronic kidney disease. *Cochrane Database Syst Rev*. 2019; 8(8): CD012379. PMID: 31425608 DOI: 10.1002/14651858.CD012379.pub2 [[PubMed](#)]
- Kang M-J, Jung CY, Kim S, Boo Y, Lee Y, Kim S. Stakeholder analysis for adopting a personal health record standard in Korea. *Health Inf Manag*. 2015; 44(2): 33–42. PMID: 26157084 DOI: 10.1177/183335831504400204 [[PubMed](#)]
- Berland GK, Elliott MN, Morales LS, Algazy JI, Kravitz RL, Broder MS, et al. Health information on the Internet: Accessibility, quality, and readability in English and Spanish. *JAMA*. 2001; 285(20): 2612–21. PMID: 11368735 DOI: 10.1001/jama.285.20.2612 [[PubMed](#)]
- McKenna L, McLelland G. Midwives' use of the Internet: An Australian study. *Midwifery*. 2011; 27(1): 74–9. PMID: 19783335 DOI: 10.1016/j.midw.2009.07.007 [[PubMed](#)]
- Wong DK, Cheung MK. Online health information seeking and eHealth literacy among patients attending a primary care clinic in Hong Kong: A cross-sectional survey. *J Med Internet Res*. 2019; 21(3): e10831. PMID: 30916666 DOI: 10.2196/10831 [[PubMed](#)]
- Harris Interactive. Number of “cyberchondriacs”—adults going online for health information—has plateaued or declined? [Internet]. 2008 [cited: 12 Mar 2023]. Available from: <http://www.harrisinteractive.com/vault/Harris-Interactive-Poll-Research-Number-of-Cyberchondriacs-Adults-Going-Online-for-2008-07.pdf>
- Rahmatizadeh S, Valizadeh-Haghi S. Evaluating the trustworthiness of consumer-oriented health websites on diabetes. *Library Philosophy and Practice (e-journal)*. 2018; 2018: 1–16.
- Ansari M, Hamzehei R, Valizadeh-Haghi S. Persian language health websites on Ebola disease: Less credible than you think? *J Egypt Public Health Assoc*. 2020; 95(1): 2. PMID: 32813057 DOI: 10.1186/s42506-019-0027-4 [[PubMed](#)]
- Valizadeh-Haghi S, Rahmatizadeh S. Evaluation of the quality and accessibility of available websites on kidney transplantation. *Urol J*. 2018; 15(5): 261–5. PMID: 30058062 DOI: 10.22037/uj.v0i0.4252 [[PubMed](#)]
- Eloy JA, Li S, Kasabwala K, Agarwal N, Hansberry DR, Baredes S, et al. Readability assessment of patient education materials on major otolaryngology association websites. *Otolaryngol Head Neck Surg*. 2012; 147(5): 848–54. PMID: 22864405 DOI: 10.1177/0194599812456152 [[PubMed](#)]
- Weiss BD. *Health literacy: A manual for clinicians*. American Medical Association; 2003.
- 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): 213–9. PMID: 15847246 DOI: 10.1007/s10900-004-1959-x [[PubMed](#)]
- Badarudeen S, Sabharwal S. Assessing readability of patient education materials: Current role in orthopaedics. *Clin Orthop Relat Res*. 2010; 468(10): 2572–80. PMID: 20496023 DOI: 10.1007/s11999-010-1380-y [[PubMed](#)]
- Lynch NP, Lang B, Angelov S, McGarrigle SA, Boyle TJ, Al-Azawi D, et al. Breast reconstruction post mastectomy- Let's Google it: Accessibility, readability and quality of online information. *Breast*. 2017; 32:

- 126-9. PMID: 28178606 DOI: 10.1016/j.breast.2017.01.019 [PubMed]
19. Valizadeh-Haghi S, Khazaal Y, Rahmatizadeh S. Health websites on COVID-19: Are they readable and credible enough to help public self-care? *J Med Libr Assoc.* 2021; 109(1): 75-83. PMID: 33424467 DOI: 10.5195/jmla.2021.1020 [PubMed]
 20. Cherrez-Ojeda I, Felix M, Mata VL, Vanegas E, Gavilanes AWD, Chedraui P, et al. Preferences of ICT among patients with chronic kidney disease undergoing hemodialysis: An ecuadorian cross-sectional study. *Healthc Inform Res.* 2018; 24(4): 292-9. PMID: 30443417 DOI: 10.4258/hir.2018.24.4.292 [PubMed]
 21. Centre for Disease Control & Prevention. Plain language thesaurus for health communications [Internet]. 2007 [cited: 15 Jul 2022]. Available from: <https://stacks.cdc.gov/view/cdc/11500/>
 22. Naude F, Rensleigh C, Du Toit ASA. Using the open Web as an information resource and scholarly web search engines as retrieval tools for academic and research purposes. *South African Journal of Information Management.* 2010; 12(1): 416.
 23. StatCounter. Browser, OS, search engine including mobile usage share [Internet]. 2020 [cited: 5 Mar 2020]. Available from: <https://gs.statcounter.com/>
 24. eBiz. Top 15 most popular search engines [Internet]. 2019 [cited: 19 Oct 2019]. Available from: <http://www.ebizmba.com/articles/search-engines>
 25. iProspect. Blended search results study 2008 [Internet]. 2014 [cited: 10 Sep 2017]. Available from: <http://www.iprospect.com>
 26. ReadabilityFormulas.com. My byline media [Internet]. 2017 [cited: 19 Oct 2019]. Available from: <http://www.readabilityformulas.com/contactus.php>
 27. Royal KD, Erdmann KM. Evaluating the readability levels of medical infographic materials for public consumption. *J Vis Commun Med.* 2018; 41(3): 99-102. PMID: 29987964 DOI: 10.1080/17453054.2018.1476059 [PubMed]
 28. National Institutes of Health. How to write easy to read health materials [Internet]. 2007 [cited: 19 Mar 2023]. Available from: <http://www.nlm.nih.gov/medlineplus/etr.html>
 29. The HON code of conduct for medical and health web sites (HONcode) [Internet]. 2010 [cited: 10 Nov 2017]. Available from: <http://www.hon.ch/HONcode>
 30. Rahmatizadeh S, Valizadeh-Haghi S, Kalavani A, Fakhimi N. Middle East respiratory syndrome on health information websites: How much credible they are? *Library Philosophy and Practice (e-journal).* 2019; 2019: 2885.
 31. HONcode Toolbar. Health On the Net [Internet]. 2014 [cited: 3 Feb 2020]. Available from: <https://www.hon.ch/en/tools.html#honcodeextension>
 32. Shahid R, Shoker M, Chu LM, Frehlick R, Ward H, Pahwa P. Impact of low health literacy on patients' health outcomes: A multicenter cohort study. *BMC Health Serv Res.* 2022; 22(1): 1148. PMID: 36096793 DOI: 10.1186/s12913-022-08527-9 [PubMed]
 33. US Department of Health & Human Services. Writing for the Web [Internet]. 2019 [cited: 9 Nov 2019]. Available from: <https://www.usability.gov/how-to-and-tools/methods/writing-for-the-web.html>
 34. Zuchowski KA, Sanders AE. Readability and implications for health literacy: A look at online patient-oriented disease information by Alzheimer's disease research centers. *Alzheimer's & Dementia.* 2018; 14: 1380.
 35. Rahmatizadeh S, Valizadeh-Haghi S. The readability of online health information on the middle east respiratory syndrome coronavirus disease. *Journal of Cellular & Molecular Anesthesia.* 2021; 6: 154-63.
 36. Cancer Information on the Internet [Internet]. 2016 [cited: 20 Feb 2018]. Available from: <http://www.cancer.org/cancer/cancer-basics/cancer-information-on-the-internet.html>
 37. McInnes N, Haglund BJA. Readability of online health information: implications for health literacy. *Inform Health Soc Care.* 2011; 36(4): 173-89. PMID: 21332302 DOI: 10.3109/17538157.2010.542529 [PubMed]
 38. Yi YJ, Stvilia B, Mon L. Cultural influences on seeking quality health information: An exploratory study of the Korean community. *Library & Information Science Research.* 2012; 34(1): 45-51.
 39. van Deursen AJAM, van Dijk JAGM. Using the Internet: Skill related problems in users' online behavior. *Interacting with Computers.* 2009; 21(5-6): 393-402.
 40. Rothrock SG, Rothrock AN, Swetland SB, Pagane M, Isaak SA, Romney J, et al. Quality, trustworthiness, readability, and accuracy of medical information regarding common pediatric emergency medicine-related complaints on the web. *J Emerg Med.* 2019; 57(4): 469-77. PMID: 31561928 DOI: 10.1016/j.jemermed.2019.06.043 [PubMed]
 41. Koo K, Yap RL. How readable is BPH treatment information on the Internet? Assessing barriers to literacy in prostate health. *Am J Mens Health.* 2017; 11(2): 300-7. PMID: 27903952 DOI: 10.1177/1557988316680935 [PubMed]