

# Readability and credibility evaluation of most-visited health websites based on eBizMBA and Alexa global ranking

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## ABSTRACT

**Introduction:** Online health information is one of the most important and widely used sources of information. Currently, a significant number of individuals use the internet for health-related information to learn about health, disease, health promotion, and threats to their health.

**Material and Methods:** This research examined the top 15 health websites based on their popularity in eBizMBA and Alexa rank from January to February 2022. A total of 30 health websites (15 from each category) were evaluated in terms of credibility by the use of Journal of the American Medical Association (JAMA) and health on the net foundation (HON) code. Also, the readability of the mentioned websites was evaluated by the use of four readability tools.

**Results:** Most of the websites ranked by both Alexa and eBizMBA met the "Authority" and "Complementarity" criteria. When it comes to the readability of the 30 most visited health websites according to eBizMBA and Alexa analytics in the world, the analysis demonstrated that the readability of highly-ranked health websites was higher than the recommended level.

**Conclusion:** Some of the websites had deficiencies according to the HONcode and JAMA criteria, and the average readability of the websites did not meet the gold standard. Despite the increasing use of the internet for medical information, these resources' poor quality and readability remain a barrier to informed decision-making of patients.

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## INTRODUCTION

With 58.7% of the world's population accessing the internet [1-4], Internet use and users have grown tremendously. The information and educational potential of the internet are enormous worldwide. The internet as a communication medium can provide health messages in numerous media, including text, images, animation, audio, and video [5].

Online health information is one of the most

important and widely used sources of information [6, 7]. Currently, a significant number of individuals use the internet for health-related information to learn about health, disease, health promotion, and threats to their health [8, 9]. Patients need to be well informed about their health concerns because the more knowledgeable they are, the more accurate and thorough their diagnosis, treatment, and follow-up. In addition, the health of the community will improve. In contrast, medical spending will be drastically reduced. In recent years, the most advanced medical

systems have devoted a significant amount of their activities and resources to health education [10, 11].

The benefits of health information websites include lower visit costs and ease of use [12]. At rapidly rising healthcare costs, low-income families are more interested in accessing free health information online than in expensive scheduling treatment with a physician [13].

The quality of health information on the internet is a timely topic [14], because users use Websites to make health-related decisions. The quality of online health information can influence people's final judgments [13, 15, 16]. Given the lack of clarity about this material's quality, validity, and accuracy, it is critical to examine and evaluate the quality of health websites [14, 15, 17].

On the other hand, people have different levels of literacy [18, 19]. Some research suggests that a mismatch between the readability of content on websites and the literacy level of users can lead to misunderstanding [20, 21]. Several studies indicate that the readability of health websites is often beyond the required level [22-25], which may lead users to misinterpret information. This lack of information comprehension can lead to a deterioration in their health status [26, 27]. Readability is the "ease of reading written content" closely related to an accurate understanding of the material [28-30]. According to the American Medical Association, the ability to read is an essential requirement for accessing health information [31, 32]. This has led the federal government and the U.S. National Library of Medicine to make proposals to improve the readability of health information [33]. The National Library of Medicine proposes that health information on the internet be written at a seventh- or eighth-grade level so that everyone, regardless of reading ability, can understand it [34]. In addition to the quality of health Websites, it is crucial to consider the readability of online health information.

Some websites are used more than other websites and have more visitors. Readable content increases search engine optimization (SEO) and traffic. The easier the website reads, the higher the visitor traffic [35]. Several tools have been developed to rank websites based on visitor traffic. These tools show which websites are visited the most by Internet users worldwide compared to other websites. These tools include Alexa and eBizMBA [36, 37].

eBizMBA is an eBusiness guide that helps people find the best resources on the internet to grow their eBusiness. Topics range from online health and analytics to website development [38]. Alexa traffic rankings are based on traffic data provided by Alexa's global sample over a rolling 3-month period [39]. Because the content of the most frequently visited websites can directly affect the health of community

members, it is critical to analyze the quality and readability of websites that community members visit more frequently for health information than other websites. Therefore, the main objective of this study is to assess the credibility and readability of high-traffic health websites [40, 41]. Determining the quality of these websites can significantly influence the health of diverse community members.

## MATERIAL AND METHODS

### Website selection and categorization

This research examined the top 15 health websites based on their popularity in eBizMBA [42] and Alexa rank [43] from January to February 2021. A total of 30 health websites (15 from each category) were evaluated.

### Measures

#### *Credibility evaluation tool*

Numerous organizations and institutions have developed techniques and standards for assessing the quality of health websites. HONcode [44] and JAMA are two methods to evaluate the reliability and quality of health web sites [45]. The main goal of HONcode is to help Internet users, health Web site developers, and health professionals identify and find accurate and up-to-date health information. HONcode uses eight indications and criteria to evaluate the credibility of websites: complementarity, privacy, attribution, justifiability, transparency, financial disclosure, advertising policy, and authority. Websites that comply with HONcode standards are considered valid [46]. JAMA is a process developed by the American Medical Association (AMA) in 1997 that uses four criteria to evaluate the quality of health websites: authorship, attribution, disclosure, and currency [45]. If a Web site does not meet at least three or four requirements of JAMA, it is not JAMA -validated. Several studies [22, 47-53] have used HONcode and JAMA to assess the validity and quality of websites. In this study, both HONcode and JAMA tools were used to evaluate the validity and quality of websites.

#### *Readability evaluation tools*

To improve the validity of the present study, four readability scales, including Flesch-Kincaid grade level (FKGL), Flesch reading ease (FRE), simple measure of Gobbledygook (SMOG), and gunning fog, were used to assess the readability of the selected websites. Each of these scales tests the readability of a written text using a different technique and has been used in numerous studies [16, 54-60]. The readability formulas tool was used to check the readability of websites. This tool is a free readability tool available at <https://readabilityformulas.com>

[61]. It has been used in numerous studies and is reliable to use [47, 48].

**Process**

HN and HM manually assessed selected websites based on HONcode and JAMA criteria. These two raters and the evaluation process were supervised by SV (health information and medical library specialist) to ensure the accuracy of the obtained data. Cohen's kappa coefficient was used to determine whether the two investigators agreed in their assessment of the credibility of 30 websites. There was high agreement between the judgments of the two reviewers ( $\kappa=0.733, 0.712, p<0.001$ ). Comparing the assessment of websites made by two evaluators produces a kappa value of 0.733 (HON) and 0.712 (JAMA), which suggests a good strength of agreement between them. This kappa value is significantly different from zero ( $p<0.001$ ).

**Data analysis**

In this research, credible websites were assumed to have high readability. Because some of the data were not normally distributed, the comparative t-test and Mann-Whitney test were used to evaluate this hypothesis. This research also hypothesized a significant relationship between the Alexa and eBizMBA ranked websites and the HONcode and JAMA criteria; the chi-square test was used to test this hypothesis. Excel and SPSS version 18 software were used to examine the data obtained.

**RESULTS**

Table 1 shows the extent to which the websites studied comply with JAMA and HONcode standards. According to the results, the majority of Alexa-recommended high-traffic websites (86.67%) meet the requirements of JAMA. However, less than half of them meet all HONcode requirements. In addition, the majority of the most popular websites, according to eBizMBA (86.67%), meet the requirements of JAMA, but approximately half of these websites (53.33%) meet all HONcode criteria (Table1).

Table 2 separately displays the status of the websites covered by eBizMBA and Alexa in terms of meeting the eight HONcode criteria. All websites met only two requirements, privacy policy, and website contact information. The advertising policy criterion was met by 9 websites captured by Alexa, while 12 of the websites retrieved by eBizMBA met the referenced and dated information requirement.

**Table 1: Frequency of websites retrieved from Alexa and eBizMBA based on their credibility**

Criteria/Tools		eBizMBA n (%)	Alexa n (%)	Total (%)
JAMA Verified	Yes	13 (86.67)	13 (86.67)	26 (86.67)
	No	2 (13.33)	2 (13.33)	4 (13.33)
HON Verified	Yes	8 (53.33)	7 (46.67)	15 (50)
	No	7 (46.67)	8 (53.33)	15 (50)

**Table 2: Frequency of websites based on compliance with HONcode criteria**

HON code Criteria	eBizMBA n (%)	Alexa n (%)	Total (%)
Authority	14 (93.33)	15 (100)	29 (96.67)
Complementarity	15 (100)	14 (93.33)	29 (96.67)
Confidentiality	15 (100)	15 (100)	30 (100)
Attribution	12 (80)	11 (73.33)	23 (76.67)
Justifiability	13 (80)	14 (93.33)	27 (90)
Transparency	15 (100)	15 (100)	30 (100)
Financial Disclosure	13 (86.67)	13 (86.67)	26 (86.67)
Advertising Policy	13 (86.67)	9 (60)	22 (73.33)

Table 3 shows the status of the websites covered by eBizMBA and Alexa in terms of meeting the four criteria of JAMA separately. Each website meets only the disclosure criterion. Eleven websites from both Alexa and eBizMBA met the attribution criterion.

**Table 3: Frequency of websites based on compliance with JAMA criteria**

JAMA Criteria	eBizMBA n (%)	Alexa n (%)	Total (%)
Authorship	13 (86.67)	15 (100)	28 (93.33)
Attribution	11 (73.33)	11 (73.33)	22 (73.33)
Disclosure	15 (100)	15 (100)	30 (100)
Currency	15 (100)	13 (86.67)	28 (93.33)

After evaluating the readability of the retrieved websites, it was determined that these websites were appropriate for those in eighth grade and above. In addition, an independent t-test showed that there was no statistically significant difference between the mean readability ratings of the websites identified by eBizMBA and Alexa ( $p>0.001$ ). See Table 4 for more details.

Table 5 demonstrates the average readability ratings of websites based on their validity according to the standards of HON and JAMA. Contrary to expectations, the readability of audited websites according to HON, measured by the Flesch-Kincaid Grade Level index, was much lower than that of non-audited websites. Other readability indicators revealed no statistically significant difference between the mean readability scores of trusted and

untrusted websites (Table 5).

## DISCUSSION

Patients are increasingly using the internet to get information about their health. However, neither the quality nor the readability of the content is controlled, highlighting the current study's importance. Therefore, patients should exercise caution when relying on information from the internet. The present study appears to be the first to investigate the credibility and readability of the most visited health websites worldwide. In this analytical study, the 30 most visited health websites according to Alexa and eBizMBA were examined for

their credibility and readability. While most websites (86.67%) met the criteria of JAMA, half of the websites could not meet the criteria of the HONcode to be classified as an accredited health information source. This is in line with some previous studies which proved the low quality of websites on COVID-19 [47], osteoporosis and fragility fractures [62], deep vein thrombosis [63], bladder cancer and urinary diversion [64], hip arthroplasty [65], dental treatment for snoring and obstructive sleep apnea [66], Ebola disease [67], kidney transplantation [50] and elderly diseases [68] based on HON criteria. These findings are alarming because patients often rely on Internet sources to diagnose their conditions and make important treatment decisions.

**Table 4: Average readability scores of Alexa and eBizMBA websites.**

Readability formula	EBizMBA (n=15)		Alexa (n=15)		Total Mean (SD)	p-value
	Mean (SD)	Difficulty	Mean (SD)	Difficulty		
Flesch Reading Ease	48.88 (13.44)	Difficult	50.29 (11.37)	Fairly Difficult	49.59 (12.25)	0.758
Flesch Kincaid Grade Level	8.85 (2.71)	8th grade	8.15 (2.74)	8th grade	8.50 (2.69)	0.492
Gunning Fog Score	6.90 (4.00)	readable	6.85 (3.35)	readable	6.87 (3.63)	0.969
SMOG Index	10.42 (2.03)	10th grade	8.88 (2.56)	8th grade	9.65 (2.40)	0.079

**Table 5: Average readability scores of websites based on various criteria**

Readability formula	HONcode (n=30)		p-value	JAMA (n=30)		p-value
	Verified Mean (SD)	Not Verified Mean (SD)		Verified Mean (SD)	Not Verified Mean (SD)	
Flesch Reading Ease	46.77 (15.63)	52.41 (7.03)	.213	48.27 (12.44)	58.18 (6.95)	0.134
Flesch Kincaid Grade Level	9.58 (3.37)	7.42 (1.12)	.031	8.78 (2.79)	6.70 (0.76)	00.155
Gunning Fog Score	7.64 (3.99)	6.11 (3.17)	.254	6.87 (3.80)	6.88 (2.58)	0.999
SMOG Index	10.15 (2.94)	9.15 (1.67)	.261	9.71 (2.55)	9.28 (1.16)	0.744

In addition, data analysis showed no significant relationship between Alexa and eBizMBA ranking with the JAMA and HONcode criteria, indicating that the guidelines of the JAMA and HON were not taken into account when ranking websites which means that highly ranked websites are not necessarily credible as well. Given that obtaining health information from the internet has become an accelerating trend in recent years [69], therefore, website ranking platforms, as one of the most recognized systems for assisting individuals in finding their desired websites, should consider the credibility of websites as well. This may help people to find the most trustable online health information.

The present study's findings showed that only two of the eight requirements of HONcode, namely "confidentiality" and "transparency", were met by all websites ranked by Alexa and eBizMBA. These findings are in line with the results of the previous

studies which showed that health websites could not meet all the HONcode criteria [48, 49, 67].

The website's content should have a date of the last update and the source of information. In addition, all advertisements should be identified and differentiated from information content. Nevertheless, the "attribution" and "advertising policy" are the least concerned HONcode criteria by the websites ranked by both Alexa and eBizMBA ranking systems in which the websites ranked by Alexa met these criteria less than eBizMBA ranked ones. As mentioned earlier, millions of individuals access the internet for health information. As a result, unreferenced or outdated information can severely impact patient health and healthcare systems.

All websites adhered to the JAMA principles for "disclosure". While the information should include references to support the medical information content to be, considered accurate health



information, only 73.33% of the ranked websites satisfied the principles for “attribution”, as stated in the JAMA guideline. The results are consistent with the findings of other health-related topics such as the study on Lingual Orthodontics [40], osteoporosis [62], and low-risk thyroid cancer [70].

When it comes to the readability of the 30 most visited health websites according to eBizMBA and Alexa analytics, the findings revealed that the readability of highly ranked health websites is higher than the recommended readability level for the general public [71, 72] and is difficult to understand by them. This may make it more difficult for users with a lower level of knowledge and literacy to understand and process the content. Some previous studies also rated the readability of online health information on Ankyloglossia [73], posttraumatic stress disorder [74], syndactyly release [75], and molar incisor hypo-mineralization [76] as difficult. It should be noted that websites that are more readable but lack credibility, pose a threat to readers because people usually tend to seek websites that are simple to understand.

This study had some limitations. First, it was only conducted on highly ranked websites by Alexa and eBizMBA; therefore, the different results might be obtained for websites graded by other ranking systems. Additionally, websites are being regularly developed and updated; therefore, the present results might have been affected.

## CONCLUSION

The current study assessed the credibility and readability of the world's 30 highly ranked health websites based on the report of Alexa and eBizMBA analytics. As mentioned in the previous section, numerous studies have assessed the credibility and readability of health websites in various health fields. However, the current study was not limited to a specific health topic but looked at and evaluated the most visited health websites worldwide. Some of the

websites had deficiencies according to the HONcode and JAMA criteria, and the average readability of the websites did not meet the gold standard. Despite the increasing use of the internet for medical information, these resources' poor quality and readability remain a barrier to patient understanding of medical information. The results of this study show that website credibility alone is insufficient. Thus, it is recommended that website ranking systems also include readability criteria to introduce users the most understandable and trustable highly ranked websites. In addition, healthcare leaders are recommended to implement health literacy programs for community members.

## AUTHOR'S CONTRIBUTION

SV: set up the concept and methods and was a major contributor in writing the manuscript; SR: analyzed and interpreted the data as well as contributed in writing the manuscript; HN and HM: gathered the data. All authors read and approved the final version of the manuscript.

## CONFLICTS OF INTEREST

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

## FINANCIAL DISCLOSURE

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## ETHICS APPROVAL

This research includes no human subjects and has been approved by the ethics committee of Shahid Beheshti University of Medical Sciences (code: IR.SBMU.RETECH.REC.1400.005).

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