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## Retrospective Study

# Assessing the readability of online information about jones fracture

Khaled Farid Khaled Al-Kharouf, Faisal Idrees Khan, Greg AJ Robertson

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## Abstract

### BACKGROUND

Hand in hand with technological advancements, treatment modalities continue to grow. With the turn of the century, the internet has become the number one source of information for almost every topic. Thus, many patients look toward the internet as their primary source of information to learn about their respective medical conditions. The American Medical Association and National Institute of Health strongly recommend that online medical information be written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level to aid comprehension by patients of all literacy backgrounds.

### AIM

To assess the readability of online information regarding Jones fracture. Our hypothesis is that the reading level of medical information published on websites far exceeds the recommended reading level of 6<sup>th</sup>-8<sup>th</sup> grade as proposed by the American Medical Association and National Institute of Health. The result of this study can help us formulate improved recommendations for publishing more comprehensible material and, thus, eventually improve patient compliance and clinical outcomes.

### METHODS

The exact phrase "Jones fracture" was queried on the three most common search engines, Google, Yahoo!, and Bing, on December 28, 2022. As of December 2022, Google held 84%, Bing held 9%, and Yahoo! held 2% of the worldwide search engine market share. Web pages uniform resource locator from the first three pages of search results were recorded from each search engine. These web pages were classified according to academic, physician-sponsored, governmental and non-government organizations (NGO), commercial, and unspecified as per

formally defined categories. Websites associated with an educational institution or medical organization were classified as academic. Websites with products for sale, corporate sponsorship, or advertisements were classified as commercial. Governmental websites or NGOs comprised those that received government subsidies or grants. Webpages that were independently owned by physicians or physician groups were respectively classed as physician sponsored. The remainder of websites that did not fall under the above categories were classified as unspecified.

## RESULTS

A total of 93 websites were analyzed for reading assessment. A whopping 44% of websites were commercial, followed by 22% of physician-sponsored websites. Third place belonged to non-government organization websites holding a 15% share. The academic website held a meager 9% portion, while unspecified sites were 3%. The table illustrates mean readability scores, along with average cumulative grade level. The average grade level was  $10.95 \pm 2.28$  for all websites, with a range of 6.18 to 18.90. Since *P* values were more than 0.05, there was not a significant statistical difference between the first page results and the results of all pages. Thus, we can rationalize that readability scores are consistent throughout all pages of a website.

## CONCLUSION

Hand in hand with technological advancements, treatment modalities continue to grow. With the turn of the century, the internet has become the number one source of information for almost every topic. Thus, many patients look towards the internet as the primary source of information to learn about their respective medical conditions. Our study demonstrates that current online medical information regarding Jones fracture is written at an extraordinarily high-grade level, with an average grade level of all websites at 10.95, nearly an 10<sup>th</sup>-grade educational level. The American Medical Association and National Institute of Health strongly recommend that online medical information should be written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level to aid comprehension by patients of all literacy backgrounds. On the contrary, most of the medical information evaluated was at an 10<sup>th</sup>-grade level, which far exceeds recommendations by AMA and NIH. This is particularly relevant because readability scores are directly proportional to the level of comprehension attained by readers, thus directly impacting patient outcomes. In conclusion, we suggest and encourage that all online reading materials should be re-written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level in a public service effort to increase compliance with treatment goals and raise awareness of preventive measures.

**Key Words:** Jones fracture; Jones fracture treatment; Jones fracture management; Jones fracture prevention; Jones fracture types; Jones fracture location

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**Core Tip:** With technological advancements, many patients look toward the internet as their primary source of information to learn about their respective medical conditions. The American Medical Association and National Institute of Health strongly recommend that online medical information be written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level to aid comprehension by patients of all literacy backgrounds. Readability measures how easy a piece of text is to read. This, in turn, affects how much information people can understand and retain. Our study aims to assess the readability of online information regarding Jones fracture. A total of 93 websites were analyzed for reading assessment. The overall mean average grade level of all websites in the study was  $10.95230 \pm 2.27862$ , corresponding to a 10<sup>th</sup>-grade reading level. In Conclusion, most of the medical information evaluated was at an 11<sup>th</sup>-grade level, far exceeding AMA and NIH recommendations.

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## INTRODUCTION

Sir Robert Jones originally described the Jones fracture in 1902 as a self-named fracture occurring within 3/4<sup>th</sup> of an inch from the base of the 5<sup>th</sup> metatarsal. Generally, the Jones fracture is defined as all fractures of the proximal 5<sup>th</sup> metatarsal distal to the tuberosity within 1.5 cm of this area[1]. Interestingly, the most common fracture of the foot is the Jones fracture, *i.e.*, fracture of the 5<sup>th</sup> metatarsal. Many classification systems exist describing the Jones fracture; however, the most widely used is the anatomical classification, dividing the proximal part of the 5<sup>th</sup> metatarsal into three zones[2].

**Table 1 Unpaired t-test for overall pages vs first page of websites**

Readability metric	Overall mean $\pm$ SD (range)	First page mean $\pm$ SD (range)	Percentage mean difference	P value
Flesch reading ease	55.3970 $\pm$ 12.7618 (23.2-86.1)	55.3290 $\pm$ 15.9812 (9.9-87.4)	2.32	0.553
Flesch-kincaid	10.1450 $\pm$ 2.7082 (5.0-20.1)	10.3840 $\pm$ 3.2056 (4.9-18.9)	0.47	0.915
Gunning fog	12.7830 $\pm$ 2.8099 (8.2-23.5)	12.4210 $\pm$ 3.1772 (7.6-20.7)	3.86	0.287
SMOG	9.3530 $\pm$ 1.9114 (5.6-15.8)	9.3000 $\pm$ 2.3224 (5.1-16.3)	2.27	0.523
Coleman-liau index	12.2460 $\pm$ 1.4778 (7.5-16.1)	11.9970 $\pm$ 2.2096 (8-19)	4.64	0.41
Automated readability	10.2340 $\pm$ 3.0205 (4.6-22.0)	10.5680 $\pm$ 3.6182 (3.8-19.2)	1.05	0.824
Average grade level	10.95230 $\pm$ 2.27862 (6.18-18.88)	10.93420 $\pm$ 2.73413 (6.22-18.48)	0.09	0.888

Zone 1 is the most proximal area, comprising the 5<sup>th</sup> metatarsal tuberosity and the metatarsocuboid joint. Injuries in Zone 1 are usually avulsion fractures, which are non-operatively managed to result in adequate clinical outcomes. Zone 2 consists of an area bordering the 4<sup>th</sup> and 5<sup>th</sup> intermetatarsal junction, stretching to the metaphyseal-diaphyseal junction and distal to Zone 1. A fracture in Zone 2 is classified as an actual Jones fracture. Finally, we have Zone 3, which contains the proximal 1.5 cm of the metatarsal diaphysis. Fractures in Zone 2 and Zone 3 are known to have high non-union rates with non-operative management, hence, promoting operative management as the preferred treatment[2].

With the turn of the century, the internet has become a valuable source of medical information for patients[3]. As per the 2022 Health Information National Trends Survey, approximately 74.7% of people initially browsed the internet to gain insight into their medical problems[4]. With increased online dissemination of medical information, the public has turned to the internet as their first source of information regarding medical illnesses. In fact, online resources have been shown to increase compliance with treatment goals and self-governed lifestyle changes[5].

Readability is the measure of how easy a piece of text is to read[6]. This, in turn, affects how much information people are able to understand and retain. Given that health literacy actively corresponds to positive patient outcomes, the readability of a text comes into play in how effectively a piece of information can be comprehended by patients[7]. The American Medical Association and the National Institute of Health recommend that patient education materials should be written between a 6<sup>th</sup> and 8<sup>th</sup>-grade level[8,9].

Our study aims to assess the readability of online information regarding Jones fracture. Our hypothesis is that the reading level of medical information published on websites far exceeds the recommended reading level of 6<sup>th</sup>-8<sup>th</sup> grade as proposed by the American Medical Association and National Institute of Health. The result of this study can help us formulate improved recommendations for publishing more comprehensible material and, thus, eventually improve patient compliance and clinical outcomes.

## MATERIALS AND METHODS

The exact phrase “Jones fracture” was queried on the three most common search engines, Google, Yahoo!, and Bing, on December 28, 2022. As of December 2022, Google held 84%, Bing held 9%, and Yahoo! held 2% of the worldwide search engine market share[10]. Web pages uniform resource locator (URLs) from the first three pages of search results were recorded from each search engine. These web pages were classified according to academic, physician-sponsored, governmental and non-governmental organizations (NGO), commercial, and unspecified as per formally defined categories[11]. Websites associated with an educational institution or medical organization were classified as academic. Websites with products for sale, corporate sponsorship, or advertisements were classified as commercial. Governmental websites or NGOs comprised those that received government subsidies or grants. Webpages that were independently owned by physicians or physician groups were respectively classed as physician sponsored. The remainder of websites that did not fall under the above categories were classified as unspecified[12-14] (Tables 1-3).

## RESULTS

A total of 101 website results were obtained, 49 from Google, 28 from Yahoo!, and 24 from Bing. Only eight websites were excluded, making a total of 93 pages manually analyzed (49 from Google, 21 from Yahoo!, and 23 from Bing; Figures 1 and 2). Exclusions were made due to duplication results. All the text from the images was included as part of the analysis. On pages where there was information about multiple subjects, only information relevant to Jones fracture was selected for analysis.



**Table 2 Percentage of websites and their grade level**

Classification	n	Percentage	Average grade level	St. Dev.	Maximum	Minimum
Academic	8	0.0860	11.36	± 3.33	18.88	8.54
Physician sponsored	21	0.2258	10.93	± 1.71	13.42	8.74
Governmental & NGO	21	0.2258	11.51	± 2.56	15.68	6.18
Commercial	40	0.4301	10.84	± 2.06	18.02	6.46
Unspecified	3	0.0323	7.61	± 1.24	8.32	6.18

NGO: Non-government organizations.

**Table 3 Unpaired t-test for government non-government organizations vs academic websites**

Readability metric	Government & NGO mean ± SD (range)	Academic mean ± SD (range)	Percentage mean difference	P value
Flesch reading ease	49.0330 ± 17.4883 (28.0-86.1)	53.5880 ± 14.3224 (23.2-66.6)	4.438	0.276
Flesch-Kincaid	10.7860 ± 2.9066 (5.0-15.6)	10.825 ± 4.083 (7.5-20.1)	0.362	0.554
Gunning fog	13.529 ± 2.869 (8.2-18.5)	13.1500 ± 4.5056 (9.6-23.5)	2.838	0.475
SMOG	9.8860 ± 2.1763 (5.6-13.4)	9.7880 ± 2.8478 (7.2-15.8)	0.998	0.453
Coleman-liau index	13.1670 ± 2.2265 (7.5-16.1)	12.0500 ± 0.7051 (11.2-13.0)	8.857	0.086
Automated readability	10.200 ± 2.8660 (4.6-16.0)	11.0000 ± 4.7413 (7.2-22.0)	7.547	0.290
Average grade level	11.51330 ± 2.55634 (6.18-15.68)	11.36250 ± 3.33421 (8.54-18.88)	1.319	0.665
Complex words	130.81 ± 117.662 (44-459)	122.380 ± 51.578 (70-210)	6.663	0.304
Percentage of complex words	0.1746810 ± 0.0552751 (0.0538-0.2356)	0.1414500 ± 0.0334975 (0.1063-0.1860)	21.024	0.187
Average words per sentence	16.90710 ± 3.23038 (14.03-25.71)	20.32130 ± 8.64815 (14.12-40.74)	18.341	0.090
Average syllables per word	1.67520 ± 0.19457 (1.21-1.85)	1.56750 ± 0.07459 (1.49-1.68)	6.645	0.041

NGO: Non-government organizations.

## DISCUSSION

With advances in technology, operative and conservative management options for Jones continue to grow. Vast amounts of information are available on the internet. In fact, in today's age, patients tend to utilize the internet as their primary source of information before actually seeing a medical practitioner. Therefore, it is of utmost significance how medical information is disseminated to patients.

Our study aimed to assess the readability of online information regarding Jones fracture. A vast majority, 77%, of websites were written above an eighth-grade level, far surpassing recommendations set by AMA and NIH[15-17]. The overall mean average grade level of all websites in the study was  $10.9523 \pm 2.27862$ , corresponding to a 10<sup>th</sup>-grade reading level. Strikingly, governmental and NGO websites were found to have the highest average grade level of  $11.51 \pm 2.56$ , representing an 11<sup>th</sup>-grade level of comprehension. Even though previous studies[18] have shown Academic websites to have the high readability score, in our case, academic websites ranked 2<sup>nd</sup> with an average grade level of  $11.36 \pm 3.33$ , which was still an eleventh-grade reading level. Considering these results, full comprehension of online medical information would require the completion of at least a secondary education.

## CONCLUSION

Hand in hand with technological advancements, treatment modalities continue to grow. With the turn of the century, the internet has become the number one source of information for almost every topic. Thus, many patients look towards the internet as the primary source of information to learn about their respective medical conditions. Our study demonstrates that current online medical information regarding Jones fracture is written at an ex-traordinarily high-grade level, with an average grade level of all websites at 10.95, nearly an 10<sup>th</sup>-grade educational level. The American Medical Association and National Institute of Health strongly recommend that online medical information should be written at the 6<sup>th</sup> to 8<sup>th</sup>-



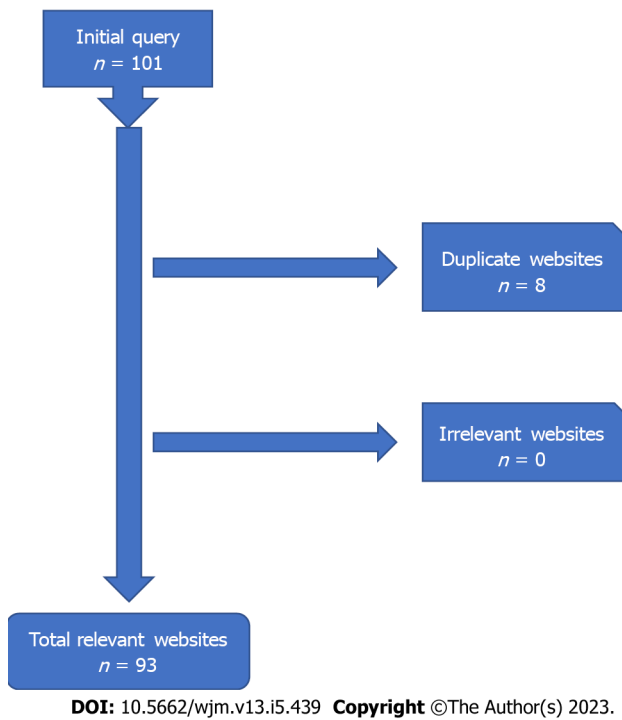


Figure 1 Flow diagram of inclusion and exclusion criteria.

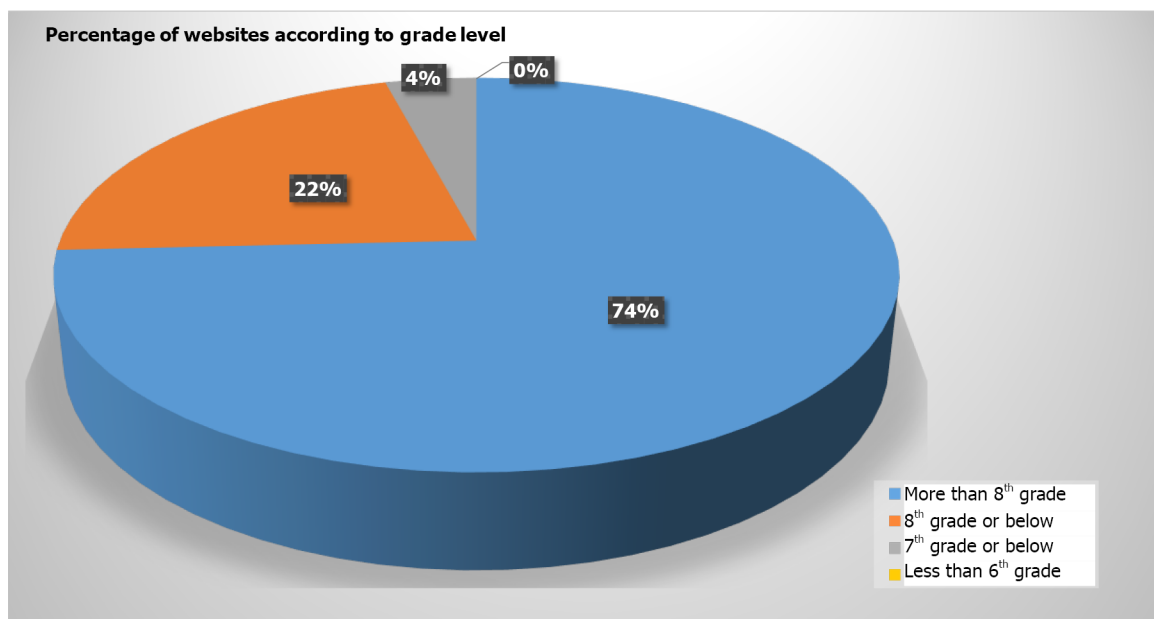


Figure 2 Percentage of websites and their grade level.

grade level to aid comprehension by patients of all literacy backgrounds. On the contrary, most of the medical information evaluated was at an 10<sup>th</sup>-grade level, which far exceeds recommendations by AMA and NIH. This is particularly relevant because readability scores are directly proportional to the level of comprehension attained by readers, thus directly impacting patient outcomes. In conclusion, we suggest and encourage that all online reading materials should be re-written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level in a public service effort to increase compliance with treatment goals and raise awareness of preventive measures.

## ARTICLE HIGHLIGHTS

### Research background

Hand in hand with technological advancements, treatment modalities continue to grow. With the turn of the century, the internet has become the number one source of information for almost every topic. Thus, many patients look toward the internet as their primary source of information to learn about their respective medical conditions. The American Medical Association and National Institute of Health strongly recommend that online medical information be written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level to aid comprehension by patients of all literacy backgrounds.

### Research motivation

With advances in technology, operative and conservative management options for Jones continue to grow. Vast amounts of information are available on the internet. In fact, in today's age, patients tend to utilize the internet as their primary source of information before actually seeing a medical practitioner. Therefore, it is of utmost significance how medical information is disseminated to patients.

### Research objectives

To assess the readability of online information regarding Jones fracture. Our hypothesis is that the reading level of medical information published on websites far exceeds the recommended reading level of 6<sup>th</sup>-8<sup>th</sup> grade as proposed by the American Medical Association and National Institute of Health. The result of this study can help us formulate improved recommendations for publishing more comprehensible material and, thus, eventually improve patient compliance and clinical outcomes.

### Research methods

The exact phrase "Jones fracture" was queried on the three most common search engines, Google, Yahoo!, and Bing, on December 28, 2022. As of December 2022, Google held 84%, Bing held 9%, and Yahoo! held 2% of the worldwide search engine market share. Web pages uniform resource locator from the first three pages of search results were recorded from each search engine. These web pages were classified according to academic, physician-sponsored, governmental and non-governmental organizations (NGO), commercial, and unspecified as per formally defined categories. Websites associated with an educational institution or medical organization were classified as academic. Websites with products for sale, corporate sponsorship, or advertisements were classified as commercial. Governmental websites or NGOs comprised those that received government subsidies or grants. Webpages that were independently owned by physicians or physician groups were respectively classed as physician sponsored. The remainder of websites that did not fall under the above categories were classified as unspecified.

### Research results

A total of 101 website results were obtained, 49 from Google, 28 from Yahoo!, and 24 from Bing. Only eight websites were excluded, making a total of 93 pages manually analyzed (49 from Google, 21 from Yahoo!, and 23 from Bing). Exclusions were made due to duplication results. All the text from the images was included as part of the analysis. On pages where there was information about multiple subjects, only information relevant to Jones fracture was selected for analysis.

### Research conclusions

Hand in hand with technological advancements, treatment modalities continue to grow. With the turn of the century, the internet has become the number one source of information for almost every topic. Thus, many patients look towards the internet as the primary source of information to learn about their respective medical conditions. Our study demonstrates that current online medical information regarding Jones fracture is written at an extraordinarily high-grade level, with an average grade level of all websites at 10.95, nearly an 10<sup>th</sup>-grade educational level. The American Medical Association and National Institute of Health strongly recommend that online medical information should be written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level to aid comprehension by patients of all literacy backgrounds. On the contrary, most of the medical information evaluated was at an 10<sup>th</sup>-grade level, which far exceeds recommendations by AMA and NIH. This is particularly relevant because readability scores are directly proportional to the level of comprehension attained by readers, thus directly impacting patient outcomes. In conclusion, we suggest and encourage that all online reading materials should be re-written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level in a public service effort to increase compliance with treatment goals and raise awareness of preventive measures.

### Research perspectives

We suggest and encourage that all online reading materials should be re-written at the 6<sup>th</sup> to 8<sup>th</sup>-grade level in a public service effort to increase compliance with treatment goals and raise awareness of preventive measures.

## FOOTNOTES

**Author contributions:** Al-Kharouf KFK conceived the methodology for the manuscript, performed the literature search and analysis for the study, and wrote the manuscript; Khan FI performed the literature search and analysis for the study and wrote the manuscript; Robertson GA advised on the study, and reviewed and edited the manuscript.

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**Data sharing statement:** Technical appendix and datasets are available from the corresponding author at [kfk990@gmail.com](mailto:kfk990@gmail.com).

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