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Evaluation of internet information about pneumothorax

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Abstract

To assess reliability and readability of online internet information on pneumothorax. The terms "pneumothorax", "tension pneumothorax", "collapsed lung" and, "chest tube" were searched in a search engine in 3 different geographic location via VPN. 507 unsuitable websites were excluded from 600 websites obtained as a result of scanning. 93 websites were included in the analysis. Reliability of information was evaluated using the Journal of the American Medical Association (JAMA) benchmark criteria, National Library of Medicine (NLM) trustworthy score and the Health on the Net code (HONcode) seal accreditation. Readability was evaluated using the Flesh-Kincaid reading scores and other readability formulas. Of the 93 websites, 45 (48.3%) has HONcode certified. The mean JAMA benchmarks score was 2.04 (±1.01) and National library of medicine trustworthy score was 6.38 (±2.25). The mean Flesh-Kincaid Ease Score of the articles was 47.99 (±17.80). All articles were of at least a high school sophomore grade level (15-16 years old) according to Flesh-Kincaid Grade Level, SMOG, Gunning Fog, Coleman-Liau, and Automated Readability Index. The reliability scores of most websites were found to be considerable low and readability was poor. As more and more people access the internet for health-related information, the need for search engines that only contain reliable health-related content is increasing.

Keywords: Pneumothorax, lung, chest

Introduction

In years past, health care professionals were often the primary source of information for patients with regards to diseases and therapies and may have provided written materials such as handouts or brochures. In the modern era, patients now turn to the most convenient and largest source of information worldwide, the Internet [1]. A life without internet is unimaginable today. internet connects millions of people worldwide and it is the main source of the information. The global internet usage is 59 percent and Northern Europe ranks first with 95 percent [2]. Also, an investigation conducted by Google® has demonstrated that 86% of physicians use the internet to collect medical or treatment information [3].

There are many reports in the literature about the reliability, accuracy, and quality of information on websites. Some of these studies are about diabetes [4)], cauda equina syndrome [5], otitis media [6] cancers [7-13], and surgical techniques [14-18]. Even in areas related to thoracic surgery and pulmonology, similar studies on idiopathic pulmonary fibrosis [19], chest pain symptoms [20], and covid-19 disease [21] have been conducted. Although pneumothorax is common in the population and has recently been associated with Covid-19 disease [22-25], such studies on pneumothorax are lacking. Our aim is to evaluate the reliability and readability of internet information on pneumothorax, which is one of the main topics in thoracic surgery and has not changed in terms of diagnosis and treatment for many years. To the best of our knowledge, this is the first report to assess the reliability and readability of internet information on pneumothorax.

Materials and Methods

Search strategy

According to Statista® report [26], Google® is the most used browser with 86.14% market share in 2020, so we chose Google® as a search engine. Also, Google Trends® provides valuable information on frequently searched terms. Thanks to Google Trends®, we selected the most 4 searched English queries about pneumothorax: Pneumothorax, tension pneumothorax, collapsed lung, and chest tube. We cleared all history, caches, and cookies

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before searching and used the anonymous private browsing feature in Google Chrome®. To reach more general results and eliminate geographic differences, we searched in English from 3 different locations (Canada, United States, and the United Kingdom) with a virtual private network software (Nord VPN®). All searches were performed on the same day on December 6. 2020.

Inclusion and exclusion criteria

Although people click less on the pages after the first page, we included the first 5 pages (50 results) for each query and location to get more accurate data. Duplicate, inaccessible, restricted, inappropriate, and uninformative URLs and scientific publications were excluded. Using an initial dataset of 600 websites, we excluded duplicates, dead links and restricted URLs (n=369), uninformative pages like audio, video, and image pages (n=11), dictionary and indexing pages (n=9), special procedure or policy documents (n=10), unrelated subjects (n=15). Since we used the "chest tube" term to get pneumothorax related results, websites containing only chest tube procedure without pneumothorax (n=36) were excluded. After 75% of the results (n=450) were excluded, 150 websites were eligible for further evaluation. Fifty seven (38% of total URLs) peer review journal article and book sections were not further evaluated because of their high reliability and quality. Therefore, we conducted our study on 93 informative websites that are not known easily whether they are reliable or not.

After the exclusion process, all websites were evaluated by two independent reviewers. Disagreements over categories or yes/no questions dissolved by consensus. In scoring, a single score was obtained by taking the average of the scores given by two referees.

Reliability

The HON Foundation (Health On the Net) is an organization founded in 1995, that gives HONcode certification to high quality and reliable websites. The HONcode consists of 8 procedural principles (authorization, complementarity, confidentiality, attribution, justification, contact information, financial disclosure, and advertising policy) that must be followed to obtain a certification [27]. We used a free plugin provided by HON to detect whether the website is HONcode certified.

Another parameter used to evaluate the reliability of information is the journal of the American Medical Association (JAMA) benchmarks. The JAMA benchmarks include website authorship, attribution, description, and currency, which scored from 0 to 4 points. Higher scores indicate higher reliability [28].

National Library of Medicine (NLM) has some criteria (accuracy, authority, bias/objectivity, currency/timeline, and coverage) for evaluating reliability. The total NLM score ranges from 0 to 10 like a similar study on stroke [29], was obtained by summing the scores from each item which was rated on a 3-point scale, where 0: no, 1: partially, and 2: yes.

Readability

Readability is the ease with which a reader can understand a written text. Various readability tests were formulated by counting words, sentences and syllables.

We analyze five readability formulas for this study: Flesch Reading Ease (FRE), Flesch-Kincaid Grade Level (FKGL), Gunning-Fog Index (GFI), Simple Measure of Gobbledygook (SMOG) Index, Coleman-Liau Index (CLI), and Automated Readability Index (ARI) by an automated tool provided by webfx.com [30].

Flesch Reading Ease, Flesch-Kincaid Grade Level and Gunning-Fog Index uses the average sentence length and syllables for establish a score for readability. The SMOG Index evaluates ten sentences at the beginning, middle and end of a text. It is calculated by counting words containing three or more syllables. Unlike other formulas, CLI does not take into account the number of syllables and takes into account the average of letters and sentences [31-33]. Like other popular readability formulas, the Automated Readability Index (ARI) formula outputs a number that approximates the grade level needed to comprehend the text.

The FRE score is calculated over 100 points and 0-30 points means the higher difficulty and 90-100 points very easy. Other formulas determine the level of education required to understand the text. Scores lower than 6 are 11-12 ages indicate their 6th grade reading level, and 10 points indicate their high school sophomore (15-16 years) level [31].

Statistical analysis

Microsoft Excel 2020 for Mac® software was used for all statistical analysis. Descriptive statistics were performed. Data were normally distributed and described using the number (n), percentage (%), mean, and standard deviation.

Results

507 unsuitable websites were excluded from 600 websites obtained as a result of scanning. 93 websites were included in the analysis [Figure 1].

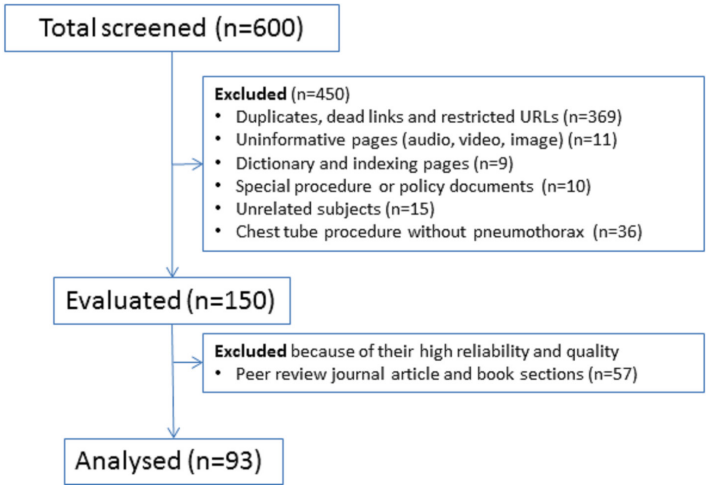

Figure 1. Flow diagram of the study

HONcode certification seal was identified in 45 (48.3%) of 93 websites. For the JAMA benchmarks, 45 (48.3%) of the 93 websites included authorship, 31 websites (33.3%) included attribution and references, 41 websites (44.1%) posted the date of published materials and 73 websites (78.5%) included disclosures. Four websites did not meet any criteria and five websites get the highest rating. The mean benchmark score of the websites was 2.04

(±1.01). The results of JAMA benchmarks are shown in [Table 1].

Table 1. JAMA Benchmarks

	Number of websites (n)	Percentage (%)
Authorship	45	48.4
Attribution	31	33.3
Currency	41	44.1
Disclosure	73	78.5

The mean National Library of Medicine trustworthy score was 6.38 (±2.25). The National Library of Medicine trustworthy scores are shown in [Table 2].

Table 2. Summary of National Library of Medicine Trustworthy scores

	Mean	Standard deviation
Accuracy	1.18	0.67
Authority	1.04	0.97
Bias / Objectivity	1.86	0.43
Currency / Timeline	0.98	0.96
Coverage	1.31	0.77
Overall	6.38	2.25

The mean number of words was 1343.11 (±1101.37), sentences was 201.53 (±154.75) and the mean percentage of complex words were 21.08 (±7.11). The mean reading level of the articles was equivalent to a high school sophomore (15 to 16 years) (10.27 ± 2.68). The minimum grade. level was 6.60, whereas the maximum grade level was 18.80. According to the mean FRE score, the articles are considered difficult to read (47.99 ± 17.80) and equivalent to a collage level. In the mean scores of the readability formulas are presented [Table 3].

Table 3. The mean scores of the readability formulas

	Mean	Standard deviation
Flesh-Kincaid Reading Ease (FRE)	47.99	17.80
Flesh-Kincaid Grade Level (FKGL)	10.27	2.68
Gunning-Fog Index (GFI)	11.82	2.77
Simple Measure of Gobbledygook (SMOG)	10.01	2.05
Coleman-Liau Index (CLI)	15.00	3.02
Automated Readability Index (ARI)	10.32	3.00

Discussion

According to our results, more than half of the websites are certified (48.3%). In many studies that evaluating the HONcode certification, lower results are seen (15, 16, 19, 21, 32, 33). Only one study on otitis media (6) had similar results about otitis media has %45.7 HONcode certified. However, the study has been done with only 35 websites.

There were no studies with higher HONcode certification score according to our knowledge. The aim of HONcode is to create a pool of quality health information available to the general public. However, HONcode certification requires the website administrator to submit a request for HON inspection. Interest in HON may be rising.

In our study the mean JAMA score was 2.04 (±1.01). In other studies, the mean JAMA score was low, as 1.6 (±1.1) in sleeve gastrectomy, 1.7 (±0.97) in spinal surgery and 1.9 (±1.3) in cauda equina syndrome. These results may be related to the methodology and exclusion criteria of the study. Most of websites (n: 73, 78.5 %) disclosed financial and or sponsored interests. Disclosure parameter is similarly high in Guo's [17], Olkun's [34], and Joury's [6] study (100%, 93% and 91.4% respectively). According to our study design high-quality peer- review articles had been excluded. In our opinion, if we included academic articles, we would reach similar results. Six websites have not met any criteria in JAMA and only 5 websites have a maximum score of 4 points. Therefore, search engines must make an effort to produce more reliable results.

NLM was the least used parameter in studies. Only one study [35] reported the NLM criteria but not comparable to ours.

The overall mean readability scores in Flesch-Kincaid Grade Level (FKGL), Gunning-Fog Index (GFI), Simple Measure of Gobbledygook (SMOG) Index, Coleman-Liau Index (CLI), and Automated Readability Index (ARI) were over 10 points indicates that the websites were difficult to read. Also, CLI was the worst with over 15 points (15.0 ±3.02).

The mean FRE score in our study was 47.99 ±17.80 and the mean Flesh-Kincaid Grade Level was 10.27 (±2.68). The grade level score was much higher than the 6th grade level recommended by the American Medical Association (AMA) and the National Institutes of Health (NIH) [36]. In similar studies on meningiomas, swallowing disorders, lumbar fusion, Covid-19 and pneumonia the mean scores for Flesh-Kincaid Grade Level were high (11.2±2.3, 11.8 ±3.4, 11.9 ±3.2, 12.04 ±2.67, respectively). In addition, a systematic review analyzing 157 readability studies found that the readability level of online health articles is inappropriate for general public use [37].

The readability and jargon of the website depends on whether it is designed for patients or for healthcare professionals. Public websites for the patients should be clear, simpler and easier to understand. Medical terminology makes it difficult to read health sites and sometimes patients can access a professional health site and find it difficult to understand. An informative note or seal may be useful to identify such websites whether it is prepared "for patients" or "for professionals" may help.

Limitations

Despite the success demonstrated, a significant limitation of our study is that, most of search engines list search results dynamically. Google® uses machine learning techniques and geographic data to generate more personalized search results. To overcome this situation, we cleared our caches, search history and cookies and performed our search from multiple geographic locations via VPN. Although some websites may not contain any information or appropriate information, they can be ranked higher in search results by using search engine optimization (SEO) techniques. On the contrary, some reliable and high-quality websites may not appear in search results (especially top of list) due to the lack of SEO techniques.

Future insights

Google developed a beautiful search engine that broadly search for academic literature. Professionals can search reliabile and high-quality data like journal articles, thesis, books, abstracts, from academic publishers, professionals societes and universities. Our hope is that maybe one day Google or another company will develop a search engine that "only" scans reliable, accurate and high-quality health content for patients.

Conclusion

The reliability scores of most websites were found to be considerable low and readability was poor. Therefore, care should be taken when reading the information obtain from internet and the reliability of the website should be considered. Access to reliable, easy to understand and high-quality information on the internet will help patients for their decision and knowledge. Healthcare professionals should pay attention to the reliability and readability parameters in the articles they prepare for their websites. This approach will allow patients to access more accurate and more reliable information and even increase their compliance. As more and more people access the internet for health-related information, the need for search engines that only contain reliable health-related content is increasing.

Conflict of interests
The authors declare that they have no competing interests.

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