Original article

Quality of online information on breast cancer treatment options

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ABSTRACT

Offering breast cancer patients treatment choice has become a priority as the involvement of patients in the decision-making process is associated with improved physical and psychological outcomes. As the Internet is increasingly being used by patients as a source of medical information, it is important to evaluate the quality of information relating to breast cancer on the Internet. We analysed 200 websites returned by google.co.uk searching "breast cancer treatment options" in terms of their typology and treatment options described. These were related to standard measures of health information quality such as the JAMA score and the presence of quality certifications, as well as readability.

We found that health portals were of higher quality whilst commercial and professional websites were of poorer quality in terms of JAMA criteria. Overall, readability was higher than previously reported for other conditions, and Google ranked websites with better readability higher. Most websites discussed surgical and medical treatments. Few websites, with a large proportion being of commercial typology, discussed complementary and alternative medicine. Google ranked professional websites low whilst websites from non-profit organizations were promoted in the ranking.

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1. Introduction

The Internet is an important source of medical information for patients; 35% of the US population [1], and over 50% in the EU [2], searched for health information online. Earlier studies were concerned that patients could find low-quality information [3], and thus several assessment tools were developed to evaluate health information quality (HIQ), including the Journal of American Medical Association (JAMA) criteria [3] and the Health on the Net Foundation seal (HONcode) [4]. Ease of readability is another parameter evaluated in addition to trustworthiness [5—7].

Breast cancer is the commonest cancer among women. Treatment options include surgical, medical and complementary and alternative medicine (CAM) [8]. Mastectomy and breast conservation surgery with radiotherapy are the most common management options [9], and offering patients treatment choice has become a priority [10—12].

Sixty-three percent of cancer patients use the Internet for information, with a higher rate of use (73%) in breast cancer patients [13], mostly using search engines, primarily Google [14,15]. Cancer patients use the Internet to verify information received from their doctors and to develop questions to discuss with them, as well as to seek alternative treatments [13]. A 2014 study on breast cancer patients found that "improvement of knowledge obtained through personal research on the Internet, books and other media" is an independent predictor of an active role in the choice of therapy [16]. Early studies have warned that breast cancer patients may be basing their decisions on inaccurate or incomplete information [17—19]. As summarised in Table 1, several studies have analysed the HIQ of websites on breast cancer using different methods.

A study measuring the completeness of online information on breast cancer found that for some important topics the relevant clinical information had been mentioned only briefly [17]. A more recent study found that although government, charity and formal educational websites had very high accuracy, inaccurate information on breast cancer was prevalent on the Internet [20].

The aim of this study was to assess websites on breast cancer treatment options and to ascertain the visibility given by Google to websites discussing CAM. This is particularly important to investigate as online health information can have significant implications on the patient's decision-making regarding treatment options. The search query "breast cancer treatment options" is also very

Table 1
Literature on IQ of breast cancer and the assessment tools used.

Search query	No. of websites	HIQ tool	Readability	Content analysis	Ref.
Breast cancer symptoms, breast cancer care, breast cancer stage, breast cancer survival, breast cancer signs	289 English	JAMA	–		[20]
Breast cancer	29 Swedish	ECQC	–	Coverage, correctness	[19]
Breast cancer, childhood asthma, depression, obesity	18 English and 7 Spanish	–	Yes	Coverage, correctness	[17]
Breast cancer	184 English	JAMA, HONcode	–	Coverage	[18]
Cancer, breast cancer, breast cancer information	10 English	ECQC	–	Coverage, correctness	[21]
Breast cancer surgery, breast cancer treatment, mastectomy, lumpectomy	45 English	DISCERN			[22]
Breast reconstruction post mastectomy	71 English	HONcode, University of Michigan Consumer Health Website Evaluation Checklist	Yes		[23]

sensitive to news reports, as shown by a spike in 2013 following Angelina Jolie's mastectomy announcement [24].

Google was used as it is the primary search engine for over 80% of users [25]. The intrinsic dimensions of HIQ were assessed using the JAMA criteria, HONcode and ease of readability, in addition to basic content analysis on the specific type of treatment mentioned, whether medical, surgical or CAM. Because patients rarely browse beyond the first 10 websites returned by a Google search engine result page (SERP) [26], we also analysed how websites were ranked by Google.

2. Methods

2.1. Data collection

A search on 'breast cancer treatment options' was conducted in September 2016 on Google.co.uk. We chose these search words over other options because nowadays patients are given the choice to decide the type of surgery, whether mastectomy or lumpectomy, and this is described as treatment option. We therefore wanted to know what the patients would find when they were specifically seeking information online to help them make a choice.

Search history, cookies and caches were cleared to avoid the possible influence of prior browsing history. The first 200 URLs of the SERP were transferred onto a spreadsheet and visited. Sample size is based on our previous studies indicating that it is powered enough to detect differences in the composition of the SERP [27—30]. Inaccessible websites (requiring registration or subscriptions), duplicates, and those containing no information were then excluded. Fig. 1 summarises how the websites were analysed.

2.2. Analysis of websites

Websites were analysed according to the criteria below. In assessing websites, if a criterion was not visible on the initial webpage, the 3-click rule was used, where if a specific feature could not be found within three clicks, the website was given a score of 0 for that criterion [27].

1. Typology. Two investigators categorised all the websites into distinct typologies as described in Table 2 [27,28].

Interrater reliability (IRR) between the two investigators' classification was then calculated. There were 181 agreements (96%) between the two investigators, which was deemed 'very good' (Cohen's kappa coefficient, 0.95). The agreement varied between 86% for commercial websites and 100% for government and

scientific websites. Where there was a disagreement in the classification, the websites were revisited and a consensus was achieved through discussion.

2. JAMA score. The websites were evaluated for the following four features: authorship, attribution, disclosure and indication of date. A score of 1 was assigned for the presence of each of these criteria, therefore websites were scored from 0 to 4. JAMA scores were assigned independently by the two investigators and the scores compared to calculate the IRR. Of the 188 websites assessed, there were only seven disagreements (96% agreement). The strength of this IRR was also considered to be 'very good' (Cohen's kappa coefficient, 0.95). Disagreements were resolved by the investigators through a discussion and reaching a consensus.

3. HONcode certification. Websites were searched to determine whether a HONcode certification was displayed.

4. Readability. An online readability test tool was used [31]. The reading grade levels of all the websites were calculated using two different readability formulas, the Flesh-Kincaid (FK) and the Simple Measure of Gobbledygook (SMOG). While the FK grade considers the average sentence length and the average number of syllables per word [32], the SMOG formula takes also into account the number of polysyllabic words in 30 sentences [32]. A lower grade indicates a readability suitable for lower age groups, and therefore easier to read. Eight websites could not be investigated as they were not accessible to the readability software.

5. Treatment options. We noted the treatment options discussed (medical, surgical or CAM), and whether clinical trials were mentioned. Although 21 websites mentioned CAM, five were not counted as CAM because they maintained a negative stance on it.

Statistical analysis was performed using Graphpad Prism 7.0 (GraphPad Software, San Diego, USA); the statistical tests used are described in the text.

3. Results

3.1. Composition of the SERP and ranking by Google

Of the 188 URLs in the search, the most frequent typologies were professional (42%) and non-profit (17%) (Table 3).

In the top 10 results, Google gives greater visibility to non-profit and government websites. There are also significantly more non-profit websites in the total top 10 (70%) compared to the rest of the SERP (17%). Conversely, professional websites are significantly underrepresented in the top 10 websites returned.