The Quality of Web-based Information for Osteoarthritis: A Cross Sectional Study

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The Quality of Web-Based Osteoarthritis Information on the Internet: A Cross-Sectional Study

Background:

Osteoarthritis (OA) is a long-term condition that affects over 8.75 million people in the United Kingdom (UK). Approximately 43% of people in the UK search for health and medical information online. However, health information on the internet is of variable quality. Research into the quality of online OA information is dated and there is a need to evaluate the existing information.

Objectives:

To assess the quality of websites which provide educational information for patients with OA.

Design: Electronic cross-sectional survey.

Methods:

The search term “Osteoarthritis” was entered into the five popular UK based search engines in order to identify 50 unique websites. Websites were then appraised by two assessors using criteria developed from available literature and recent OA NICE guidelines. The appraisal considered both general website quality and OA specific content.

Results:

Most of the websites evaluated (34/50, 68%) scored more than half of the maximum available quality score (which was 59). The median total score was 41. For general website quality, the median score was 9 (range 3-16, out of 16) and for content specific to OA, the median was 31 (range 2-43, out of 43). Websites of higher quality were created more recently, disclosed sources of information, had external seals of approval and directed the reader onto other relevant websites.

Conclusions:

The internet is a potentially useful tool for educating and empowering healthcare consumers. The websites evaluated were generally of a ‘high’ standard; however, there was a wide variation in the quality of information.

Keywords: Osteoarthritis, Internet, Patient education, websites

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CONTRIBUTION OF THE PAPER

- The quality of the online OA information evaluated in this study is of a high standard, however, there is a wide variability in the quality that is available.
- Due to the variation in the quality of online OA information, internet users may find it difficult to consistently access information of a high quality.
- Higher quality websites tended to be created more recently, disclosed sources of information, had external seals of approval and directed the reader onto other relevant websites.

Introduction

Osteoarthritis (OA) is the most common form of arthritis, affecting approximately 15% of the population in the United Kingdom (UK) [1] and has been established as one of the leading causes of pain, functional disability and impaired quality of life worldwide [2]. The number of people affected by OA is expected to increase, with an ageing population and an ever increasing prevalence of obesity meaning more people are diagnosed with the disease every year [1]. In the UK alone over 8.75 million people are affected by the disease [3].

The range of treatments for OA varies from conventional modalities, including pharmacological and surgical interventions, to non-pharmacological interventions such as exercise, physical activity, education and self-management [4]. Healthcare providers and people diagnosed with OA are therefore faced with several management decisions. Key to facilitating a shared decision making process is effective patient education. Previous studies have shown that lack of knowledge of one's health can lead to depression, anxiety and poor coping strategies, while effective health education can help to reduce pain and disability; highlighting its importance as a vital component of self-management [5].

Healthcare professionals have traditionally relied upon printed sources of information to help aid patient education [6]. However, since the early 2000's there has been a dramatic increase in access to, and usage of the internet. In the UK alone, 38 million adults use the internet everyday [7], and 43% use it as a source of health and medical information [8]. Online health information can educate patients about their condition, support decision making, clarify unfamiliar medical terms and identify treatment options [9]. Its accessibility and convenience make it a potentially useful tool for managing long term conditions such as OA, as patients are often expected to manage their disease independently beyond the physical health care setting [10, 11].

However, the quality of internet based medical information is extremely variable [12, 13]. Unlike print media, there is a lack of editorial control of the internet as a communication system; meaning anyone, regardless of qualification or motive can place information online [4]. Issues with quality are exacerbated by the internet's continued growth as a communication system; new information appears faster than it can be appraised. Therefore, the greatest barrier to the internet reaching its

potential, as a key health related educational resource is not the quantity of information, but rather finding accurate, reliable and valid information [4].

To assist internet users distinguish between sites that provide health information, a wide range of organisations have developed methods to evaluate and assess the quality of websites [14]. Organisations such as Health on the Net (HoN) [15] and the DISCERN instrument [16] are some of the most commonly used forms of regulation for health and medical information. In total, as many as 273 unique evaluation tools have been described within the literature [18]. Yet, it is currently unclear if these tools can consistently and accurately identify quality information and there remains no consensus on a single best method of appraisal [14].

Previous research has investigated the quality of online OA information via several different methods including by use of the DISCERN instrument and a self-created appraisal tool [4, 6]. However, no previous research has appraised OA websites against clinical guidelines for the care and management of OA [19]. Additionally, previous research was carried out over a decade ago, and was not based within the UK [4, 6].

The primary objective of this study was to assess the quality of websites that a user might access in search of information about OA. The secondary objective was to identify any key characteristics that indicated quality information on the internet and to identify any significant correlations between these characteristics.

Methods

Website Identification:

A key-word search of the internet was performed in January 2015 and all websites identified by February 2015. The search term “Osteoarthritis” was entered into the five most popular search engines used within the UK (‘Google’, ‘Bing’, ‘Yahoo’, ‘Ask’, and ‘AOL’) [20]. The search term was chosen as previous research has also used comparatively broad search terms to duplicate the type of search a patient may make [4, 21].

A key word search of “Osteoarthritis” at the time of the study returned between 2.6 million to 14.4 million results, dependent upon the search engine used. However, previous studies have found that sites listed on the first search results page generate 92% of all traffic from an average search [22]. This indicated that individuals are significantly more likely to visit websites found in the first ten matches from search engines results [23]. It was therefore decided to identify 10 unique websites from each of the five search engines in order to achieve a reliable sample of websites in which patients would access in search of information about OA.

Following the initial search, a collective analysis involving all the researchers took place in which the websites were subjected to exclusion criteria, consisting of three phases in order to identify 50 unique websites (See Figure 1). Websites were initially excluded if they were duplicates of another site that had already been identified under a different search engine. Many of the search engines returned very similar web results on the phrase ‘Osteoarthritis’. This required the researchers to go as far as the sixth page in some cases in order to obtain unique websites. When websites were present in more than one of the search engine results a random programme

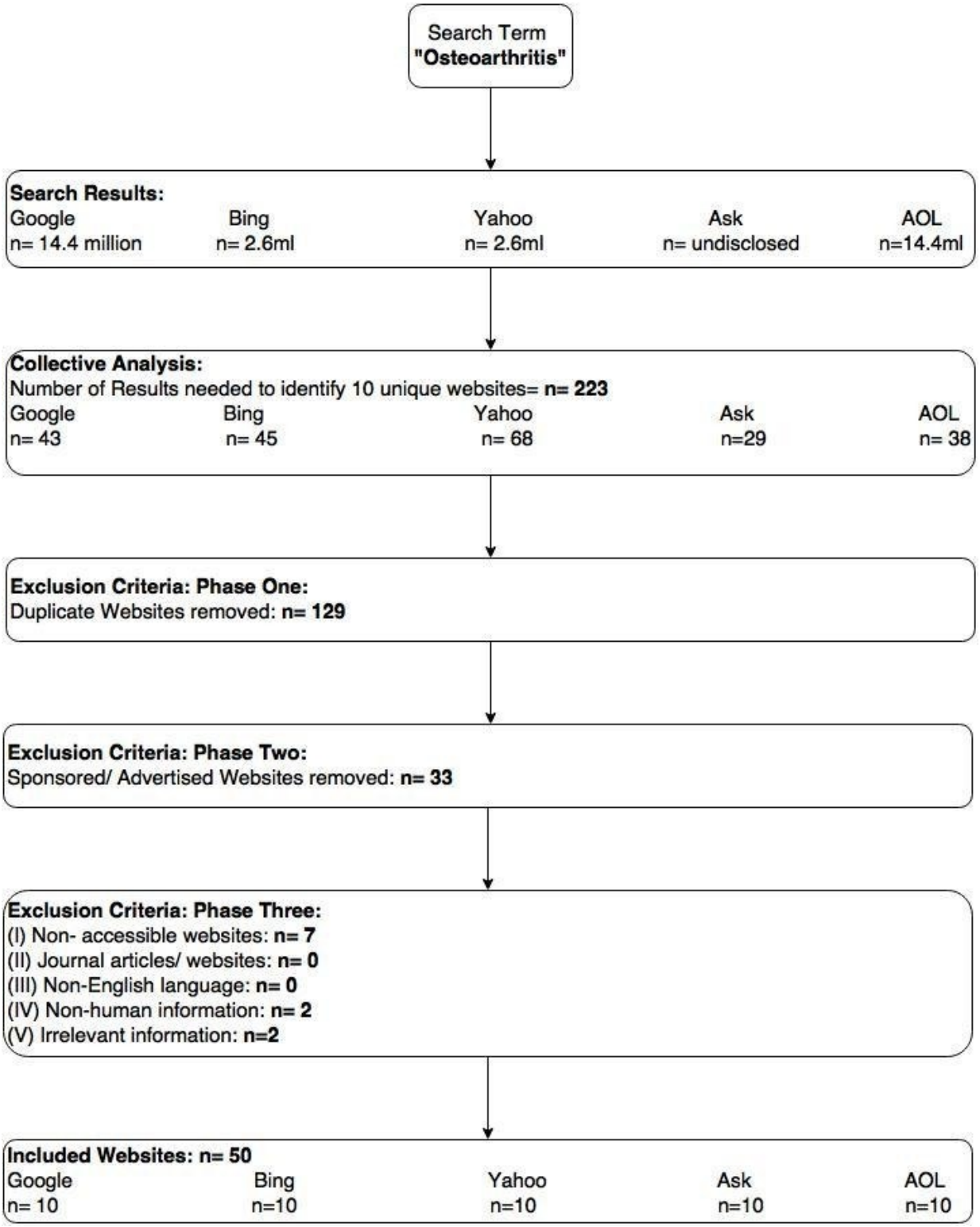
generator [24] was used to determine which search engine the website would be allocated to.

Once duplicate websites had been removed from the analysis, websites were also excluded if they were sponsored or were advertisements (websites that pay for a higher rank position within the top search results), as these are subject to change with each search and would not be relevant to the studies aims.

Following this process websites were additionally excluded if (i) users were denied direct access through password requirements or repeated server unavailability, (ii) they were journal articles or journal websites, (iii) they were not in the English language (iv) they provided information about OA in animals or (v) they contained information irrelevant to the study's aims.

This process was completed until 10 unique websites from each search engine were identified. Screenshots were taken of relevant websites and associated URL's were saved within a Microsoft Excel spreadsheet to avoid any potential changes that may have been made to the selected websites during the period of analysis.

138 **Figure 1: Website Search Strategy:**



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Assessment of Website Quality:

To accurately measure and assess the quality of information that is available to a 'typical' patient population, websites were appraised using the 'Osteoarthritis Quality Proforma' (OQP) which was developed by the research team (Appendix A). In total, it consisted of 18 criteria, which led to the calculation of three scores:

1) *General quality content (criteria 1 to 8)* with a maximum score of 16.
2) *Specific OA content (criteria 9 to 18)* with a maximum score of 43.
3) *Total score (sum of all criteria)* with a maximum score of 59.

General Quality Content:

The general quality criteria were developed based upon several research papers and reviews which have been published on the appraisal of online health and medical information [21, 25, 26]. These were used in conjunction with other widely used quality evaluation tools such as the JAMA benchmarks [27] and the DISCERN instrument [16]. Key criteria that were included within the proforma were disclosure of authorship (and credentials) and funding sources; currency and whether the website was certified by an external organisation such as HoN [15] or the Information Standard [17]. Additional criteria included whether a source of the websites information was provided on the website and whether the site referred the reader onto other useful sources.

Specific OA Content:

The criteria used to evaluate content specific to OA were framed around recent NICE guidelines for the care and management of OA [18]. Additionally, International and European guidelines [28, 29] and surrounding literature [30, 31] on the condition

were screened and changes made accordingly to ensure that a holistic and comprehensive overview of the disease had been incorporated into the criteria. A total of 10 sections were present within the OA criteria, including information about (i) anatomy and physiology, (ii) risk factors, (iii) symptoms, (iv) diagnosis, (v) holistic approach of the condition, (vi) self-management strategies, (vii) non-pharmalogical treatment, (viii) pharmalogical treatment, (ix) Consideration of surgery and (x) The follow up and review process of the condition.

Following an initial piloting stage to test the usability and application of the proforma, an Osteoarthritis Quality Proforma (OQP) Guidance Document was produced for assessors to use in conjunction with the OQP. This helped to assist in a more standardised and reproducible process of data collection. Following initial piloting, the OQP demonstrated consistency between assessors, therefore the decision was made for each website to be independently appraised by two researchers and average scores to be calculated. Websites were assessed during a three week period in February 2015, marks were given for the presence of any correct information, and no marks were provided if the information was incorrect. For any websites which had a discrepancy of more than 6 marks between assessors, the researchers met and discussed the websites as a group and any marks which had been incorrectly awarded/ not awarded were discussed and adjusted accordingly. Finalised copies of the OQP and OQP guidance document are available on request to the corresponding author.

Data were entered into the IBM Statistical Package for the Social Sciences (SPSS) Statistics Version 22 (IBM Corporation 2013). The data was found to be non-

normally distributed and therefore non-parametric analysis was used throughout. A Wilcoxon test was used to identify if there were any statistically significant differences between assessors in their use of the OQP tool. Mann-Whitney tests were used to determine if there were statistically significant differences in the overall website quality score in the presence of different website quality indicators (for example between those websites which had or had not received certification from an external organisation).

Results

Overall Quality Scores:

Of the 50 websites that were assessed the highest score overall was 57 from an available 59 and the lowest was 5. The median total score was 41/59 (69%). The Wilcoxon test highlighted that there was no significant difference between the two assessors' scores (p=0.192), supporting the *a priori* decision to use the mean score for analysis. Table 1 gives a complete list of assessed websites and their overall scores. Table 2 reports the analysis of specific quality criteria on overall website quality scores.

220 **Table 1: Details of Websites Evaluated and Overall Scores:**

No.	Website Publisher/ Author	Uniform Resource Locator (URL):	General Score (max 16)	OA Score (max 43)	Quality Score (max 59)	OQP Grading Scale
1	NICE (National Institute for Health and Care Excellence)	http://www.nice.org.uk/guidance/cg177	14	43	57	Excellent
2	eMedicine Health	http://www.emedicinehealth.com/osteoarthritis/page2_em.htm	15	38	53	Excellent
3	About	http://osteoarthritis.about.com/od/osteoarthritis101/a/what_is_OA.htm	11	40	51	Excellent
4	Healthline	http://www.healthline.com/health/osteoarthritis	14	37	51	Excellent
5	Arthritis Care	http://www.arthritiscare.org.uk/Home	11	39	50	Excellent
6	Boots WebMD	http://www.webmd.boots.com/arthritis/	14	36	50	Excellent
7	NHS (National Health Service)	http://www.nhs.uk/conditions/osteoarthritis/Pages/Introduction.aspx	13	36	49	Excellent
8	NLM- NIH (National Library of Medicine- National Institutes of Health)	http://www.nlm.nih.gov/medlineplus/osteoarthritis.html	14	34	48	Good
9	NIAMS (National Institute of Arthritis and Musculoskeletal and Skin Disorders)	http://www.niams.nih.gov/Health_info/Osteoarthritis/default.asp	10	38	48	Good
10	Medical News Today	http://www.medicalnewstoday.com/articles/27871.php	11	36	47	Good
11	Patient UK	http://www.patient.co.uk/health/osteoarthritis-leaflet	16	31	47	Good
12	The New York Times	http://www.nytimes.com/health/guides/disease/osteoarthritis/overview.html	10	37	47	Good
13	eMedicine Medscape	http://emedicine.medscape.com/article/330487-overview	13	34	47	Good
14	Mayo Clinic	http://www.mayoclinic.org/diseases-conditions/osteoarthritis/basics/definition/CON-20014749	14	32	46	Good
15	Bupa	http://www.bupa.co.uk/health-information/directory/o/osteoarthritis	13	33	46	Good

16	NHS Direct Wales	http://www.nhsdirect.wales.nhs.uk/encyclopaedia/o/article/osteoarthritis/	9	37	46	Good
17	Arthritis Foundation	http://www.arthritis.org/arthritis-facts/disease-center/osteoarthritis.php	9	36	45	Good
18	almostadoctor	http://almostadoctor.co.uk/content/systems/orthopaedics-and-rheumatology/arthritis/osteoarthritis	13	32	45	Good
19	WebMD	http://www.webmd.com/osteoarthritis/default.htm	8	36	44	Good
20	Arthritis Research UK	http://www.arthritisresearchuk.org/arthritis-information/conditions/arthritis.aspx	6	38	44	Good
21	MedicineNet	http://www.medicinenet.com/osteoarthritis/article.htm	14	30	44	Good
22	Spine-health	http://www.spine-health.com/conditions/arthritis/osteoarthritis-spine	8	35	43	Good
23	Arthritis Ireland	http://www.arthritisireland.ie/go/information/booklets/living_with_osteoarthritis	5	38	43	Good
24	Everyday Health	http://www.everydayhealth.com/arthritis/osteoarthritis/index.aspx	8	35	43	Good
25	Wikipedia	http://en.wikipedia.org/wiki/Osteoarthritis	11	31	42	Good
26	American College of Rheumatology	http://www.rheumatology.org/practice/clinical/patients/diseases_and_conditions/osteoarthritis.asp	11	29	40	Good
27	NIH Senior Health	http://nihseniorhealth.gov/osteoarthritis/whatisosteoarthritis/01.html	9	31	40	Good
28	Orthopaedics and Sports Medicine- University of Washington	http://www.orthop.washington.edu/?q=patient-care/articles/arthritis/osteoarthritis.html	11	26	37	Good
29	University of Maryland Medical Centre (UMM)	http://umm.edu/health/medical/altmed/condition/osteoarthritis	9	28	37	Good
30	Age UK	http://www.ageuk.org.uk/health-wellbeing/conditions-illnesses/osteoarthritis/	9	27	36	Fair
31	Medical Dictionary	http://medical-dictionary.thefreedictionary.com/osteoarthritis	3	33	36	Fair
32	Drugs.com	http://www.drugs.com/osteoarthritis.html	9	27	36	Fair
33	Arthritis.com	http://www.arthritis.com/osteoarthritis_symptoms	5	31	36	Fair

34	Johns Hopkins Arthritis Center	http://www.hopkinsarthritis.org/patient-corner/disease-management/role-of-body-weight-in-osteoarthritis/	10	25	35	Fair
35	NHS- British Dietetic Association (BDA)	http://www.nhs.uk/ipgmedia/National/British%20Dietetic%20Association/assets/DietandOsteoarthritis.pdf	13	16	29	Fair
36	Medinfo	http://www.medinfo.co.uk/conditions/osteoarthritis.html	9	20	29	Fair
37	Health.com	http://www.health.com/health/gallery/0,,20443612,00.html	8	20	28	Fair
38	The College of Podiatry	http://www.scpod.org/foot-health/common-foot-problems/osteoarthritis/	7	21	28	Fair
39	Sports Injury Clinic	http://www.sportsinjuryclinic.net/sport-injuries/knee-pain/osteoarthritis-of-the-knee	4	24	28	Fair
40	AposTherapy	http://apostherapy.co.uk/en/conditions-we-treat/knee-osteoarthritis	4	24	28	Fair
41	Better Health Channel	http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Osteoarthritis	10	17	27	Fair
42	Centers for Disease Control and Prevention (CDC)	http://www.cdc.gov/arthritis/basics/osteoarthritis.htm	10	16	26	Fair
43	Acupuncture.org	http://www.acupuncture.org.uk/a-to-z-of-conditions/a-to-z-of-conditions/osteoarthritis.html	6	19	25	Fair
44	Stannah	http://www.stannahstairlifts.co.uk/news/osteoarthritis-uk-closer-look	8	14	22	Poor
45	Imperial College London	http://www3.imperial.ac.uk/osteoarthritis	9	9	18	Poor
46	The Telegraph	http://www.telegraph.co.uk/news/science/science-news/11346259/Killer-heels-could-lead-to-osteoarthritis-in-knees-warn-scientists.html	8	10	18	Poor
47	Daily Mail Online	http://www.dailymail.co.uk/health/article-2839542/Running-GOOD-knees-actually-prevent-osteoarthritis-experts-claim.html	7	10	17	Poor
48	Dictionary.com	http://dictionary.reference.com/browse/osteoarthritis	8	8	16	Poor
49	Institute of Inflammation and Repair- The University of Manchester	http://www.inflammation-repair.manchester.ac.uk/Musculoskeletal/research/CfE/roam/	5	6	11	Very poor
50	Kennedy Institute of Rheumatology - University of	http://oacentre.kennedy.ox.ac.uk/patientinfo.html	3	2	5	Very poor

	Oxford					

The research team developed an OQP grading scale. It was based upon the DISCERN grading scale [32], but was modified accordingly to fit our scoring up to 59, whereas the DISCERN grading scale grades websites up to a score of 75.

Using this scale, with the median of the data being 69% the average quality of the information is categorised as 'good'. Of the 50 assessed websites, seven were categorised as 'Excellent' by the authors' OQP Grading Scale. These websites, which scored 48 or more, were NHSUK, Arthritis Care, BootsWebMD, NICE, OA.About, Healthline and E-medicine health.

General Website Quality:

The general quality scores ranged from 3 to 16 (median 9, 56%) from an available 16 marks, indicating that the median was of a 'fair' quality when judged against the authors' OQP Grading Scale. In total 64% (32/50) of the websites scored more than half of the available marks.

Of the 50 websites appraised, just under half (24/ 50, 48%) identified a named author or their affiliations. In addition to this, 84% (42/50) of websites appraised provided a date of website creation or when they were last updated; with 64% (32/50) being created/ updated during or after 2014. Sites that had been updated since 2014 had a higher median quality score than those that had not but this was not statistically significant.

In total, 36% (18/50) of websites failed to provide a source for their information; with 32% (16/50) quoting other sources (such as other websites), and the remaining 32% (16/50) having peer review processes. Websites that had a peer review process had higher median quality scores than those that quoted other sources or none. The

difference in quality between those quoting other sources or no sources was not statistically significant.

Of the websites that were assessed, 32% (16/50) had been approved by an external organisation such as HoN [16] or the Information Standard [17]. Those that had received external approval had significantly higher median quality scores than those that had not.

The majority of websites (39/50, 78%) referred the reader on to further OA information, with 58% (29/50) of websites containing links to four or more relevant sites. Sites that referred on to four or more websites received significantly higher median quality scores than those that referred to none.

Table 2: The influence of specific quality criteria on total quality scores. * = statistically significant (Mann Whitney test).

Quality criteria		**Median quality score (max 59) (IQR)**	**Median difference (95% CI), p-value**
Updated since 2014	Yes (n=32)	44 (28, 47)	Yes v No: -4 (-11, 2), p=0.108
	No (n=18)	36 (28, 43)	
Source of information	Peer (n=16)	47 (44, 49)	Peer v Other: -9 (-16, -3), **p=0.008*** Peer v None: -17 (-26, -8), **p<0.001*** Other v None: -8 (-17, 1), p=0.081
	Other (n=16)	36 (29, 44)	
	None (n=18)	28 (18, 41)	

External approval	Yes (n=16)	46 (42, 49)	Yes v No: -9 (-17, -3), **p=0.004***
	No (n=34)	36 (26, 44)	
Number of websites referred to	4+ sites (n=29)	46 (36, 47)	4+ v 0 sites: -12 (-20, -5), **p=0.002*** Other statistical comparisons not conducted due to low numbers
	2-3 sites (n=6)	43 (26, 46)	
	1 site (n=4)	32 (22, 38)	
	0 sites (n=11)	28 (21, 36)	

OA Specific Quality Scores:

The OA specific quality scores ranged from 2 to 43 out of a possible 43, with a median score of 31 (71%), indicating 'good' quality overall using the OQP grading scale. Of the 50 websites, 72% (36/50) scored over 50% of the available marks.

Upon analysing specific criteria many websites scored highly (>half of available marks) in the reporting of anatomy and physiology (42/50 websites, 84%), risk factors (42/50 websites, 84%) and symptoms of OA (43/50 websites, 86%). In addition to this, the diagnosis of OA (37/50 websites, 74%), self-management strategies (37/50 websites, 74%) and pharmalogical management (38/50 websites, 76%) was also well reported throughout. However, scoring at this level was less well represented in relation to non- pharmalogical management (25/50 websites, 50%) and consideration of surgery (24/50 websites, 48%). Furthermore, the holistic management of OA (17/50 websites, 34%) and the follow up and review process (5/50 websites, 10%) were the least well reported sections within the OA criteria.

Specific management strategies such as exercise and weight loss were the most frequently documented throughout the assessed websites (84% (42/50) and 80% (40/50) respectively). However, many websites failed to report upon OA effect on sleep (30%, 15/50) and just 26% (13/50) mentioned the possible other medical conditions associated with the disease. In addition to this just 15% (8/50) mentioned the need for regular monitoring of the disease and only 11% (6/50) reported on the importance of regular reviews by a healthcare professional, despite both being highlighted as key recommendations in the NICE [18] guidelines.

Discussion

The purpose of this study was to assess the quality of websites that are available to the public searching for information about OA. Overall, the findings suggest an improvement in the quality of OA websites as previous research had found the quality of OA websites to be poor [4, 6].

However, while this study found the overall quality of information to be of a high standard, it is also in accordance with previous research that has found there to be a wide variability in the quality of OA information that is available to users [4, 6]. This helps to highlight that there is a wide inconsistency of information available to users, making it difficult for internet users to consistently access information of a high quality. The reason for this wide discrepancy in quality is multifactorial, with variations occurring in general and OA specific scores.

Many websites failed to disclose authorship or affiliations (52%, 26/50) and sources of information (36%, 18/50), while just 32% (16/50) were certified by an external organisation, such as HoN [16]. This highlighted that there were several of the general criteria, which have previously been identified as indicators of quality

information [25, 26] which were not well documented by a large proportion of the assessed websites. This is despite the fact that a number of general website indicators were shown to have a significant relationship with the overall quality of a website. Our findings are in accordance with previous research in that quality online information is created more recently, discloses the source of information, has external certification and directs the reader to other useful sites [4, 6].

Despite this, the researchers would advise that the results be treated with caution as these relationships were not definitive. There were many websites which scored highly, yet did not disclose these factors, suggesting that these indicators are not pre-requisites to quality information.

Over 70% of websites scored over half of the available marks (22 marks or more) on the OA section, indicating that many of the websites published information which was in accordance with the current NICE guidelines [18]. Certain aspects of the NICE guidelines such as anatomy and physiology, risk factors and self-management were well documented throughout. In particular, treatment strategies such as exercise and weight loss were the most frequently cited modalities of the websites that were assessed, highlighting that core modalities recommended in NICE guidelines were present within the appraised websites. Therefore, this information may assist people diagnosed with OA and encourage them towards adhering to healthy lifestyle habits [33].

Conversely, the reporting of factors associated with a holistic approach to OA and the follow up and review process were not consistently documented. This is despite the fact that several research papers [34, 35] and guidelines [19] have emphasised the importance of a holistic, patient-centred approach for people affected by OA, with

evidence that this approach can help aid function, independence and enhance a person's attitudes towards their disease. It is therefore recommended that healthcare professionals and website developers in the future ensure that sites incorporate a greater range of holistic information for patients. This may include OA effect on sleep and pain management, and a greater emphasis on how it can affect social life and an individual's moods and attitudes.

Limitations:

The results of this study raise some important considerations regarding the quality of OA material available to people online. However, due to several limitations, the results of this study must be considered with caution. Firstly, it should be noted that as the internet is a dynamic entity in which websites move, change or become inaccessible on a continual basis [36], repetition of the current study is likely to result in the identification of different websites. For that reason, while conclusions can be made on the data obtained during February 2015, the results should not be generalised to the quality of OA websites in the future.

There are also several limitations with the use of the OQP tool. The creation of the proforma meant that the websites were appraised using a non-standardised and non-validated tool; limiting the validity of the results. Despite this, the present study found there to be good consistency with use of the tool; and so future research would be recommended to assist in validation of the OQP tool.

Moreover, the manner in which the OQP appraised websites could also be criticised. While the proforma did not award marks for incorrect information, it did not take into account the level of detail or explanation that individual websites explored for certain criteria and only commented on the presence or otherwise of information. Therefore,

to what degree this research accurately assessed the true 'quality' of information is unclear.

A further limitation is that the study doesn't reflect the way the general public search for health and medical information. During website appraisal, assessors were using the OQP and guidance document to appraise the information in a systematic and reproducible manner. However, this process of searching for information is somewhat artificial. Previous research has also found that healthcare professionals and consumers evaluate online information in different ways [37]. In light of this, future research may be targeted at facilitating a representative sample of patients or service users to appraise online information as opposed to healthcare practitioners.

Clinical Implications:

Within the internet era, the role of healthcare professionals in guiding patients towards high quality health information has expanded into the digital setting. This study helps to highlight the difficulty healthcare professionals have in recommending an optimal approach to this complex and evolving environment.

The wide variability in the quality of OA information available has the potential to not only limit the ability of the patient to become informed and to promote self-management of their condition, but also to directly misinform and mislead healthcare decisions.

Within the clinical health setting, more time spent in discussion with patients on aspects such as education about OA may be a beneficial, individualised alternative to online information. For computer literate patients, empowering and educating

internet users to find and recognise quality health information for themselves may be a necessary step to help people navigate the myriad of information available to them.

Guidelines do not currently exist for the assessment of material online and it may be that formal guidelines can be established or quality assessment criteria delineated and standardised by organisations such as NICE. This would allow consensus of the same method and standard of appraisal for general or specific condition based information, which may be necessary in order to stay ahead of the growing body of inaccurate material on the internet.

Conclusion

The internet has the potential to be a useful tool for educating and empowering healthcare consumers. It can help to facilitate improvements in health status indicators, access to care and enhance communication between patients, families and healthcare professionals [38]. However, if the internet is to assist patients in making informed choices about their health, then digital information needs to be of the highest possible quality.

The results of this study show that overall, websites available to a 'typical' population searching for information on OA are of a high standard. However, as previous research has found there is a wide variability in the quality of information available [4, 6]. Internet users are therefore at risk of accessing material that is unsubstantiated and unreliable, which can negatively impact upon patient decision making.

It is therefore of the upmost importance that healthcare professionals become proactive in evaluating existing information online to help patients locate reliable and accurate information. In addition to this, in the future practitioners should become

389 actively involved with website developers in establishing high quality, evidence
390 based websites.

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397 References

398 [1] Johnson, V.L. and Hunter, D.J. (2014) The epidemiology of osteoarthritis. Best
399 Practice & Research Clinical Rheumatology [online]. 28, pp. 5-15. [Accessed 06
400 December 2014].

401 [2] Larmer, P.J., Reay, N.D., Aubert, E.R. and Kersten, P. (2014) Systematic review
402 of guidelines for the physical management of osteoarthritis. Archives of Physical
403 Medicine and Rehabilitation [online]. 95, pp. 375-389. [Accessed 01 December
404 2014].

405 [3] Arthritis Research UK (2013) Osteoarthritis in General Practice. Data and
406 Perspectives. Available from: http://www.arthritisresearchuk.org/arthritis-
407 information/data-and-statistics/osteoarthritis.aspx [Accessed 26 March 2015].

408 [4] Maloney, S., Ilic, D. and Green, S. (2005) Accessibility, nature and quality of
409 health information on the internet: a survey on osteoarthritis. Rheumatology [online].
410 44 (3), pp. 382-385. [Accessed 01 December 2014].

411 [5] Pietrzak, E., Cotea, C., Pullman, S. and Nasveld, P. (2013) Self-management and
412 Rehabilitation in Osteoarthritis: Is There a Place for Internet-Based Interventions?.
413 Telemedicine and e-Health. 19 (10), pp. 800-805.

414 [6] Ansani, N.T., Vogt, M., Fedutes Henderson, B.A., McKaveney, T.P., Weber, R.J.,
415 Smith, R.B., *et al* (2005) Quality of arthritis information on the Internet. American
416 Journal of Health-systems Pharmacy [online]. 62 (11), pp. 1184-1189. [Accessed 03
417 December 2014].

418 [7] Office for National Statistics (2014) Internet Access- Households and Individuals,
419 2014. Available from: http://www.ons.gov.uk/ons/dcp171778_373584.pdf [Accessed
420 02 December 2014].

421 [8] Office for National Statistics (2013) Internet Access - Households and Individuals,
422 2013. Available from: http://www.ons.gov.uk/ons/dcp171778_322713.pdf [Accessed
423 02 December 2014].

424 [9] Sillence, E., Briggs, P., Harris, P. and Fishwick, L. (2007) Going online for health
425 advice: changes in usage and trust practices over the last five years. Interacting with
426 Computers. 19 (3), pp. 397-406.

427 [10] Stvilia, B., Mon, L. and Jeong Yi, Y. (2009) A model for online consumer health
428 information quality. Journal of the American Society for Information Science and
429 Technology. 60 (9), pp. 1781-1791.

430 [11] Williams, P., Huntington, P. and Nicholas, D. (2003) Health information on the
431 internet: a qualitative study of NHS direct online users. Aslib Proceedings [online]. 55
432 (5), pp. 304-312. [Accessed 02 December 2014].

[12] Baker, L., Wagner, T.H., Singer, S. and Bundorf, M.K. (2003) Use of the Internet and e-mail for health care information: results from a national survey. JAMA: Journal of the American Medical Association. 298 (18), pp. 2400-2406.

[13] Diaz, J.A., Griffith, R.A., Ng, J.J., Reinert, S.E., Friedmann, P.D. and Moulton, A.W. (2002) Patients' Use of the Internet for Medical Information. Journal of General Internal Medicine. 17 (3), pp. 180-185.

[14] Kitchens, B., Harle, C.A. and Li, S. (2014) Quality of health-related online search results. Decision Support Systems. 57, pp. 454-462.

[15] Health On the Net Foundation: HON (2013) Available from: https://www.healthonnet.org/pat.html [Accessed 24 March 2015].

[16] British Library and The University of Oxford (1997) The DISCERN Instrument. Available from: http://www.discern.org.uk/discern_instrument.php [Accessed 24 March 2015].

[17] NHS England (2014) *The Information Standard.* Available from: https://www.england.nhs.uk/tis/ [Accessed 04 January 2016].

[18] Bernstam, E.V. (2005) Instruments to assess the quality of health information on the world wide web: what can our patients actually use?. International Journal of Medical Informatics. 74 (1), pp. 13-19.

[19] National Institute for Health and Care Excellence: NICE (2014) Osteoarthritis: Care and Management in Adults. Available from: http://www.nice.org.uk/guidance/cg177/resources/guidance-osteoarthritis-pdf [Accessed 02 December 2014].

[20] Gesenhues, A. (2014) Search Engine Land- Study: Top 5 Search Engines See Search Traffic Drop By As Much As 31% Since December 2013 .Available from: http://searchengineland.com/study-google-bing-yahoo-ask-aol-see-17-32-decline-search-traffic-last-6-months-194634 [Accessed 09 December 2014].

[21] Butler, L. and Foster, N.E. (2003) Back pain online: a cross sectional survey of the quality of web-based information on low back pain. Spine. 28 (4), pp. 395-401.

[22] Chitika (2013) Chitika Insights: *The value of Google Result Positioning*. Westborough, Massachusetts: Chitika.

[23] Eysenbach, G. and Kohler, C. (2002) How do consumers search for and appraise health information on the world wide web? qualitative study using focus groups, usability tests, and in-depth interviews. BMJ: British Medical Journal. 324, pp. 573-577.

[24] Urbaniak, G.C., Plous. C., (2008) Social Psychology Network. *Research Randomizer.* Available from: http://www.randomizer.org/form.htm [Accessed 24 March 2015].

[25] Gagliardi, A. and Jadad, A. (2002) Examination of instruments used to rate quality of health information on the Internet: chronicle of a voyage with an unclear destination. British Medical Journal. 324, pp. 569-573.

[26] Kim, P., Eng, T.R. and Deering, M.J. (1999) Published criteria for evaluating health related web sites: Review. British Medical Journal.318 (4), pp.647-649.

[27] Silberg, W.M., Lundberg, G.D. and Musacchio, R.A. (1997) Assessing, controlling and assuring the quality of medical information on the internet. JAMA: Journal of the American Medical Association. 277, pp. 1244-1245.

[28] Fernandes, L., Hagen, K.B., Bijlsma, J.W.J., Andreassen, O., Christensen, P., Conaghan, P.G., *et al* (2013) EULAR recommendations for the nonpharmacological core management of hip and knee osteoarthritis. Annals of the Rheumatic Diseases.10 (1136), pp.1-11.

[29] National Guideline Clearinghouse (2012) Recommendations for the use of Non-pharmacologic and Pharmacologic Therapies in Osteoarthritis of the Hand, Hip, and Knee. Available from: http://www.guideline.gov/content.aspx?id=36893 [Accessed 05 April 2015].

[30] Ashford, S. and Williard, J. (2014) Osteoarthritis: A review. The Nurse Practitioner. 39 (5), pp. 1-8.

[31] Hunter, D.J. and Felson, D.T. (2006) Osteoarthritis. British Medical Journal. 332, pp. 639-642.

[32] Hargrave, D.R., Hargrave, U.A. and Bouffet, E. (2006) Quality of health information on the internet in paediatric neuro-oncology. Neuro-oncology. 8 (2), pp. 175-182.

[33] Bennell, K.L. and Hinman, R.S. (2011) A review of the clinical evidence for exercise in osteoarthritis of the hip and knee. Journal of Science and Medicine in Sport. pp. 4-9.

[34] Huskisson, E.C. (2010) Modern Management of Mild-to- Moderate Joint Pain due to Osteoarthritis: a Holistic Approach. The Journal of International Medical Research. 38 (4), pp. 1175-1212.

[35] Oliver, S.M. (2008) Holistic management of osteoarthritis. Practice Nursing. 19 (6), pp. 298-304.

501 [36] Sandvik, H. (1999) Health information and interaction on the internet: a survey of
502 female urinary incontinence. BMJ: British Medical Journal. 319, pp. 29-32.

503 [37] Stanford, J., Tauber, E., Fogg, B.J., Marable, L. (2002) Experts vs. online
504 consumers: a comparative credibility study of health and finance web sites. Available
505 from: https://consumersunion.org/wp-content/uploads/2013/05/expert-vs-online-
506 consumers.pdf [Accessed 13 April 2015].

507 [38] Fahy, E., Hardikar, R., Fox, A. and Mackay, S. (2014) Quality of patient health
508 information on the internet: reviewing a complex and evolving landscape.
509 Australasian Medical Journal. 7 (1), pp. 24-28.

510 [39] UWE Research Ethics Committee (2012) Research Ethics Committees: Policy
511 and Procedures for Research Ethical Approval. Available from:
512 http://www2.uwe.ac.uk/services/Marketing/research/doc/ethicsandprocedures/Resea
513 rch_Ethics_Policy_and_Procedures.docx [Accessed 30 November 2015].

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Supplementary

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