

# Quality of web-based information for osteoarthritis: a cross-sectional study

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

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**Word Count:** 3707

## **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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28 there was a wide variation in the quality of information.

30

31 **Keywords:** Osteoarthritis, Internet, Patient education, websites

32

### 33 **CONTRIBUTION OF THE PAPER**

- 34 • The quality of the online OA information evaluated in this study is of a high  
35 standard, however, there is a wide variability in the quality that is available.  
36
- 37 • Due to the variation in the quality of online OA information, internet users may  
38 find it difficult to consistently access information of a high quality.  
39
- 40 • Higher quality websites tended to be created more recently, disclosed sources of  
41 information, had external seals of approval and directed the reader onto other  
42 relevant websites.

43

### 44 **Introduction**

45 Osteoarthritis (OA) is the most common form of arthritis, affecting approximately  
46 15% of the population in the United Kingdom (UK) [1] and has been established as  
47 one of the leading causes of pain, functional disability and impaired quality of life  
48 worldwide [2]. The number of people affected by OA is expected to increase, with an  
49 ageing population and an ever increasing prevalence of obesity meaning more  
50 people are diagnosed with the disease every year [1]. In the UK alone over 8.75  
51 million people are affected by the disease [3].

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

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

70 However, the quality of internet based medical information is extremely variable [12,  
71 13]. Unlike print media, there is a lack of editorial control of the internet as a  
72 communication system; meaning anyone, regardless of qualification or motive can  
73 place information online [4]. Issues with quality are exacerbated by the internet's  
74 continued growth as a communication system; new information appears faster than it  
75 can be appraised. Therefore, the greatest barrier to the internet reaching its

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

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

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

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



## 99 **Methods**

### 100 *Website Identification:*

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

107 A key word search of "Osteoarthritis" at the time of the study returned between 2.6  
108 million to 14.4 million results, dependent upon the search engine used. However,  
109 previous studies have found that sites listed on the first search results page generate  
110 92% of all traffic from an average search [22]. This indicated that individuals are  
111 significantly more likely to visit websites found in the first ten matches from search  
112 engines results [23]. It was therefore decided to identify 10 unique websites from  
113 each of the five search engines in order to achieve a reliable sample of websites in  
114 which patients would access in search of information about OA.

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

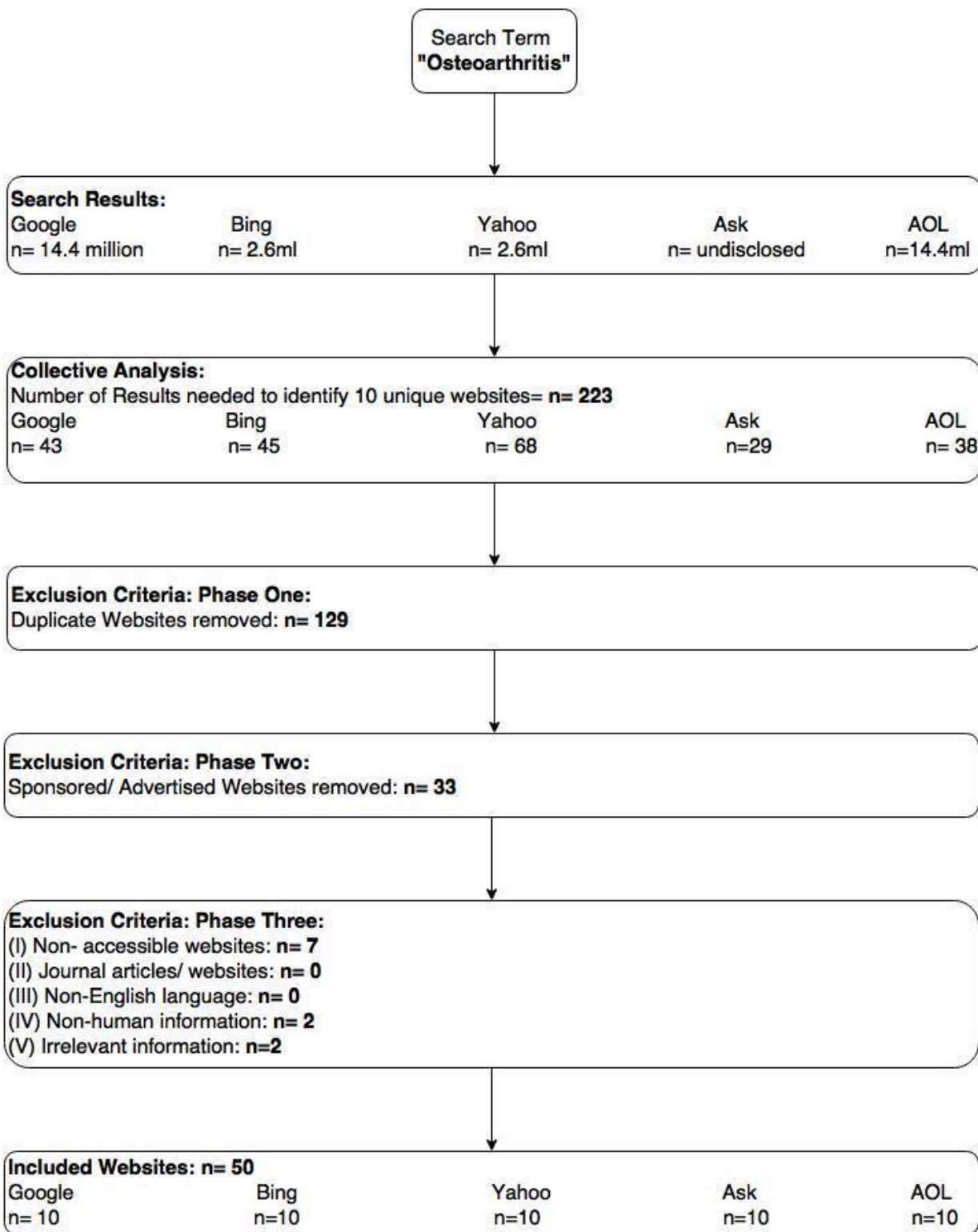
123 generator [24] was used to determine which search engine the website would be  
124 allocated to.

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

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

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

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



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140

141 *Assessment of Website Quality:*

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

146 1) *General quality content (criteria 1 to 8)* with a maximum score of 16.

147 2) *Specific OA content (criteria 9 to 18)* with a maximum score of 43.

148 3) *Total score (sum of all criteria)* with a maximum score of 59.

149

150 *General Quality Content:*

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

161

162 *Specific OA Content:*

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

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

173

174 Following an initial piloting stage to test the usability and application of the proforma,  
175 an Osteoarthritis Quality Proforma (OQP) Guidance Document was produced for  
176 assessors to use in conjunction with the OQP. This helped to assist in a more  
177 standardised and reproducible process of data collection. Following initial piloting,  
178 the OQP demonstrated consistency between assessors, therefore the decision was  
179 made for each website to be independently appraised by two researchers and  
180 average scores to be calculated. Websites were assessed during a three week  
181 period in February 2015, marks were given for the presence of any correct  
182 information, and no marks were provided if the information was incorrect.

183 For any websites which had a discrepancy of more than 6 marks between  
184 assessors, the researchers met and discussed the websites as a group and any  
185 marks which had been incorrectly awarded/ not awarded were discussed and  
186 adjusted accordingly. Finalised copies of the OQP and OQP guidance document are  
187 available on request to the corresponding author.

188

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

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

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## 210 **Results**

### 211 **Overall Quality Scores:**

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

219

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

N o.	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)	<a href="http://www.nice.org.uk/guidance/cg177">http://www.nice.org.uk/guidance/cg177</a>	14	43	57	Excellent
2	eMedicine Health	<a href="http://www.emedicinehealth.com/osteoarthritis/page2_em.htm">http://www.emedicinehealth.com/osteoarthritis/page2_em.htm</a>	15	38	53	Excellent
3	About	<a href="http://osteoarthritis.about.com/od/osteoarthritis101/a/what_is_OA.htm">http://osteoarthritis.about.com/od/osteoarthritis101/a/what_is_OA.htm</a>	11	40	51	Excellent
4	Healthline	<a href="http://www.healthline.com/health/osteoarthritis">http://www.healthline.com/health/osteoarthritis</a>	14	37	51	Excellent
5	Arthritis Care	<a href="http://www.arthritiscare.org.uk/Home">http://www.arthritiscare.org.uk/Home</a>	11	39	50	Excellent
6	Boots WebMD	<a href="http://www.webmd.boots.com/arthritis/">http://www.webmd.boots.com/arthritis/</a>	14	36	50	Excellent
7	NHS (National Health Service)	<a href="http://www.nhs.uk/conditions/osteoarthritis/Pages/Introduction.aspx">http://www.nhs.uk/conditions/osteoarthritis/Pages/Introduction.aspx</a>	13	36	49	Excellent
8	NLM- NIH (National Library of Medicine- National Institutes of Health)	<a href="http://www.nlm.nih.gov/medlineplus/osteoarthritis.html">http://www.nlm.nih.gov/medlineplus/osteoarthritis.html</a>	14	34	48	Good
9	NIAMS (National Institute of Arthritis and Musculoskeletal and Skin Disorders)	<a href="http://www.niams.nih.gov/Health_info/Osteoarthritis/default.asp">http://www.niams.nih.gov/Health_info/Osteoarthritis/default.asp</a>	10	38	48	Good
10	Medical News Today	<a href="http://www.medicalnewstoday.com/articles/27871.php">http://www.medicalnewstoday.com/articles/27871.php</a>	11	36	47	Good
11	Patient UK	<a href="http://www.patient.co.uk/health/osteoarthritis-leaflet">http://www.patient.co.uk/health/osteoarthritis-leaflet</a>	16	31	47	Good
12	The New York Times	<a href="http://www.nytimes.com/health/guides/disease/osteoarthritis/overview.html">http://www.nytimes.com/health/guides/disease/osteoarthritis/overview.html</a>	10	37	47	Good
13	eMedicine Medscape	<a href="http://emedicine.medscape.com/article/330487-overview">http://emedicine.medscape.com/article/330487-overview</a>	13	34	47	Good
14	Mayo Clinic	<a href="http://www.mayoclinic.org/diseases-conditions/osteoarthritis/basics/definition/CON-20014749">http://www.mayoclinic.org/diseases-conditions/osteoarthritis/basics/definition/CON-20014749</a>	14	32	46	Good
15	Bupa	<a href="http://www.bupa.co.uk/health-information/directory/o/osteoarthritis">http://www.bupa.co.uk/health-information/directory/o/osteoarthritis</a>	13	33	46	Good



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

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

Oxford					
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221 The research team developed an OQP grading scale. It was based upon the  
222 DISCERN grading scale [32], but was modified accordingly to fit our scoring up to  
223 59, whereas the DISCERN grading scale grades websites up to a score of 75.  
224 Using this scale, with the median of the data being 69% the average quality of the  
225 information is categorised as 'good'. Of the 50 assessed websites, seven were  
226 categorised as 'Excellent' by the authors' OQP Grading Scale. These websites,  
227 which scored 48 or more, were NHSUK, Arthritis Care, BootsWebMD, NICE,  
228 OA.About, Healthline and E-medicine health.

### 229 **General Website Quality:**

230 The general quality scores ranged from 3 to 16 (median 9, 56%) from an available  
231 16 marks, indicating that the median was of a 'fair' quality when judged against the  
232 authors' OQP Grading Scale. In total 64% (32/50) of the websites scored more than  
233 half of the available marks.

234 Of the 50 websites appraised, just under half (24/ 50, 48%) identified a named  
235 author or their affiliations. In addition to this, 84% (42/50) of websites appraised  
236 provided a date of website creation or when they were last updated; with 64%  
237 (32/50) being created/ updated during or after 2014. Sites that had been updated  
238 since 2014 had a higher median quality score than those that had not but this was  
239 not statistically significant.

240 In total, 36% (18/50) of websites failed to provide a source for their information; with  
241 32% (16/50) quoting other sources (such as other websites), and the remaining 32%  
242 (16/50) having peer review processes. Websites that had a peer review process had  
243 higher median quality scores than those that quoted other sources or none. The

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

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

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

254

255 **Table 2: The influence of specific quality criteria on total quality scores.** \* =  
 256 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), <b>p=0.008*</b> Peer v None: -17 (-26, -8), <b>p&lt;0.001*</b> 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), <b>p=0.004*</b>
	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), <b>p=0.002*</b> 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)	

257

258 **OA Specific Quality Scores:**

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

262 Upon analysing specific criteria many websites scored highly (>half of available  
 263 marks) in the reporting of anatomy and physiology (42/50 websites, 84%), risk  
 264 factors (42/50 websites, 84%) and symptoms of OA (43/50 websites, 86%). In  
 265 addition to this, the diagnosis of OA (37/50 websites, 74%), self-management  
 266 strategies (37/50 websites, 74%) and pharmacological management (38/50 websites,  
 267 76%) was also well reported throughout. However, scoring at this level was less well  
 268 represented in relation to non- pharmacological management (25/50 websites, 50%)  
 269 and consideration of surgery (24/50 websites, 48%). Furthermore, the holistic  
 270 management of OA (17/50 websites, 34%) and the follow up and review process  
 271 (5/50 websites, 10%) were the least well reported sections within the OA criteria.

272 Specific management strategies such as exercise and weight loss were the most  
273 frequently documented throughout the assessed websites (84% (42/50) and 80%  
274 (40/50) respectively). However, many websites failed to report upon OA effect on  
275 sleep (30%, 15/50) and just 26% (13/50) mentioned the possible other medical  
276 conditions associated with the disease. In addition to this just 15% (8/50) mentioned  
277 the need for regular monitoring of the disease and only 11% (6/50) reported on the  
278 importance of regular reviews by a healthcare professional, despite both being  
279 highlighted as key recommendations in the NICE [18] guidelines.

## 280 **Discussion**

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

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

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

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

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

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

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



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

### 326 **Limitations:**

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

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

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

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

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

#### 354 **Clinical Implications:**

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

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

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

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

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

## 374 **Conclusion**

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

381 The results of this study show that overall, websites available to a 'typical' population  
382 searching for information on OA are of a high standard. However, as previous  
383 research has found there is a wide variability in the quality of information available [4,  
384 6]. Internet users are therefore at risk of accessing material that is unsubstantiated  
385 and unreliable, which can negatively impact upon patient decision making.

386 It is therefore of the utmost importance that healthcare professionals become  
387 proactive in evaluating existing information online to help patients locate reliable and  
388 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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394 *Conflict of interest:* None

395

396

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514

**Supplementary**

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