

and interpretation of data, and drafted the paper. EVB was involved in the conception and design of the study, collection of data on links, interpretation of data, and drafting of the paper. NQM carried out the statistical analysis. KKH, FCA, MIR, HMK, and REP were involved in interpreting the data and revised the paper for intellectual content. MAM and SES advised on methods and revised the paper for intellectual content. FM and EVB are the guarantors.

Funding: Supported in part by Grant LM06594 from the National Library of Medicine (EVB).

Competing interests: None declared.

- 1 Metz JM, Devine P, DeNittis A, Stambaugh M, Jones H, Goldwein J, et al. Utilization of the internet by oncology patients to obtain cancer related information. *Proc Am Soc Clin Oncol* 2001;20:395a (abstract 1575).
- 2 Yakren S, Shi W, Thaler H, Agre P, Bach PB, Schrag D, et al. Use of internet and other information resources among adult cancer patients and their companions. *Proc Am Soc Clin Oncol* 2001;20:398a (abstract 1589).
- 3 Helft PR, Hlubocky FJ, Gordon EJ, Ratain MJ, Daugherty CK. Hope and the media in advanced cancer patients. *Proc Am Soc Clin Oncol* 2000;19:633a (abstract 2497).
- 4 O'Connor JB, Johanson JF. Use of the web for medical information by a gastroenterology clinic population. *JAMA* 2000;284:1962-4.
- 5 Health on the Net. Survey on the evolution of internet use for health purposes: raw data for the survey February-March 2001. www.honch/Survey/FebMar2001/ (accessed 14 Jan 2002).
- 6 Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the internet: Caveant lector et viewer—let the reader and viewer beware [editorial] [see comments]. *JAMA* 1997;277:1244-5.
- 7 Jadad AR, Gagliardi A. Rating health information on the internet: navigating to knowledge or to Babel? *JAMA* 1998;279:611-4.
- 8 Bichakjian CK, Schwartz JL, Wang TS, Hall JM, Johnson TM, Sybil Biermann J. Melanoma information on the internet: often incomplete—a public health opportunity? *J Clin Oncol* 2002;20:134-41.
- 9 Price SL, Hersh WR. Filtering web pages for quality indicators: an empirical approach to finding high quality consumer health information on the world wide web. *Proc AMIA Symp* 1999;911-5.

- 10 Shon J, Musen MA. The low availability of metadata elements for evaluating the quality of medical information on the world wide web. *Proc AMIA Symp* 1999;945-9.
- 11 Hoffman-Goetz L, Clarke JN. Quality of breast cancer sites on the world wide web. *Can J Public Health* 2000;91:281-4.
- 12 What is popularity: thewritemarket.com. www.thewritemarket.com/search/popularity.htm (accessed 14 Mar 2001).
- 13 Kerber R. Direct hit uses popularity to narrow internet searches. *Wall Street Journal* 1998;232 (July 2): B4, Op 1.
- 14 Search engines take a quantum leap: 19 out of 20 now use link popularity to determine relevancy. www.webseed.com/page1007.html (accessed 14 Mar 2001).
- 15 Brin S, Page L. The anatomy of a large-scale hypertextual web search engine. *Computer Networks and ISDN Systems* 1998;30:107-17.
- 16 Linkpopularity.com. www.linkpopularity.com/ (accessed 21 Dec 2001).
- 17 Google. <http://google.com/> (accessed 14 Mar 2001).
- 18 Rumsey E. Peer-review popularity vs. dotcom popularity. www.lib.uiowa.edu (accessed 7 Feb 2002).
- 19 Eysenbach G, Diepgen TL. Towards quality management of medical information on the internet: evaluation, labelling, and filtering of information. *BMJ* 1998;317:1496-500.
- 20 Lacroix E-M. Health topics most hit March 2000. www.nlm.nih.gov/pubs/staffpubs/10/medlineplus/sld013.htm (accessed 27 Jan 2001).
- 21 Bateman M, Rittenberg CN, Gralla RJ. Is the internet a reliable and useful resource for patients and oncology professionals: a randomized evaluation of breast cancer information. *Proc Am Soc Clin Oncol* 1998;17:419a (abstract 1616).
- 22 Berland GK, Elliott MN, Morales LS, Algazy JI, Kravitz RL, Broder MS, et al. Health information on the internet: accessibility, quality, and readability in English and Spanish. *JAMA* 2001;285:2612-21.
- 23 Health On the Net Foundation. HON code of conduct (HONcode) for medical and health web sites: principles. www.hon.ch/HONcode/Conduct.html (accessed 25 May 2001).
- 24 Sandvik H. Health information and interaction on the internet: a survey of female urinary incontinence. *BMJ* 1999;319:29-32.

(Accepted 22 January 2002)

Accuracy of information on apparently credible websites: survey of five common health topics

Heinke Kunst, Diederik Groot, Pallavi M Latthe, Manish Latthe, Khalid S Khan

The internet provides an easily accessible forum to disseminate both accurate and inaccurate health information—so it has the potential to facilitate but also to jeopardise healthcare provision.^{1,2} Many criteria have been alleged to capture the quality of health websites,^{3,4} but the validity of these criteria needs to be examined.⁵ The source, currency, and hierarchy of the evidence posted on a website may be used to judge its credibility—that is, the power of inspiring belief. If these criteria were fulfilled, the contents of the website would be expected to be accurate. We determined whether websites that seem to be credible provide accurate health information.

Methods and results

We determined the relation between credibility features and accuracy of contents of 121 websites that provided information on five common health topics: chronic obstructive pulmonary disease (23 sites), ankle sprain (36), emergency contraception (32), menorrhagia (9), and female sterilisation (21). These sites were identified either by searching each of the most commonly used engines (such as Altavista, Excite, Hotbot, Infoseek, Lycos, Northern Light, Webcrawler) or by simultaneously consulting them using a meta-search engine, Copernic 4.1 (www.copernic.com/). We

selected English language websites whose content provided information about the topics. Website selection and data extractions were performed in duplicate, and agreement between the two assessors was high.

The entire contents of the selected websites were assessed for three credibility features (source, currency, and evidence hierarchy) and accuracy of contents. Source and currency are widely used to assess scientific credibility of a website.^{3,4} The source of medical information is usually regarded as the main criterion for its credibility; sites should display the source of the information clearly. Currency is shown by websites that display the date of the original document or content posting on the internet, and that of any updates. We looked at the hierarchy of evidence posted on each website, examining whether the levels assigned to various pieces of information were related to their validity or methodological quality. This allows users to assess the strength of the recommendations being made. Our assessment showed that 113/121 (93%) websites described source, 59 (49%) currency, and 22 (18%) evidence hierarchy.

Accuracy of website contents was judged against rigorously developed, peer reviewed, and published guidelines for each of the five health topics (see table on bmj.com). The data on accuracy were extracted as a proportion of guideline statements included in the

Department of Respiratory Medicine, St Mary's Hospital, London W2 1NY

Heinke Kunst
specialist registrar

Maastricht University, 6200 MD Maastricht, Netherlands

Diederik Groot
medical student

continued over

BMJ 2002;324:581-2



A table of sources of websites appears on bmj.com

Birmingham Women's Health Care NHS Trust, Birmingham B15 2TG
Pallavi M Latthe *specialist registrar*
Khalid S Khan *consultant, education resource centre*
Tower Hill Medical Centre, Birmingham B42 1LJ
Manish Latthe *general practitioner*
Correspondence to: K S Khan k.s.khan@bham.acuk

Relation between credibility of website and accuracy of website's contents. Values are numbers (percentages) unless otherwise indicated					
Feature of website credibility	Levels of accuracy*			Rank correlation	
	I	II	III	Kendall's tau b	P value
Description of source:					
Present (n=113)	27 (24)	42 (36)	44 (39)	0.15	0.48
Absent (n=8)	1 (12)	1 (12)	6 (76)		
Description of currency:					
Present (n=59)	20 (34)	19 (32)	20 (34)	0.21	0.05
Absent (n=62)	8 (13)	24 (39)	30 (48)		
Description of an evidence hierarchy:					
Present (n=22)	7 (32)	10 (45)	5 (23)	0.16	0.25
Absent (n=99)	21 (21)	33 (33)	45 (46)		

*Level I: more than two thirds of guideline statements covered; level II: one third to two thirds of guideline statements covered; level III: less than one third of guideline statements covered.

website's contents and they were converted into three accuracy levels. In level I, more than two thirds of guideline statements were covered (28/121 (24%) websites); in level II, one third to two thirds of guideline statements were covered (43 (35%) websites); in level III, less than one third of guideline statements were covered (50 (41%) websites).

We examined the relation between features of website credibility and level of accuracy of contents by cross tabulation and assessed the strength of association with Kendall's rank correlation, which adjusts for tied ranks in the data. The value of the coefficient (tau b) ranges from -1 to 1. Interpretation is subjective, but values near zero may be taken to indicate no correlation whereas values near 1 indicate a strong correlation. As shown in the table, websites with description of credibility features tended to have higher levels of accuracy of contents, but this relationship was not strong.

Comment

Our study shows that features of website credibility—source, currency, and evidence hierarchy—have only

slight or at best moderate correlation with accuracy of information in five common health topics. Thus, apparently credible websites may not necessarily provide higher levels of accurate health information.

We thank Julie Morris for statistical input.

KSK conceived and designed the study. HK, DG, PML, ML, and KSK searched, selected, and assessed websites. KSK and DG analysed and interpreted the data and wrote the manuscript. HK, PML, and ML revised the manuscript. KSK is guarantor for the paper.

Funding: None.

Competing interests: None declared.

1 Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the internet. Caveant lector et viewor—let the reader and buyer beware. *JAMA* 1997;277:1244-5.

2 Roberts JM, Copeland KL. Clinical websites are currently dangerous to health. *Int J Med Inf* 2001;62:181-7.

3 Kim P, Eng TR, Deering MJ, Maxfield A. Published criteria for evaluating health related websites: review. *BMJ* 1999;318:647-9.

4 Health Information Technology Institute. Criteria for assessing the quality of health information on the internet. <http://hitiweb.mitretrek.org/iq/onlycriteria.html> (accessed 15 Jan 2002).

5 Griffiths KM, Christensen H. Quality of web based information on treatment of depression: cross sectional survey. *BMJ* 2000;321:1511-5.

(Accepted 4 February 2002)

Follow up of quality of public oriented health information on the world wide web: systematic re-evaluation

Chiara Pandolfini, Maurizio Bonati

Laboratory for Mother and Child Health, Istituto di Ricerche Farmacologiche "Mario Negri", 20157 Milan, Italy
Chiara Pandolfini *senior research fellow*
Maurizio Bonati *head*
Correspondence to: C Pandolfini chiara@marionegri.it
BMJ 2002;324:582-3

In 1997 one of the first studies to evaluate the quality of health information on the internet was published.¹ This article assessed the reliability of information for managing fever in children at home and found that the quality of information was poor. Four years after publication these findings were mentioned in 78 journals (from *Journal Citation Report*), and the message should therefore have reached a wide audience. We investigated the effects of the earlier findings by re-evaluating the quality of the original web pages four years later, as well as that of a more recent sample of pages, using the same methods.

Methods and results

On 28 June 2001 we searched articles through the Institute for Scientific Information's citation index for references to the earlier study.¹ We searched for the 41 web pages evaluated in the original study to see if they still existed and if they did whether they had been substituted with new pages or their content had been modified. We compared the content with copies of the original pages, and we noted changes and assigned scores by using the guidelines and scoring system applied in the original study.¹ We then repeated the 1997 search for new pages, found 40, and scored them as well.