Health Promotion Journal of Australia, 2017, **28**, 15–20
http://dx.doi.org/10.1071/HE15127

How well are health information websites displayed on mobile phones? Implications for the readability of health information

Christina Cheng [A,B] ***and Matthew Dunn*** [A]

[A]School of Health and Social Development, Faculty of Health, Deakin University, 221 Burwood Highway, Burwood, Vic. 3125, Australia.
[B]Corresponding author. Email: christina.cheng@deakin.edu.au

Abstract

Issue addressed: More than 87% of Australians own a mobile phone with Internet access and 82% of phone owners use their smartphones to search for health information, indicating that mobile phones may be a powerful tool for building health literacy. Yet, online health information has been found to be above the reading ability of the general population. As reading on a smaller screen may further complicate the readability of information, this study aimed to examine how health information is displayed on mobile phones and its implications for readability.

Methods: Using a cross-sectional design with convenience sampling, a sample of 270 mobile webpages with information on 12 common health conditions was generated for analysis, they were categorised based on design and position of information display.

Results: The results showed that 71.48% of webpages were mobile-friendly but only 15.93% were mobile-friendly webpages designed in a way to optimise readability, with a paging format and queried information displayed for immediate viewing.

Conclusion: With inadequate evidence and lack of consensus on how webpage design can best promote reading and comprehension, it is difficult to draw a conclusion on the effect of current mobile health information presentation on readability.

So what? Building mobile-responsive websites should be a priority for health information providers and policy-makers. Research efforts are urgently required to identify how best to enhance readability of mobile health information and fully capture the capabilities of mobile phones as a useful device to increase health literacy.

Key word: health literacy.

Received 28 October 2015, accepted 14 April 2016, published online 2 June 2016

Introduction

The ever-expanding capabilities of mobile phones have transformed how we access information. More than 87% of Australians own a mobile phone with Internet access[1] and 82% of phone owners use their smartphones to search for health information.[2] The advance of communication technology has provided unprecedented access to health information at the convenience of our fingertips. However, studies have found that the readability of online health information is beyond the average reading ability of the general population.[3–6] Although there has been a substantial amount of evaluation studies conducted on the readability of online health information accessed through personal computers, the readability of health information on the much smaller screens of mobile phones has rarely been explored.

Access to health information is greatly enhanced by communication technology, and the Internet has been hailed as a useful tool to increase health literacy,[7,8] that is, the skill and ability to make healthcare decisions that involve 'knowledge, motivation and competencies to access, understand, appraise and apply health information.'[9(p4)] Yet, readability studies have put these claims into doubt, as they continue to find that the reading grade level of online health information is above the reading ability of adults. In a review of 352 global health websites, McInnes and Haglund found an average reading grade of 12.3 and none of the websites met the recommended level of grade six, the equivalent of 6 years of USA education.[5] Cheng and Dunn also reported an average reading grade of a minimum of 10.54 for Australian health websites.[3] So although people may have greater access to health information,

they may lack the basics of health literacy to comprehend and use such information.

Although reading grade level may have a role in the understanding of information, it is also posited that information comprehension, which includes readers' experience, the reading environment and presentation format also contribute to readability.[10] Hence, the readability of health information may be further complicated when reading on devices with smaller screen sizes, such as a mobile phone, smartphone, or tablet device. In a study comparing text reading on desktop and mobile screens, it was found that comprehension dropped by half when reading on the smaller screens of mobile devices.[11]

Users of mobile phones also display different information-seeking behaviour from tablet or personal computer users. A study by Google Australia found that 86% of Australian smartphone users prefer visiting a mobile-friendly site,[2] that is, a site with responsive design optimised for easier access to content on smaller screens.[12] Furthermore, mobile visits tend to be shorter and less information is viewed compared to visits from fixed devices.[13] Hence, it is recommended that significant information should be displayed above 'the fold'[14], the area where 'a user can see without scrolling down'[15] (see Fig. 1, for examples of queried information positioned above and below the fold). As such, users will have immediate access to the queried information once the webpage is loaded. Studies have also demonstrated that mobile webpages using the paging format – presenting text over several pages that fit the screen area – is easier to read than the scrolling format, in which users need to scroll down to keep reading.[10,16]

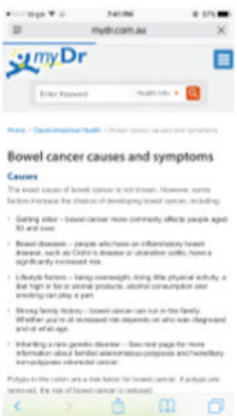
Reading grade level of online health information has already received much research attention,[3–6] however mobile users demonstrate different reading patterns than personal computers users. As such, this study aimed to examine how health information is displayed on mobile phones with the objective to examine its possible effects on readability. The specific research questions were:

(1) How many health webpages accessed through a mobile phone are mobile-friendly?
(2) How many mobile health webpages display the queried information above the fold?
(3) How many mobile webpages use the paging format?
(4) Are there differences between the mobile-friendliness of government, not-for-profit and commercial health webpages?

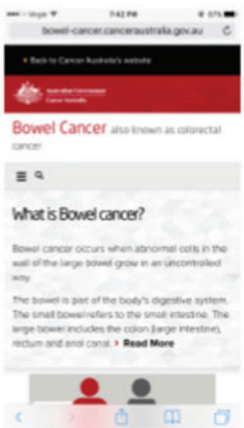
Methods

This study used a cross-sectional design with convenience sampling. Twelve common health conditions were identified based on the National Health Priority Areas,[17] Google 2013 most searched 'what is' list[18] and most searched terms on Google Trend. It was assumed that the 12 conditions would represent the most commonly searched health topics among Australians. To simulate the search of an average Australian, simple English terms instead of medical terminology were used. The 12 search terms selected were bowel cancer, breast cancer, prostate cancer, heart disease, anxiety, depression, diabetes, asthma, arthritis, back pain, obesity, and dementia. Since the most searched health categories are causes, symptoms, and treatments,[19] the 12 health terms were further combined with these three categories to create a total of 36 search terms.

Sample webpages were identified through a search engine, as 80% of online health searches start from a search engine.[20] With over 96% of mobile users using Google as their search engine of choice,[21] Google was used for webpage identification. Studies of mobile search behaviour indicate that users often look only at the first page of search results,[22] therefore, only the first page of results was included. The webpages needed to be in English, written for consumers and be freely available to the general public for inclusion. The search, using an iPhone 6 Plus and accessing the Internet via



Above the fold – causes of bowel cancer can be viewed immediately



Below the fold – scrolling is required to view causes of bowel cancer

Fig. 1. Examples of queried information positioned above and below the fold on iPhone 6 Plus.

Safari, the default browser on iPhone, was conducted on one day (5 December 2014) to minimise the effect of changes to website content.

Exclusion criteria for websites included broken links, irrelevant information, news, advertisements, and medical journals. Search engine-generated results, such as definition, feedback, blogs, forums, and video and audio links were also excluded, as were links to outside resources. In addition, websites on which relevant health information was five clicks away from the search engine results page were excluded as they were considered too difficult to access and were not likely to be read.[5]

Webpages that met the inclusion criteria were recorded with information including the name of the associated organisation, position on search result page, country of origin, type of organisation and the three features of webpage design as stipulated in the research questions. For research questions 1, 2 and 3, descriptive statistics were used for analysis. Chi-square analyses were performed to determine if there were any significant differences between webpage designs across types of organisations. The statistical analyses were performed using STATA version 13. *P*-values of 0.05 were set for all statistical tests.

Results

The results for the 36 search terms generated a total of 344 links. Based on the selection criteria, 74 did not meet the inclusion criteria, resulting in a final sample of 270 webpages from 80 websites. Diabetes-related searches produced the highest number of eligible results ($n = 27$) and bowel cancer-related searches produced the least results ($n = 18$; see Fig. 2 for distribution of webpage design by health condition). For types of organisation, 42.59% were commercial webpages, 38.15% were run by not-for-profit organisations and 19.26% were government webpages. For country of origin, 51.11% were webpages from the USA, 36.67% were Australian webpages, 10.37% were UK webpages and 1.85% was from other countries.

When accessed via a mobile phone, 193 (71.48%) health webpages were mobile-friendly and 77 (28.52%) led to a desktop site. When breaking down into individual health condition, dementia webpages had the highest proportion of mobile-friendly webpages, with 20 being mobile-friendly and only two desktop sites. Bowel cancer information has the lowest proportion of mobile-friendly sites with 10 being mobile-friendly and eight being desktop sites (see Fig. 2 for distribution of webpage design by health condition). Of the 193 mobile-friendly webpages, 69.96% ($n = 135$) displayed the queried information above the fold and 30.05% ($n = 58$) required scrolling to view the queried information. The majority of mobile-friendly webpages (67.88%) employed the scrolling format with only 32.12% designed in the paging format.

Although 71.48% of health webpages were mobile-friendly, only 50% health webpages were mobile-friendly with the queried information displayed above the fold. When the variable of paging format is included, the result indicated that only 15.93% were mobile-friendly webpages in a paging format with queried information positioned above the fold for immediate viewing (see Fig. 3 for distribution of webpage design and format).

Of the commercial webpages 84.35% were mobile-friendly compared to 69.23% of government webpages and 58.25% of not-for-profit webpages. The relationship between organisational type and webpage design was statistically significant (χ^2 (2, 270) = 18.3104, $P < 0.001$). However, the strength of the relationship is small (Cramer's V = 0.26).

For mobile-friendly webpages, 85% of not-for-profit webpages placed the queried information above the fold whereas 64.95%

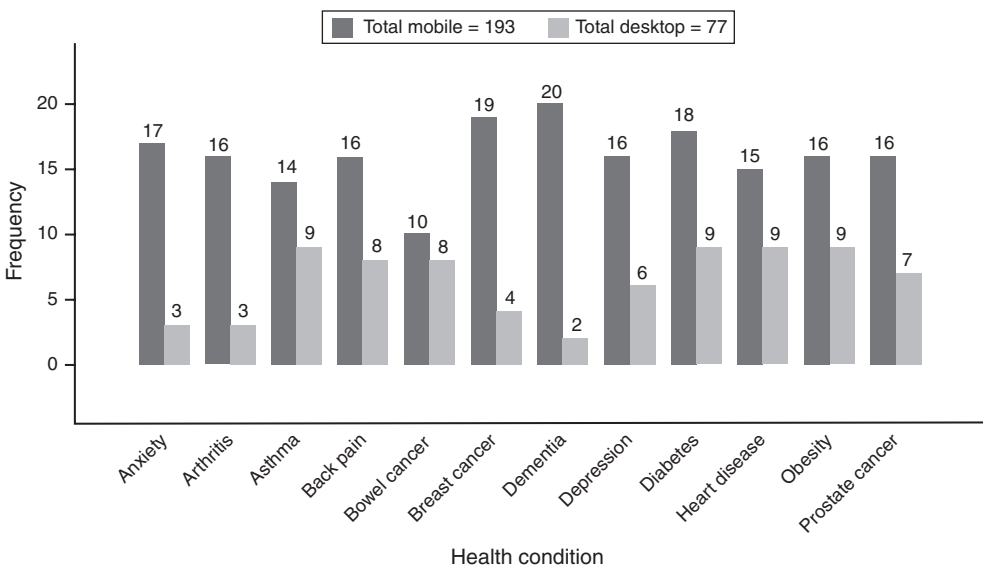


Fig. 2. Distribution of webpage design by health condition.

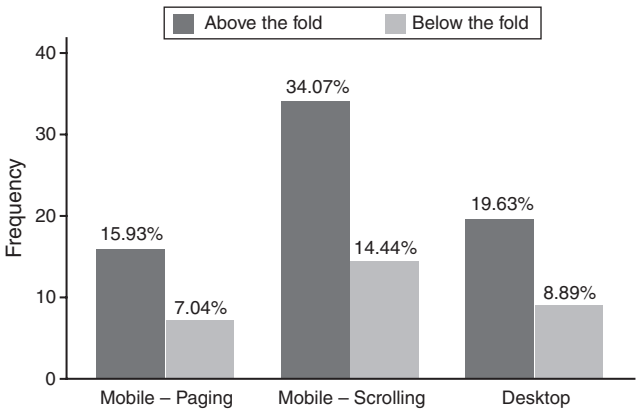


Fig. 3. Distribution of webpage design and format.

of commercial and 58.33% of government webpages did so. The relationship between organisational type and information position was statistically significant (χ^2 (2, 193) = 9.93, $P = 0.01$). However, the strength of the relationship was small (Cramer's V = 0.23).

Regarding webpage format, 46.39% of commercial webpages used the paging format whereas only 25.22% of government and 15% of not-for-profit webpages used the paging format. The χ^2 test result (χ^2 (2, 193) = 18.74, $P < 0.001$) indicates that the relationship between organisational type and webpage format is statistically significant and the strength of relationship is strong (Cramer's V = 0.31).

It is noted that dementia-related webpages had the highest number of mobile-friendly webpages ($n = 20$) and least number of desktop pages ($n = 2$). However, no significant relationship between health condition and mobile-friendly design was found (χ^2 (11, 270) = 14.56, $P = 0.20$). For the 30 number-one ranking webpages, 70% of them were mobile-friendly. However, only 56.57% were mobile-friendly with queried information displayed above the fold and the proportion again fell to 20% for mobile-friendly webpages with information positioned above the fold and in a paging format. The trend is similar to the overall result of all webpages.

Discussion

With increasing demand for self-management of chronic diseases to minimise health costs in the face of an ageing population, combined with an array of health services and treatment choices, health literacy is deemed 'an essential life skill' in the 21st century.[23] As health literacy is a key outcome of health education, access to easy-to-read health information is crucial in building health literacy.[24] The present study sought to examine how health information was displayed on mobile phones based on webpage design and found that 71.48% of health webpages were mobile-friendly but only 15.93% were mobile-friendly webpages designed in a paging format with queried information positioned above the fold, which has been recommended as the optimal way information should be presented on mobile-friendly webpages.

With the advance of communication technology, accessibility of health information has been greatly improved for the general public and the popularity of smartphones adds further momentum to the ease and speed of finding health information. However, mobile phone users demonstrate very different behavioural patterns from tablet and desktop users. A mobile-friendly site is essential for encouraging users to stay on a site when using a mobile device, as 75% of users will leave a site solely because it is not mobile-friendly.[2] Although the results of this study indicate that the majority of health websites are mobile-friendly, there is still about one-third of health websites that users may abandon before reading any important information simply due to the fact that they are not mobile-friendly.

The result shows that more commercial websites are mobile-friendly than government or not-for-profit websites. Commercial organisations may have more resources to develop their websites optimally over multiple platforms to ensure that they have websites that cater to the reading needs of consumers, and in turn may attract more viewing than government or not-for-profit websites. Given that government websites should be evidence-based and designed for the general public, increased resources should be directed towards ensuring that the public can access this information across multiple platforms, thus providing consumers with appropriate and evidence-based information.

The present study also found that health websites are predominately designed in the scrolling format and queried information may not be displayed above the fold. Mobile users are impatient users; they use the mobile phone to look for quick answers and will abandon a site if it is not loaded within 3 seconds.[2] Therefore, it is not surprising that studies have found that the fold and scrolling could affect reading of information.[14,16,25] Furthermore, an eye movement tracking experiment reported that the area above the fold received 102% more viewing than below the fold.[14] Therefore, if health information is not displayed above the fold for immediate viewing, it is highly likely that the information may not be read. However, mobile viewing habits continue to evolve and Nielsen has argued that the concept of above the fold is no longer relevant in an environment of varying screen sizes.[26] Moreover, people may have now become accustomed to the action of scrolling as it is the commonly used format in social media.

The effects of scrolling and paging formats on reading and comprehension are also inconclusive due to limited evidence. It has been found that text presented in a paging format could be read significantly faster than in a scrolling format,[25] and comprehension of narrative texts could be improved in a paging format when reading on small screens.[16] Users may also experience the psychological burden of feeling drowned in an information abyss with infinite scrolling.[27] Scrolling also presents cognitive challenges for users, requiring them to recall information displayed earlier on the screen and low-literacy users may get disoriented, lose track of the context and miss important health information when scrolling.[28] However, Nielsen posited that the scrolling action may be

easier for users than clicking through pages.[26] Given the fact that many users would leave a site if it were not loaded within 3 seconds,[2] it is plausible that readers may not want to click and wait for the loading of subsequent pages.

The limited evidence and lack of consensus on how to present health information in the mobile environment to promote reading and comprehension is a major limitation of this study. That mobile-responsiveness of a website affects readability of mobile health information can be ascertained; however, whether the display of health information on mobile phones has any implications for readability cannot be easily concluded. Due to limited time and resources, this study did not evaluate the reading grade level of health information on mobile phones. However, although no specific comparison was conducted, the health information accessed via the mobile device was essentially similar to those accessed through personal computers, and previous studies have already found that online health information is beyond the reading ability of the general population.[3–6] Therefore, displaying health information in an easy-to-read format will only be effective in enhancing readability when it is complimented with health information that is written in an easy-to-read style.

The other limitation of this study is that only 12 common health conditions were included in the analysis. Although they did reflect current health priority areas, whether they are the most commonly searched topics on mobile phones cannot be determined since there is only a very limited number of studies investigating mobile search behaviour. A further limitation of the study was the use of iPhone 6 Plus for viewing webpages, as other mobile devices with different screen sizes may produce different viewing effects.

Mobile searching for health information is a much overlooked research area[29] and little is known about search behaviour and the needs of information seekers.[22] Hence, the current study can only rely on the limited knowledge available to assess the affect of mobile health information display on readability. Further studies on the needs and actual usage patterns of mobile users are needed for health professionals to be able provide usable and comprehensible health information in the unique environment of mobile phones.

Conclusion

The Internet has been found to be an effective medium for delivering health information to the wider population including people with lower income and less education, as well as minority groups.[30] Internet accessibility of health information has greatly increased as the popularity of smartphones grows and it is predicted that mobile Internet will soon become the foremost way of accessing information.[10] The fact that most mobile users will abandon a desktop site when searching on their mobile phones indicates that building mobile-responsive websites should become a priority for health information providers in an effort to build health literacy. At the same time, research efforts are urgently required to establish a comprehensive knowledge base for health professionals and policy-makers to fully capture the capabilities of mobile phones as a useful health literacy tool.

References

1. Australian Bureau of Statistics. Mobile handset subscribers. 2013. Available from: http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/8153.0Chapter8December%20 2013 [Verified 10 January 2015].
2. Google Australia. What users want most from mobile sites today. 2012. Available from: https://static.googleusercontent.com/media/www.google.com.au/en/au/events/thinkmultiscreen/pdf/gomo-study-australia-logo.pdf [Verified 6 October 2014].
3. Cheng C, Dunn M. Health literacy and the Internet: a study on the readability of Australian online health information. *Aust NZ J Publ Heal* 2015; **39**(4): 309–14.
4. Fitzsimmons PR, Michael BD, Hulley JL, Scott GO. A readability assessment of online Parkinson's disease information. *J R Coll Physicians Edinb* 2010; **40**(4): 292–6. doi:10.4997/JRCPE.2010.401
5. McInnes N, Haglund BJA. Readability of online health information: implications for health literacy. *Inform Health Soc Care* 2011; **36**(4): 173–89. doi:10.3109/17538157.2010.542529
6. Walsh TM, Volsko TA. Readability assessment of Internet-based consumer health information. *Respir Care* 2008; **53**(10): 1310–5.
7. Christmann S. Health literacy and Internet: recommendations to promote health literacy by the means of the Internet. 2005. Available from: http://eurohealthnet.eu/sites/eurohealthnet.eu/files/publications/pu_8.pdf [Verified 10 November 2014].
8. Dart JM, Gallois C. Community desires for an online health information strategy. *Australian Health Review* 2010; **34**(4): 467–76. doi:10.1071/AH08719
9. Kickbusch I, Pelikan J, Apfel F, Fsouros A. Health literacy: The solid facts. 2013. Available from: http://www.euro.who.int/__data/assets/pdf_file/0008/190655/e96854.pdf [Verified 10 November 2014].
10. Öquist G. Three eye movement studies of mobile readability. In Lumsden J, editor. Handbook of research on user interface design and evaluation for mobile technology (Vols 1 and 2). pp 945–971. Hershey: Information Science Reference/IGI Global; 2008.
11. Singh R, Sumeeth M, Miller J. Evaluating the readability of privacy policies in mobile environments. *IJMHCI* 2011; **3**(1): 55–78. doi:10.4018/jmhci.2011010104
12. ExactTarget. 2014 mobile behavior report. 2014. Available from: http://www.exacttarget.com/sites/exacttarget/files/deliverables/etmc-2014mobilebehaviorreport.pdf [Verified 5 October 2014].
13. Nicholas D, Clark D, Rowlands I, Jamali HR. Information on the go: a case study of European mobile users. *J Am Soc Inf Sci Technol* 2013; **64**(7): 1311–22. doi:10.1002/asi.22838
14. Schade A. The fold manifesto: why the page fold still matters. 2015. Available from: http://www.nngroup.com/articles/page-fold-manifesto/ [Verified 6 February 2015].
15. Google. Above the fold. Available from: https://support.google.com/adsense/answer/132618?hl=en [Verified 10 January 2015].
16. Fukaya TY, Ono S, Minakuchi M, Nakashima S, Hayashi M, Ando H. Reading text on a smart phone: scrolling vs. paging: toward designing effective electronic manuals. 2011 International Conference on User Science and Engineering (i-USEr); 2011. doi:10.1109/iUSEr.2011.6150537doi:10.1109/iUSEr.2011.6150537
17. Australian Institute of Health and Welfare. National health priority areas. 2014. Available from: http://www.aihw.gov.au/national-health-priority-areas/ [Verified 10 November 2014].
18. Google. Trends: explore the 2013 zeitgeist. 2013. Available from: http://www.google.com/trends/topcharts#vm=chart&cid=zg222&geo=AU&date=2013&cat= [Verified 11 November 2014].
19. Jadhav A, Andrews D, Fiksdal A, Kumbamu A, McCormick JB, Misitano A, Nelsen L, Ryu E, Sheth A, Wu S, Pathak J. Comparative analysis of online health queries originating from personal computers and smart devices on a consumer health information portal. *J Med Internet Res* 2014; **16**(7): e160. doi:10.2196/jmir.3186
20. Fox S, Duggan M. Health online 2013. 2013. Available from: http://www.pewinternet.org/2013/01/15/health-online-2013/ [Verified 10 November 2014].
21. StatCounter. StatCounter global stats: top 5 mobile search engines in Australia from Sept 2013 to Sept 2014. 2014. Available from: http://gs.statcounter.com/#mobile_search_engine-AU-monthly-201309-201409 [Verified 22 October 2014].
22. Church K, Smyth B, Cotter P, Bradley K. Mobile information access: a study of emerging search behavior on the mobile Internet. *ACM Trans Web* 1–38. doi:10:1145/1232722.1232726
23. Kickbusch I. Health literacy: an essential skill for the twenty-first century. *Health Educ* 2008; **108**(2): 101–4. doi:10.1108/09654280810855559

24. Nutbeam D. Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promot Int* 2000; **15**(3): 259–67. doi:10.1093/heapro/15.3.259
25. Öquist G, Lundin K. Eye movement study of reading text on a mobile phone using paging, scrolling, leading, and RSVP. Proceedings of the 6th international conference on mobile and ubiquitous multimedia. Oulu, Finland: ACM; 2007. pp. 176–183.
26. Nielsen J. Scrolling and attention. 2010. Available from: http://www.nngroup.com/articles/scrolling-and-attention/ [Verified 5 January 2015].
27. Loranger H. Infinite scrolling is not for every website. 2014. Available from: http://www.nngroup.com/articles/infinite-scrolling/ [Verified 3 January 2015].
28. Summers K, Summers M. Making the web friendlier for lower-literacy users. *Intercom (Des Moines)* 2004; **51**(6): 19–21.
29. Westlund O, Gomez-Barroso J-L, Compano R, Feijoo C. Exploring the logic of mobile search. *Behav Inf Technol* 2011; **30**(5): 691–703. doi:10.1080/0144929X.2010.516020
30. Bessell TL, Silagy CA, Anderson JN, Hiller JE, Sansom LN. Prevalence of South Australia's online health seekers. *Aust N Z J Public Health* 2002; **26**(2): 170–3. doi:10.1111/j.1467-842X.2002.tb00912.x