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Kertas Asli/*Original Articles*

Usage of Health Information Websites: A Systematic Review of Older Adults' Preferences for Web Features

(Penggunaan Laman Web Maklumat Kesihatan: Kajian Sistematik Pilihan Warga Emas terhadap Ciri-ciri Laman Web)

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ABSTRACT

Online health information have a role in enhancing health in older adults. However, age-related physiological changes and non-senior friendly websites proved to be a challenge for older adults. Research investigating older adults' preferences of features in health information websites is limited. Thus, in this review, we aim to summarize older adults' preferences regarding the design and content of health websites. Medline, CINAHL, Cochrane Library, Scopus, Journal of Medical Internet Research (JMIR) and Google Scholar were searched for relevant articles in February 2018, using key words 'older adults', 'Internet', 'health information' and 'usability'. The methodological quality of included studies was evaluated using the McMaster critical appraisal tools by two independent reviewers. Individual study design, participants' characteristics, and identified preferences for health website features were extracted and summarized narratively. (PROSPERO registration number: CRD42018096281). Five studies (3 qualitative, 2 quantitative) were included in this review. The quality appraisal score ranged from 32% to 83%. The web feature preferences of older adults were grouped into three domains: web presentation factors, web navigation factors and health information preferences. The results highlight older adults have specific preferences when engaging with online content. This review suggests that readable text, simple design, consistent layout and straightforward web navigation are the preferred priorities for a health information website for older adults. Findings from this review may be useful to healthcare professionals and developers to understand older adults' preferences pertaining to web design and contents in health websites specifically designed for this population.

Keywords: Older adults; Internet; health information; usability; preferences

ABSTRAK

Maklumat kesihatan atas talian mempunyai peranan dalam mempertingkatkan tahap kesihatan dalam kalangan warga emas. Namun, perubahan fisiologi akibat penuaan dan laman web yang tidak mesra warga emas terbukti sebagai satu cabaran bagi warga emas. Penyelidikan yang mengkaji pilihan warga emas mengenai ciri laman web kesihatan adalah terhad. Oleh itu, kajian ini bertujuan untuk merumus pilihan warga emas mengenai reka bentuk dan kandungan laman web kesihatan. Artikel yang berkaitan dicari dari Medline, CINAHL, Cochrane Library, Scopus, Journal of Medical Internet Research (JMIR) dan Google Scholar pada Februari 2018, menggunakan kata kunci 'older adults', 'Internet', 'health information' dan 'usability'. Kualiti metodologi penyelidikan yang terlibat dinilai oleh dua pengulas bebas menggunakan McMaster critical appraisal tools. Reka bentuk penyelidikan, ciri-ciri peserta dan keutamaan kriteria laman web kesihatan yang dikenal pasti diestrak dan dirumus secara naratif. (Nombor pendaftaran PROSPERO: CRD42018096281). Sebanyak lima penyelidikan (3 kualitatif, 2 kuantitatif) dimasukkan dalam kajian ini. Skor penilaian kualiti adalah antara 32-83%. Pilihan ciri web warga emas dikategorikan kepada tiga domain: faktor persembahan web, faktor navigasi web dan keutamaan maklumat kesihatan. Dapatan kajian ini menunjukkan warga emas mempunyai pilihan spesifik semasa mengakses kandungan atas talian. Kajian ini mencadangkan teks yang senang dibaca, reka

bentuk yang ringkas, susun atur yang konsisten dan navigasi web yang mudah merupakan pilihan utama warga emas mengenai laman web kesihatan. Penemuan kajian ini mungkin akan memanfaat profesional kesihatan dan pembangun web untuk memahami keutamaan warga emas terhadap reka bentuk dan kandungan laman web kesihatan yang dibina khas bagi golongan ini.

Kata kunci: Warga emas; Internet; maklumat kesihatan; kebolehgunaan; pilihan

INTRODUCTION

The use of Internet is proliferating in the modern society. Growing ageing population has led to older adults using the Internet more frequently, with many engaged with health-related Internet content (Hong & Cho 2016; Pew Research Center 2017; Zheng et al. 2015). Seeking health information was the most common online health-related activity among older adults (Burns et al. 2018; Hong & Cho 2016). Common details sought online were symptoms, prognosis and treatment options (Medlock et al. 2015). As older adults are more prone to health conditions as they age, they are likely to become the main consumers of health information websites. Although older adults are increasingly online, the way they interact with the Internet differ substantially from other age groups.

Older adults with less education and of lower socioeconomic status are less likely to use computers (Hong & Cho 2016; Hunsaker & Hargittai 2018; Pew Research Center 2017). Many are discouraged from accessing the Internet because of lack of knowledge and computing skills (Pew Research Center 2004). Computer use anxiety, confidence, self-efficacy and perceived task complexity were some of the other factors which limit Internet access in older adults (Chu et al. 2009; Gatto & Tak 2008; Pew Research Center 2017). In addition, age-related physical limitations such as vision, hearing, motor and memory impairments were identified as barriers for this group of users (Hawthorn 2000; Pew Research Center 2017). As a result, many older adults express confusion and frustration when searching for specific information online (Gatto & Tak 2008).

Nevertheless, older adults were optimistic about using the Internet in their daily lives (Pew Research Center 2017) with several benefits highlighted in the literature. Using computers allows them to improve their personal traits and relationships and provides a sense of self control (Aguilar et al. 2010). Some also considered using computer to keep their brains active (Aguilar et al. 2010) with targeted training helping to embrace this technology (Chu et al. 2009).

Despite the growing proportion of older adults who access online resources and use the Internet for health information seeking purpose, usability problems in accessing health websites may persist. Attention has been drawn towards website interface design to ease and empower older adults to use online health information (Pew Research Center 2004). Direct involvement of end-users while designing a website could help in accommodating the special needs of the older population (Alpay et al. 2004; Demiris et al. 2001). Despite this recognition, to date, there is a limited body of research exploring the impact of websites which are designed specifically for older adults. One study showed that re-designing websites based on the needs of older adults improved website usability (Chadwick-Dias et al. 2002) and therefore may result in better engagement.

Various studies and guidelines on developing websites targeting older adults are now available (Davis & Lafrado 2003; National Institute on Aging/National Library of Medicine 2001; Reeder et al. 2011; Sillence et al. 2007; W3C 2010; Zaphiris et al. 2006). For example, the checklist on 'Making your website senior friendly' developed by NIA/NLM (2001) focuses on four main aspects of web design features namely (1) designing readable text (2) presenting information (3) incorporating other media and (4) increasing ease of navigation. Zaphiris et al. (2006) also provide comprehensive guidance for designing a website targeted at older people. The authors propose a total of 38 criteria, which are classified under 11 headings (target design, use of graphics, navigation, browser window features, content layout design, links, user cognitive design, use of colour and background, text design, search engine, and user feedback and support). While there have been increasing guidance on web design features, to date, there have been no research initiatives which have systematically summarized the current evidence on older adults' preferences on design and content of health websites. This systematic review aims to address this knowledge gap.

METHODS

This review was registered in PROSPERO: International prospective register of systematic reviews (ID number: CRD42018096281, available at https://www.crd.york.ac.uk/prospero/). This review process was informed by best practice standards in the conduct and reporting of systematic reviews.

SEARCH STRATEGY

We searched six commonly used electronic health databases Medline @EBSCOhost, CINAHL @EBSCOhost, Scopus, Cochrane Library, Journal of Medical Internet Research (JMIR) and Google Scholar for relevant articles. The key words 'older adults', 'Internet', 'health information' and 'usability' were used for all databases. Medical subject headings (MeSH) and CINAHL subject headings were used and connected with Boolean operators 'OR' and 'AND' (Supplementary Table 1). In order to avoid publication bias and to maximize search efforts, a range of strategies were used. The references of the retrieved articles were reviewed to avoid missing relevant studies (pearling). As Google Scholar results are displayed based on the level of relevance (Giustini & Kamel Boulos 2013; Hoseth 2011), searches were performed to the first 10 pages, with each page consisting of 10 search results. Searches were limited to English language publications, ranging from December 2002 to the present. This time period was chosen as it appears to mark the beginning stages when using online resources for health information became a common phenomenon (Pew Research Center 2003). The searches were conducted from February 2018 till April 2018 and updated in February 2020. No new related articles were found following the update process.

SELECTION CRITERIA

The search strategy was based on the Population, Exposure, Comparison, Outcome and Study framework and search terms of this review were as depicted in Table 1. There was no definite cut-off age for defining older adults (World Health Organization 2018). In developed and developing countries, older adults are referred to as a person of age ≥60/65 and ≥50 years respectively (World Health Organization 2018). To be inclusive, we included older adults at age 50 and above. This review focused on users' exposure to health information websites. We excluded articles related to portals, website-delivered intervention, online assessment tools, mobile health applications and telemedicine as website features and user-interface are not comparable with these. Both qualitative and quantitative or mixed-methods studies that met the inclusion criteria were included.

LITERATURE SELECTION

Literature selection was underpinned by a three-stage process. First, all the relevant hits from the search process was collated into one large repository. Second, two reviewers independently screened the titles and abstracts for eligible articles. Eligibility was based on the inclusion and exclusion criteria with disagreements resolved through discussion between the reviewers. Finally, the third step involved assessing the eligibility of each study using full text as per the inclusion and exclusion criteria. Reasons for exclusion of studies were recorded with disagreements resolved through discussion between the reviewers.

TABLE 1. Search strategy

	Definition
P (population)	Older adults, at age 50 years and above
E (exposure)	Accessed to health information websites/online health information
C (comparison)	N/A
O (outcome)	Preferences of older adults when accessing health information websites/online health information
S (study)	Qualitative, quantitative or mixed method studies

Abbreviation: N/A, Not applicable.

QUALITY ASSESSMENT

Modified McMaster quantitative and qualitative (version 2.0) appraisal tools were used to critically appraise the methodological quality of related articles (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004; Nayak et al. 2006; Robertson-Lang et al. 2011). A score of '0' was assigned to those elements marked as 'No / Not addressed', while a score of '1' was assigned to those elements marked as 'Yes'. Elements inapplicable to individual studies were removed from the checklist. The total score was then calculated. The McMaster critical appraisal tool for quantitative studies was scored on a scale of 0-18, while that for qualitative studies the score ranged from 0-22. A higher score indicates better methodological quality. Retrieved articles were critically appraised by two independent reviewers. Any discrepancy which emerged was resolved through discussion.\

DATA EXTRACTION AND ANALYSIS

A customized data extraction form was developed to extract data which provided an overview of the included studies.

TABLE 2. Characteristics of the included studies

Authors	Country	Study approach	Method	n / Male / Female / Age	Participants' characteristics	Ways to gather answers related to this review
Bolle et al. 2016	Netherlands	Qualitative study	Video-recorded think-aloud observations	n=23, M=11, F=12, median age =73	Colorectal cancer patients, survivors and their partners	Search tasks - to obtain insight in terms of the general navigation behavior of the participants. - to access information preferences. Evaluations - opinions on content and usefulness of websites. Application tasks - how websites are used.
Good et al. 2007	United Kingdom	Qualitative study	Think-aloud observations followed by a questionnaire	n=26, age range=60-85	Novice users, with little or no experience of using computers. All had some degree of vision impairment with 2 having motor restrictions	Search tasks - to address any problems relating to ease of use and accessibility of websites. Post-task evaluations - elements of the websites which affected information accessibility.
Nahm et al. 2004	United States of America	Qualitative study	Heuristic evaluation and modified usability testing using observation, a think-aloud method, audiotaping, and an interview.	n=10, M=1, F=9, mean age=73.9	Cognitively intact (MMSE≥28) online users with unimpaired vision and hearing ability.	Specific tasks were developed (eg navigation, finding information). - to test the usability of the websites.
Nayak et al. 2006	United Kingdom	Quantitative study	Search task followed by a questionnaire	n=99, M=41 F=58, age range=58-90	Internet users and non-users.	Post-task questionnaire -Rating of level of satisfaction using a 4-point scale
Robertson-Lang et al. 2011	Canada	Quantitative study	Search tasks followed by questionnaires	n=83, M=38, F=45, age range=55-86	Community living, of which majority were internet users.	Post-task evaluations - description of likes and dislikes about the chosen website.

Abbreviation: MMSE, Mini-Mental State Examination.

The data was extracted by the lead author (CN) and verified by a member of the research team (DS). Extracted data included: country in which the study was undertaken, study design, data collection method, and participants' characteristics and broadly followed the PECOS framework (Table 2). Given the nature of the review question and heterogeneity of the included studies, data were descriptively synthesized.

RESULTS

STUDY SELECTION

An initial search of the various databases yielded 127 results. After removal of duplicates, 107 studies remained. Following the review of titles and abstracts, 95 studies

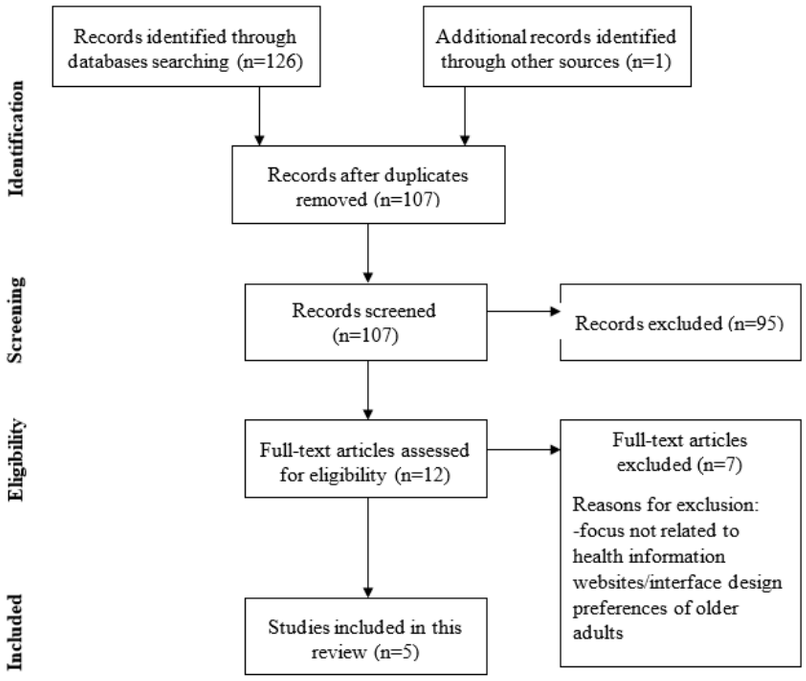

FIGURE 1. PRISMA flowchart of the study selection process

were excluded. Twelve studies were retrieved for full text evaluation. Out of the 12 full text articles, 7 were subsequently excluded because the studies either did not assess the use of health information websites among older adults or failed to report older adults' preferences from their perspectives. Of the five included studies, three were qualitative studies and two were quantitative studies. The search process is summarized in Figure 1.

STUDY CHARACTERISTICS

The characteristics of the included studies are outlined in Table 2. The included studies used different research approaches or methods and participants were recruited from various countries. Two studies were conducted in the United Kingdom (Good et al. 2007; Nayak et al. 2006), one each in the Netherlands (Bolle et al. 2016), the United States (Nahm et al. 2004) and Canada (Robertson-Lang et al. 2011). Age range of older adults varied within the included studies. Two studies used the cut-off age at 55 years (Nahm et al. 2004; Robertson-Lang et al. 2011) and one study used the cut-off age at 65 years (Bolle et al. 2016). While two studies did not state a cut-off age per se, age range of older adults were reported to be 60-85 and 58-90 years old respectively (Good et al. 2007; Nayak et al. 2006). The number of recruited older adults differed among studies. The three qualitative studies consisted of 23, 26 and 10 older adults respectively (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004). While the number of participants in two quantitative studies were 99 and 83 respectively (Nayak et al. 2006; Robertson-Lang et al. 2011). Four studies included older adults from the community or across a range of settings (Good et al. 2007; Nahm et al. 2004; Nayak et al. 2006; Robertson-Lang et al. 2011) with no condition-specific focus. One study however had a focus on colorectal cancer patients, survivors and their partners specifically (Bolle et al. 2016). Most of the older adults within the included studies had some level of computer or Internet experience (Bolle et al. 2016; Nahm et al. 2004; Nayak et al. 2006; Robertson-Lang et al. 2011), except the study by Good and colleagues (2007), where older adults had little or no experience of using the Internet. All qualitative studies used think-aloud observation methods to identify the participants' preferred design and content of the health websites (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004). Supplementary methods such as questionnaire, interview, or audio / video-recording were utilized to further improve the validity of the collected data. The two quantitative studies required older adults to perform Internet search tasks, followed by answering questionnaires (Nayak et al. 2006; Robertson-Lang et al. 2011).

METHODOLOGICAL QUALITY

The methodological quality of the three qualitative studies were low to moderate (Table 3), with quality appraisal scores ranging from 7 (32%) to 11 (50%) out of a maximum

of score of 22 (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004). In all three studies, the description of data collection methods was insufficient (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004). There was lack of clear and complete description of the site and participants, the role of the researcher and relationship with participants and the assumptions and biases of research. The participants' details were provided comprehensively in only one study (Bolle et al. 2016). None of the studies audited their findings, either through development of the decision trail or detailed description of the data analysis process. All three studies inadequately described data triangulation, which raised queries about the trustworthiness of the results. Only data credibility was demonstrated in all studies. Analytical rigour was adequately reported in one study (Bolle et al. 2016). In another study, the methods used for data analysis were described, but information on study findings lacked details (Good et al. 2007).

The two quantitative studies scored 10/12 (83%) and 5/12 (42%) respectively (Table 4) (Nayak et al. 2006; Robertson-Lang et al. 2011). Two items (6b, 6c) from the McMaster Quantitative Studies Critical Appraisal Tool were excluded (as these items were not applicable for the research design), bringing the total score to 12. The studies did not have detailed descriptions of their samples or demonstrated appropriate sample size calculation or justification for their sample size (Nayak et al. 2006; Robertson-Lang et al. 2011). One of the studies was rated as low quality (Robertson-Lang et al. 2011) as the validity and reliability of the outcome measures, data collection methods, data analysis and results were not described adequately.

PREFERRED DESIGN AND CONTENT OF THE HEALTH INFORMATION WEBSITES

Older adults' preferences when searching for online health information were identified from the included studies through systematic data extraction. Once summarized, these preferences were broadly classified into three main areas. They are: web presentation factors, web navigation factors, and health information preferences (Table 5).

WEB PRESENTATION FACTORS

These factors which include readable text, advertisements or pop-ups, design and layout of the website set the first impression of the health websites. The fonts used, font sizes, spacing between lines or paragraphs, use of white space, background colour and contrast affect the readability of text on the health websites. Small font size was a major factor affecting readability (Bolle et al. 2016; Good et al. 2007; Nahm et al. 2004; Nayak et al. 2006), while consistent font sizes and styles on the web pages was appreciated by older adults (Nahm et al. 2004). Appropriate spacing between lines or paragraphs and proper use of white space also enhanced the readability of website contents (Nahm et al. 2004). In addition, older adults preferred white backgrounds with colours that contrasted with the text (Bolle et al. 2016; Good et al. 2007; Nayak et al. 2006). Advertisements and pop-ups were among the other factors that affected older adults' preferences towards the health information websites (Good et al. 2007). Older adults disliked embedded or pop-up advertisements in the websites (Robertson-Lang et al. 2011).

Other preferences included the design and layout of the websites. Websites with appealing designs are more likely to attract older adults (Nahm et al. 2004), while plain pages affected the website accessibility (Good et al. 2007). The layout of websites led older adults to decide whether or not to continue browsing a particular site (Robertson-Lang et al. 2011). An overall poor website layout greatly reduced older adults' interest in continuing to browse the website (Good et al. 2007).

WEB NAVIGATION FACTORS

Within this category, web navigation factors included various navigation tools, such as menu bars, scroll bars, navigation buttons, navigation cues, search bar, content organization, links, headings, labeling and technology terms. All these elements guided the users on where and how to search for information on the particular website.

Large and appropriately positioned navigation buttons providing options to return to the previous page or homepage after visiting a link were well accepted (Bolle et al. 2016). Lack of navigation cues, on the other hand, left users uncertain of where to find information (Good et al. 2007). Clear headings and labeling using the appropriate font size may provide users with a smoother web navigation process (Good et al. 2007; Nayak et al. 2006).

Most older adults were unfamiliar with drop-down menu bars (Nahm et al. 2004). They disliked websites with two or more menu bars, as they found them too complex to process the perceived information (Bolle et al. 2016). The web navigation process can be made difficult due to the unavailability of menus on the index page (Good et al. 2007). As for scroll bars, some older adults stated that they were able to and did not mind scrolling up and down websites (Bolle et al. 2016). However, it was a problem for those with motor restrictions (Good et al. 2007) and some were not aware of the need to scroll (Nahm et al. 2004).

Search bars which are easy to use can help users to quickly locate the required information. The entire search process can be inconvenient for users when the search bar

TABLE 3. Methodological quality for qualitative studies

Authors	Criteria																							Score	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Raw	%
Bolle et al. 2016	Y	Y	Qualitative	N	Video-recorded think-aloud observations	Y	NAD	Y	N	Y	N	N	N	Y	Y	N	N	Y	Y	N	N	N	Y	Y	11/22	50
Good et al. 2007	Y	Y	Qualitative	N	Think-aloud observation followed by a questionnaire	Y	NAD	NAD	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	7/22	32
Nahm et al. 2004	Y	Y	Qualitative	N	Observation, a think-aloud method, audiotaping and an interview	Y	N	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	Y	Y	9/22	41

1 point for each Y response. 0 point for each N or NAD response. (Y: Yes, N: No, NAD: Not addressed)

McMaster criteria: 1. Study purpose clearly stated; 2. Relevant background literature reviewed; 3. Study design; 4. Theoretical perspective identified; 5. Method(s) used; 6. Process of purposeful selection described; 7. Sampling done until redundancy in data was reached; 8. Informed consent obtained; 9. Clear & complete description of site; 10. Clear & complete description of participants; 11. Clear & complete description of the role of researcher & relationship with participants; 12. Identification of assumptions and biases of researcher; 13. Procedural rigor used in data collection strategies; 14. Inductive data analyses; 15. Findings consistent with & reflective of data; 16. Decision trail developed; 17. Process of analyzing data described adequately; 18. A meaningful picture of the phenomenon under study emerged; 19. Evidence of credibility reported; 20. Evidence of transferability reported; 21. Evidence of dependability reported; 22. Evidence of confirmability reported; 23. Conclusion appropriate; 24. Findings contributed to theory development & future practice/ research.

TABLE 4. Methodological quality for quantitative studies

Authors	Criteria															Score	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Raw	%
Nayak et al. 2006	Y	Y	Cross sectional	N	N	Y	Y	Y	N/A	N/A	Y	Y	Y	Y	Y	10/12	83
Robertson-Lang et al. 2011	Y	Y	Cross sectional	N	N	N	N	N	N/A	N/A	N	NAD	Y	Y	Y	5/12	42

1 point for each Y response; 0 point for each N or NAD response; and N/A items were removed from the total score. (Y: Yes, N: No, NAD: Not addressed, N/A: Not applicable)

McMaster criteria: 1. Study purpose clearly stated; 2. Relevant background literature reviewed; 3. Study design; 4. Sample described in detail; 5. Sample size justified; 6. Outcome measures reliability reported; 7. Outcome measures validity reported; 8. Intervention described in detail; 9. Contamination avoided; 10. Cointervention avoided; 11. Results reported in terms of statistical significance; 12. Analysis method(s) appropriate; 13. Clinical importance reported; 14. Drop-outs reported; 15. Conclusions appropriate.

TABLE 5. Factors influencing older adults' preferences for websites

Website elements	Study				
	Bolle et al. 2016	Good et al. 2007	Nahm et al. 2004	Nayak et al. 2006	Robertson-Lang et al. 2011
Web presentation factors					
Font size	√	√	√	√	
Font style			√		
Spacing between lines or paragraphs			√		
Use of white space			√		
Backgrounds	√			√	
Colour	√	√		√	
Contrast	√	√		√	
Design		√	√		
Layout		√			√
Advertisement and/or pop-ups		√			√
Web navigation factors					
Menu bars	√	√	√		
Scrolling	√	√	√		
Navigation buttons	√				
Navigation cues		√			
Search bar	√				
Pages traversed before obtaining the required information			√		
Links		√			
Headings		√		√	
Labeling		√			
Technology terms			√		
Health information content					
Information modality					
-Videos	√		√		
-Images	√	√			
Amount of information	√	√	√		√
Quality of information					√

is not visible (Bolle et al. 2016). During navigation, the number of pages the users had to visit before they could successfully retrieve the target information affected their search performance. The users did not like searching too many pages to find the desired information (Nahm et al. 2004).

Lack of headings or ambiguous headings and labeling were considered disadvantages (Good et al. 2007). Choice of terminology may lead to confusion or misunderstanding. For example, older adults interpret the term 'Home' page differently, as they may think of 'Home' as a physical home (Nahm et al. 2004).

Adding relevant links to the website can be helpful. However, the embedded links were viewed by older adults as a component which affected them (Good et al. 2007). Hardly visible, small and blue links appeared to affect the usability of the website (Good et al. 2007).

HEALTH INFORMATION PREFERENCES

This category focused on the quality and quantity of the information, and the modality or media used to deliver the health information. Delivery of health information via

video was preferred (Nahm et al. 2004). However, it has a number of usability problems, such as the size of video screens, absence of labeling on the media player buttons, and lack of instructions on how to play media (Nahm et al. 2004). Furthermore, frequent problems with downloading video clips were highlighted as a common problem (Nahm et al. 2004). Illustrations used to further clarify the text (Bolle et al. 2016) and the use of high quality images or pictures were appreciated by older adults (Good et al. 2007).

As for the amount of information presented, overloading of information on a single page was discouraged (Good et al. 2007; Nahm et al. 2004). In contrast, inadequate information presented also resulted in negative feedback (Robertson-Lang et al. 2011). The amount of information requirement, varied based on individual preferences (Bolle et al. 2016). Offering long lists of content was, however, considered an undesirable feature (Good et al. 2007). Regardless, high quality, comprehensive information was preferred (Robertson-Lang et al. 2011).

DISCUSSION

Despite the growing popularity of online health information, to date no research has explored older persons' preferences when accessing online health information. This systematic review aimed to address this knowledge gap and, in the process, despite an extensive search, identified five relevant studies which met the inclusion criteria. The findings from our review complement those of the widely used guidelines for developing senior-friendly web resources (NIA/NLM 2001; W3C 2010; Zaphiris et al. 2006). The main difference between our review and the published guidelines is that this review reports findings which were generated from the end-user's perspectives rather than web designers' viewpoints.

An important, but unsurprising, finding from our review was that the most common problem identified by older adults when accessing online health information was small font sizes, which discouraged older adults from looking for further information on websites (Aula 2005). Age-related visual decline makes it difficult for older persons to read text on screens. A font size of 12-14 point, San-serif theme fonts, medium or bold type weight, double spacing, left justified text and uppercase letters for headlines have been suggested to enhance readability (NIA/NLM 2001; Zaphiris et al. 2006).

Low level of colour contrast between the background and the text was not favored (Bolle et al. 2016; Good et al. 2007; Nayak et al. 2006) as older adults may find it difficult to differentiate similar colours, due to age-related decline in colour recognition (Hawthorn 2000). Older adults may have problems differentiating colours within shorter wavelengths, such as blue or green (Hawthorn 2000). Moreover, multiple colour usage was considered by older users as a design issue (Good et al. 2007). Thus, website designs should consider appropriate colour selection with greater contrast.

Older adults preferred plain backgrounds, with a simple web design where all the features are clearly stated on a consistent layout (Bolle et al. 2016). Patterned backgrounds or background with blurred illustrations should be avoided (Hawthorn 2000; NIA/NLM 2001), as older adults' ability to discriminate texts or figures embedded inside another pattern is reduced (Hawthorn 2000). In addition, the use of dark font colour or graphics against a light colour background can make the displayed texts or graphics more prominent (NIA/NLM 2001). Advertisements or pop-ups on websites are not recommended as they could distracting, and some may obscure information on screen which may lead to queasiness (Alpay et al. 2004; Aula 2005; Good et al. 2007; Zaphiris et al. 2006).

Constant navigation cues are important as they keep older adults informed of where they are on the website and where to go next (Good et al. 2007). Poor short-term memory may explain why older adults are frequently unclear where they are on a website (Chadwick-Dias et al. 2002). Therefore, consistent navigation button placement, website name display, and notification of the users' current location (NIA/NLM 2001; Zaphiris et al. 2006) can enhance the navigation experience of the older adult user. The presence of navigation buttons such as 'Previous Page' or 'Next Page' were appreciated as older adults thought it facilitated forward or backward movement (Bolle et al. 2016). This response is consistent with the recommendations from existing guidelines (NIA/NLM 2001). As older adults also disliked small navigation button sizes (Bolle et al. 2016), it is, therefore, recommended that navigation buttons should be made visibly larger (Hawthorn 2000; NIA/NLM 2001; Zaphiris et al. 2006), to accommodate the decline in fine motor function (Hawthorn 2000; NIA/NLM 2001; Zaphiris et al. 2006) in older adults, and also to improve performance and reduce error rates (Hertzum & Hornbæk 2010).

Headings are important as older adults can easily identify and review the information provided. These categories, headings or sub-headings, must be clear, large, concise (W3C 2010; Zaphiris et al. 2006), and not be confusing (Hart et al. 2008) to ease searching. Older adults favored websites with only one menu bar (Bolle et al. 2016; Good et al. 2007). However, they were more likely to search for information using keywords or began their search in the center of the website, without using the

existing menu bar (Bolle et al. 2016; Nahm et al. 2004). Regarding the type of menu used, pull-down menus should be used cautiously or avoided if possible (NIA/NLM 2001; Zaphiris et al. 2006). This is because older adults may lack the fine motor skills to use pull-down menus (Taylor et al. 2014).

Older users indicated that embedded links, small links or blue links affected their ability to access the web. Making the embedded links appear visually different from the rest of the items is important as older adults tend to click on items other than the links repeatedly (Chadwick-Dias et al. 2002). The proposed solution for this issue was using consistent blue links and inserting icons or bullets to make the links more obvious and distinguishable (Chadwick-Dias et al. 2002; NIA/NLM 2001; Nayak et al. 2006). In addition, the use of action words to notify what is to be expected on the link selection has been recommended (Chadwick-Dias et al. 2002).

Although some older adults find it easier not to scroll, others did not find scrolling a problem (Bolle et al. 2016). Too much scrolling can be difficult for older users (Hart et al. 2008). Scrolling leads to difficulties in understanding web information, more so with older adults with cognitive impairment (Sanchez & Wiley 2009). Also, it is more likely that information on the bottom of the screen is missed (Nahm et al. 2004; Taylor et al. 2014). Therefore, display of information is best done on separate pages (Sanchez & Wiley 2009) and the scrolling format should not be applied if possible (Zaphiris et al. 2006). If scrolling is necessary, automatic scrolling should be avoided and scrolling icons should be inserted (NIA/NLM 2001).

As for website content, there are conflicting recommendations on the appropriate amount (Good et al. 2007; Nahm et al. 2004; Nayak et al. 2006; Robertson-Lang et al. 2011). On one hand, too much information was undesirable (Good et al. 2007; Nahm et al. 2004; Nayak et al. 2006), while inadequate information was viewed as a drawback (Good et al. 2007) for those who wanted explicit information (Bolle et al. 2016). This may indicate that there is perhaps no "one size fits all" when it comes to the amount of content, and this need to be carefully considered. As the website content was one of the more important aspects to attract users to revisit or recommend to others (Thielsch et al. 2014), the importance of balancing between too much and too little cannot be overstated.

With regards to the information modalities used, a combination of text and video and illustrations to explain text were valued by older adults (Bolle et al. 2016). Older adults did not like using websites which did not have enough graphics (Good et al. 2007). This is consistent with the recommendation by NIA and NLM (2001) to incorporate text-relevant and simple images that includes illustrations, photos, animation, video or audio. These images help with task performance and information retention (Riaz et al. 2018). Older adults with low working memory capacity and poor attention control were more likely to be distracted by irrelevant images. Hence, decorative graphics should be avoided in websites (Zaphiris et al. 2006).

Although older adults preferred health information delivered via video (Bolle et al. 2016; Nahm et al. 2004), they have difficulties using video. The problems experienced by older users may be resolved by presenting videos in large screen sizes, providing clear and simple instructions, labeling of buttons and excluding the need for video downloading (Nahm et al. 2004). While photos, audios and videos are helpful additions to websites, they should always be complemented with text alternatives (Alpay et al. 2004; NIA/NLM 2001). However, caution should be exercised to avoid blocking the video screen with a pop-up transcript, which would make it difficult for older adults to watch the video and read the transcript at the same time (Nahm et al. 2004).

LIMITATIONS

Despite this review using best practice standards in the conduct and reporting of systematic reviews, as with any research, this research too has some limitations. Despite a comprehensive search strategy which included access to black (peer reviewed) and grey literature, we were able to include only five studies. While this is a limited evidence base, the very nature of a systematic review means the focus is on the depth of a topic (and not the breath of the topic). Furthermore, the limited evidence base as well as concerns regarding the methodological quality of the included research on this topic, highlights the need for ongoing research to address persistent knowledge gaps through the conduct of methodologically robust research. Given that the searching was limited to English language only, all studies included in this review were conducted in Western countries. This is an important limitation as it is unknown what are the preferences of older adults in countries where English is not the first language. Given the growth of technology and increasing computer use amongst people in developing countries, it is important to address this limitation. Another limitation to consider was the variation in the level of computer competency among the participants across the studies. Both novice older adults and older adults with basic computer skills were recruited, and this meant differing levels of computer competency amongst the included sample. While this may have confounded some of the findings, it may also reflect the reality of what occurs in the community as older people in the community have different levels of computer competency. Finally, the results of our review may not be

generalized to all older populations as older adults with age-related impairments or medical illnesses may have distinct web design features and content preferences.

CONCLUSION

The purpose of this systematic review was to examine the current research on older adults' preferences on design and content of health websites. Based on a limited body of evidence, the findings suggest that readable text, simple design, consistent layout and straightforward web navigation are the preferred priorities for a health information website for older adults. An ageing population, information-savvy health consumers and the move to online resources for health information present an ideal opportunity to provide online health information using user-led interface design ideas. By doing so, it could promote better engagement with health information, which in turn could positively impact health outcomes such as supporting better self-management amongst older adults. While this undoubtedly will have positive impacts on an individual's health and well-being, the benefits are likely to extend to the wider community, including families and caregivers. Preferences of older adults as users could be layered with the technical know-hows and best practice standards on developing senior-friendly online health resources. This will ensure the user perspective, as an important component of senior-friendly online health resource development, is valued and acted upon. As the engagement with online for heath continues to grow, including in response to the current COVID-19 pandemic, ongoing further research could contribute to the knowledge base by exploring preferences of older adults and their engagement with online resources specifically designed for them. This will help to unlock the "black box" of preferred priorities for older people in terms what works for whom, why and how when engaging with senior-friendly online health resources.

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The author(s) declare(s) that there is no conflict of interest.

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