

Usability and Accessibility Evaluation of South Korean and American Health-Related Websites for the Elderly*

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노인들을 위한 건강관련 웹사이트의 사용성과 접근성 평가*

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주요어

소비자 건강 정보, 웹 사이트, 노인, 웹 접근성

Key words

Health Web Site, Older Adults, Usability, Accessibility

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Abstract

연구목적: 노인을 위한 건강정보 웹사이트들이 사용성과 접근성을 높이기 위해 지켜야 할 디자인 요소를 어떻게 반영하고 있는지 평가·비교함으로써 개선 방향을 제언하고자 하였다. **연구방법:** 국내 및 미국에서 개발된 노인 대상의 건강정보 웹사이트를 각각 9개씩 선정하였다. 근거 기반의 웹디자인 지침서인 Make Your Website Senior Friendly: Checklist 와 Research-based Web Design & Usability Guideline을 통합·수정하여 얻은 4개 영역의 평가 항목 48개를 적용해 두 명의 평가자가 선정된 총 18개 웹사이트를 평가하였다. **연구결과:** '가독성' 영역 중 서체 선택, 줄 간격, 배경색과 글자색 선택 등은 양호하였으나 국내 웹사이트들 중에는 글자 크기가 조절되지 않는 경우가 빈번하였다. '정보의 표현과 구성' 영역에서 다수의 웹사이트들은 정보 배치 등이 우수하고 소비자 용어를 사용하는 노력을 보였다. 그러나 일부 국내 웹사이트들은 프린트 기능을 제공하지 않거나, 노인들의 저하된 인지 능력을 배려하려는 노력이 부족하였다. '미디어 사용' 영역에서 국내 웹사이트들은 글자 외에 다른 매체를 사용하는 빈도가 미국 웹사이트들에 비해 낮았고, 시청각 매체를 사용할 때는 동일한 내용을 문자로도 볼 수 있도록 하라는 권고안을 준수하지 않았다. '내비게이션과 검색의 용이성'에서는 메뉴나 링크의 명칭이 명확하며, 이용 중에도 쉽게 홈페이지로 돌아갈 수 있도록 구성되었다. 그러나 다수의 국내 사이트들이 사이트맵을 제공하지 않거나, 검색어의 철자오류 등에 대한 배려가 부족하였다. **결론:** 국내 웹사이트들은 미국 웹사이트들에 비해 노인들의 사용성과 접근성을 높이는 것으로 밝혀진 연구 근거들을 제대로 반영하지 못하고 있었다. 노인 대상의 인터넷과 웹을 활용한 교육이 지속적으로 증가할 것이므로, 그 효과성을 높이기 위해 간호사들은 정보의 질 뿐만 아니라 디자인 측면의 중요성을 인식하고 실천할 수 있어야겠다.

INTRODUCTION

Today, healthcare knowledge is no longer in the sole possession of healthcare professionals; the general public now

has the possibility to access health information via the World Wide Web. That said, there exists a "digital divide" related to inequality in the accessibility of computer technology itself. Elderly people in particular are often to be found on one

side of this divide (For the purposes of this article, by “elderly” or “senior” we mean people aged approximately sixty and above.): they often do not have a computer at home or lack the knowledge and skills to use the Internet. However, regardless of the computer skills or education of an elderly Internet user, there are certain barriers that elderly people have to overcome to successfully use the Internet and websites. For instance, declined cognitive function with age influences attention processes, working memory, and information-processing speed; thus the elderly learn new skills at a slower rate than they do in their younger years (White et al., 1999). The way hypertext is used in websites often causes confusion and disorientation to the elderly, requiring extra effort to navigate web pages in a nonlinear sequence (Czaja & Sharit, 1998). Healthcare websites clearly need to be designed to minimize the cognitive burden among elderly users. There are also psychological barriers. Elderly people perceive the Internet to be less useful, more difficult to use, and less efficacious than younger people do. The elderly have higher level of perceived complexity of navigation too (Adams, Stubbs, & Woods, 2005).

Surveys carried out in the Republic of Korea (henceforth “ROK” or “South Korea”) and the United States (henceforth “U.S.”) have found a negative relationship between age and access to or usage of computers and the Internet. Only about 20% of South Koreans over the age of sixty and of American elderly at the age of 65 years or older use the Internet, whereas over 60% of adults in their forties use the Internet (Korea Communications Commission & Korea Internet & Security Agency, 2009; U.S. Census Bureau, 2010). Nevertheless, elderly people in the countries referenced above are willing to use the Internet in their daily lives, and seeking health information is one of the most common reasons for the elderly to access the Internet (Department of Welfare for Seniors Seoul City Government, 2010; Morrell, Mayhorn, & Bennett, 2000; Wagner & Wagner, 2003). Though age is likely to influence the practical use of computers or the Internet, it does not necessarily influence the interest in using them: the attitudes of the elderly towards computers seem to be not dissimilar to those of young adults (Detlefsen, 2004; Kelley, Morrell, Park, & Mayhorn, 1999). To accommodate their needs and interest in health information

on websites, factors in the normal aging process-including vision degeneration, cognitive decline, and psychomotor impairment-should be taken into account.

Health-related websites can be less than useful if elderly people are unable to easily access information. Their performance was rather dependent on the interface of each website. Although the quality of health information itself is a priority, usability and accessibility are equally important in the case of websites for the elderly. Nielsen (2002) said that satisfaction of websites significantly increased as usability is enhanced among the elderly. Guidelines and recommendations for designing websites for seniors have been published that identify the characteristics of Internet usage by older people. According to Adams, Stubbs, and Woods (2005) websites for the elderly need to be: transparent, comprehensive, responsive, self-explanatory, adaptive, efficient, forgiving, flexible, informative, timely, and consistent with other designs familiar to the user. More specific guidelines discussed how different designs can improve usability and accessibility including readability, ease of navigation, and simplicity (Bernard, Liao, & Mills, 2001; Davis & Lafrado, 2003). Healthcare professionals paid relatively little attention to the significance of usability or accessibility related to website design (Nahm, Preece, Resnick, & Mills, 2004). Moreover, few study reported usability and accessibility issues of Korean websites for the elderly (Kwon, Kang, Kang, & Chung, 2004).

In spite of the rapid growth of the elderly population and of elderly Internet users in the ROK (Korea Communications Commission & Korea Internet & Security Agency, 2009), inadequate attention has been paid to their experience with websites. Specific attention is needed so that the elderly can easily access available healthcare resources on websites. An increasing number of health professionals, including registered nurses and physicians, are likely to interact with the elderly through the web in the future. As content providers of health-related websites, healthcare professionals are expected to be able to understand the online experiences of elderly users and their diverse accessibility and usability needs.

This study proposes to discuss current issues related to web design in the delivery of health information to the elderly on the web. The specific aims of this study are to: 1) evaluate how well certain health-related websites for the

elderly are taking care of age-related changes based on research evidence; 2) compare South Korean and American websites and suggest room for improvement; and 3) examine the feasibility of two evidence-based guidelines as an evaluation tool.

METHODS

This study was conducted using a three-step methodology. Health-related ROK- and U.S.-based websites for the elderly were selected; evaluation criteria were developed by integrating two evidence-based guidelines; and an evaluation of the selected websites was carried out by applying the criteria to those sites.

1. Selecting health-related websites for the elderly

First, health-related websites for the elderly were selected by a convenient sampling method. Websites were included if 1) they indicated that their target population was the elderly; 2) one of their primary purposes was to provide health information; and 3) they provided up-to-date information. Excluded from the study were websites that 1) targeted health professionals or all age groups; 2) were healthcare

portals providing only links to other sites instead of directly providing health information; 3) were commercial websites selling products or promoting healthcare facilities.

A total of nine South Korean websites satisfied the inclusion criteria among the top one hundred websites found using the search term ‘노인 건강(“noin geongang” in Hangul)’ from Naver (www.naver.com) and Daum (www.daum.net), respectively, the most popular portal search engines in the ROK. For example, the search engine Naver showed 382 websites in the order of accuracy for the search term. Among the top 100 websites, six websites were selected and 94 websites were excluded because, for example, they were promoting healthcare facilities or social welfare organizations (74 sites), they were created for professionals or the public in general regardless of age (12 sites), or they were selling products (3 sites). Applying the same search term and selection criteria, also six websites were found among the top 100 sites from the search engine Daum. Three websites were found in both search engines, and thus nine websites were included for this study.

Nine was also the number of American websites that were selected out of a total of twelve senior healthcare websites recommended by the American Medical Library Association and Consumer and Patient Health Information Section (<http://>

〈Table 1〉 Selected health-related websites for the elderly

No.	Name	Web address
South Korean Websites		
ㄱ	9988어르신 프로젝트	http://9988.seoul.go.kr/
ㄴ	실버넷뉴스	http://www.silvernews.or.kr/
ㄷ	노년시대신문	http://www.nnnews.co.kr/
ㄹ	노후닷컴	http://www.nohoo.com/
ㅁ	대한노인신문	http://www.daehannoin.co.kr/
ㅂ	스포츠 건강 노화연구회	http://www.dynamicaging.or.kr/
ㅅ	유어스테이지	http://www.yourstage.com/
ㅇ	실버조이	http://www.silverjoy.net/
ㅈ	메드시티 노인건강	http://www.medcity.com/noin.html
American Websites		
A	AARP: Health	http://aarp.org/health/
B	CDC's Health Aging	http://www.cdc.gov/aging/
C	MedlinePlus Senior's Health Issues	http://www.nlm.nih.gov/medlineplus/seniorhealthissues.html
D	Administration on Aging Elders & Families	http://www.aoa.gov/AoARoot/Elders_Families/index.aspx
E	Geriatric Mental Health Foundation	http://www.gmhfonline.org/gmhf/
F	NIH Senior Health	http://nihseniorhealth.gov/
G	Centers for Medicare & Medicaid	http://www.medicare.gov/
H	Mayo Clinic Senior Health Center	http://www.mayoclinic.com/health/senior-health/HA99999
I	The AGS Foundation for Health in Aging	http://www.healthinaging.org/

caphis.mlanet.org/consumer/consumerSeniors.html). Two American sites were excluded because their target audience was care givers and families rather than the elderly, and one was excluded because it provided only extensive links to other organizations. The final selection of the eighteen selected websites is listed in Table 1.

2. Selecting evaluation criteria

As shown in Table 2, website evaluation criteria were selected and integrated from two sets of guidelines- "Making Your Websites Senior Friendly: A Checklist" (National Institute on Aging & National Library of Medicine, 2002) and "Research-Based Web Design and Usability Guideline" (National Cancer Institute, 2003)-because they are research-based guidelines while others are mostly experts' experience-based. "Making Your Websites Senior Friendly: A Checklist" (henceforth "Checklist") is a simple guideline specifically for websites for the elderly. This Checklist consists of 25 items in four major categories: designing readable text for older adults, presenting information to older adults, incorporation of other media, and increasing the ease of navigation. A few authors applied this guideline to evaluate websites for the elderly in previous studies (Nahm et al., 2004). However, certain of the items in

the Checklist are so broad and general that they were deemed rather inadequate for the purpose of website evaluation. The "Research-Based Web Design and Usability Guideline" is more comprehensive with 209 criteria covering eighteen topics and graphic examples for each criterion. Each criterion is rated by the relative importance and the strength of research evidence using a five-point Likert-like scale, determined by raters that included website designers and usability researchers. The level of agreement among raters was high with a Cronbach's alpha= .92.

As a first step, one hundred and one criteria of which both the importance and the strength of evidence were rated at level three or higher were selected. Three points issued for "strength of evidence" indicated that a criterion was supported by limited research evidence; four points, moderate research support; five points, strong research support. They were closely reviewed and items were selected that were closely related to one of the four topics of the Checklist: readability, textual content, alternative media, and navigation. Twenty-five items from the Checklist overlapped with those independently selected items from "Research-based Web Design and Usability Guidelines." Very similar or closely related items were combined into one item, as appropriate. Forty-eight evaluation criteria were selected and assigned one

<Table 2> Evaluation criteria for health-related websites for the elderly

Item No.	Evaluation criteria	Reference
I	Designing readable text for older adults	Chapter
1	Align items on a page for items such as text blocks, rows, columns, check boxes, etc.	6: 7
2	Use bold text sparingly	11: 5
3	Use familiar fonts: a sans serif typeface—such as Helvetica, Arial, Gothic—that is not condensed	11: 7
4	Ensure visual consistency: type size, spacing, colors, fonts, backgrounds etc.	11: 4
5	Use black (dark-color) text on plain, high-contrast non-patterned, simple background	11: 1 14: 1
6	Optimize physical spacing of body text (e.g., double space for English) and use moderate white space between paragraphs or items	6: 6 6:11
7	Avoid yellow, green, blue in close proximity	3: 3
8	Allow visitors to select a type size	11: 8
9	Do not use color alone to convey information: ensure that all information conveyed with color is also available without color.	3: 3
10	Use mixed-case for prose text	11: 3 15: 6
II	Presenting information to older adults	Chapter
11	Display related items in a vertical list rather than as continuous text	12: 4
12	Use static menus rather than adaptive menus	12: 6
13	Place your organization's logo in a consistent place on every page	14: 5
14	Ensure the home page look like a home page and be easily perceived as a home page	5: 6

(Table 2) Evaluation criteria for health-related websites for the elderly(continued)

Item No.	Evaluation criteria	Reference
15	Place important items consistently	6: 2
16	Use acronyms and abbreviations sparingly and define them	15: 4 15: 5
17	Minimize page download time (<10 seconds)	2: 6
18	Display information in a format that does not require conversion by the user and that is consistent with the standards and conventions most familiar to users (e.g., a unit or a clock format)	2: 8
19	Format common items consistently (e.g., telephone number, time records)	11: 2
20	Place important items at top center; place important items at top of the list	6: 3 12: 2
21	Avoid jargon or use familiar words. Otherwise provide a glossary or a dictionary	15: 2 15: 3
22	Facilitate scanning, mainly in a home page	16: 2
23	Distinguish required and optional data entry fields	13: 1
24	Organize information clearly	16: 1
25	Minimize user data entry. Do not require users to enter the same information more than once (e.g., remembering IDs or entering an address by selecting a zip code)	13: 6
26	Provide a 'print option' for long documents (>5 pages)	2: 9
27	Order elements to maximize user performance (e.g., alphabetical order)	12: 1
28	Limit home page length: one screenful of information	5: 7
29	Reduce the user's workload: allocate functions to take advantage of the inherent respective strengths of computers and users (e.g., calculating body mass indexes and remembering user IDs are best performed by computers)	2: 4
30	Make task or action sequences clear and consistent: allow users to perform tasks in the same sequence and manner across similar conditions	2: 3 15: 1
III	Incorporating other media	Chapter
31	Ensure that images do not slow downloads (>10 seconds)	14: 3
32	Label clickable images: labeled or readily understood by typical users	14: 2
33	Ensure website images convey intended messages	14: 8
34	Use video, animation, and audio meaningfully	14: 4
35	Provide text equivalents for non-text elements like images, animation, video, and audio	3: 5
IV	Increasing the ease of navigation and search	Reference
36	Offer contact information (telephone number, email address) for providing assistance to users:	2:16
37	Eliminate horizontal scrolling	8: 1
38	Use text for links (Do not use only image without text for links)	10: 6
39	Enable users to access the home page from any other page on the Website	5: 1 10: 1
40	Use meaningful, not-confusing link labels	10: 3
41	Do not create or direct users into pages that have no navigational options like the backward/forward navigation buttons.	7: 1 7: 6
42	Use clear labels (use descriptive tab labels; use clear category labels)	9: 1 9: 3
43	Differentiate and group navigation elements in a consistent and easy to find place on each page (locating tabs, headings, lists, search, sitemap, etc.)	7: 2 16: 4
44	Place primary navigation menus in the left panel	7: 5
45	Provide a site map	7:10
46	Design search around users' terms for common searches, or provide a 'best bets' set of results; design the site's search engine to accommodate common misspelling, extra spaces, alternative punctuation, misused plurals.	17: 5
47	Include hints to improve search performance	17: 8
48	Provide guidance about using a Website using users' terminology to describe element and features	2:14

Note, Reference of each criterion indicates relevant guideline numbers of "Research-based Web Design and Usability Guidelines"

of the above four topics, as presented in Table 2: 10 criteria for designing readable text for older adults (#1 to #10), 20 criteria for presenting information to older adults (#11 to #30), 5 criteria for incorporating other media (#31 to #35), and 13 criteria for increasing the ease of navigation and search (#36 to #48).

3. Evaluating the selected websites

Lastly, the two authors independently evaluated the selected eighteen websites. "Home" pages and all menus were evaluated by reviewing all of the web pages under each menu link. When there were such a large number of pages that made it untenable for the researchers to review them all, a minimum of five pages under each menu link were evaluated. To evaluate a website's search function, common diagnoses among old people, such as stroke, arthritis, or dementia, were selected as appropriate. Each of forty-eight evaluation criteria was graded in three levels: fully satisfied with no violation (O), partially satisfied with mixed results (Δ), or failed (X). Also, some criteria were not applicable (NA) to a certain website. Cohen's Kappa was calculated to see inter-rater agreements, which indirectly indicates a feasibility of the evaluation criteria used in this study. There were some instances in which the two researchers initially disagreed with evaluation results (O, Δ or X). In these cases agreement came about through re-evaluation and discussion.

RESULTS

The evaluation results of the eighteen websites for the elderly (comprising the nine South Korean websites and nine American websites) are summarized in Table 3 with the total numbers of fully-satisfied (O), partially-satisfied (Δ), and failed (X) items on each website and for each evaluation criterion. The total number of unrelated items (NA) was omitted from Table 3 and not considered when comparing (or ranking) the websites. Although calculating an exact score for each website was not within the purview of this study, the websites were ranked by assigning a number to them of fully-satisfied (1 point) or partially-satisfied (0.5 point) items. The top ranked South Korean website being "9988 어르신 프로젝트" (<http://www.9988.seoul.go.kr>), and the lowest ranked website originating in the ROK was "메드시티 노인건강" (<http://www.medcity.com/noin.html>). Among the American websites, the best ranked was AARP: Health (<http://www.aarp.org/health/>), with the lowest ranked being The AGS Foundation for Health in Aging (<http://www.healthinaging.org/>).

None of the eighteen websites conformed to all of the forty-eight criteria. The U.S. websites followed the evaluation criteria to a closer degree than all but two of the South Korean websites. The variation of evaluation results was larger among Korean websites than American sites, which indirectly implies lower quality of the former in terms of usability and accessibility.

In the following section, the forty-eight guidelines are

<Table 3> Evaluation results of health-related websites for the elderly

No	Korean Website										American Website													
	ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ	ㅇ	ㅈ	ㅊ	Total	A	B	C	D	E	F	G	H	I	Total			
	O	Δ	X	O	Δ	X	O	Δ	X	O											Δ	X		
I	Designing readable text for older adults																							
1	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	9	-	-
2	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	9	-	-
3	O	X	O	O	O	X	O	O	O	O	7	-	2	O	O	O	O	O	O	O	O	9	-	-
4	O	O	O	O	O	X	Δ	O	X	X	6	1	2	O	O	O	O	O	Δ	O	Δ	7	2	-
5	Δ	Δ	O	O	O	Δ	O	Δ	Δ	Δ	4	5	-	O	O	O	O	O	O	Δ	Δ	7	2	-
6	O	O	O	X	X	Δ	O	Δ	X	X	4	2	3	O	O	O	O	Δ	O	Δ	O	7	2	-
7	X	O	Δ	O	O	X	Δ	X	X	X	3	2	4	O	O	X	O	O	O	X	X	6	-	3
8	O	X	O	O	X	X	Δ	X	X	X	3	1	5	O	O	Δ	O	X	O	O	O	7	1	1
9	O	NA	NA	NA	NA	NA	NA	O	NA	NA	2	-	-	NA	NA	NA	X	NA	NA	NA	NA	-	-	1
10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	O	O	O	O	O	O	O	O	9	-	-

<Table 3> Evaluation results of health-related websites for the elderly(continued)

No	Korean Website										American Website															
	ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ	ㅇ	ㅈ	ㅊ	Total			A	B	C	D	E	F	G	H	I	Total			
											O	△	X											O	△	X
II Presenting information to older adults																										
11	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	O	9	-	-
12	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	O	9	-	-
13	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	O	9	-	-
14	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	△	O	O	O	O	8	1	-
15	O	O	O	O	O	O	△	O	O	O	8	1	-	O	O	O	O	O	O	O	O	O	O	9	-	-
16	O	O	O	O	O	O	△	O	O	O	8	1	-	O	O	O	O	O	O	O	O	O	O	9	-	-
17	O	O	O	O	O	△	O	O	O	O	8	1	-	O	O	O	O	O	O	X	O	O	O	8	-	1
18	O	O	O	O	O	O	O	NA	O	O	8	-	-	O	O	O	O	O	O	O	O	O	O	9	-	-
19	O	O	O	O	O	O	X	O	O	O	8	-	1	O	O	O	O	O	O	O	O	O	O	9	-	-
20	O	O	O	O	O	O	O	O	X	X	8	-	1	NA	O	O	NA	O	△	O	O	O	O	6	1	-
21	O	O	O	O	O	△	O	X	O	X	7	1	1	O	O	O	O	O	O	O	O	O	O	9	-	-
22	O	O	O	O	O	△	△	O	△	△	6	3	-	O	O	O	O	O	O	O	O	O	O	9	-	-
23	X	O	O	X	O	O	X	O	X	X	5	-	4	O	O	O	O	O	O	O	NA	O	8	-	-	
24	O	△	△	O	△	O	X	O	△	△	4	4	1	O	O	O	O	O	O	O	O	△	8	1	-	
25	O	△	△	△	△	O	O	X	X	X	3	4	2	O	O	O	O	O	NA	O	NA	O	7	-	-	
26	X	O	O	X	O	X	△	X	X	X	3	1	5	O	O	O	O	X	O	O	O	△	7	1	1	
27	△	O	O	NA	NA	X	O	NA	X	X	3	1	2	O	O	O	NA	O	O	O	O	O	8	-	-	
28	△	X	X	X	X	O	X	O	X	X	2	1	6	X	X	X	X	X	X	X	X	X	-	-	9	
29	△	X	X	X	X	△	O	X	X	X	1	2	6	O	O	O	X	O	NA	NA	NA	△	4	1	1	
30	O	△	NA	1	1	-	O	O	O	O	O	NA	O	NA	O	7	-	-								
III Incorporating other media																										
31	O	O	O	O	O	X	O	O	O	O	8	-	1	O	O	O	O	O	O	O	O	O	9	-	-	
32	O	O	O	O	NA	O	O	X	O	O	7	-	1	O	O	O	NA	O	O	O	O	NA	7	-	-	
33	O	O	O	O	O	O	X	△	△	△	6	2	1	O	O	O	O	O	O	O	O	O	9	-	-	
34	O	O	NA	NA	NA	X	O	NA	NA	NA	3	-	-	O	O	O	O	O	O	O	O	NA	8	-	-	
35	△	△	NA	O	NA	△	NA	NA	△	△	1	4	-	O	NA	O	O	X	O	O	O	NA	6	-	1	
IV Increasing the ease of navigation and search																										
36	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	9	-	-	
37	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	9	-	-	
38	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	O	O	O	9	-	-	
39	O	O	O	O	O	O	O	O	O	O	9	-	-	O	O	O	O	O	O	X	O	O	8	-	1	
40	O	O	O	O	O	O	△	O	△	△	7	2	-	O	O	O	O	O	O	O	O	O	9	-	-	
41	△	O	O	O	O	O	O	O	X	X	7	1	1	O	O	△	O	O	O	△	O	△	6	3	-	
42	O	O	△	O	O	O	O	△	X	X	6	2	1	O	O	O	O	O	O	O	O	△	8	1	-	
43	O	O	O	O	△	O	△	△	X	X	5	3	1	O	O	O	O	O	O	O	O	O	9	-	-	
44	O	X	X	O	O	O	X	△	X	X	4	1	4	O	O	X	O	O	O	O	X	O	7	-	2	
45	X	O	△	X	O	O	△	△	X	X	3	3	3	O	O	O	O	X	O	O	O	X	7	-	2	
46	△	X	△	△	X	X	NA	X	NA	NA	-	3	4	O	O	O	O	O	NA	O	△	X	6	1	1	
47	X	X	X	X	X	X	NA	X	NA	NA	-	-	7	O	X	△	X	X	NA	X	X	X	1	1	6	
48	X	X	X	X	X	X	X	X	X	X	-	-	9	O	X	O	O	X	O	O	O	X	6	-	3	
Total	O	34	33	32	33	31	27	25	25	19				45	43	41	41	40	39	38	37	32				
	△	7	5	6	2	3	7	10	7	6				-	-	3	-	1	2	3	2	7				
	X	6	8	5	8	7	11	7	10	17				1	3	3	4	6	1	5	4	50				

Note, O, fully satisfied; △, partially satisfied; X, failed; NA, Not Applicable

considered by means of four usability and accessibility issues:
 1) readability, 2) textual content, 3) alternative media, and 4)
 navigation and search, Evaluation criteria numbers in Table 2

are presented with findings, as appropriate.

1. Designing readable text for older adults

Guidelines concerning the alignment of text items (#1) and the cautious use of bold letters (#2) were followed by all eighteen websites. The use of common typefaces (#3) and a visual consistency of font, type size, and spacing (#4) were found in most websites except in two South Korean sites. These last websites had typefaces using two fonts: batang (in Hangul) and gothic together or spacing and type colors that were not used consistently throughout all of the web pages on those sites. The physical spacing between text lines (#6) was mostly acceptable; however three of the websites in Korean used single spacing, causing problems for those seniors who find distinguishing detail difficult. A majority of the websites used black text on a white background or some other easy-to-distinguish high contrast text-background color scheme (#5). One American website offered a user-controlled contrast on-off preference button. Texts in low color saturation or patterned backgrounds were found in a few instances. Meanwhile, type size (#8) was controllable on most web pages on four Korean websites and eight American websites by using the website's embedded function (for example: [+] larger; or [-] smaller) or by means of the browser's function (Internet Explorer 7.0 or 8.0). Thus on the six remaining sites (five Korean sites and one American) did not allow users to the size aspect of the text, despite their primary target end-users being senior citizens.

Five ROK and six American websites had color schemes appropriate for seniors, but the remaining used blue, green, or yellow proximately (#7). For example, the use of blue and green colors next to each other on the large image on the home page of 스포츠 건강노화 연구회 (<http://www.dynamicaging.or.kr/>) may cause difficulties among visually-challenged elderly people. Also, color alone must not be used to deliver information for those with less-than-perfect eyesight (#9). Two of the South Korean websites (<http://www.9988.seoul.go.kr>, <http://www.silverjoy.net/>) had a good system of using both color and pattern to differentiate two groups, allowing for easy differentiation even for those with a monochromatic monitor. Overall, we found that the gap between knowing what to do to make websites more senior-friendly in terms of text sizing and the actual putting into practice that knowledge was larger in the South Korean websites than in the American.

2. Textual content: presenting information to older adults

Almost all of the websites presented information in a consistent and conventional format (#13, #15, #18, #19) and positioned items depending on importance (#20), facilitating scanning (#11, #12, #22). Regarding the level of complexity of the language (#16, #21), most of the websites used simple vocabulary, avoiding jargon and abbreviations. "Consumer" vocabulary was used in addition to professional medical terms, such as "sugar disease" for diabetes, "break" for fracture, "쥐" for muscle spasm. However, efforts to reduce the elderly user's workload (#29) or data entry (#25) were insufficient among the ROK sites. For example, the elderly had to remember user IDs or even calculate a final score of a web-based test by themselves. In order to reduce a user's burden is to provide him or her with relevant search terms as soon as the user starts to type letters in a search box, as was found in some of the American websites. Four of the South Korean sites did not indicate to users whether the completion of data fields was mandatory or optional (#23), for example, as in the process of creating an account for the sites. This criterion, indicating which data were required and which data were optional, is important for both reducing the user's workload and enhancing clarity of communication between the site operator and the end-user.

Just one of the ROK sites included a task or action that allowed interaction between site visitors and the site itself (#30), while seven American sites did so. It might be because elderly Internet users in the ROK are considered by South Korean website operators or developers as passive receivers of information rather than active participants. However, this trend may change given the increasing number of more experienced elderly Internet users. The researchers found it surprising that five South Korean sites and one U.S. site did not offer a print option at all (#26). Web pages with a considerable amount of text are expected by general users not only to be read online, but also to be printed as a hard copy for improved legibility among the elderly. Although printing a web page is possible using a browser, an imbedded print option is needed to obtain a best-adjusted copy with proper text size and layout according to the original content. With the exception of two of the South

Korean websites, the home pages of sixteen websites contained content that would not fit on a single page when viewed on a 19-inch monitor (#28). A single-page screen is ideal for home pages because all of the menus are visible at the same time and elderly users do not need to remember their location. When a page contains a lot of content, vertical scrolling is necessary. This may lead to navigation difficulties among the elderly.

Another weakness of South Korean sites was that information was not always listed in any logical order (alphabetically or chronologically), thus decreasing user performance (#27). As an example, county names on one such site were not listed in Hangeul alphabetical order and so the user had to go through the time-consuming process of reviewing the entire list to find specific data. Most websites failed to follow between one and four out of the twenty criteria regarding the presentation of information on a website. The American sites performed better than the South Korean sites but the variation between them was not large, excluding one outlier with the lowest rank.

3. Incorporating other media

Nearly all the websites used images consistent to their content and helped their visitors better understand intended messages (#33), one example of this being an image of the anatomy of the body. Though, downloading web pages with images took longer than ten seconds in one of the sites using a broadband LAN connection and it caused inconvenience (#31). While text with or without images was dominantly used to deliver health information, video and audio were also used meaningfully in seven American websites and in three South Korean websites (#34). These Korean sites did not provide text equivalents (the transcription of contents of video, audio, and so on), whereas most American sites not only provided text but also gave users the option of turning captions on or off (#35).

With one exception, all of the sites with clickable images had labeled them. If a clickable image is not labeled with a text, the message of that image can be unclear to the visitor (#32). The future inclusion of a greater diversity of media (video, animation, or audio, as appropriate, in addition to

text) on South Korean websites is, in our view, desirable. For those non-text media, websites should always provide text equivalents, with the option of turning these on or off by users.

4. The ease of navigation and search

In none of the websites' home pages was horizontal scrolling required (#37), although vertical scrolling was a common necessity for navigation. Home pages were easily reached by locating a linked logo or an appropriate icon on every page of the website (#39), lowering possibility of disorientation when navigating different web pages. Nevertheless, some of the websites directed users to web pages without backward or forward navigation buttons without prior warning (#41). To make navigation easier, navigation elements were grouped and clearly labeled in most instances. Also, links were provided with text (#38) and link labels were meaningful and clear in all websites (#40). However, tab labels or headings were not descriptive enough to anticipate the sub menus or contents in a few Korean sites (#42). For example, headings like 관절염 (arthritis) 1, 관절염2, or 관절염 3 was not meaningful to readers.

Surprisingly, even though a site map (#45) is a convenient tool to understanding a website's organization, three South Korean and two American websites did not provide one. On three South Korean sites, their site maps were accessible from the home pages only. None of the South Korean sites, but six American sites did provide guidance about how to use the websites (#48). All selected sites offered contact information (#36), useful in the event of encountering problems or difficulties in using websites.

A serious weakness was found in terms of user support for searches among the Korean sites (#46, #47). While most American sites incorporated common misspellings for search performance, Korean sites often did not. For example, on a U.S. site if a user typed the misspelled search word "arthritiis", the site's search function recognized the error and asked "Did you mean arthritis?" instead of returning the result "There is no result". Accordingly, South Korean elderly users have to know and enter exact search terms, as used in the site. Moreover, the evaluation criterion #47 (Table 3)

recommends including hints to let users understand different searching methods in the site. However, no site did so, and most sites with a search function did not even mention how it worked. Only two American sites offered a little help through an FAQ (Frequently Asked Questions) menu.

5. Feasibility of the evaluation guidelines

To discern the feasibility of the evaluation guidelines in this study, Kappa scores were calculated and ranged 0.7-0.9 for ROK websites and 0.6-1.0 for U.S. websites. These Kappa scores indicated substantial or outstanding inter-rater reliability. Therefore, the website evaluation criteria of this study were considered feasible.

DISCUSSION

The health-related websites varied in their usability and accessibility, either facilitating or limiting the use of information among the elderly. South Korean websites did not properly take into account age-related changes of the elderly when compared with American websites. This difference may be accounted for as the high quality American websites were among the best ones in the country, according to the U.S. National Medical Library and Consumer and Patient Health Information Section. The selected American websites were often operated or sponsored by the U.S. government or some other large organization, whereas most South Korean websites were operated by a private organization or research group. Even though the ROK is ranked second in the world (after Sweden) among 154 countries according to the ICT Development Index (Korea Communications Commission & Korea Internet & Security Agency, 2009), there are few reliable health-related websites targeting the elderly. 9988 어르신 프로젝트 was the best performing South Korean website, and was the only one supported by a public organization, the Seoul Administrative Organization. However, this site does not provide health information on diseases and treatments; it is mainly focused on informing the public of government-supported health and welfare programs. The authors suggest that the government of the ROK develop or sponsor health-related websites

tailored to the needs of the elderly.

In addition, the level of guideline adherence varied greatly and depended on criterion. Twenty-two out of 47 (because criterion #10 [Use mixed-case for prose text] is not applicable to Korean language) and 34 out of 48 criteria were fully or partially satisfied among all South Korean sites and all American sites, respectively. The former showed weakness often because they did not allow users to control type size, did not take into account reduced cognitive ability, did not include printing function, nor did they provide guidance on how to use the websites, in contrast to the American sites. It is tentatively concluded that health-related Korean websites for the elderly have not been constructed considering the characteristics of the older population and the attendant relevant research evidence, thus possibly spoiling usability and accessibility. In Chisnell and Redish (2004)'s study, healthcare websites for older adults were more user-friendly than other types of information websites. If this is true, many elderly people in the ROK are likely to experience greater difficulty in using non-healthcare websites than health-related ones.

Based on this study's findings, critical guidelines that can be easily adopted are set out below. Websites for the elderly should be designed using a simple typeface with wide line spacing as well as allow users to tailor type size according to their visual acuity. Research showed that typeface and type size on screens influenced readability in general (Tullis, Boynton, & Hersh, 1995). The elderly reported eye fatigue and strain because of small type size or line spacing on the Internet (Echt, 2002). Nevertheless, a majority of home pages of health information news sites used a small font size (Becker, 2004). Bernard, Liao, and Mills (2001) found that the elderly read faster using 14-point fonts than 12-point fonts. In the meantime, research evidence on a typeface was contradictory: for example, the guidelines applied in this study advised the use of sans serif typefaces, yet other research said that serif fonts were preferable to sans serif (Bernard et al., 2001). Further study is necessary to discover influences of different typefaces on usability among the elderly.

Website designers need to carefully consider cognitive changes as well as relatively low health literacy among the

elderly (Becker, 2004). Cognitive capability such as problem solving, working memory, attention, and concept formation influences the use of web features. As cognitive functions decline with aging, seniors' experience of websites could be influenced negatively by complex navigation schemes, poorly designed search functions, and cluttered web pages (Strong, Walker, & Rogers, 2001). In addition, the comprehension of written material gradually decreases with aging because of the reduction in working memory capacity (Xiao, Lunsford, Coulston, Wesson, & Oviatt, 2003). For these reasons, the health-related websites for the elderly should use simple words, minimize users' workloads, and establish easy-to-use organized web structures.

Alternative media, such as animation, video, and audio, should be more often available on South Korean websites for the elderly, given that they can assist reduced cognitive functions and visionary or audio impairments among older adults. On the other hand, for the elderly using older computers or dial-up modems, those alternative media can be disadvantageous due to long download wait times. Therefore, the use of "several small images rather than a single large image" (National Cancer Institute, 2003 p. 145) and letting users know approximate download times are recommended. Research shows that alternative media should be used with text, but these two should not automatically be used at the same time for the elderly because much of this population cannot concentrate on both (National Cancer Institute, 2003). Therefore, alternative media needs to be more widely adopted as an alternative to plain text (Center for Medical Education, 2000).

To increase the ease of navigation and search, a site map, guidance about using the site, and search examples should be available. A site map may help the elderly understand relationships between web pages aid their navigation. Without a site map, the elderly who often need technical or contextual help to navigate websites can get lost before reaching the information they are searching for (Becker, 2004). Guidance is essential for those elderly people with low Internet skills even though most websites can be used via a common approach. If a website has a search function, it should include hints about successful search methods and be able to accommodate common typos or consumer

vocabulary that differs from professional terminology. However, to do so, more research is necessary to learn about users' search behaviors and preferred search terms in relation to health among the elderly.

In summary, there is a large gap between research evidence and its application in the field of web design, and health-related Korean websites seem not very considerate to their consumers, the elderly population. Because of this uncaring web environment, the elderly population may not be able to access precise health information on the web. The quality of websites is determined not only by content but also by its design. In other words, low performance in terms of web accessibility and usability is likely to damage credibility and reliability of the whole website even when high quality content is present. As a profession that understands and deals with the physical and psychological characteristics of the elderly, nurses and physicians should be expected to participate in improving more user-friendly websites or web-based programs.

Overall the evaluation criteria from the Checklist and Research-Based Web Design and Usability Guidelines were easy and clear to use for evaluating health-related websites. In the evaluation of websites, subjective opinion came into play in addition to empirical data. Disagreement between the two authors of this study occurred on occasion because a different researcher even when examining for the same criterion reviewed different web pages; for example, one researcher checked for Alzheimer and the other for arthritis, thus obtaining unequal results.

Although this study applied the forty-eight evaluation criteria only to health-related websites specifically designed for the elderly, all websites whose audience includes the elderly need to follow these criteria and support seniors. These evaluation criteria do not make for an instrument with validity or reliability. The calculation of evaluation scores by the authors is not acceptable. So this study has its limitations. First, it did not evaluate all health-related sites for the elderly and used a convenient sampling method to select websites. Second, this study did not examine all the web pages of each website due time and resource constraints, and thus the evaluation results are not conclusive. Third, human evaluation of websites cannot completely eliminate

investigators' subjective decisions. Finally, because this study evaluated only the design aspects of websites, the evaluation results do not reflect the quality of the health information content itself.

CONCLUSIONS

Although the elderly are known to have difficulties in searching for information on the Internet, there is a lack of knowledge about how well health-related websites support the elderly with proper usability design of the sites and accessibility to the information on those sites. This study evaluated how well health-related websites for the elderly took care of age-related changes and tried to identify room for improvement. Our research revealed that the design of health-related South Korean websites for the elderly was often not consistent with evidence-based guidelines. Good age-related changes seemed to be lacking in those websites.

The elderly population of the ROK is rapidly growing. In 2010, about one in every eight Koreans (11.0%) or 5.36 million people is aged 65 years old or older, and the percentage of that population is anticipated to grow to 24.3% (11.8 million) by the year 2030 (Korea National Statistical Office, 2006). The elderly are anticipated to receive the greatest benefits from utilizing health information. A majority of them suffers from one or more chronic conditions, disabilities, or activity limitations, consuming a considerable amount of healthcare resources. Health-related websites can help by educating the elderly about knowledge and skills needed for self-care. Web accessibility for seniors was seriously low in the Republic of Korea (Kwon et al., 2004). This is not only because a majority of the current elderly is less skillful in using computers or surfing the Internet, but also because aging naturally decreases the physical or cognitive functions of the elderly without exception. Although competency for using health information via the Internet should improve as more of the computer generation enters into the old age, special attention is necessary for them to conveniently access health information on the Internet. Current social trends including personal health records and mutual care decisions force the elderly to actively utilize health information online. Moreover, the Internet and health-

related websites are being integrated with more traditional healthcare systems: online with face-to-face. Health-related websites, then, are playing an important role with other e-health applications for quality of life among the elderly. In spite of this, many South Korean websites for the seniors are not proactive in attracting their target clientele: the elderly. Healthcare professionals are encouraged to improve accessibility of their websites or web-based programs for seniors by considering the evaluation criteria used in this study.

Suggestions follow for future research in the field

More precise understanding may be necessary for different segments of old-age groups, such as people in their 60s compared with those, say, in their 70s. A qualitative study would help researchers understand details of behavior patterns while using health information websites in particular among older adults (Center for Medical Education, 2000). Moreover, websites or web-based programs should be produced by directly involving the elderly in the process of their development (Ellis & Kurniawan, 2000; Kurniawan & Zaphiris, 2003).

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