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Cognitive Age and Usability of Health Website among Older Adults

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Abstract

Chronological age is widely used in the literature as an objective measure. Age is more than a physical state; it is also a state of mind. Cognitive age refers to how a person perceives their age to be. Evidence has shown that attitudes and behaviors to the use of technology are critically linked with the user's age. Older adults are the fastest growing internet users. There are barriers to the usability of technology among adults. The purpose of this paper is to describe whether cognitive age has an effect on the usability of health web site among older adults. Sixty-six percent of the older adults in the study perceived themselves at ten or more years younger than their actual age. Those who perceive themselves more than 20 years younger have the highest usability score. This study suggested that older adults who perceive themselves younger found a health web site usable.

Keywords

Cognitive age, Chronological age, Usability, Older adults, African-Americans, Heart failure

Introduction

Aging is inevitable but the process varies across individuals. There are numerous ways to determine one's age. Chronological age is widely used in the literature as an objective measure. It is defined as the number of years that a person is alive [1]. Age, however, is more than a physical state; rather it is also a state of mind [2]. Psychological age is a subjective description of one's experience through the use of non-physical features. An important psychological age is the self-perception age also called cognitive age. Cognitive age refers to how a person perceives their age to be [3]. It captures an aspect that is different and separate from chronological age [2]. Cognitive age is seen as a more accurate reflection of age-related changes than chronological age [4]. Barak and Schiffman (1981) described cognitive age in terms of four dimensions - the feel age, look age, interest age and do age [3].

Review of the literature revealed that the construct cognitive age has been around since the 1950s. It is a widely explored construct in aging and consumer research. There are substantial evidences that showed cognitive age to be a predictor of consumer behaviors and successful aging [5-12]. In the 21st century, the role of age is much more important in information technology research; as technology becomes omnipresent in everyday lives. Evidence has demonstrated that attitudes and behaviors toward acceptance and use of technology is critically linked with the user's age [1,13].

Contrary to popular beliefs, there are increasing data related to older adults having positive attitudes toward technology [5,14,15]. This is very encouraging as recent statistics showed older adults are the fastest growing internet users [16,17]. Latest data from the Pew Research Center (2014) reported that in 2012, more than half of older adults (aged 65 an older) go online; this translates to six in ten seniors are users of the internet [16]. Older adults use the internet for personal reasons, including obtaining health information, thus leading to their greater connectivity with society. It is also evident that older adults who "surf the net" maintain their sense of independence, control, and are empowered, hence improved quality of life [16,18-20]. However, barriers such as cognitive and functional limitations associated with normal aging, and the internet not always user friendly may prevent older adults' successful interface with technology. Issues related with interface could be addressed through usability evaluation. Usability is best described as the fit between the users and technology [19,21]. It is key towards user's acceptance of technology [22]. Usability of technology by older adults is extremely important since technology is now being incorporated as part of disease management particularly in self-care management of chronic illnesses. One example of scientific innovation in human computer interaction for older adults is the usability of mobile devices to monitor diabetes [23]. However, majority of usability studies among older adults have used chronological age to measure age variable. This paper will describe the results from a pilot study to determine whether cognitive age has an effect on the usability of health web site among older adults. Technology is defined for the purpose of this study as an interactive multimedia video viewed from a desktop computer.

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Method

Design and sample

This was a quantitative, non-randomized and descriptive pilot study. A convenience sample of 30 self-identified African-Americans over the age of 50 with a diagnosis of systolic heart failure was enrolled. Systolic heart failure was based on an ejection fraction of 40% and less from an echocardiogram or angiogram done within the past year. Additional inclusion criteria included the ability to read, speak and understand the English language. Exclusion criteria included those with significant and untreated psychiatric conditions, a diagnosis of Alzheimer's dementia, significant visual and hearing impairments, and significant musculoskeletal dysfunction prohibiting them from using the computer. Participants were recruited from a cardiology clinic at a large state university institution in Brooklyn, New York. Data from 29 participants were included in the analysis. One of the participants was not able to complete the study due to technical problem and participant did not wish to return another time to repeat the study.

Ethical consideration

Approval from the Institutional Review Board was obtained. Informed consent (IC) was taken from all study participants prior to initiation of the study.

Procedure

Participants were identified by the clinic nurse practitioner (based on approved recruitment flyer posted); then the principal investigator (PI) explained the study, answered questions and obtained IC. After signing the IC, study participants were instructed to go to a designated room with a computer to watch a 30-minute interactive educational video on "Congestive Heart Failure" provided by X-Plain [24]. The video was presented in English language. Participants were first asked some demographic questions, and to complete the Rapid Estimate of Adult Literacy in Medicine-R (REALM-R) [25] and cognitive age questions [3]. After which, participants were given instructions on how to use the mouse and were given ten minutes to practice moving the mouse before beginning the video. At this time, participants were asked to start watching and navigating the program. The PI, stayed in the room, in case the participant needed help with technical problem only. During the time the participants were navigating the website; the PI was performing other tasks, such as reading or writing, and faced away from the participant. After the participants finished watching the video, they were asked to answer the Use of Technology for Adaptation by Older Adults and/or those with Limited Literacy (U.S.A.B.I.L.I.T.Y.) Survey©.

Instruments

Cognitive age: Barak and schiffman's multidimensional scale was used to measure cognitive age [3]. Respondents were asked to identify with one of seven age decades (20's; 30's etc.) along the dimensions of feel, look, interest and do age. A composite measure of cognitive age was computed by averaging the mid-point value on each dimension. Reliability of the cognitive age was measured using test-retest, Guttman's Lambda test and split test reliability. The test-retest coefficient was 0.88; Guttman Lambda and Spearman-Brown split half reliability tests were 0.86 and 0.85, respectively [3].

Usability score: A newly developed U.S.A.B.I.L.I.T.Y. Survey© was used to determine the usability of the health web site [19]. The survey was a 25-item on a 5-point Likert scale consisted of 9-item efficiency, 4-item learnability, 6-item perceived user experience and 6-item perceived control. Usability scores ranged from 29-121, with scores 98 and above indicating good interface between the user and technology. Face and content validity were obtained from panel of experts. Panel of experts consisted of six master's and doctoral prepared nurse educators and NPs, and one systems engineer. Content validity index (CVI) was calculated as item CVI (I-CVI) and scale CVI (S-CVI). The calculated I-CVI was 0.97, whereas the S-CVI was 0.97 both considered to be acceptable. The preliminary reliability was established using internal consistency. The internal consistency of the four subscales ranged from 0.71 to 0.95; all but the perceived control subscale exceeded Cronbach alpha of 0.80 [19].

Data analysis: The SPSS Version 22 was used to perform data analysis. Means, percentages, standard deviations were used to analyze demographic and clinical characteristics. Pearson product moment-correlation was used to analyze continuous variables and Spearman rho for non-parametric variables.

Table 1: Socio-demographic and clinical characteristics.

Demographic characteristics (n = 29)	Frequency (%)
Age	Mean = 67.7 ± 8
Gender	(%)
Males	18 (62.1%)
Females	11 (37.9%)
Birthplace	(%)
Born in the US	7 (24%)
Born outside the US	20 (69%)
Missing	
Educational background	(%)
Elementary education	9 (31%)
High school education	8 (28)
College education	11 (38%)
Other (not specified)	1 (3%)
Literacy Score	6
Ownership of computer	(%)
Yes	9 (31%)
No	20 (69%)
Computer expertise	(%)
Novice	21 (72%)
Intermediate	8 (28%)
Expert	0
Usability Score	Mean = 108.1 ± 16.7
Ejection fraction	Mean = 32.9% ± 14

Table 2: Comparison between cognitive and chronological age.

N = 29	30s (30-39)	40s (40-49)	50s (50-59)	60s (60-69)	70s (70-79)	80s (80-89)
Cognitive age	6.9%	38%	27.6%	17.2%	10.3%	-
Chronological age	-	-	13.8%	44.8%	34.5%	6.9%

Results

Table 1 presents the socio-demographic characteristics of the study participants. Study participants' age ranged from 52 years to 87 years; 13.8% of the cohorts were aged 50-59, 44.8% were aged 60-69, 34.5% were aged 70-79 and 6.9% were over 80 years of age. Sixty-two percent of the participants were male, and majorities were born outside the US. Of the participants born outside the US; 90% were from various Caribbean countries and 10% were from South American. The mean literacy score was 6, indicating low or limited literacy; this despite 38% of the study participants reported some form of college education compared to 31% elementary education.

Cognitive age

The mean cognitive age of the study participants was 53.5 ± 10.7 years; whereas the chronological age was 67.7 ± 8 years. The mean age difference between chronological and cognitive age was 14 ± 8 years. Approximately 66% of the study participants perceived themselves ten or more years younger than their actual age. The mean cognitive

ages for the different dimensions include: Feel age - 55.3 ± 12.7; Look age - 54 ± 11.8; Do age - 51.6 ± 13.4 and Interest age - 53 ± 13.4. Table 2 presents the distribution of responses on each of the cognitive age questionnaire by the participants and compared to chronological age. Using Pearson product moment correlation, data showed that the difference between the participants' chronologic age and cognitive age was statistically significant (r = 0.671, p = 0.01).

The mean cognitive age of female was - 54 ± 13.6 and male was 53 ± 9; whereas the mean chronological age of female was 68 ± 10 and male - 68 ± 7. There was no statistically significant difference in cognitive age between genders.

Usability Score

The overall usability score was 108.1 ± 16.7, indicating good interface between the older adult and health website. Review of usability survey subscales showed that each subscale significantly correlated with each other (Table 3).

There was no difference in the health website's usability score between males and females (112.8 ± 9, 100.4 ± 23.1, respectively). Study participants who perceived they to be less than ten years younger than their actual age gave the website a mean usability score of 112.1 ± 8; whereas those who perceived themselves 10-20 years younger than their actual age gave usability score of 100.3 ± 23. Participants who perceived they to be 20 or more years younger than their actual age gave the highest usability score (115.6 ± 6). This depicts a trend towards linear increase in usability score the more years the older adults perceived themselves younger than their actual age. Figure 1 presents the usability of the health web site in each cognitive age decade. There is no difference in the usability of the health web site in each cognitive age decade.

Discussion

This study examined two constructs that have significance to acceptance and use of technology - cognitive age and usability. Cognitive age, a construct that is believed to be influenced by a person's life experiences, which affects a person's outlook and control they have of their life [13]. The mean cognitive age of the study participant was 53.5 ± 10.7, a difference of 14 years younger than their chronological age. This finding is consistent with previous studies on cognitive age or self-perceived age [1,7,12,23,26]. The present study, however, did not find any difference in cognitive age between

Table 3: Correlation of four usability survey subscales.

Correlation		Efficiency	Learnability	User experience	Perceived control
Efficiency	Correlation coefficient		0.728**	0.598**	0.552**
	Sig. (two-tailed)		0	0.001	0.002
	N		29	29	29
Learnability	Correlation coefficient	0.728**		0.737**	0.549**
	Sig. (two-tailed)	0		0	0.002
	N	29		29	29
User experience	Correlation coefficient	0.598**	0.737**		0.549**
	Sig. (two-tailed)	0.001	0		0.002
	N	29	29		29
Perceived control	Correlation coefficient	0.552**	0.549**	0.549**	
	Sig. (two-tailed)	0.002	0.002	0.002	
	N	29	29	29	

**Correlation is significant at the 0.01 level (2-tailed).

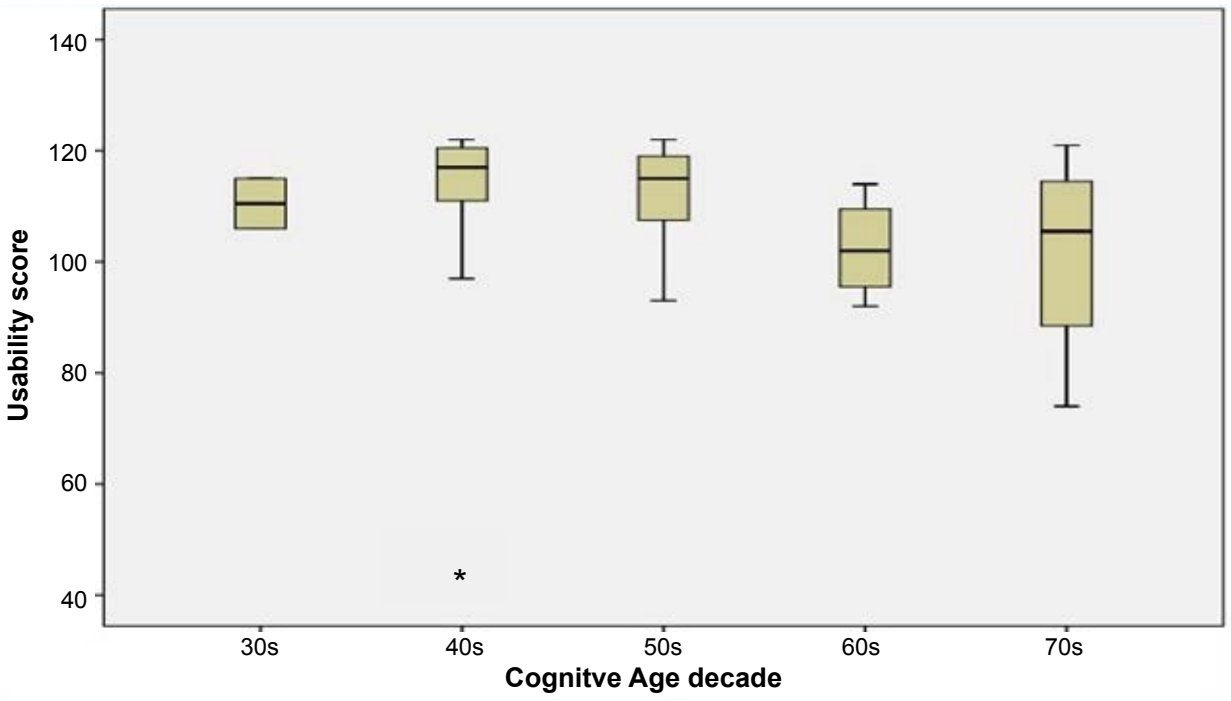

Figure 1: Usability scores in each age decade.

genders. This is in contrast to previous studies that reported females have younger cognitive age than men [12,27]. The participants in this study were all African-Americans, whereas other studies were mostly Caucasians. This area may require further research to determine whether cognitive age is different between genders and those from diverse cultural backgrounds.

Usability refers to how well and easily a person can perform a task using technology without formal training [28]. This study showed that older adults found the health website usable, despite having limited experience with computer and have lower literacy level. This suggests that older adults may have the ability to use the internet or technology, in general, particularly if given the opportunity. The usability scores were not different in each age decade; although those who perceived themselves to be more than 20 years younger than their actual age gave the highest usability score. This study further substantiated results from previous studies on how cognitive age may predict attitudes and behavior, including acceptance and use of technology [5].

There are several limitations acknowledged in this study. The present study only assessed the correlation between cognitive age and the usability score. Correlation is not causation; therefore, the results from the current study do not explain the association between age (older age) and website use among African American patients with systolic heart failure. This study is also a non-randomized, descriptive, pilot study using a convenience sample. Those who participated in the study may be those who were interested in learning about the internet perhaps contributing to potential sampling bias. The study sample was recruited from one cardiology clinic; thus generalizability is applicable only to those who participated in the study. The usability survey used was developed for the purpose of the study; therefore, the survey has never been used before. Further research is needed with diverse group to establish additional reliability and validity of the usability survey.

Conclusion

Age has been a pervasive measure in the use technology. Age, however, is both physical as well as psychological state [2]. Chronological age is no longer considered the only determinants to lifestyle and behavior [10]. The Institute of Medicine [29] described cognitive aging as a basic attribute for a person to successfully engage with activities, accomplish goals, and negotiate through life. It may also have significant effect on the individual's daily activities and independent living. One characteristic of successful aging is active engagement in life. Using the computer and surfing the net are active rather than passive. As the numbers of older adults continue to increase, and their increasing engagement with technology, age not should not only be the pervasive measure of technology.

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