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Research-in-Progress

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ABSTRACT

Despite widespread availability, the use of smart devices is still very limited among seniors who could benefit from adopting these systems. This research-in-progress study draws on the theory of aging and subjective assessments of health, as well as information systems adoption literature to propose a theoretical model to explore the effects of older adults' cognitive age on their disability perceptions which can influence their adoption of smart devices. The results will be achieved using a combination of qualitative and quantitative methods. Potential contributions from this research to theory and practice are also outlined.

Keywords

Cognitive age, smart devices, wearable activity monitors, disability perception.

INTRODUCTION

Whereas only 5.2% of the population was over 65 in the year 1950, this percentage is projected to rise to 15.9% by 2050, and to 27.5% by 2150 (Baecker et al. 2012). For persons over age 65, continued independent living is a critical issue. Concurrently, there is exponential growth in the use of smart devices that can give older adults informative insights about their activity levels and presumably encourage them to take corrective actions if they are under the recommended levels. Smart devices (e.g., wearable activity monitors) refer to devices that automatically gather information about users or their environment to help them in gaining knowledge about themselves (e.g., their daily physical activity) (Lazar et al., 2015). Despite their availability, only 17% of seniors use Wearable Activity Monitors (WAM) (e.g., Fitbit) which is still very limited among seniors who could benefit from adopting these systems (Japsen 2016).

Daily Physical Activity (PA) is a strong independent predictor of morbidity, mortality, and independence; hence, use of WAM could motivate people to achieve greater levels of PA and independence (McLean, 2011). Thus, the use of WAM has the potential to positively affect older adults' quality of life and decrease the use of expensive health resources (Skubic et al., 2009). However, many members of this demographic group perceive high level of disability (i.e., cognitive and physical limitations) that would make it difficult for them to independently utilize smart devices (Demiris et al., 2004). In 2012, 39% of older adults in the United States reported some type of cognitive or physical disability (He and Larsen 2014). Given the predicted growth of the older adult population, the number of older adults living with disability will also increase (Gell et al., 2013). Subjective assessments of disability among older adults, viewed in the light of health decline, have received little attention both in the literature and in practice. Little is known about why some older adults consider themselves as disabled, which places them further along the aging continuum versus their chronological age.

Cognitive age refers to how old individuals perceive themselves to be based on their self-perceptions regarding their actions, feelings, appearance and interests. Cognitive age has been found to be more effective in capturing older adults' lifestyle habits, and predicting their perceptions and behavior, than other widely used variables such as education, income and health (Barak, 2009). Hence, individuals' cognitive and physical disability perceptions may be influenced by their cognitive age. In fact, a reproducible finding is that as people age their self-perceptions of disability increase. However, age is most often reported as chronological age with very little attention to individuals' self-perception of their age (Ghasemaghaei et al., 2014).

To address the identified gaps, we draw on the theory of aging and subjective assessments of health, as well as information systems adoption literature to propose a theoretical model to explore the effects of older adults' cognitive age on their disability perceptions which can influence their adoption of smart devices like WAM. A combination of qualitative and quantitative methods will be utilized to achieve the stated objective. This study is particularly timely and important given the fast growing older adult segment of Information Technology (IT) users and their desire to remain independent within their home. Hence, the results of this research are anticipated to provide actionable insights for both system designers and health care providers. Through corrective enhancements we propose that senior-friendly WAM could result in benefit as it relates to peoples' confidence in utilizing the emerging technologies, and most importantly that their overall health through the increased PA would also improve.

THEORETICAL BACKGROUND

Aging

According to aging research, most adults tend to feel younger than their chronological age (i.e., the number of years since birth), and such tendencies become more noticeable as people get older (Barak & Gould 1985; Czaja et al., 2001). Barak & Schiffman (1981) suggest that individuals' behaviors are mainly based on perceived rather than their chronological age. For example, Lindberg et al. (2006) argue that predictions regarding technology user performance should not be based merely on an individual's chronological age. Schwall et al. (2012) suggest that there are three main subcategories of individual aging: social, biological, and psychological. They argued that cognitive age is a type of subjective age that considers all these subcategories in measuring one's age. Cognitive age has been found to be a good predictor of older adults' behavior and lifestyle (Ying and Yao 2010). In the context of IT, Ghasemaghaei et al. (2014) argue that cognitive age is a better measure for understanding individuals' behavior towards adopting new IT. Hence, in this study we use cognitive age as a more appropriate measure to understand how age impacts individuals' perceptions toward their disability as well as their adoption of smart devices (here WAM).

Disability Perception

The World Health Organization defines disability as any restriction or lack of ability to perform an activity resulting from physical or cognitive limitation (Wood, 1980). Perceived disability is a subjective assessment of an individual's health and functional status influenced by their cognitive and physical limitations. When assessing individual's disability status, older adults tend to compare themselves with the same age peers, which includes a subjective ranking relative to others (Leinonen et al., 2001). Often, older adults with a greater number of chronic conditions, medication use, and pain, tend to rate their disability as higher (Kelley-Moore et al., 2006). Disability in older adults has been associated with enhanced risk for adverse health outcomes such as functional decline, social isolation, and higher health care needs and costs (Gell et al., 2013).

The subjective assessments of disability status among older adults and its impact on the use of IT have received little attention in the literature. Very little is known about why some older adults perceive themselves as having a disability and others do not, even when their health status is similar. Likewise, there is no study describing if perceptions of disability influence how older individuals perceive their age based on their looks, feelings, actions, and interests (i.e., cognitive age). Hence, in this study we will explore this impact.

RESEARCH MODEL AND HYPOTHESES

To answer the research questions identified in this study, we propose the research model shown in Figure 1 below.

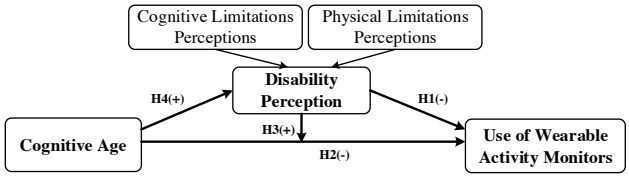

Figure 1. Research Model

Use of WAM refers to the use of devices (e.g., Fitbit and other Internet-connected monitoring devices) that automatically gather information about users or their environment to help them in gaining knowledge about themselves (e.g., their daily PA) (Lazar et al., 2015). Smart devices, including WAMs, are quickly emerging as popular devices with increasingly powerful computing, sensing, and networking capabilities (Suarez-Tangil et al., 2014). One key reason behind the popularity of the use of smart devices is their mobile nature and their capabilities to provide pervasive user connectivity. Wireless communication technologies enable smart devices to communicate with a number of varied Internet services, and wearable objects (Suarez-Tangil et al., 2014). In the context of this study, seniors could benefit from the use of WAM as their medical staff could seamlessly monitor their activity levels. Furthermore, the use of WAM relates to seniors' confidence in utilizing the emerging technologies and, as we propose, with their overall health through the increased physical activity.

Disability Perception refers to a subjective assessment of individuals' health and functional status affected by their physical and cognitive limitations. Despite the expansion of digital media ownership, compared to non-disabled people, individuals with physical and cognitive limitations are less willing to use smart devices (Gell et al., 2013). Physical and cognitive limitation perceptions refer to the subjective assessments regarding the limitations individuals have in terms of the overall

abilities of their body and mind to do a purposeful task. Fundamental physical (body) disability could include one or all of an impairment in: physical function, strength, vision, communication, or hearing. Examples include lifting objects, walking, reading standard-size print, climbing stairs, and hearing other people speak in a room. Basic cognitive (mind) actions include emotional functions, and central cognitive. Examples are intelligible speech and short-term memory. Physical and cognitive actions constitute the basic interface between a person and the physical and social environment in which people perform daily activities (Verbrugge & Jette, 1994). In the context of the use of smart devices, Morris et al. (2013) found that those with disability have major difficulties in using smart phones. Thus we hypothesize that:

H1: *Higher disability perceptions is associated with lower use of WAM.*

Cognitive age refers to individual's age perceptions regarding their feelings, looks, actions, and interests (Barak and Gould 1985). Studies have found that most adults perceive themselves as having a lower cognitive age compared to their actual chronological age (Montepare and Lachman 1989). We hypothesize that while using new technologies, older adults with greater cognitive age will be less efficient in their ability to inhibit irrelevant information, have less attentional capacity, and have lower speed with which information processing can be executed (e.g., Zhou et al., 2014; Ziefle et al., 2007). Thus we hypothesize that:

H2: *Higher cognitive age is associated with lower use of WAM.*

When examining individuals' disability status, older adults incline to compare themselves with the same age groups, which includes a subjective ranking relative to others (Leinonen et al., 2001). Older adults with more health challenges, such as medication use, the presence of chronic conditions, and pain, often tend to rate their disability as higher (Kelley-Moore et al., 2006). Thus we hypothesize that:

H3: *Disability perception moderates the effect of cognitive age on the use of WAM, such that those with higher disability perception have a lower use of WAM.*

Welford (1980) found that, compared to younger adults, deficits in working memory are more pronounced in older adults. Researchers have argued that smart device technologies, such as WAM, would be beneficial for older adults when they decrease requirements to maintain information in working memory (Morris and Venkatesh 2000). It has been proposed that older adults with higher cognitive age will perceive higher levels of deficits in their physical and cognitive abilities compared to younger adults. In addition, beliefs that people may become forgetful and slower with age have been supported in the literature (Bol et al., 2014). To the extent that older adults believe that these characteristics decline with age, these beliefs may lead to perceptions that they are not capable of learning and improving (Warr and Pennington 1993); thus, they may perceive higher disability to perform their daily tasks. Since aging is associated with declines in physical and cognitive functioning, these changes may be associated with feelings of disability among older persons(Shapira et al. 2007). Thus we hypothesize that:

H4: *Higher cognitive age is associated with higher disability perceptions.*

METHODOLOGY

Research Methodology

We will use a combination of qualitative and quantitative methods in which participants will be greater than 60 years old.

Qualitative Study

An in-depth qualitative study will be conducted to understand how individuals' cognitive age may affect their perceptions of being disabled. These results will then inform a subsequent quantitative study that will validate a research model highlighting the causal chain from cognitive age to disability perceptions to the use of WAM. In this study, the use of Fitbit technology will be considered that serves as a representative example of a WAM that seamlessly monitor individuals' activities (e.g., daily steps, energy expended, sleep patterns) (Schrack et al., 2016). For the qualitative study, the impact of proposed cognitive age influential factors (i.e., individuals' perceptions regarding their actions, feelings, appearance and interests) on older adults' cognitive and physical disability perceptions will be explored via focus groups. Focus groups can provide rich information when a theory is being tested or developed (Bachiochi & Weiner, 2002).

Quantitative Study

The qualitative study, discussed above, will inform a quantitative study by identifying factors that affect disability perceptions of older adults. The proposed research model (Figure 1), subject to modification based on the results of the qualitative study, will be empirically validated through an online survey of older adults.

To ensure content validity, scales for all constructs will be selected from the extant literature with appropriate adaptation to context. Cognitive age will be measured using a 4-item scale from Barak and Schiffman (1981) where participants indicate which age group (fifties, sixties, seventies…) they perceive themselves belonging to in terms of their actions, feelings, appearance and interests. Cognitive age will then be computed as the numerical average of the decade midpoints of these four components with higher numbers showing a higher cognitive age (Wilkes, 1992). Perceived physical disability will be measured using the 11-item scale from

Kelley-Moore et al. (2006) and perceived cognitive disability will be measured using the 11-item scale from Pfeiffer (1975). Finally, the use of WAM will be measured using a 3-item scale adapted from Venkatesh et al. (2008). A pilot survey will be used to test and refine the measurement instruments.

Prior to testing the research model, we will evaluate the validity of each of the constructs. Particularly, we will measure the validity and reliability of all the constructs in the model.

DATA ANALYSIS

The main research questions will be answered through validating the model shown in Figure 1 using structural equation modeling techniques. Structural Equation Modeling (SEM) will be used to validate the proposed model. In particular, Partial Least Squares (PLS) will be used as it is suitable for exploratory studies and theory building (Gefen et al., 2000). Furthermore, the goodness of model fit indices will be measured to assess the PLS model in terms of overall (both structural and measurement levels) prediction performance of the research model (Vinzi et al., 2010). Moreover, ANOVA tests will determine if there are significant differences between the perceptions of subjects whose cognitive age is below 60 and those of higher age (above 60).

CONCLUSION

The research findings from this work will make significant contributions to both theory and practice. It will leverage and draw on the theory of aging and subjective assessments of health, as well as information systems adoption literature to propose a theoretical model to explore the effects of older adults' cognitive age on their disability perceptions which can influence their adoption of smart devices such as WAM. Using this unique integrative view, this study addresses a gap in the literature and advances our understanding of the impact of older adults' cognitive age and their disability perceptions on the use of WAM. This knowledge can be used to conduct further research and develop theories for better understanding the role of individuals' cognitive age and their disability perceptions on the use of new technologies designed to increase the levels of daily physical activity to promote independence of older adults.

The results of this study will also have important implications for both system designers and health care providers. Currently, many health care providers try to motivate older adults to use smart devices (e.g., Fitbit) to monitor their activities and presumably take corrective action if they performing below recommended levels. Health care providers need to pay particular attention to considering the potential impact of older adults' self-perceptions regarding their actions, feelings, appearance and interests (i.e., cognitive age), as well as their self-perception of their physical and cognitive abilities on the use of such new technologies. Without considering these factors, although many older adults want to remain independent in their homes, they may reluctant to use such devices. In addition, the results from the qualitative study will help system designers to understand some of the main design elements that are necessary to be considered while designing smart devices for older adults.

In summary, this study is both timely and relevant as globally there is a rapidly growing older adult and there is increasing interest in the use of smart devices like WAM that aim to promote well-being, improve health, and enhance quality of life. Ultimately, older adults will benefit from the enhancements in WAM technology as it relates to their confidence in utilizing the emerging technologies, and with their overall health through the increased PA.

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