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Analyzing older users' home telehealth services acceptance behavior—applying an Extended UTAUT model

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ABSTRACT

Background: Although telehealth offers an improved approach to providing healthcare services, its adoption by end users remains slow. With an older population as the main target, these traditionally conservative users pose a big challenge to the successful implementation of innovative telehealth services.

Objectives: The objective of this study was to develop and empirically test a model for predicting the factors affecting older users' acceptance of Home Telehealth Services (HTS).

Methods: A survey instrument was administered to 400 participants aged 50 years and above from both rural and urban environments in Slovenia. Structural equation modeling was applied to analyze the causal effect of seven hypothesized predicting factors. HTS were introduced as a bundle of functionalities, representing future services that currently do not exist. This enabled users' perceptions to be measured on the conceptual level, rather than attitudes to a specific technical solution.

Results: Six relevant predictors were confirmed in older users' HTS acceptance behavior, with Performance Expectancy (r = 0.30), Effort Expectancy (r = 0.49), Facilitating Conditions (r = 0.12), and Perceived Security (r = 0.16) having a direct impact on behavioral intention to use HTS. In addition, Computer Anxiety is positioned as an antecedent of Effort Expectancy with a strong negative influence (r = −0.61), and Doctor's Opinion influence showed a strong impact on Performance Expectancy (r = 0.31). The results also indicate Social Influence as an irrelevant predictor of acceptance behavior. The model of six predictors yielded 77% of the total variance explained in the final measured Behavioral Intention to Use HTS by older adults.

Conclusion: The level at which HTS are perceived as easy to use and manage is the leading acceptance predictor in older users' HTS acceptance. Together with Perceived Usefulness and Perceived Security, these three factors represent the key influence on older people's HTS acceptance behavior. When promoting HTS, interventions should focus to portray it as secure. Marketing interventions should focus also on promoting HTS among health professionals, using them as social agents to frame the services as useful and beneficial. The important role of computer anxiety may result in a need to use different equipment such as a tablet computer to access HTS. Finally, this paper introduces important methodological guidelines for measuring perceptions on a conceptual level of future services that currently do not exist.

1. Introduction

Increasing pressure in the health care sector is driving the need for changes in the way health services are delivered and organized [1,2]. Users are altering their traditionally hierarchical attitude to health service providers, causing a fundamental change from physician-oriented to patient-centered healthcare systems [3]. Within this challenging context, emerging information and communication technology (ICT) appears very promising by using tools such as the digitalization of data collection, advanced diagnostics, and monitoring for patient-centered and personalized care [3–5].

The older population (aged 50 years and above) is the main target of emerging telehealth solutions development as it generates a large share of service demand [6–8]. Many different health ICT solutions have been developed to address older users' specific needs: advanced diagnostics, biosensors and vital signs measurement, electronic health records, home access to healthcare services,

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and assistive living services [9–12]. In our study, services including this broad spectrum of functionalities are referred to as Home Telehealth Services ("HTS").

Despite rapid technological advancement, HTS adoption rates remain slow due to their disruptive nature and traditionally conservative older users. A review of current HTS research puts engaging the end users at the frontier of successful telehealth implementation [13,14]. Understanding the process of how and why people develop relationships with technology and integrate it into their life plays a pivotal role [15]. People age biologically, psychologically, socially, and even spiritually, influencing the way they form and induce perceptions [16]. Older users tend to show behavioral specifics which have to be considered in the development and marketing of health ICT for this specific group [17]. Understanding older users' needs, behavioral specifics, technology use behavior, and their interrelation in their decision-making is thus at the forefront of telehealth services development [6,14,18,19].

This study's key objective is to analyze two main questions: firstly, what are the dimensions underlying older adults' HTS acceptance behavior and what is the underlying model? And secondly, how does such model perform in an empirical setting?

An important challenge is to analyze the behavior of users with respect to future HTS services that currently do not exist. There is clearly a lack of a conceptual approach in acceptance modeling since studies usually focus on a specific technology or service [5,6,20]. However, our study concentrates on factors that influence HTS acceptance as a concept and not as a specific telehealth product or service. This approach offers a basic framework for understanding acceptance behavior of HTS on a conceptual level, which is essential for the future development of HTS.

The structure of this paper is as follows: first, the factors affecting technology acceptance of older users are analyzed. The hypotheses of our model are theoretically grounded and the model is conceptualized. The methodology of the study is then described, followed by statistical analysis and results with the final model. In the discussion, implications for theoretical and practical implications are described, along with limitations and opportunities for further research.

2. Theoretical background and model development

2.1. Background

Telemedicine industry and technology have been developing rapidly for over two decades with its benefits being lauded [21,22]. Many different concepts had been developed and tested, usually to address a certain specific need in the context of disease management, security, easier access, preventive services integration, or enhancing general quality of daily living for older users in their home environment [9–12].

Most of the studies have used a specific solution to address the needs of the patients/users, such as chronic disease management, independent living, communication, preventive care, social services [6,7,21,23], or a specific area of technologies, such as mobile, wireless, web applications, cloud solutions, biosensors or diagnostic software [24–28]. There is little understanding regarding which factors should be considered when patients accept telemedicine [29]. Often, a very specific telemedicine solution is considered such as the research about electronic medical records in [30] which identified 78 factors in 8 categories affecting the adoption.

Van Gemert-Pinjen et al. [18] reviewed the uptake of HTS, finding that one of the most frequent root causes in low adoption ratios is the lack of holistic approach in designing HTS solutions. Most of the past research and development often disregards the interdependency between human characteristics, technology and

socio-economic background in designing and planning new technology, which usually leads to low impact on healthcare practices. There is a clear mismatch between users' expectations and technology development and services provisioned [5,18].

Home Telehealth Services (HTS) are new, innovative and complex ICT-based services in the conservative field of healthcare, targeted to the conservative older users [31]. While technology, regulations and physician buy-in are often cited reasons, patient acceptance has not received much consideration [32] and few studies have examined this area from the users' perspective [33]. Thus despite the high and increasing technological development, the end-user adoption of technology-based healthcare services is becoming the main barrier for HTS implementation [18] and further quantitative studies are needed to explore patients' intentions to use [34].

When considering older users' acceptance of ICT based services, such as conceptualized HTS, user engagement is especially challenging, since the older users are traditionally highly reluctant to innovative solutions acceptance [35]. Understanding older users' behavior and decision making in the context of innovative HTS adoption presents the main challenge in successful HTS acceptance and commercialization [5,15,36]. The market response suggests that older adults' adoption of technology is not simply a matter of performance and price, but a complex issue that is affected by multiple factors [36]. Van Gemert-Pinjen et al. [18] reviewed the uptake of HTS, finding that one of the most frequent root causes in low adoption ratios is the lack of holistic approach in designing HTS solutions. Most of the past research and development often disregards the interdependency between human characteristics, technology and socio-economic background in designing and planning new technology, which usually leads to low impact on healthcare practices. There is a clear mismatch between users' expectations and technology development and services provisioned [5,18].

Therefore, previously developed theories about technology acceptance should be used to study those factors. The Technology Acceptance Model ("TAM") is the leading theory in health ICT acceptance analyses [37]. As shown in a recent literature review TAM has evolved to become a key model in understanding predictors of human behavior toward potential acceptance or rejection of the technology [38]. The Unified Theory of Acceptance and Use of Technology (UTAUT) is the latest derivative of TAM [39]. Since being introduced, the UTAUT model has been tested extensively in various fields and promises to be a great tool for analyzing users' acceptance of health technology [40–42].

The final measured construct in UTAUT model is Behavioral Intention to Use (BI) defined as "a measure of the strength of one's intention to perform a specified behavior" [43]. It is, influenced by four main constructs: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC).

The UTAUT model is usually supplemented with additional contextual constructs that integrate specific elements of the field of use [44,45], such as the addition of the physician-patient relationship construct [42] or the social capital factors (social trust, institutional trust, and social participation) [46]. Introducing additional contextual predictors enables a more accurate understanding of users' acceptance of technology, which is always domain-specific [37,44,47]. Based on review of previous research in the field of older adults' health technology acceptance, the three context-specific predictors were added to the original model, namely Doctor's Opinion (DOC), Computer Anxiety (CA), and Perceived Security (PS) [48]. The augmented model therefore includes two groups of predictors: universal (technology acceptance) predictors and context-specific predictors.