OLDER ADULTS’ PERCEPTIONS OF HOME TELEHEALTH SERVICES

Complete Research

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Abstract

The success of home telemedicine depends on end-user adoption which has been slow despite rapid advances in technological development. This study focuses on an examination of significant factors that may predict the successful adoption of Home Telemedicine Services (HTS) among older adults. Based on previous studies in the fields of remote patient monitoring, assisted living technologies and consumer health information technology acceptance, eight factors were identified as a framework for qualitative testing. Twelve focus groups were conducted with an older population living in both urban and rural environments. The results reveal seven predictors which play an important role in perceptions of HTS, namely Perceived Usefulness, Effort Expectancy, Social Influence, Perceived Security, Computer Anxiety, Facilitating Conditions and Physicians’ Opinion. The results provide important insights in the field of older adults’ acceptance of HTS, with guidelines for the strategic planning, developing and marketing of HTS.

Keywords: home telehealth services, older adults, telehealth adoption predicting factors
1 Introduction

The telemedicine industry and technology have been developing rapidly for over a decade with its benefits being lauded. However, implementation and adoption processes are still in their infancy (Koch 2006; Moeckli et al., 2013, Bensink et al. 2006). The adoption of telemedicine has so far been modest, if not disappointing, as several interconnected barriers have yet to be overcome. While inpatient care is a stable environment for implementing telemedicine solutions (Liu 2011), the adoption of Home Telemedicine Services (in the continuation HTS) remains a relatively unexplored area. For the older population, due to the rise of chronic disease and other age-related health disorders, HTS are a promising option for increasing life quality, decreasing healthcare costs and offering more independent living (Onor et al. 2008; Finkelstein et al. 2006). This makes older adults the main target of efforts to implement HTS (Chiu & Yang 2010, Heart & Calderon, 2013). HTS include three main groups of services: home access to the healthcare system (partial access to personal health records); assisted living technologies; remote patient monitoring and chronic disease management (vital signs measurement and on-line communication). The conceptualized HTS in the study included functionalities from all three groups, which are presented in Table 1. While previous studies tested the user’s perception of a specific function of HTS (typically a specific service involved in remote patient monitoring or a specific Internet health information exchange), the main objective of this study is to analyse the user’s perception of the broad concept of HTS adoption.

This is challenging for several reasons. HTS are complex services with technical solutions either not yet existing or unknown to the target population. The target population (older adults) has less understanding of new, innovative and information technology-based solutions and concepts. Introducing the concept of HTS to the conservative users in a conservative field of healthcare involves special challenges. Potential additional predictors related to older users’ specifics and the adoption of healthcare services should be investigated to ensure a more reliable prediction of the acceptance of HTS. An important question is how those factors can be influenced to facilitate the adoption of a particular type of HTS by the older population. We thus conducted 12 focus groups to analyse older adults’ perceptions of both the acceptance of general technology and additional, context-specific predictors. For further empirical testing, a more quantifiable approach was used in Extended UTAUT model evaluation. Quantitative analysis was performed in three main steps, starting with development of measurement instrument and model operationalization, followed by statistical analysis of measurement model, and finally structural model evaluation and analysis of path coefficients.

We begin by reviewing behavioural predictors of the acceptance of information technology by older consumers and describe the specific features of healthcare services. In the next section we present the methodology, the results and their implications. In the conclusion, theoretical and practical implications are extracted along with directions for HTS service development and marketing as well as future research directions.

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1 The qualitative part of the research has been previously published in Cimperman, M., Makovec Brenčič, M., Trkman, P., & de Leonni Stanonik, M. (2013). Older adults’ perceptions of home telehealth services. Telemedicine and e-Health, 19(10), 786-790.
2. A review of potential predictors

2.1 Technology acceptance predictors

Telemedicine solutions are technology-based services. Several theories try to explain users’ intention to adopt technology. The most widely used theory is the technology acceptance model, using perceived usefulness and perceived ease of use as the main construct when measuring the intention to use new technology or services (Davis 1989). The Unified Theory of Acceptance and Use of Technology Model (UTAUT) by Venkatesh et al. offers an improved model for testing the acceptance of technology (Venkatesh et al. 2003). Since its introduction, the UTAUT model has been tested extensively, including in the context of health information technology, providing a rigorous framework for testing its acceptance (Janz & Hennington 2007, Rho et al., 2014). Its root constructs are Perceived Usefulness, Effort Expectancy, Social Influence and Facilitating Conditions.

Perceived Usefulness (PU) is the degree to which an individual believes that using the system will help them attain gains (Venkatesh et al. 2003). In the context of using HTS, the construct of PU can be defined as the degree to which a user believes using HTS can improve one’s quality of life. Effort Expectancy (EE) is the degree of ease associated with using the system (Venkatesh et al. 2003). EE is conceptualized as the extent to which patients/users believe HTS will be easy to use. PU and EE are the most common constructs used for testing technology acceptance. Social Influence (SI) is the degree to which an individual perceives that important others believe he or she should use the system (Venkatesh et al. 2003). Its root constructs include subjective norm, social factors and image (Taylor & Todd 1995). Facilitating Conditions (FC) are defined as the extent to which an individual believes that an infrastructure exists to support use of the system (Venkatesh et al. 2003). This includes technical support, price and organizational support (Or & Karsh 2009). In this study, SI is conceptualized as the influence of important others on older users’ decision to use HTS. Perceived price, technical and organizational supports are considered as facilitators.

2.2 Context-specific predictors

In the context of older users’ acceptance of HTS, an overview of previous studies reveals four major factors as additional predictors for HTS acceptance; Computer Anxiety, Perceived Security, Self Efficacy, and Doctor’s Opinion (Agarwal & Angst 2009; Agarwal & Lau 2010; Jen & Hung 2010; Or & Karsh 2009; Or et al. 2011; Rahimpour et al. 2008; Steele et al. 2009; Botis & Hartvigsen 2008).

Computer Anxiety (CA) refers to a negative affective reaction toward computers such as an apprehension or fear of using computers (Beckers & Schmidt 2001; Ellis & Allaire 1999; Rosen & Weil 1995). Studies testing information technology acceptance by older users report CA is the most consistent predictor with a negative impact on attitude and intention to use technology (Ellis & Allaire 1999; Rahimpour et al. 2008; Phang et al. 2006). CA has an even more important role among seniors (Laguna & Babcock 1997).

Perceived Security (PS) is conceptualized as the level to which transacting with the system is perceived as secure, enabling data integrity and reliability. Initial trust formation is particularly relevant in the information system adoption context since users must overcome perceptions of risk and uncertainty before using a novel technology (Li et al. 2008). The use of electronic services such as e-commerce and e-banking shows consumer trust in secure transacting with the system plays an important role in the acceptance of such services (Chellappa & Pavlou 2002; Suh & Han 2003). Older adults have negative views about health information technology performing accurately and dependably and therefore PS is predicted to exert an important influence on older users’ acceptance of HTS (Welsh et al. 2003).
Self Efficacy is defined as the belief that one has the capability to perform an action (Bandura 1977). Especially in the context of older people using computer technology, Computer Self Efficacy (CSE) has proved to be an important influence on attitude and intention to use (Igbaria & Livari 1995; Lam & Lee 2005).

The incentive and recommendation of one’s physician has been shown to play a pivotal role in enrolment in preventive health care services (such as vaccination) and in using Internet as a resource for medical information (Abramson & Cohen-Naor 2000). The influence of a doctor’s opinion on a patient’s decision can be regarded as an expert power influence, and can be applied in different contexts; manager–employee, salesman–customer or, in the HTS context, a doctor–patient relationship (Asherman & Asherman 2001, p.70). Doctor’s opinion (DO) is predicted to have an important influence on a user’s acceptance of HTS.

The identified eight predictors were used for testing the acceptance of HTS. Factors consist of two basic subgroups of predictors. Group 1 represents universal technology acceptance predictors and includes Perceived Usefulness (PU), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC). Group 2 are context-specific predictors which include Computer Anxiety (CA), Perceived Security (PS), Doctor’s Opinion (DO) and Computer Self Efficacy (CSE).

3 RESEARCH METHODOLOGY

3.1 Focus groups interviews

Firstly, 12 focus group interviews (FGIs) were conducted with the first author acting as a moderator. These FGIs were used to survey the needs, expectations, and problems of older adults with respect to using HTS. Conducting focus groups is a useful method when analysing consumerism and attitudes to various themes, and can reveal the beliefs, attitudes, experience, and feeling of the participants through interaction, which would not be feasible via individual interviews or questionnaires (Litosseliti, 2003, p.16). A topic guide was developed and used to match the concepts of the eight preliminarily defined predictive factors.

Each of the 12 FGI groups had 6 to 12 participants. In total, 87 subjects living in Slovenia participated; 22 men and 65 women all of whom were retired. The study sample’s age distribution was between 55 and 75, including retired participants living in households in both rural and urban environments. In the context of consumer behaviour, the lower boundary for defining an older consumer usually ranges from 50 to 55 years, including the population with a need for a wide variety of products and services (Moschis et al. 1997). This segment has also often been used in testing the adoption of telemedicine among the older population (Shea et al. 2006). The FGI settings were in centres for older people’s daily activities and education in Slovenia. Such centres organize social, educational and cultural activities for healthy older citizens. This is an active and independent living segment of older people with financial autonomy. Most importantly, all participants were living at home and thus the population included was not in palliative care, residential homes or hospital care. Further, most participants had previously been involved in programs for computer literacy and education, and were familiar with basic use of computers and the Internet. As HTS services are targeted at the older population with a tendency for independent living, with increased quality in their older life, with financial autonomy, and higher risks of health hazards (European Commission, 2010; Morris et al. 2012, p.8), the selected sample represented a target population for the implementation of HTS and solutions.

The FGI participants had no prior experience with HTS and the challenge was to introduce the concept to them without improperly influencing their attitudes. For this purpose, a PowerPoint computer presentation with graphic materials concerning the conceptualized HTS was used. The presentation
alone proved to be an insufficient method for presenting the concept. In addition, the participants rated the usefulness of HTS functionalities on a seven-point Likert scale (not useful/very useful), as shown in Table 1. They were thereby given an incentive to not only listen but to actively form opinions about various HTS. This combination of introductory methods enabled an efficient start to the discussion of the FGIs.

3.2 Survey

Questionnaires were administered in the population 50 years and older in Slovenia. Due to the nature of the participants (elderly population), administering the survey using on-line communication channels, seemed inappropriate. Also, using ICT technology for administering the survey could cause a bias response due to the type of participants included; including elderly with higher computer literacy would probably bias the role of some factors in HTS use (especially Computer Anxiety). Therefore, survey was administered in printed version and data were later digitalized for further statistical analysis. Participants were selected randomly, using professionals from market screening agency, to contact elderly in their household environment. Participants had the opportunity to autonomously complete the questionnaire without additional assistance. In total, 400 surveys were administered. This covered the broad area of the region of Slovenia yielding the ratio of 42% of rural and 58% of urban population among survey participants. Male and female were represented in essentially equal proportions (49.25% female and 50.75% male). Age distribution of participants reflects dispersion across the interval of 50 to 90 years, minimum 48 years, maximum 86 years and mean participant’s age of 61.13 years.

4 RESULTS

4.1 Focus group analysis

The analysis of the FGIs indicated the importance of all four universal technology acceptance predictors; Perceived Usefulness, Effort Expectancy, Social Influence and Facilitating Conditions. PU, EE and FC were consistently mentioned in all FGIs. Two main dimensions of FC were identified; costs were exposed as the most important part of FC with participants expressing great concerns about financing the HTS. With statements like: “even 10 euro a month for us seniors can represent a price many people cannot afford” or “I think these services would have to be free of charge”. The participants revealed a willingness to pay for additional special services such as home monitoring or home intervention, but believed that the general technology services (e.g. access to their personal health and health care information) should be free.

As a second facilitator, technical support was consistently identified. Participants exposed a need to access a call centre, technical guidelines, and/or workshops for using HTS. Related comments were: “I think we would be able to use the system, especially if there was somebody we could call if we needed technical assistance” or “it is important that technical assistance is organized if I have problems using the system”.

HTS were presented by the FGI facilitator as being as secure as e-banking services. Most participants had prior experience with e-banking services and perceived them as a secure means of transacting. The participants commonly rely on the help of their close relatives for e-banking services, at least at the beginning. However, security issues regarding data integrity and reliability when using HTS were still a major question: “it is important that I am the only one with access to my personal health data” and “it would be important to control who to give permission to see my personal data, and which part” or “I would not want my family to access my information if I had cancer or similar” and “I think only my personal doctor should be able to see this information, at least in complete form”. At least one
participant in each FGI expressed anxiety about using computers, even though it had been explained that no computer knowledge is required to use the services: “it is different with you young people, we are not so keen on using computers” and “but still, this means we would have to use a computer, wouldn’t we?” A preference to use a tablet PC rather than a standard PC, was most often revealed.

The physician was reported as an important source of information in the FGIs. Especially in terms of using remote monitoring, recommendations by the physician and other healthcare professionals are an important source of information when deciding to use the system: “in this case, it would probably be wise to ask my doctor whether it is really appropriate to use this system” and “Of course, my doctor would have to approve the use of HTS, after all, he will be the one examining the results”. Similarly, this refers to the influence of their colleagues and people they trust (SI); “I think I would ask somebody I know who already uses the system for opinion and recommendations”. Interestingly, SI was related more to a colleague’s opinion and not to family members as an important source of information. With DO and SI mentioned in 9/12 and 8/12, respectively, these two factors show lower consistency in the FGI interviews. Still, the exposed factors proved to have a relevant role in predicting perceptions of HTS usage.

However, CSE was only mentioned in one FGI and therefore cannot be confirmed as a relevant predictor. A common statement was: “I think we can usually learn if we have support and motivation”, or “If one has motivation to use it, then most probably he/she will learn to use it”.

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-prescription and E-prescription extension (for chronic disease patients)</td>
<td>6.01</td>
</tr>
<tr>
<td>On-line referrals for examinations and laboratory testing</td>
<td>5.90</td>
</tr>
<tr>
<td>Communication with personal doctor’s/GP’s office (consultations)</td>
<td>5.82</td>
</tr>
<tr>
<td>Up-dates about recent changes, received medical reports and laboratory tests</td>
<td>5.67</td>
</tr>
<tr>
<td>Overview of waiting lists</td>
<td>5.59</td>
</tr>
<tr>
<td>Access to information in case of traveling (vaccination, preventive interventions, etc.)</td>
<td>5.53</td>
</tr>
<tr>
<td>Access to general health related information (published papers, updated information, etc.)</td>
<td>5.14</td>
</tr>
<tr>
<td>E-pharmacy (for ordering medications and pharmaceuticals)</td>
<td>5.11</td>
</tr>
<tr>
<td>Communicating with other users, who have similar problems (sharing experience, opinion, etc.)</td>
<td>4.98</td>
</tr>
<tr>
<td>Access to personal health record</td>
<td>4.95</td>
</tr>
<tr>
<td>Access to second medical opinion</td>
<td>4.87</td>
</tr>
<tr>
<td>Home monitoring (vital signs measuring – blood pressure, glucose, weight, etc.), with using computer</td>
<td>4.83</td>
</tr>
<tr>
<td>E-medical triage (after hospital discharge)</td>
<td>4.68</td>
</tr>
</tbody>
</table>

* Measured with a seven-point Likert scale: 1-not useful / 7- very useful, N=87

Table 1. Assessment of usefulness of Home Telemedicine system functionalities

### 4.2 Survey analysis

For further empirical testing, a more quantifiable approach was be used in Extended UTAUT model evaluation. Quantitative analysis was performed in three main steps, starting with development of measurement instrument and model operationalization, followed by statistical analysis of measurement model, and finally structural model evaluation and analysis of path coefficients (hypotheses testing). To obtain quality data, a minimum of three items per scale were used, to avoid
problems with reliability and validity of measurement model in further statistical analysis (Baumgartner & Homburg 1996). Here, only the main findings are reported; the survey is described in much more detail in (Cimperman 2014).

Before estimating structural model relationships and hypotheses testing, reliability and validity of measurement model must be carefully evaluated. Validity defines the level to which constructs actually measure what they are supposed to measure, while measurement reliability define consistency of measurement scales (the extent to which measurement variables are free from measurement error) (Diamantopoulos & Siguaw 2000). The main measurement model fit indices are reported in Table 2.

<table>
<thead>
<tr>
<th>Index</th>
<th>Measurement model</th>
<th>Recommended value</th>
<th>Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2/df)</td>
<td>2.72</td>
<td>(\chi^2 = 3566.89) (df = 1311)</td>
<td>Good fit</td>
</tr>
<tr>
<td>Root Mean Square Error of Approximation</td>
<td>0.006</td>
<td>(&lt; 0.05 - \text{good fit})</td>
<td>Good fit</td>
</tr>
<tr>
<td>Normed Fit Index</td>
<td>0.959</td>
<td>Above 0.90</td>
<td>Good fit</td>
</tr>
<tr>
<td>Non-normed Fit Index</td>
<td>0.966</td>
<td>Above 0.90</td>
<td>Good fit</td>
</tr>
<tr>
<td>Comparative Fit Index</td>
<td>0.969</td>
<td>Above 0.90</td>
<td>Good fit</td>
</tr>
<tr>
<td>Incremental Fit Index</td>
<td>0.970</td>
<td>Above 0.90</td>
<td>Good fit</td>
</tr>
<tr>
<td>Global Fit Index</td>
<td>0.896</td>
<td>Above 0.90</td>
<td>Conditional</td>
</tr>
<tr>
<td>Standardized Root Mean Square Residuals</td>
<td>0.052</td>
<td>(&lt; 0.05 - \text{good fit})</td>
<td>Good fit</td>
</tr>
</tbody>
</table>

Table 2: Measurement model fit indices

After revising measurement model reliability and validity and evaluating acceptable overall SEM model fit, the next step was SEM path analysis. Path coefficients were estimated. All the hypotheses, except the SI impact on BI, were confirmed with high statistical significance of \(p < 0.001\), yielding 99.9% confidence interval in t-tests. The model is shown in Figure 1.

As shown in figure 1, antecedents of EE, namely CA and PS show strong impact on the level to which HTS are perceived as easy to use (free of effort). Especially CA with standardized estimated correlation of 0.61 on EE shows a very high influence. This confirms our projections from the FGIs analysis, where using a computer and ICT in healthcare context seemed problematic for the elderly users.

PS resulted as a strong predictor, having a mediate impact on BI, similar to the influence of PE. This puts EE, PE and SI as the three main predictors in HTS use by the elderly. Furthermore, the influence of PS on EE and PE is even higher. Results indicate strong impact of PS on EE and moderate impact on PE. In other words, users who perceive using HTS as more secure will perceive it much easier to use and also more useful. When the services are perceived as less secure, elderly users have the need for more in depth understanding of the system to operate the HTS, since the need to control security risks would be greater.

Most interestingly, the role of SI was not confirmed, with t-test of hypothesized relationship well below the threshold value of 1.96 to confirm significance. The preliminary analysis in FGIs already indicated lower consistency of the role of SI, as it was not confirmed in three FGI, though still included in further SEM analysis. The unsupportive results of SI influence on BI show that peers’ and colleagues’ opinion and recommendation does not have significant role in elderly users’ acceptance of HTS. SI reflects the influence of external pressure to perform certain behaviour or decision, formed by the peers, colleagues or coworkers (Venkatesh et al. 2003). The UTAUT model was introduced for measuring users’ technology acceptance in organizations where the influence of co-workers and
colleagues is more relevant. The situational context of technology use can change the role of SI. Previous studies show volatile role of SI in technology acceptance, where the nature of the user and the context of the use strongly influence the significance of SI (Lewis et al. 2003). The route mechanism of SI influence on the BI is grounded in image perception and increasing social status with socially desirable behaviour. This however changes in elderly users’ decision making. As described by Carstensen et al. (2003) elderly people tend to pursue more emotionally meaningful goals, presumably because the meaning is in the context of oneself. Changes in goal selection also relates to changes in perception of time (Yoon et al. 2009), resulting in decreasing role of SI behaviour and decision making.

Note: N=400, Maximum Likelihood estimator. All path coefficients are significant at the level p<0.001, with exception of SI→BI (p>0.05).

Figure 1: Extended UTAUT with Latent Variables and path coefficients in LISREL

DOC influence on PE shows a high moderate effect. In other words, doctor’s recommendation will influence the level to which HTS are perceived as useful. Results are consistent with FGIs findings, where participants exposed using doctor’s recommendation or advice when deciding regarding the clinical efficacy and benefits of using HTS (especially when considering services such as remote
patient monitoring). Similarly, the correlation between FC and BI is significant and the technical support will be a very important facilitator in HTS use.

The statistical analysis was performed with two different software applications. Results of both analyses yield practically identical results, adding additional confirmation of the overall validity of statistical analyses. As previously mentioned, Extended UTAUT showed good fit of the implied model to the sample data, and therefore reflects acceptable representation of sample population. Moreover, analysis of total variance explained in endogenous variables (PE, EE and BI) shows large share of total variance measured in all three variables, all above 60%. 77.6% of all influence in elderly users’ Behavioural Intention to use HTS was explained by the six predicting factors (SI excluded, since the hypothesis was not confirmed). Based on overall good fit of the model and large share of total variance explained in BI, we conclude that Extended UTAUT is an efficient tool for analysing HTS acceptance by the elderly.

5 DISCUSSION

Our paper confirms that it is not easy to present telemedicine to the older population. The use of a demo presentation can in itself cause a biased perception of participants. A short questionnaire with a list of key functionalities enabled an efficient introduction without the need for an additional explanation for both focus group and survey based research. Results of the analysis indicate seven key predictors for the acceptance of HTS by older adults; Perceived Usefulness, Effort Expectancy, Facilitating Conditions and Social Influence, including three additional factors; Perceived Security, Doctor’s opinion and Computer Anxiety. Those seven predictors can be used as a framework for quantitatively testing older adults’ acceptance of HTS.

The results of the analysis also offer further insights into older users’ behavioural specifics. The security questions expose the concern older people have regarding access to their personal health data by an unauthorized person and their need to be able to control authorization for third party access. Interestingly, they also expressed the need to be able to limit access by close family members.

Family members are the primary and preferred source of help for elders regarding the use of computer and e-services (Chu 2010; Jacko & Sears 2003, p.417). Older users’ reluctance to allow family members access to their own health data combined with their lower ability to use electronic services influence their anxiety about the use of computers for HTS. Since they would probably be reserved in asking for assistance from their own family members, they want to feel autonomous even in the initial phase of using HTS. Therefore, technical support will also be very important to facilitate such use.

In addition, the costs of using HTS are important for older users. General HTS were perceived as infrastructural services for the delivery of healthcare and were therefore perceived as something that needs to be free of charge. This requires innovative business models to cover the costs of providing free basic services.

5.1 Practical implications

In terms of service design and development, some practical implications can be drawn as guidance for the development of HTS. The influence of CA will most probably result in the need to use different visual equipment, such as a tablet PC, to reduce the effect of HTS as a computer-based service. Further, the presence of secure mechanisms must be clearly visible so as to create a trustworthy environment. The simplicity and intuitiveness of graphical user interfaces (GUI), price of using HTS, and technical support will probably be the most important facilitators determining the success of the initial adoption of HTS. Further on, marketing interventions and technical support will moderate the scale-up process in the follow-up phase. Marketing interventions can focus on promoting HTS...
services among health professionals in the scale-up process, using healthcare professionals as social agents. As suggested by the perceived usefulness of functionalities in Table 1, HTS providers should first focus on IT support for existing processes. The “offline world” users will perceive less effort expectancy for using the adjusted existing services (e.g. e-prescription and online referrals), while the adoption of more advanced services may follow only later.

The presented research offers insights to help predict older users’ perceptions of the HTS solutions and general guidelines for further development. More importantly, it offers an approach for performing a preliminary analysis and prediction of older users’ preferences/demands when it comes to using HTS. Using a short list of functionalities in the introduction to the questionnaire proved to be an excellent way of introducing the new concept to the participants and also gave us additional insights into the preferred functionalities.

This and further similar studies should contribute to a better understanding of the ways in which older adults adopt HTS and which benefits they expect. Such studies can contribute to the development of sustainable business models for technology and services providers and, most importantly, to the higher quality of life for older adults.

References


