Senior citizens' acceptance of connected health technologies in their homes

By
Reza Etemad-Sajadi & Gil Gomes Dos Santos

ABSTRACT

Purpose - The objective of this paper is to focus on seniors' acceptance of the usage of connected healthcare technologies in their homes. We integrated into TAM (Technology Acceptance Model) several latent variables such as social presence, trust, and degree of intrusiveness perceived with the use of connected health technologies.

Design/methodology/approach - We distributed our survey by post to 605 seniors. We targeted elderly people using connected health technologies (assistive alarm, telecare, sensors, etc.) at home and/or receiving health care at home. We received 213 questionnaires back. As we had several latent variables, we used partial least squares (PLS), a variance-based structural equation modeling method.

Findings - The results show that the level of trust in these technologies impacts significantly the perception of usefulness and the degree of intrusiveness. In parallel, the degree of usefulness of these technologies impacts positively elderly people's intention to accept their usage. Finally, one can claim that the perception of the social presence with the use of these technologies impacts positively the degree of perceived usefulness, trust, and intrusiveness.

Research limitations - Our sample covers a population benefiting from similar connected health technologies. It was difficult to distinguish and interpret the added value of each technology separately. As more and more elderly people use or are least familiarizing themselves with a range of connected technologies it would be interesting to identify which sets of connected technologies contribute the most to a positive feeling of social presence.

Social implications - These results are particularly relevant to stakeholders in the health industry in their quest to improve their products/services. A better understanding of the relation that the elderly have with connected health technologies is an essential prerequisite to supporting the development of new solutions capable of meeting the specific needs of our seniors.

Originality/value - We want to apply the Technology Acceptance Model (TAM) to connected health technologies designed for elderly people and we also want to extend it by integrating the social presence, trust, and degree of intrusiveness variables to our research model.

1. INTRODUCTION

Life expectancy is increasing worldwide. According to the World Health Organization (2011), this trend shows no sign of slowing in the coming years. Due to chronic health problems that arise with increased life expectancy, improving the quality of life of elderly people represents a major challenge for today's society. Faced with an exploding elderly population and longer life expectancies, seniors increasingly need care and new healthcare technologies that can be useful in improving their quality of life at home. Indeed, we have to rethink the way in which services are provided to the elderly.

Seniors expect and desire to stay at home as long as possible instead of going to nursing homes (Townsend *et al.*, 2011; Demiris *et al.*, 2004). Connected technologies cannot prevent transfer to a nursing home but may enable the elderly to stay in their houses for longer. Continuing home care is therefore becoming a pressing objective. In this context, connected technologies (e.g. assistive alarm, telecare, sensors, etc.) may play a key role. One such concept is the "smart home", which refers to a house equipped with technology that enhances the safety of elderly people at home and monitors their health (Demiris *et al.*, 2004). The system is able to track the senior and trigger an alarm if any abnormal vital signs are detected (Virone *et al*., 2002). It is also able, for example, to collect data such as respiratory or sleeping disorders in order to have a better understanding of the senior's problems (Nishida *et al*., 2000). Obviously, the choice of the connected technology depends on the pathology, the context, and the kind of care desired. As mentioned by Höpflinger *et al.* (2011), although healthcare needs are the first cause of a transfer to a nursing home, other factors such as age-related fragility (increased risk of falls) or social, mental and economic problems (social isolation, depression, alcoholism and other addictions, poverty) also play a decisive role. Nevertheless, we have to ask ourselves

several questions about these technologies that strengthen healthcare services, including: What can be done to facilitate the implementation of these technologies? Are seniors ready, willing and able to use them? Do they have trust in these solutions? How intrusive are these technologies? Can these technologies impact the perception of social presence? By answering the above mentioned research questions we expect to contribute to the enrichment of knowledge about the elderly's perception of smart home technologies.

The goal of this study is to improve the quality of life of elderly persons by focusing on the use of these connected technologies. We also want to focus on the feeling of social presence (the perception that there is personal human contact) with these connected technologies and the degree of trust of elderly people using these systems. In parallel, we want to identify the relationship between the degree of intrusiveness of these technologies and their acceptation by the elderly. We want to apply the Technology Acceptance Model (TAM) to connected health technologies designed for elderly people and we also want to extend it by integrating the social presence, trust, and degree of intrusiveness variables to our research model. To the best of our knowledge, this is something new for the academic world in this context.

1.1 Connected Health Technologies

Rapid technological advances have led to the development of a wide range of solutions to assist aging. While investigating the potential or the impact of these solutions, researchers have used multiple terms to classify these solutions according to their utility or their technological features. New delivery modes for healthcare, such as smart homes, are required to ensure quality as well as cost effectiveness for the services provided to an aging population (Townsend *et al.*, 2011). Smart homes rely on data acquisition equipment and devices to assess the current status of residents and their environments (Alam *et al.*, 2012). In addition, ambient-assisted living (AAL) consists of assisted living technologies based on ambient intelligence

(Rashidi and Mihailidis, 2013). These monitoring devices can be put into three categories: sensors (identifying the user's location, body temperature, etc.), physiological devices (monitoring the user's heart rate, blood flow velocity, etc.), and multimedia devices (displaying information, speaker voice command, etc.).

2. THEORETICAL BACKGROUND AND HYPOTHESES

According to TAM, the ease of use of a new technology will influence its perceived usefulness (Davis, 1989). Ease of use is a key factor to promote the usage of new technologies among older adults. Research points out several reasons for that. The ageing population is believed to have more diverse needs in relation to new technologies than younger populations given the lower level of IT literacy (when compared with younger populations) and the physical and cognitive limitations that may arise with ageing. These factors may affect the capability of seniors' to use different technologies (Lorenz and Oppermann, 2009). Thus, poor design of new technologies can render the adoption of new technologies difficult by elderly people (Fisher, 2014). This assumption is also supported by Coughlin *et al.* (2007). McEvoy (2006) also suggested that new health technologies need to be user-friendly to optimize their uptake with older adults. The difficulty in understanding the functioning of new technologies could negatively influence elders' perceived usefulness regarding their own use of a technology. Therefore, we propose the following hypothesis:

H1. Ease of use has a positive influence on the usefulness.

Another important issue that we have to consider is the feeling of social presence through the use of these connected technologies. Indeed, social presence is described as the perception that there is personal, sociable, and sensitive human contact (Gefen and Straub,

2004; Etemad-Sajadi, 2016). The impact of perception of social presence on the acceptance of robots and screen agents in eldercare was investigated by Heerink *et al.* (2009). Their study showed that the feeling of social presence was indirectly impacting the intention to use the technology. Bickmore *et al.* (2005), found that seniors can consider the feeling of social presence as positive if they believe the technology is beneficial to them. Therefore, we propose the following hypothesis:

H2.   Social presence has a positive influence on usefulness.

Heerink *et al*. (2009)'s study showed that elders' perception of social presence can be predictive of perceived enjoyment when interacting with screen agents or robots. This is interesting as it suggests that the usage or presence of connected technologies in elders' homes can be perceived differently than in an intrusive fashion. Indeed, the presence or interaction with connected technologies is believed to potentially alleviate elders' loneliness (Broadent *et al.*, 2009; Portet *et al.*, 2013). On this basis, one might believe that the feeling of intrusiveness is not necessarily perceived badly if individuals are in need of a social presence. Thus, we propose the following hypothesis:

H3.   Social presence has a positive influence on intrusiveness.

Several authors identified that the perception of social presence can affect user trust (Sung and Mayer, 2012; Gefen and Straub, 2004; Hassanein and Head, 2007; Etemad-Sajadi, 2016). According to these authors, the inclusion of social cues facilitates the building of trust. The feeling that, through the use of these technologies, there is a connection between the senior and the external world may reassure and increase the feeling of trust. It would be interesting in our context to identify if there is a relationship between these two variables. Therefore, we propose the following hypothesis:

H4.   Social presence has a positive influence on trust.

One important question that we have to ask ourselves is the role of trust in the perception of usefulness. In research conducted with older consumers, McCloskey (2006) found that trust has a significant effect on usefulness. The more a senior trusted a system, the higher his/her belief in its usefulness. Having trust in a technology is primordial for increasing its usage (Gefen and Straub, 2003; Kim, 2012). It can also increase users' enjoyment and emotional appeal to use that technology (Hassanein and Head, 2004; Zhang *et al*., 2014). Therefore, we propose the following hypothesis:

H5.   Degree of trust has a positive influence on usefulness.

Ziefle and Holzinger (2011) explored the attitudes of users towards video-based monitoring systems for long-term care of elderly or disabled people in smart home environments. The authors found that trust and privacy are central requirements for the implementation of such technology in private spaces. The potential loss of privacy appears to raise concerns amongst elders depending on the range of activities they plan to do there (Lorenzen-Huber *et al*., 2011). According to Lorenzen-Huber *et al.* (2011) some activities are viewed as more privacy sensitive than other activities and therefore elders feel concerned about these activities being monitored, perhaps because such data could be fall into the wrong hands. Indeed, the monitoring of parameters or putting data to use beyond those explicitly agreed upon by users can undermine trust Mittelstadt *et al*. (2013). For Lorenzen-Huber *et al.* (2011), enhancing data transparency, inclusion of privacy awareness, and the development of user-friendly control over personal data are required to foster the adoption of these solutions amongst the elderly. Thus, given the importance of privacy for some activities one might believe that

trust in connected health technologies and their related companies influences the degree of intrusion older people are willing to accept. Therefore, we propose the following hypothesis:

H6.   The degree of trust decreases the degree of intrusiveness.

The intention to accept a new technology is driven by its perceived utility (*Beach et al.*, 2009*; Tomita et al.*, 2007*).* In another context, McCloskey (2006) found that for older Americans, ease of use of e-commerce transactions had a significant impact on usefulness, which in turn had a positive direct effect on usage (i.e. acceptance or intention to use). The authors explain that the perceived usefulness can be enhanced by making on-line shopping easy enough to overcome physical limitations that seniors might suffer from. This is congruent with extant research and underscores the idea that a facilitated interface or design can positively influence seniors' perceived usefulness. Melenhorst *et al.* (2006) also found that the perceived benefits of the technology was an important factor in its adoption. Therefore, we propose the following hypothesis:

H7.   Usefulness has a positive influence on intention to accept.

In this research we also want to see if there is a relationship between the degree of intrusion of these technologies and their acceptance by the elderly. Arcelus *et al.* (2007) mentioned the difficulty for elderly people to accept having their daily lives monitored by different health systems. It can be perceived intrusive and they can reject their usage. Access to personal health information (e.g., medication compliance, daily life activities and vital signals) can potentially be perceived as intrusive, raising privacy concerns (Parra *et al.*, 2013). As carrying alarms, devices or sensors can be perceived as physically obtrusive, they need to be designed carefully (Melenhorst *et al.*, 2004). Himmel and Ziefle (2016) found that visual monitoring is not well accepted by seniors. They compared various domestic spaces (living room, home office, kitchen, bedroom, and bathroom) and identified that the acceptance of

visual monitoring is negative. It seems to be too intrusive and infringes on seniors' privacy. Townsend *et al.* (2011) found that seniors are willing to accept monitoring technologies that improve their autonomy. They found that even video cameras (very intrusive method) were accepted in exchange for increased autonomy. Several studies (Rialle *et al.*, 2008; Ziefle and Wilkowska, 2010), found that the degree of acceptance of intrusive technology varies with the severity of the pathology of the elderly person being supported. Consequently, smart homes must be designed to protect privacy and should provide reassurance regarding who is going to access the private data that is collected (Portet *et al.*, 2013). In our context, the technologies used are not based on visual monitoring. Nevertheless, we believe it is worthwhile to explore the relationship between the degree of perceived intrusiveness and the intention to accept or refuse the use of these connected health technologies. Therefore, we propose the following hypothesis:

*H8.   Degree of intrusiveness has a positive influence on intention to accept.*

According to the literature, the facets of trust are reliability, ability, integrity, benevolence, and honesty (Kumar, 1996; Geffen and Straub, 2004). Having trust in a technology is primordial for increasing the desire to use it in the future (Gefen and Straub, 2003; Kim, 2012). Furthermore, another aspect of trust is what will be done with these data. Since the system receives information of vital importance, the system has to make sure that the information reaches only the right people. Thus, connected health technologies must be respectful of privacy and should provide reassurance regarding who is going to access the collected private data (Portet *et al.*, 2013).

H9.   Degree of trust has a positive influence on intention to accept.

Figure 1 depicts our research model. We employed the technology acceptance model (TAM), which describes the intention to accept or use a new technology (Davis, 1989). The original TAM has been widely used to explain technology adoption. As connected health technologies are a type of information technology, users' attitudes can be partially explained by TAM (Cyr *et al.*, 2007; Etemad-Sajadi, 2014; Davis, 1989). According to TAM, the ease of use of a new technology will influence its perceived usefulness. In our case, we expanded the original TAM and integrated social presence, trust, and degree of intrusiveness.

Figure 1: Research model

An extended version of TAM applied to connected healthcare technologies
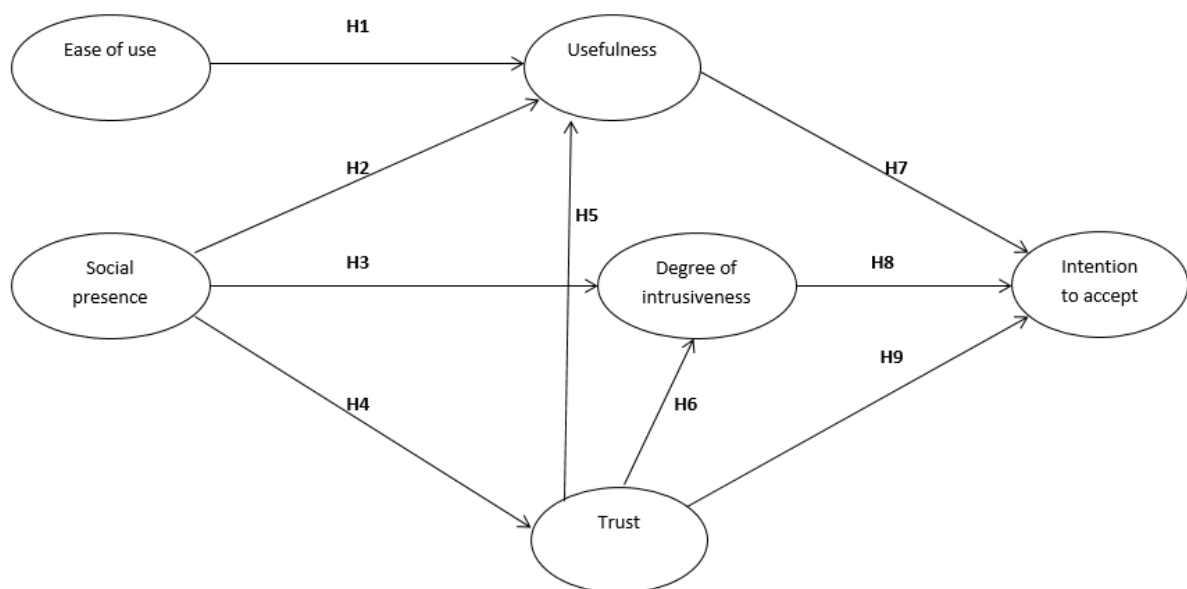
3. METHODOLOGY

3.1 Measures

Responses to the items presented below were used to create this current study's measures and to assess its hypothesized structural model. Response options for each item ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

Ease of use and *usefulness* were assessed with items adapted from Steele *et al.* (2009), Cyr *et al.* (2007), and Davis (1989). *Social presence* was assessed with items adapted from Gefen and Straub (2003). *Trust* was assessed with items adapted from Steele *et al.* (2009), Gefen and Straub (2003), Gefen and Straub (2004), and Cyr *et al.* (2005). *Degree of intrusiveness* was assessed with items adapted from Li *et al.* (2002) and Steele *et al.* (2009). Finally, *intention to accept* was assessed with items adapted from Hellier *et al.* (2003). Table 1 summarizes our items.

Table 1: Questionnaire items

Constructs	Items
EASE OF USE	It is easy to understand the use of this technology. The use of this technology is practical.
USEFULNESS	This technology is useful. This technology is efficient. With this technology, I feel less anxious.
SOCIAL PRESENCE	The technology used makes me feel connected with the external world. There is a sense of human contact through the use of this connected technology. The technology used makes me feel less dependent on people.
TRUST	I trust the reliability of information delivered by this system. I trust this technology to keep personal information secure. The technology used looks trustworthy.
DEGREE OF INTRUSIVENESS	This technology is intrusive. Through this technology, I feel that I am observed.
INTENTION TO ACCEPT	I intend to continue my use of this technology in the future. The use of this technology increases my quality of life.

3.2 Sampling and data collection procedures

For the distribution of the questionnaire, we had the opportunity to reach the clients of the Croix-Rouge (Neuchâtel), Secutel, and Domosafety. We sent the questionnaire by post (with a return stamped envelope) to 605 seniors. We targeted elderly people using connected health technologies (assistive alarm, telecare, sensors, etc.) at home (72.5% of our sample have connected technologies) and/or receiving healthcare at home (63.3% of our sample receive healthcare at home). As far as the technologies are concerned, our respondents use the traditional assistive alarm and/or sensors installed in the senior's house. We did not focus on more intrusive techniques such as cameras. Overall, we received 213 questionnaires back (34.9%). Considering the profile of the respondents, we were very positively surprised by the high number of respondents. As far as gender is concerned, it was divided with 27.8% male and 72.2% female. The average age of the respondents was 82.10. Finally, 64.9% were living alone, 22.8% with their husband or wife, and 12.3% did not answer if they live alone or not.

3.3 Data analysis method

Structural equation modeling (SEM) was adopted to test the hypotheses due to the fact that the model contains several latent variables. SmartPLS 2.0 was used for the analysis. We employed a bootstrapping method (200 sub-samples) to test the significant level of regression path coefficients (Hair *et al.*, 2011). We used the blindfolding approach (cross-validated communality and redundancy). The cross-validated communality index measures the quality of the measurement model of each block. The quality of each structural equation is measured by the cv-redundancy index (i.e. Stone-Geisser Q^2). The Stone-Geisser Q^2 for usefulness, trust, degree of intrusiveness, and intention to accept is respectively 0.51, 0.19, 0.14, and 0.39. Q^2 measures the extent to which observed values are reconstructed by the model and its parameter estimates (Chin, 1998). The technique represents a synthesis of function fitting and cross-validation (Henseler *et al.*, 2009). If it is negative, the model has no predictive relevance; values

around 0.15 indicate a medium predictive relevance and around 0.35 a high predictive relevance (Henseler *et al.*, 2009; Hair *et al.*, 2012). In this model, the independent variables are therefore good predictors for usefulness and intention to accept. For trust and degree of intrusiveness, the independent variables have a moderate predictive relevance.

4. RESULTS

4.1 Descriptive analysis

Table 2 shows the means and the loadings of each item. Comparing the averages together, one can claim that the highest item is the usefulness of the technology with an average of 6.03 on a scale from 1 to 7. The level of trust is relatively high (respectively item 1 = 5.61, item 2 = 5.77, and item 3 = 5.78). The level of social presence tends to be positive (respectively item 1 = 4.87, item 2 = 4.68, and item 3 = 4.40). We observed that there is a significant positive correlation between the age of respondents and the perception of the social presence with these technologies ($\gamma = 0.131$). Concerning the degree of intrusiveness, we found an average of 2.79 and 3.28 for the two items. Gender has a significant impact on the degree of perceived intrusiveness. Men judge the connected technologies more intrusive than women ($\gamma = -0.118$). We also observed that people who are living alone are more willing to accept the use of these technologies compared to people who are living with their husband or wife.

Table 2: Descriptive statistics and items' loadings

Constructs	Item loading	Mean	Std deviation	Min	Max
1. Ease of use					
1.1 It is easy to understand the use of this technology.	.840	**5.55**	1.544	1	7
1.2 The use of this technology is practical.	.911	**5.83**	1.348	1	7
2. Usefulness					
2.1 This technology is useful.	.905	**6.03**	1.184	1	7

2.2 This technology is efficient.	.877	**5.85**	1.247	1	7

2.3 With this technology, I feel less anxious.	.770	**5.17**	1.600	1	7

3. Social presence

3.1 The technology used makes me feel connected with the external world.	.761	**4.87**	1.825	1	7
3.2 There is a sense of human contact through the use of this connected technology.	.784	**4.68**	1.889	1	7
3.3 The technology used makes me feel less dependent on people.	.780	**4.40**	1.775	1	7

4. Trust

4.1 I trust the reliability of information delivered by this system.	.901	**5.61**	1.418	1	7
4.2 I trust this technology to keep personal information secure.	.799	**5.77**	1.323	1	7
4.3 The technology used looks trustworthy.	.895	**5.78**	1.320	1	7

5. Degree of intrusiveness

5.1 This technology is intrusive.	.840	**2.79**	1.694	1	7
5.2 Through this technology, I feel that I am observed.	.887	**3.28**	1.977	1	7

6. Intention to accept

6.1 I intend to continue my use of this technology in the future.	.870	**6.00**	1.194	1	7
6.2 The use of this technology increases my quality of life.	.829	**5.07**	1.711	1	7

4.2 Reliability and validity of measures

Table 3 shows that all latent variables have a composite reliability higher than 0.7, confirming that the scale reliabilities have adequate and stable measurement properties. Convergent and discriminant validity are components of a larger measurement concept known as construct validity (Straub *et al.*, 2004). Convergent validity is shown when each measurement item is strongly correlated with its construct. It is usually satisfied by retaining

variables whose loadings are high, indicating that they share sufficient variance with their related construct. Discriminant validity is satisfied when each measurement item is weakly correlated with all other constructs except with the one with which it is theoretically associated (Gefen and Straub, 2005). With PLS, convergent and discriminant validities are confirmed if each construct AVE is larger than its correlation with other constructs. Moreover, each item should load more highly on its assigned construct than on the other constructs (Gefen *et al*., 2000; Straub *et al*., 2004). Table 3 shows the intercorrelation of the research constructs. The diagonal of this matrix represents the square root of the average variance extracted. For adequate discriminant validity, the diagonal elements should be significantly larger than the correlation of the specific construct with any of the other constructs and should be at least 0.5 (Fornell and Larcker, 1981). In our case, one can claim that discriminant validity is confirmed and sufficient to support the model.

Table 3: Reliability and discriminant validity

Constructs	Composite reliability	1	2	3	4	5	6
1. Ease of use	.86	.87					
2. Usefulness	.88	.77**	.84				
3. Social presence	.81	.33**	.53**	.77			
4. Trust	.89	.66**	.77**	.50**	.86		
5. Degree of intrusiveness	.85	-.11	-.07	.32*	-.11	.86	
6. Intention to accept	.83	.61**	.74	.60**	.63**	-.01	.84

Notes:
*   Correlation is significant at the 0.05 level.
**   Correlation is significant at the 0.01 level.
a   Diagonal: (Average Variance Extracted)$^{1/2}$ = $(\Sigma\lambda_i^2/n)^{1/2}$

4.3 Results and discussion

Figure 2 presents the results of the PLS analysis and the values of different path coefficients. One can observe that ease of use impacts significantly usefulness ($\gamma = 0.453$). Hence *H1* is accepted. Social presence also has a significant impact on usefulness ($\gamma = 0.177$) even if the path coefficient is lower than for ease of use. In parallel, social presence positively impacts trust ($\gamma = 0.507$) and perceived degree of intrusiveness ($\gamma = 0.503$). Hence, *H2*, *H3*, and

H4 are all accepted. Regarding the impact of trust on usefulness, one can claim that it is significant ($\gamma = 0.381$). Hence, *H5* is also accepted. Overall, 74.3% of usefulness is explained by ease of use, social presence, and trust. For *H6*, we found a significant negative correlation between trust and degree of intrusiveness ($\gamma = -0.350$). In other words, the less respondents trust the connected technologies, the more they judge these tools intrusive. Therefore, *H6* is confirmed. Finally, considering the intention to accept the use of these technologies, we found that only the perception of their usefulness impacts it significantly ($\gamma = 0.636$). The degree of intrusiveness and trust have no significant impact on intention to accept. *H7* is accepted, while *H8* and *H9* are both rejected.

Figure 2: Results of the PLS analysis

Notes:
**   Significant at 0.01 level
***   Significant at 0.001 level
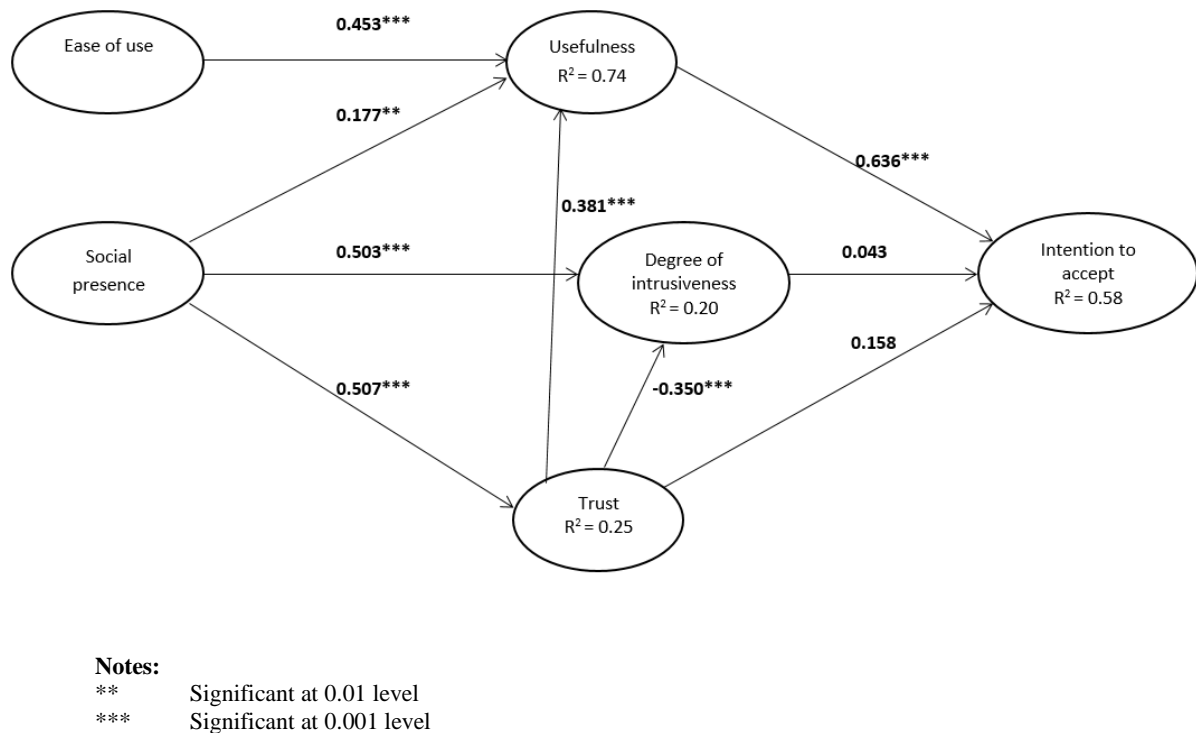
5. CONCLUSION

The aim of the study was to get a better understanding of how our seniors perceive connected health technologies in order to enhance their quality of life. The results regarding the

positive influence of the feeling of social presence on the perceived usefulness, degree of intrusiveness, and the feeling of trust are particularly interesting. If the feeling of social presence heavily influences perceived intrusiveness and degree of trust, its moderate influence on perceived usefulness is also noteworthy. Indeed, this result is important as it indicates that the ability to generate a feeling of social presence can also be a key factor. Another interesting finding regarding the impact of social presence is that, the older the respondents are the more they perceive a social presence through these technologies. This raises the question of ascertaining what triggers this perception. For example, is this based on the type of technology used by this category of elders or simply a different relation to the technology while ageing? Further research is needed to explore the influence of age in the perception of these technologies.

Our study does not show that trust has a direct influence on intention to accept, although the relationship is very close to being significant. However, results show that trust has an indirect impact on the intention to accept by positively influencing perceived usefulness and by contributing to reduce the feeling of intrusiveness. We found that people who are living alone are more willing to accept the use of connected health technologies compared to people who are living with their husband or wife. Our results also showed that men tend to find these technologies more intrusive than women. Understanding why men are more sensitive to intrusiveness could be interesting for companies that develop these solutions, especially since this category of senior citizens is expected to grow in the next decades. If the feeling of intrusiveness has been identified in the literature as one of the main barriers to technology acceptance, our study did not find evidence of a direct influence of degree of intrusiveness on intention to accept these technologies. A possible explanation for this result is that respondents were already benefiting from these solutions and that this might change their perception about the degree of intrusiveness.

Our hypothesis regarding the positive influence of usefulness on the intention to accept is also confirmed. That means that for our sample the perception of usefulness of these technologies will foster their acceptance. Although the relation of these two variables has been widely discussed in the literature, little empirical evidence relying on large samples has been provided so far. The present research contributes to filling this gap since the results are based on a survey that counted on the participation of more than 200 respondents.

Overall our research model is deemed reliable since seven hypotheses were confirmed out of nine. These results are particularly relevant to companies in their quest to improve their products/services and communication strategies. A better quality of healthcare services inclines to build satisfaction and loyalty among patients (Fatima *et al.*, 2018). Indeed, a better understanding of the relation that the elderly have with connected health technologies is an essential prerequisite to supporting the development of new solutions capable of satisfying the specific needs of our seniors. Connected healthcare technologies can also reassure the family and avoid the difficult decision of opting for a nursing home or staying at home. We conclude with the observation that the next generation of seniors may be more eager to use new technologies as they will be more in touch with technology throughout their lives. It goes without saying that every senior citizen has specific medical needs that affect the extent to which they use connected health technologies. Therefore, we will have to follow along closely as the needs of the elderly evolve over time.

5.1 Barriers to better usage of connected health technologies

- Caregivers show a lack of enthusiasm for, and knowledge of, new technologies
- Financial issues and a lack of government participation (for example, teleassistance is not covered by Swiss health insurance law, LaMal)
- A lack of centralized data and coordination between different partners (food and health service providers, teleassistance, occupational therapists, etc.)
- Ethical issues (i.e. Where will the data will be stored? Who will have access to it ?)

5.2 Some recommendations and challenges for home care service companies

We believe it is time to rethink the way services are provided to the elderly. We have made recommendations – and highlighted some challenges – for home care service companies based on feedback from clients in our study:

- ***Keep the same hours for visits -*** [“Lack of precise time of visits”, “Deliver services at a fixed and regular time", "Come on time", "Keep me informed about the time of visits.”]

- ***Retain the same employees (if possible) -*** ["I'd like to always have the same person", "No change of people”, "Have only two people taking care of me."]

- ***Improve communications between the service company and clients, family members and other home care providers***

- ***Enhance socialization -*** ["Bring me out with my scooter", "Give me more mobility", "A person to eat with", "Break with loneliness".]

- ***Make clients feel more safe and secure through connected technologies -*** [“Will the alarm really work when I will need it? 24 hours a day?” (Possible solution: test the alarm at least once a month)]

- ***Increase socialization between neighbors in case of an emergency***

5.3 Limitations

Our study has several limitations. First, our sample covers a population benefiting from similar connected health technologies. It was difficult to distinguish and interpret the added value of each technology separately. As more and more elderly people use or are least familiarizing themselves with a range of connected technologies it would be interesting to identify which sets of connected technologies contribute the most to a positive feeling of social presence. Our study is also limited to a population with a similar culture. Further research is needed to understand if the perception of connected health technologies differs according to cultural characteristics. In addition, our study only captures the opinion of senior citizens at a specific moment in time. Further research could investigate the degree to which the acceptance

of connected health technologies changes while ageing or as they become increasingly familiar

with such technologies.

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