PSYCHOSOCIAL, SOCIO-DEMOGRAPHIC AND HEALTH DETERMINANTS IN INFORMATION COMMUNICATION TECHNOLOGY USE BY OLDER-ADULTS

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Blekinge Institute of Technology
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Department of Health

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ABSTRACT

The aim of the thesis was to investigate factors influencing Internet and ICT use by older-adults. A selection of psycho-social, socio-demographic and health determinants were investigated with Internet use. Data were collected through questionnaires (Studies I-III) and interviews (Study IV).

Univariate analyses were first conducted (Studies I-II). Thereafter, logistic regressions were conducted (Studies I-III), investigating Internet use as a dichotomous variable, with the significant factors from the univariate analyses (Study I-II). The dependent variable in Study II was whether the older adult started to use the Internet after a period of six years or not. In Study III, four logistic regressions were conducted and the C-statistic. Study IV, was qualitative in design and analysed using a content analysis.

The results indicated that psycho-social determinants were not affecting whether the older adults were using the Internet (Study I). Scoring higher on the personality traits openness & extraversion were not affecting whether the older-adults started to use the Internet (Study II). However, well-being clearly increased for some frail older-adults when using the tablet computer and connecting to the Internet (Study IV).

Some socio-demographic determinants affected Internet use. Being younger in age was a strong determinant in all four studies whether the older-adult would be using the Internet. Higher education influenced Internet use (Study I & III), correlated with living in a rural or urban setting (Study III); yet education was not an influential factor in whether they would start to use the Internet after a period of six years. Living alone was an influential factor in Internet use, especially if the older-adult was living in an urban setting (Study III). Household economy was not affecting Internet use.

Finally, the health determinants affecting Internet use were quite strong. Normal cognitive functioning was influencing whether older-adults would start to use the Internet; functional disability did not (Study II). The older-adult living urban would use the Internet if they had normal cognitive functioning (Study III). It was noted also from Study IV that the learning to use the Tablet PC and Skype, took longer for older people where more repetition was needed. Being frail was a strong factor whether the older-adult would use the Internet. They would not want to learn or try to use the technology if they were too ill (Study IV).

The implications of these findings are that the following factors are indicators of non-use of ICT by older-adults: higher in age, lower educated, living alone or rural, lower cognition and frailty. There are two different profiles of Internet users living rural and urban. For a

healthcare provider it will be important to know that in certain cases Internet use is not a given. Technological advancement is moving fast and there will be more of a need for older-adults to use the Internet even if their purposes and amount of usage will differ from a younger adult. But as ICT continues to develop as a means to provide better healthcare, it will be important to take into account the abovementioned indicators, along with an understanding of the use of technology and a good support system; these are a few pillars in ICT adoption by older-adults. Part of healthy aging is social participation; therefore, being connected and included in the digital society is important. Alternative and not only one design solutions should be explored in healthcare and by organisations, so as to cater to the heterogeneity of the aging population.

ABBREVIATIONS & Definitions

Determinant: An influencing factor

FFM: Five Factor Model

Frail older adults: older-adults living with at least 3 diagnosed chronic conditions according to ICD-10 and that were admitted to inpatient care at least three times in the last twelve months.

IADL: Instrumental Activities of Daily Living

ICD-10: International Classification of Diseases (from the World Health Organisation)

Information Communication technology (ICT): Computer PC, tablet PC, Internet and Internet applications

LSI-A: Life Satisfaction index

MMT: Mini-Mental Sate Test

Older-adult: 65 years and above

Oldest older-adult: 81 years and up

SEK: Swedish crowns

SNAC: Swedish National Study on Aging and Care

SNAC-B: Swedish National Study on Aging and Care - Blekinge

SOC: sense of coherence

Younger older-adult: between 65- 81 years of age

ORIGINAL PAPERS

This thesis is based on the following four Papers, referred to in the text by their Roman numerals:

I. Berner J., Rennemark M., Jogréus C. & Berglund, J (2011). Distribution of personality, individual characteristics and Internet usage among Swedish older-adults, Aging & Mental Health, doi: 10.1080/13607863.2011.602958

II. Berner J., Rennemark M., Jogréus C. & Berglund, J (2013). Factors associated with change in Internet use of Swedish older adults (2004-2010), Health informatics Journal, vol 19 (2), doi: 10.1177/1460458212462151

III. Berner J., Rennemark M., Jogréus C., Anderberg P., Sköldunger A., Wahlberg M., Elmståhl S. & Berglund J. (2013). Factors influencing Internet usage in older-adults (65 years and above) living in rural and urban Sweden. (Accepted December 2013 by Health informatics)

IV. Berner J., Anderberg P. Rennemark M. & Berglund J. Case management for frail older-adults through Tablet computers and Skype. (Submitted to Interacting with computers).

CONTENTS

INTRODUCTION

We are experiencing different demographics on the planet with a total population of 7 billion people and also for the first time in history, an incredible increase in life expectancy. Most developed countries have projections of around 15- 20% of their population above 80 years of age by the year 2050, and for Mediterranean countries as well as Japan two thirds of the population above 65 ("Ageing OECD Societies," 2008). Almost everywhere in the world women live longer ("Ageing OECD Societies," 2008), with the oldest woman in the world being 119 ("'World's oldest person' found in South Africa," 2013). These numbers are interesting in so far that in order to handle this increase in longevity, societies are reorganising themselves. In healthcare, systems and solutions are being implemented to work more efficiently, so as to reduce costs and sustain the increased number of older patients healthcare will have, in ratio to the number of healthcare professionals (OECD, 2011; World health organisation, 2002). Similarly government policies and pension funds are currently being reformed so as to support the elderly. It will be necessary to have a different view on one's working life as a whole. Early pensions will no longer be sustainable (OECD, 2011). There will be a need to continue working much later than before, even to consider changing jobs in ones fifties if the job is too physically demanding.

So, living close to one hundred years of age calls for a shift in the way we think and definitely in how we live today. Health aspects are one main focus, as seen with initiatives such as trying to help older people be more active ("Europe year for active aging and solidarity between generations," 2012).

The individual is at the forefront more than before, where a different responsibility is felt and is encouraged to be taken by the individual himself (De Boer & Van der Lans, 2011). In certain countries, there is a new relationship between the citizen and the government; the citizen is moving from being a client in society (welfare systems) to having more self-management and taking initiative (De Boer & Van der Lans, 2011). Societies pour energy into public health solutions, empowering the individual to take responsibility through awareness campaigns and health-promoting education and media.

It is important that the older-adult has a place in society. Healthy aging and staying active has been in focus for many years (World health organisation, 2002) making sure the older-adults are more capable, aware and have control over their lives so as to stay overall in good physical and mental health. One initiative by the European Union ("Europe year for active

aging and solidarity between generations," 2012), has been to encourage different regions across Europe to create integrative, smart solutions for independent living, and a public awareness toward the older-adult. The silver economy is growing; older people represent a big market potential especially when it comes to healthy and active aging (Ahtonen, 2012). However, determinants are still needed to create a different perspective and acceptance of aging, and especially for the older-adult to live in their third and fourth ages more comfortably.

Technology can be expected to play a major role in this. First of all, technology can play a vital role in facilitating the care of older-adults. It can facilitate the workload of a caregiver or a doctor, for example. Within the realm of aging, technology can be seen as a strategic management of the costs of an increase in life expectancy (Coughlin, 2010). Society today is creating more devices that surround the older-adults (Vasconcelos, Silva, Caseiro, Nunes, & Teixeira, 2012). Technology can open up numerous subjective and individual possibilities for the older-adult. Giving them tools and devices, new worlds can open, such as increasing their social networks by just getting online or giving them more freedom in daily life by having a functional device reminding the older-adult to take their medicine. Many devices have already been on the market for a while that function as support and help for chronically ill older people and their care givers (Milligan & Passey, 2011). These devices range from the alarm button, such as a pendant or watch that the older-adult wears, or smart sensors monitoring movement and detecting falls, which connect to call centres (Milligan & Passey, 2011; Sixsmith & Johnson, 2004). There are also wireless broadband and audio visual technology, which offer potential for virtual and tele-consultations between the user and the doctor/nurse/support worker (Milligan & Passey, 2011). This type of technology requires the older-adult to be able to use the Internet.

The technology that is specific to this thesis is Information Communication and Technology (ICT), with focus on Internet use and tablet computer use.

Older-adults are slow adapters to the Internet even if many are using it for email, booking travel and looking up governmental information (Findahl, 2011). Previous research has investigated varying reasons, situations, and learning tools to seek and understand the older-adults' position toward and adaptation to the Internet and computers (Kim, 2008; Slegers, Van Boxtel, & Jolles, 2012).

Older-adults have for many years in fact been part of the digital divide, which is the uneven distribution and inequality of access to the Internet (Yang et al. 2010; Mahmud et al. 2012).

The term divide is today moving more toward digital inequality (The European Union, 2010), where a focus is now on different uses of the Internet.

Many older-adults are late-adapters, and do not feel the need to learn new technology as they seem to manage life perfectly without. This is very often the case as they do not see the usefulness and usability of the product (Hanson, 2010). Exclusion arises when the technology itself is pushed by the developers rather than the end-users themselves (Coleman, Gibson, Hanson, Bobrowicz & McKay, 2010). When developers create technological products often they have younger people in mind; media trends tend to focus on the bigger markets at first and minority groups are therefore neglected. This is partly where the technology falls through the cracks for older-adults.

Today, this problem is a little urgent as there is a lack of choice in whether one wants to be part of the Internet economy and society. Not being able to access, or use the Internet will automatically exclude those not part of it. Investigating where the equity of access is less evident and sometimes overlooked by highlighting who is not adapting and why (Coughlin, 2010), is important for long-term care, for example, that may rely on technology and that the patients themselves are somewhat technologically knowledgeable (Ruppe, 2011). Gradually more elderly are using the Internet, yet some are clearly not adopting it. This problem may seem like a generational aspect, but in effect "if the needs of the users are not addressed, the rapid rate of technology change coupled with age-related changes … will likely leave not only today's older adults but tomorrow's older adults digitally excluded" (Hanson, 2010, p. 508). It is therefore important to highlight that the Internet economy and society is still in 2014 excluding a group of older-adults. This thesis investigates how Northern European older-adults are adapting to the Internet and possible factors which influence their Internet or lack of usage.

Gerontechnology

This thesis is making a contribution to the interdisciplinary field of Applied health technology (AHT), more specifically, within the field of Gerontechnology. AHT is a field that merges both technology and health. Gerontechnology highlights the dynamic interaction specifically between ageing and technological advances, which are dominant in today's society (Bouma, Fozard, Bouwhuis, & Taipale, 2007). Rather than focusing on the burden of an ageing society, Gerontechnology focuses on the positive aspects and solutions technology can bring to aging placing the individual at the forefront. Technology has "a potential to improve the life of aging people and to facilitate their participation as full citizens in their own society" (Bouma

et al., 2007. p.191). Yet technology also needs to be placed in context. There are five technology applications used in Gerontechnology (Fozard, 2001):

1. To prevent age-related decline in functioning
2. To compensate for existing age-related limitations
3. To enhance pleasure and participation in activities which may change for older people with time
4. To support the caregiver
5. To improve the applied and other research that is suggesting technology use as a solution for scientific problems in gerontology.

The Internet is seen as potentially playing a part in four of the five applications. In order to prevent age-related memory declines, the Internet and gaming has shown to increase memory function in old age (Anguera et al., 2013). ICT can provide many alternatives for extending professional active life for the older adults, contributing in turn to the silver economy (Leonard, Afsarmanesh, Msanjila, & Playfoot, 2009). The potential of online shopping and virtual social platforms are a good feasible solution to handle existing age-related limitations, as well as enhancing participation. Online chat forums or video calls from a nurse are ways to support a caregiver in so far as alleviating the burden of handling a frail older-adult for example, or just to be able to share experiences with a group online (Stephen et al., 2013).

BACKGROUND

Aging

Human aging refers to a combination of processes that occur in one's life, namely psychological, physiological, social and societal dimensions (Baltes, 1996).

Psychological aging

The body and mind operate as a psychophysiological unit, where the level of adjustment and mental health can influence the rate at which a person ages (Aiken, 1995). The maintenance of high self-esteem and feelings of achievement in old age is important because it increases resistance to stress and contributes to physical and mental health (Antonovsky, 1987). Becoming dependent can influence the older-adult's feeling of competence and play a devastating role in increasing depression, decreasing life satisfaction and self-esteem (Qualls & Abeles, 2000). More focus should be placed on supporting the older-adult through such phases making them more comfortable; learning how to use the Internet can even be seen as a way to move from a 'dependent' situation, and be able to look things up online and to do one's own banking.

Vision and hearing develop throughout life, which, in turn, facilitates understanding and recognition of the environment making selective processing possible (Bouma et al., 2007). Interpretation of one's surroundings is a complicated task, which puts forward the question how the older-adult in effect is adapting to the rapid virtual reality that is in place, with such a constantly changing perceptual environment (Bouma et al., 2007). Memory, perception and communication are intertwined (Fozard, 2001).Their connections are important to explore when investigating questions such as an older-adult saying: "I have no interest in this technology…."; for there could be many layers to that statement. Would that be a case of interpreting one's surrounding as hostile? Or is it a lack of understanding or cognitive ability to learn the new technology? Even new terminology in the language can suddenly have a massive impact on the extent to how excluded a person can feel, for example, in the technical terms like "sms", "google it" or "go online".

Physiological aging

Physiological aging refers to the decline of performance of digestive, respiratory, neurological and other systems' functioning (Aiken, 1998). Primary aging is inevitable, which is

genetically based; secondary aging which has to do with trauma, disease and even heredity is something that can be a little more controlled (Aiken, 1998). As people grow older the body goes through a number of changes which are inevitable, such as the respiratory system going through structural changes, much like the musculoskeletal system causing alterations in one's bodily capacities. It can be a disturbing and an emotional experience as people do not prepare themselves for a physical breakdown. Even if the adult gradually experiences these changes from the mid-twenties onwards, many people often find themselves with a strong functioning mind in their 80's but a body that has just not followed.

It is, however, valid to say that older-adults do not perform cognitively as well as a younger adult (Aiken, 1995, 1998; Birren, Schaie, Abeles, Gatz, & Salthouse, 2006). The reason is that older-adults might not actively try and learn as younger adults, but also that there is a decline in neurons and an accumulation of plaque in the brain (Aiken, 1998). Having said this, however, it does not mean that memory is something that necessarily declines with age (Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005). Research suggests that older-adults have a hard time storing and retrieving memories, due to the fact that they are less adept at organising, associating and integrating material so that it goes into permanent storage (Anguera et al., 2013). Older-adults also have a problem of retrieval of information, seen starting at the age of 63 (Aiken, 1998).

Nevertheless, this is also very individualistic as, for example, adults who read books and take courses, engaging in both sedentary and physical activities experience less age-related decline. What is important is to focus on ways to improve memory, abstract reasoning, concentration and other intellectual functioning of the older-adult (Aiken, 1998). Learning rests on the basis of earlier learned activities (Bouma et al., 2007), which may lead to believing that older-adults have difficulty learning new things. This may turn out to be a reduced learning capacity because old knowledge and habits come into play (Aiken, 1998), making it more difficult to learn new ones. As much as it is recognised that continued learning and problem solving in older adulthood can sustain and even improve intellectual abilities, attitudes and interests, one must adapt the information to the older-adult. Age-related differences have been noted as factors which influence older-adults' learning and use of computers (Xie, 2003). It has also been shown that older-adults are more cautious, more disrupted by emotions, and less likely to use imagery to understand (Aiken, 1995) and all this should be taken into account when considering the older-adult as someone learning software applications and the Internet. It is even necessary to take into account the content, design and

conditions of learning so as to improve their learning experience (Ala-Mutka, Malanowski, Punie, & Cabrera, 2008; Finn & Johnson, 2013).

Social and societal dimensions of aging

Attitudes on aging and old age can play a big role in how older-adults behave, and feel in their current society. The idea is to stress the role of the individual in the determination of his or her functioning. The older-adult is in a new phase of life, which he or she should embrace, as it is all part of adapting to the continuous process. Successful aging, today, is to have personal vitality, adaptive flexibility, autonomy, activity, control (Cerrato & de Trocóniz, 1998), with biological and psychological functioning; this implies that there is great opportunity for the older-adult to have continuous optimisation throughout life. Through selective choices in behaviour a new and sustainable continuation of living is allowed. For example, older-adults will not 'waste' time with people they find irrelevant, or of no interest. When in social settings, older people will tend to only sit through discussions which interest them and probably also where they can show off their own competencies.

This process of selectivisation can be linked to the concept of good aging (Bouma et al., 2007), where the older-adult actively selects and makes conscious decisions accordingly to be able to live the best way possible in later life. To be able to facilitate good aging with the help of information communication technology would, in effect, be an achievement.

Information Communication Technology

The Internet

The increasing presence of the Internet and computers in society no longer leaves room for non-users. Many services are becoming digitalised and require a person today to know how to handle the Internet and its websites. Technological advancement, however, does not necessarily go hand in hand with technological adaptation. The rapid upgrades and increase in technological devices (for example, smart phones) and applications (internet banking) may not appeal to everyone, where people prefer face-to-face contact or feel that the Internet may be lacking in security. Technological devices may have also developed so fast that people do not follow the trends, as the constantly changing element of ICT makes it difficult to keep up. The Internet, officially in place in society in 1995 (Giles, 2003), did not at first, cater to minority groups but to the mainstream population. The Internet found its way into people's everyday lives eventually, by both a push (forced to use the Internet, an external push) and pull (enticed to use the Internet, user-driven) phenomenon (Mante-Meijer & Loos, 2011).

Growing older means a change in one's lifestyle, therefore, when suggesting that older-adults engage in using the Internet it means understanding their different lifestyles and needs. It is, therefore, important to consider the user, and his or her background. An example of this could be an octogenarian (aged 80 something) who has no previous computer experience, and a younger older-adult who has just retired (say around the age of 65). These can both be seen through the push and pull lens, where an octogenarian may be required to start using an Internet-monitored device in the home, which would be necessary in order to live independently (pushed). On the other hand, a newly retired person may feel a strong desire to have continuous access online (pulled), in order to stay in touch with friends after retirement for example.

Internet use up to the beginning of 2014 has grown into varying patterns of use, intensities and problems within every age group. A recent concern in Sweden has been that younger people are spending too much time online, as they are always connected to a device able to check varying accounts, websites and social networks. Then on the other spectrum there are the older-adults who are not evident users of the Internet. This is suggested by the low numbers of Internet use by senior citizens in Europe (The European Union, 2010). Few older-adults are actually 'just getting online' (Karahasanović et al., 2009) especially in their seventies and above (Fox & Madden, 2006). Often external efforts are needed to trigger an interest in older-adults to use the Internet, where they can then Skype or email with their children and grandchildren. If one compares Internet use among older-adults in the United States, the numbers are similar, where a recent poll suggested that only 58% of older-adults are connected to and use the Internet (Zickuhr & Madden, 2012)).

Many older-adults are pushed into using the Internet contrary to being pulled into using it. Virtual services are slowly replacing the traditional face-to-face contact of organisations and businesses. The Internet is also becoming much more prominent within health care as seen with video conferencing in health care planning (Hofflander, Nilsson, Eriksén, & Borg, 2013) and much quicker services overall (Wright, 2012). Strong developments within interactive health communication (Rimal & Lapinski, 2009), open up possibilities where it is not only about the older-adult gaining knowledge (looking up information about chronic diseases or how to manage a sick partner), but getting stronger support to regular care. This does call for a shift in habits and ways of thinking, which may not be as evident for an older person. Older-adults who do not go online for 'recreational' purposes, may find it harder to get into the habit of doing so for healthcare reasons.

Research has focused on how the older-adult can benefit from Internet use (Cresci, Yarandi, & Morrell, 2010), by, for example, demonstrating that the Internet can increase well-being (Slegers, Van Boxtel, & Jolles, 2008). The Internet can most certainly be a way for older-adults to engage on a social level, be part of networks, gain any information by browsing websites, join classes, and be part of any recreational aspect online. Promoting those aspects may pull the older-adult into using the Internet more.

Tablet Computer and Skype

Touch screen mobile devices, such as tablets, have been on the market since 2010 (Medeiros, 2010). They are developing fast as a new-generation electronic device, replacing the desktop and laptop running operating systems (Kaur, 2013). As of yet not many studies have investigated what frail older-adults think of the tablet PC and how they use it.

Some studies have investigated interfaces, where results indicate that older-adults are quick to learn and basic touchscreen operations are easy for the elderly, without much training or previous experience (Kobayashi et al., 2011). Games on tablets were shown to be positively accepted and taken on by older-adults, if customised and targeted toward their interests (Vasconcelos et al., 2012).

Previous research has demonstrated that older-adults are willing to try new technologies (Eastman & Iyer, 2004). However older-adults may not connect to the technology if they do not see the point in using it; technology acceptance is coupled with the personal needs of the user and the environment (Bailey & Sheehan, 2009). A recent study investigated new functions of smart phones and tablets, where the authors wanted to understand older-adults' reasons for accepting or rejecting the use of these devices (Zhou, Rau, & Salvendy, 2013). They found that older people, in fact, were still strongly influenced by their lifestyles and current living situations where habit influences change negatively; there were still many substitutes such as paper newspapers. Being open to try new things was an important trigger especially as learning some of these devices was quite complex for the older-adult.

Another recent study investigated Skype as a means of increasing social relationships and health of older-adults (Jimison, Klein, & Marcoe, 2013), which through their intervention led to positive results. Yet mostly older-adults are triggered to use Skype through their grandchildren and children. For some this then means that there are not so many other people to Skype with. Increasing the number of social contacts by creating a shared learning environment or taking a course may be necessary (Waycott et al., 2012). In addition, the older-adult relies on family members for the encouragement needed and assistance in getting

access to the Internet. These family members become the support for the older-adult (Choi & Dinitto, 2013a); and without their support the older-adult may not get online and Skype.

Psycho-social determinants

Personality traits

Personality is a complex phenomenon that directs a person's behaviour. It is a very broad term, which has been studied in psychology for many years. The challenge has been to define personality and categorise a person to fit into 'a box', which is very difficult as the human is so immensely intricate.

The five-factor model (FFM), is one way to understand personality. FFM was established by Costa and McCrae in the mid-eighties, and contains five main personality traits that are fundamental to every person: conscientiousness, neuroticism, agreeableness, openness and extraversion (Costa & McCrae, 1986). The factors are bipolar (agreeableness vs. disagreeableness), and they are built on specific definers with scales and trait adjectives (McCrae & John, 1992). Neuroticism indicates an individual's tendency to suffer from psychological distress, think in negative patterns with a high sensitivity to threats. Extraversion signifies that a person has a tendency to be socially outgoing and talkative. Openness (to experience) suggests someone who has an appreciation for alternative perspectives, has intellectual curiosity and a desire for artistic pleasures. Agreeableness is defined as a tendency to be cooperative, sympathetic and reliable and finally Conscientiousness suggests someone who is careful and plans ahead (McCrae & John, 1992). There are varying theories on how stable or changeable these traits are, where some claim that we peak until we are 30 and then the personality traits stabilise (Costa & McCrae, 1986); or that we are changeable until the age of 30 but reach a plateau level between 50-70 years of age (Roberts & DelVecchio, 2000). Alternatively, there are theorists who claim that investigating whether personality traits remain stable without taking into consideration environmental changes make little sense and give faulty results (Ardelt, 2000). It is difficult to know for certain how much personality changes in healthy aging. When discussing personality changes in the older population, they are often associated with frontotemporal lobar degeneration, mild cognitive impairment or Alzheimer's disease (Lautenschlager & Förstl, 2007).

Some research has suggested that some personality traits contribute to living longer. A study conducted on the five traits, demonstrated how Conscientiousness, Openness and Extraversion were contributing to longevity (Iwasa et al., 2008). For those with high levels of

Conscientiousness, there were 50% fewer disabilities than those scoring low on that trait (Lautenschlager & Förstl, 2007). Being Conscientious suggests one is careful and will be more likely to refrain from smoking and drinking for example. Openness means one is more open to new things, and accepting changes in everyday life; for example, an older person would then be more likely to try new treatments or new diets which will increase their life-expectancy. Being Extravert means that a person finds it easy to meet and be around people. Such people have a strong social network; living with company has been linked to longevity (Pope, 2012). Neuroticism in old age has often been linked with lower levels of social engagement, which in turn has led to pre-morbidity, disability and cognitive decline (Lautenschlager & Förstl, 2007).

In turn, patterns of Internet use have been linked to personality. Previous research, on younger people has indicated that Agreeableness, Conscientiousness and Extraversion are inversely related to more traditional uses of the Internet (Landers & Lounsbury, 2006), such as just emailing, chatting and browsing websites. Recent studies conducted on social media, however, indicated that extraversion was positively related to social media use (Correa, Hinsley, & de Zúñiga, 2010; Ross et al., 2009). Scoring high on Neuroticism indicated specific types of behaviour online, seeking specific websites, or chatting more than others as the more neurotic could spend more time contemplating their answers, facilitating communication (Correa et al., 2010; Hamburger & Ben-Artzi, 2000).

Few studies have conducted research on the personality of older-adults and their Internet use. It was therefore investigated in this thesis as possible contributing factors in their usage.

Life satisfaction

The factors that contribute to life satisfaction are dependent on age and origin (Fagerström, 2007). Results from aging studies have indicated that even if older people have cumulative losses throughout the years, many report having a strong sense of life satisfaction (Bourque, Pushkar, Bonneville, & Béland, 2005). Life satisfaction can be understood as a retrospective view or subjective summary of one's quality of life by one's own standards. It is sometimes linked with personality, the assumption being that there are strong traits which predict emotional responses to the environment which are consistent with time (McCrae & John, 1992). The concept combines an estimation of one's life's results and can be considered similar to happiness, which in turn is also a strong predictor of longevity (Veenhoven, 2005, 2008).

Life satisfaction is often based on contextual variables, health, demographic and psychosocial factors (Bourque et al., 2005) and can become quite broad and confusing as the factors influencing Life satisfaction vary a lot from person to person. The Internet and computers could easily be one of those factors.

Studies have investigated Life satisfaction along with Internet use in the older population. Often the assumption is made that an increase in computer use will also increase life satisfaction for the older-adult (Karavidas, Lim, & Katsikas, 2005). Internet use has been reported to relate to more interpersonal contact for the older-adult, which in turn leads to an increase in well-being (Shapira, Barak, & Gal, 2007). Life satisfaction in this thesis was investigated as a reason for using the Internet, as in if the older-adult scores high on life satisfaction it may trigger or be a reason for Internet use.

Sense of Coherence

Sense of coherence (SOC) is a concept that differs from the pathogenic orientation as to why people are healthy. It is considered a combination of resources such as character, strength, social support and cultural stability that promote someone's health (Antonovsky, 1993). It has to do with how someone can handle life experiences, tackle stressors and use successful coping strategies. The model bases itself on why some people feel confident and healthy despite horrible external and stressful conditions.

The coping of the individual is defined, according to the SOC scale, on three components: comprehensibility (the internal and external stimuli are structured and cognitively handled and understood), manageability (there are resources available to handle the stimuli to control and influence events) and meaningfulness (the challenges are worthy of investment) (Antonovsky, 1987). The three components cannot be separated, as they work together to build an understanding of how a person exerts control over stressors and other life events.

SOC has been interchanged by some researchers with personality (Saevareid, Thygesen, Nygaard, & Lindstrom, 2007), but is not considered a trait in this thesis. It is, however, understood here to relate to life satisfaction, as SOC has previously been correlated positively with well-being (Antonovsky, 1993; Saevareid, Thygesen, Nygaard, & Lindstrom, 2007). Gender differences have been found in how SOC influences health, where men tended to score higher on SOC than women (Eriksson & Lindström, 2007). In addition to that, if one scores high on SOC then according to Antonovsky this will be stable with time (Antonovsky, 1987). Due to this fact, it seems important to include in a model as it may be a strong effect modifier. This was seen in a longitudinal study conducted in Sweden, where people tended to

show a decrease in their SOC score with time and the older they became, especially with the presence of disease comorbidity (B. Nilsson, Holmgren, Stegmayr, & Westman, 2003). It was therefore of interest to investigate whether SOC contributed to Internet use in any way for the older-adults, both in usage and over time. This was to see, not if it increased well-being like much research has tried to demonstrate inconclusively, but whether scoring high on life satisfaction and coping would suggest an older-adult was also using the Internet.

Socio-demographic determinants

Research has often shown that there are very different patterns in technology use between genders (Scherer & DiCowden, 2008). Data on Europe from 2007, has indicated that between the ages 55-74 years of age, men use the Internet more than women (Seybert, 2007). This difference still exists but is on the decline in the younger age groups.

Many studies used to indicate less computer and Internet use by women compared to men , to a point where a study conducted in the US suggested that much of the digital divide was originally attributed to gender (Bimber, 2000).

Surveys of ICT usage in Europe, show that age is a strong predictor in whether technology is used or not, and also by marital status, gender and education (Selwyn, Gorard, Furlong, & Madden, 2003). It has been noted that older-adults who live alone tend to use the Internet less, or engage less in learning or adopting new technologies. There could be different reasons for this; the first is that up until now, more women tended to outlive the men. And as mentioned above, fewer women are interested in new technologies and therefore will not begin to engage in using them. Another possibility is that there is a lack of support if something goes wrong – it is always easier to ask a husband or wife if memory fails in how to access a website or another aspect on a computer. Previous research has also indicated that those people living with someone, had higher scores on mental and physical abilities (You & Lee, 2006). In effect, it becomes self-explanatory that if the older-adult lives alone and suffers from depression, he or she will not engage in learning new technology.

Financial resources and education levels have often been linked to the grey digital divide. In the beginning, the spread of the Internet led to the exclusion of the older generations and the underprivileged (Sackmann & Winkler, 2013). The differences of access due to economic situation, with older people reporting in 2010 that they chose not to have a computer or the Internet due to the cost (Findahl, 2011). Lower education has also been linked to fewer financial resources, which could also explain why in previous research education was a strong factor stratifying those older-adults using a computer or not (Selwyn et al., 2003).

Studies have shown that there is much less Internet use in rural areas (Boase, 2010), and that how the Internet is used differs in urban and rural living (Hale et al., 2010). Urban living means significantly more computer usage (Calvert, Kaye, Leahy, Hexem, & Carlson, 2009). The reasons for this are obscure. There are previous studies that have shown that there is the element of access to the Internet, which in rural areas tends to be worse than in urban areas (Boase, 2010). It can be seen as ironic as the Internet promises abundance of and equal access to information online anywhere, when, in fact, it is hindered by the location of where one lives. Research has also shown that older-adults will not use the Internet if the broadband access is not good (Hanson, 2010).

Rural living has been related to less internet use depending on gender, age and education (Yang, Park, Yoon, & Kim, 2010). In addition, people living in rural areas have worse health than those living in towns and cities (Zimmer, Wen, & Kaneda, 2010). Lower socio-economic status, unfortunately, influences how healthy people are and it often correlated with rural living. A possibility here would be to increase contact between older-adults living in rural areas and nurse practitioners (through online video calls, for example), as a means to improve access to medical and nursing care, which in turn may improve the health of older-adults in rural settings (Arbuthnot, Dawson, & Hansen-Ketchum, 2012).

Health determinants

Cognition

Cognitive functioning is something that declines with age. As mentioned above in the section on physiological aging, older-adults are less adept at organising, retrieving and remembering due to varying factors such as receptors in the brain working less efficiently (Zamzow, Elias, Shumaker, Larson, & Magnusson, 2013). But it is agreed that general bodily aging influences cognitive functioning in aging (Deary et al., 2009).

There are varying forms of cognitive decline. Dementia for example, is not part of normal aging and is a syndrome which can be caused by a number of progressive disorders that affect memory, thinking, behaviour and ability to perform everyday activities. The prevalence of dementia in Europe in 2010 was 6% for people over 60, where Sweden, France, Italy, Spain and Switzerland had the highest prevalence 6.3% - 6.6% compared to other EU countries (Wimo, Prince, Winblad, & Jönsson, 2010).

Mild cognitive impairment (MCI) is a decline in the ability to perform certain tasks such as planning, language and memory. However, it is not sufficiently severe to be diagnosed as dementia. Many who develop MCI are at a 10-15% risk of developing dementia (Dajani,

n.d.). The causes are quite unclear as to why some people develop MCI or dementia. However, what is clear is that many studies are focusing on ways to improve cognition in the later years, where searching for information online was said to be positive on the older-adult's brain ("New Evidence Suggests That Using the Internet Might Make You Smarter, Not Rot Your Brain," n.d.) as well as gaming which can function as enhancing cognition (Richtel, 2013). Both researches point to the same thing, which is if one trains one's mind (in sustained attention or divided attention or the working memory), this will in turn increase the cognitive ability of the brain.

Studies have also indicated that other factors are mediated by cognition, namely age, Conscientiousness and education (Soubelet, 2011). The personality trait Openness, which concerns the process of knowing and intellectual memory functions has also a significant relationship with cognition (Booth, Schinka, Brown, Mortimer, & Borenstein, 2006).

A decline in cognition however, could mean that learning a new task actually is not feasible. Having mild cognitive impairment (MCI) is associated with a reduction in ability to pursue everyday activities, therefore it does not come as a surprise that those with mild cognitive impairment have more difficulty than a healthy older person with the use of technology (Malinowsky, Almkvist, Kottorp, & Nygård, 2010).

Internet use in older-adults has been strongly related to cognitive age and abilities (Czaja 2006) because of the problem solving and short-term memory (fluid intelligence) which are necessary for web use. This means it is important to investigate whether and how much cognition influences the older-adults' Internet use. With the frequency of MCI and dementia and high numbers of people that have these impairments, it is not a factor to be ignored when investigating learning new technology for the older-adult.

Health and Assisted Daily Living (IADL)

A major concern for governments and people who are aware that they are going to live close to a century, is to try and remain in as good health as possible. After retirement, depending on where one lives in the world, one could have close to thirty or forty more years to live (Young, 2003). Yet according to European statistics in 2011, the number of healthy years after the age of 65, was 8.6 years on average; differing per country but ranging in Sweden, for example, with 15.2 years of age for females and 13.9 years for men; contrary to Slovakia with 2.9 years for women, and 3.5 years for men (European Commission, 2013). If one has to live in pain or with disabling illnesses, it makes growing older unappealing. Health is really a very strong predictor of well-being, and living well in later life.

Impaired or declining ability to perform activities of daily living (ADL capacity) is related to advanced age (Persson et al., 2001). There are both ADL impairments (feeding/eating, bathing, grooming dressing, toileting and getting in and out of bed) and IADL impairments (cleaning, preparing meals, doing laundry, grocery shopping, making telephone calls, and taking medications). Older people are therefore a very large consumer of healthcare services, with frail older-adults the highest consumer among the aging population. Frail older-adults are a segment of the older-adults that are defined as living with multiple acute or chronic conditions. In Sweden the definition applies to people ≥ 75 years of age, that have at least three diagnoses according to the ICD-10, and that have been admitted to inpatient care at least three times in the last twelve months (National board of health and welfare, 2003).

The Internet offers to sustain the independence of an older-adult, if restricted in mobility, for example, online shopping, or video conferencing with a nurse, can open up many new opportunities for an older-adult. Yet there has to be a minimum level of health in order to learn or use technology (Chen & Chan, 2013; Xie, 2003). Therefore, being able to perform activities of daily living (ADL), as measured by identifying the impact of health problems and diseases on daily living, seems to be an important factor as to whether an older person will (start to) use the Internet or not. Furthermore, access to technology is important, as the Internet becomes an important focal point in health care (Czaja, Lee, Nair, & Sharit, 2008). It promises to be part of a solution to accommodate for older-adults and frail older-adults who are currently being handled by many different actors in the health care system, which is not optimal (Höjgård, Wånell, Meinow, & Lagergren, 2011).

AIMS

The overall aim of this thesis was to investigate factors influencing Internet and ICT use by older-adults. A selection of psycho-social, socio-demographic and health determinants were investigated with Internet use. In addition, interviews were conducted with older-adults in order to grasp a more in-depth understanding of what these factors could be.

The specific aims were:

- To investigate whether personality factors, based on the FFM, and individual characteristics such as Sense of Coherence and Life Satisfaction, influenced the older-adults' Internet usage (Paper I).
- To investigate factors associated with starting to use the Internet by older-adults, over a period of six years (Paper II).
- To investigate whether living rural and urban areas influenced Internet usage in older-adults throughout Sweden (Paper III).
- To obtain the frail older-adult's feelings and experiences of using a tablet computer and a communication application (Paper IV).

METHODS

Design

This thesis has three quantitative Studies and one qualitative Study. The former are cross-sectional (Paper I & III), cross-national (Paper III) and longitudinal in design (Paper II). The fourth Paper is a qualitative Study (Paper IV), where interviews were conducted.

The Data

The data for this thesis has been collected from two different sources. The first data collection is taken from The Swedish National Study on Aging and Care (SNAC). This is a longitudinal multi-centre cohort study, from four centres throughout Sweden, which began in (2001-2004) and is on-going for the coming thirty years (Lagergren et al., 2004). The sample is randomly selected from the national population register. The participants are invited on two occasions, by mail to take part in the investigation. The data is then collected by a research team including physicians and nurses, through structured interviews, questionnaires and medical examinations. If the participant could not come to the research centre, the study was

performed in the respondent's home; help was also provided in filling in the questionnaire if needed.

The second data collection was taken from a case-management project, which had taken place in Blekinge (2010-2013). The project aimed to provide a case manager (CM) for every frail elderly with co-morbidity. In order to find the frail elderly, a selection was conducted based on the number of entries into hospital within the last year. The older-adult was then contacted and asked whether they were interested in participating. A case manager was then assigned to a frail older-adult for the time of the project; they met frequently either via telephone or physically in the older person's home. Part of the project was to test a tablet (IPad/Android) and a communication application, as a means to communicate between the CM and the older-adults. 19 tablets were available for the project and handed out for a test period of six months. The case managers were the ones who selected which older-adults they would ask to try this new technology.

Sampling and procedures

The samples in each Paper (I- IV)

In Study I, the sample was taken solely from one centre based in Karlskrona, in the south-eastern part of Sweden, Blekinge (SNAC-B). Today there are around 63 500 inhabitants and is considered representative of a small to mid-size town in Sweden. The total sample in the Study (Paper I) was N=1402, with 585 men and 817 women. There were ten age cohorts - 60, 66, 72, 78, 81, 84, 87, 90, 93 and 96 – with a mean age in the sample of 75 years. The baseline survey for SNAC-B, began in 2001 where participants were asked to participate and the response rate varied between 55-75% depending on the age groups (Fagerström, 2007), where mainly the younger cohorts provided higher response rates. Reasons for not participating were due to not being interested or too ill.

In Paper II, the sample was taken from SNAC-B; both baseline and follow-up data (which was collected six years later) were used. This baseline data has a follow-up every six years where the same individuals are re-examined. Most baseline questionnaires are given again, depending on the formal SNAC procedures and requirements. The total sample in follow-up was (N=848), where the lower number was due to censoring or death. The data from baseline and follow-up was paired, for Study II.

In Paper III, the sample was taken from all participating centres in SNAC (SNAC-Skåne, Nordanstig, Kungsholmen and Blekinge). This meant that baseline data from all four regions were collected and put together, N=7181; ages ranged from 59-100 years old with a mean age

of 73. The non-response rate overall was 33.6%, where those who did not respond tended to be women, oldest older-adults and the frail elderly.
In Paper IV, the sample was collected through the case-management project by the case managers themselves. Some case managers chose to ask every one of their frail elderly, whereas others did a purposive sampling, knowing which ones would be more willing than others to try new technology. 19 tablets were handed out but only 15 people were interviewed; there were some that chose not to participate.

Data collection

The SNAC Study (used in Paper I & II & III), consists in effect of two parts: one studying the population and the other studying the care and services. The data for all Studies (I-III) were based on the population part; the answers to the questionnaires in the Papers I-III were those concerning personality traits, sense of coherence, life-satisfaction, functional and cognitive ability, household economy, living alone/with someone, gender, age, education, having two km or further to a shop or health care centre and, finally, whether they were using the Internet or not (see Table 1).
For Paper IV, semi-structured interviews were deemed the most appropriate method to grasp the perception of the frail older-adult and let them explain their subjective experience of the situation. Using a human-as-instrument to collect data, where the realities are assumed multiple and the statements context bound (Guba & Lincoln, 1982), was reflected on throughout the entire research process. The interviews were conducted on 15 people in their own homes, in a confidential setting with the interviewee, the interviewer (main author) and the case manager. It was decided that the case manager was to be present, as the frail older-adults would feel more secure with them there. The case managers were briefed beforehand to try and stay as quiet as possible, as the aim of the Study was to investigate the older-adult's personal views on the tablet and allow them to tell their experience and opinion on this. The interviews were audio taped, and lasted between 30 and 60 minutes.

Questionnaires and other measurements

Internet use

The baseline questionnaire used in SNAC contained a few questions referring to usage, how often and for what. However, due to the fact that the questionnaire was being modified and improved from the initial version, the selected question for the Studies I-III involved a simple yes or no answer possible as to whether the subject used the Internet/computers.

Personality traits - The Five Factor Model (FFM)

The FFM questionnaire used in SNAC is adapted into Swedish and contains 60 questions with possible answers ranging from *completely agree* to *completely disagree*. Studies that have used the FFM claim a Cronbach alpha from 0.79 to 0.93 (Costa & McCrae, 1986; Iwasa et al., 2008). The Cronbach alpha in this Study was 0.925 (and for each individual component: N 0.912; E 0.904; O 0.912; A 0.907; C 0.905).

Life satisfaction

Life satisfaction was measured using Neugarten's instrument of the Life satisfaction Index, LSI-A. The instrument is a self-reported measure of well-being, which is frequently used for older-adults (Borg et al., 2008; Neugarten, Havighurst, & Tobin, 1961). It consists of 20 multiple choice questions (Neugarten et al., 1961), which are positively and negatively loaded, where answers can be *agree*, *disagree* and *undecided.* There is a possibility to score between 0 and 40 - the higher the number the more life-satisfaction. In SNAC, the instrument has been adapted and translated into Swedish. Its objective is to gain a self-reported view on the person's own life satisfaction including their social network, their current living situation, health and socio-economic status.

Other research that used this instrument had an internal consistency ranging from 0.72 to 0.82 (Lubeck et al., 2000; Morgan et al., 1987). The Cronbach alpha for Study I was 0.87.

Sense of Coherence

In SNAC, a shortened version of Antonovsky's Sense of coherence instrument is used. The instrument measures how a person handles stress, and is built on a composition of three elements: manageability, comprehensibility and meaningfulness. The scale contains 13-items (as opposed to 29 items in the full scale), and is translated into Swedish. The answers ranged from *never* to very *often*, and are sometimes reversed. Other research has shown quite high internal consistencies, ranging from 0.70- 0-90 (A. Antonovsky, 1993; Rennemark, Holst, Fagerstrom, & Halling, 2009). Study I had a low Cronbach α "0.649".

Cognitive Functioning Mini-mental test (MMT)

In Paper II & III, cognitive functioning was investigated in relation to Internet use. The Swedish translation of the "Mini-Mental State" test is an instrument that measures the presence of normal cognitive functioning versus the presence of cognitive difficulty. Normal cut-off points for the test range between 26 and 30 (maximum), suggesting good cognitive

functioning (Folstein, Folstein, & McHugh, 1975). Scores lower than 26 suggest cognitive difficulty.

Functional Disability (ADL)

In Paper II, functional disability was investigated as a possible factor influencing whether an older-adult would start to use the Internet or not. This was measured using the Instrumental Activities of Daily living scale (IADL), which was translated into Swedish. The scale is based on a total sum of questions regarding the ability to use the telephone, shop, prepare food, do housekeeping, laundry and use one's own transportation, such as a car (Lawton & Brody, 1969). This has also been used in previous research to investigate how older-adults feel hindered by functional disabilities (Fagerström, Persson, Holst, & Hallberg, 2008). The higher the score, the less able one is. It was decided to categorise these scores into two categories, both in order to understand them better but also for the analyses. The results then became that either the older-adults were in need of "no/little help" or "moderate/total help" .

In Paper IV: The interview guide

The interviews were structured around an interview guide, containing three main concepts: the older adults' current living situation, their use of the tablet and the communication application. Some examples of the questions were: "Can you describe your current living situation?"; "Can you explain your use of the tablet?"; "Can you describe how the conversation went via the application?". The subject's (self-) reflection is an important element to empower the participants, in order to understand their constructed social reality (Hewitt, 2007).

Data Analysis

Statistical analyses

The analyses in Studies I-III were conducted using PASW Statistics 17.0- 20.0 (SPSS inc. Chicago, IL)

In Paper I, II and III, the socio-demographic variables: age, sex, education, living alone/with someone and household economy, were used. Age varied between 59 to 100 years of age in all Papers. The ages were collapsed into different groups in Studies I-III, so as to handle the different age cohorts better. In Paper I the age groups were classified into five age groups: group 1 (60 & 66), group 2 (72 & 78), group 3 (81 & 84), group 4 (87 & 90) and group 5 (93 & 96). In Paper II a division between the younger older-adults (60-80) and the oldest older-adults (81 and over) was made. In Paper III, four groups were made: group 1 (59-74); group

2: (75-84); group 3: (85-90) and group 4: (91-100). Education was a variable which had to be recoded into lower, middle and higher education, according to the Swedish education system relevant for the age groups in these studies. Lower, were those who did not finish secondary school; middle, were those who finished secondary school; higher, were those with some form of higher education. Education was dichotomised in Study III, so as to only have those with higher education (level 3) and those with no higher education (level 1 & 2).

In Studies I & II, descriptive statistical analyses and group comparisons were conducted to get an overview of the data. In Study I, mean scores of factors sex, education and age with each of the personality factors and the individual characteristic scores were examined. This was to investigate whether there was already a tendency in the data, to have a higher score on certain traits if older, for example. A Mann-Whitney U-test was used to see whether gender and Internet use (both nominal data) were individually associated with FFM, LSI-A and SOC. A Kruskal-Wallis one-way analysis of variance was conducted on the ordinal data, education level (1-3) and age group (1-5), with FFM, LSI-A and SOC. This was done taking education and age as independent samples of each other.

A chi-square test was conducted in Studies I & II, Internet use was selected with all the independent variables in each separate study. Study I used a chi-square test with internet use at baseline (using the Internet yes or no) with the independent variables: sex, education and age.

In Study II, change in Internet use was categorised into two groups. Group 1 contained those who began to use Internet from baseline (2001–2004) to follow-up (2007–2010). Group 0 contained those who did not start to use the Internet. The chi-square test was conducted on the dependent variable with all independent variables: cognition, extraversion, openness, disability, household economy, sex, age and education. Where the data needed to be recoded into nominal categories, for the chi-square test, this was done.

Cognition was categorised into good or poor cognitive functioning. Those who had good cognitive functioning had a score between 30 (highest score) and 27. Those who had poor cognitive functioning had a score of 26 or less. Extraversion and openness were dichotomised at their mode, 38 in both cases. The average score was deemed a less valuable interpretation in reference to Internet usage; therefore, the mode was used as it shows the most frequent score in these older-adults. Functional disability was categorised into no/little need of help (low scores were between 12 and 15) to moderate/total need of help (high scores: 16–24). This categorisation was chosen to handle the scores more easily according to the distribution of the data, where too few people were actually in need of no help at all.

Cronbach's alpha coefficient was calculated in Paper I, to calculate the internal consistency of the FFM, LSI-A and the SOC.

In Papers I,II & III, the statistical significance was set at a p-value < 0.05. Logistic regressions were conducted in all these three Papers, with a dichotomous outcome variable. To study the differences between the explanatory variables, first correlations between independent variables were calculated in Study I (Spearman's rho) and in Study II. This was to reduce the risk of covariance in the regression model, so where the variables had correlations below 30% there was little risk (Paper I & Paper II). Collinearity diagnostics Variance Inflation Factor (VIF) was used only in Study III, to check for multicollinearity between the independent variables. A VIF higher than 10 indicates multicollinearity (Norman & Streiner, 2008). A concordance (c) statistic was also calculated in Study III, as a way to see how well the selected variables discriminate between the observations at different levels in every model. The range is from 0.5 (no differentiation) to 1.0 (outstanding differentiation). C-statistic values of 0.7 to 0.8 are considered to show acceptable discrimination, values of 0.8 to 0.9 to indicate excellent discrimination, and values of ≥0.9 show outstanding discrimination (Hosmer, Lemeshow, & Sturvivant, 2013). Previous research has indicated that using the C-statistic strengthens the results of the logistic regression in cases where there is strong heterogeneity in the population. The population in Study III exceeds 7000 people, which is why the odds ratio alone is then not enough, especially when having continuous explanatory variables (Austin & Steyerberg, 2012).

In all three Papers I-III, the logistic regressions were shown with 95% confidence intervals (CI), their unstandardised coefficient β and their significance values.

In Paper I, a stepwise logistic regression was conducted with sex, education, age, openness, extraversion and LSI-A as independent variables. The significant results from the Mann-Whitney U-test were used in the logistic regression, namely openness and extraversion and LSI-A. Dummy variables were used for education as it is a categorical variable, and age was entered as a continuous variable as that model provided a better fit to the data.

In Paper II, two logistic regressions were conducted. The first was based on the significant results of the chi-square tests: cognition, sex and age. Cognition was entered as a continuous variable. Sex and age were entered as categorical variables, signifying that the results would indicate being male and lower in age (following their coding and as lowest number was the point of reference; age needed to be reversed for the logistic regression). Thereafter, a second analysis was conducted stepwise, selecting only the younger age group, with cognition, sex and age again. This time, age was entered as a continuous variable.

In Paper III four logistic regressions were conducted. The first used Internet use as the dependent variable with rural, mid-size and big city in Sweden as independent variables. The second logistic regression investigated the effect of age, sex, education, cognition, rural/urban living, living alone/with someone, household economy on Internet use. The last two regressions had rural Internet use and urban Internet use as dependent variables, with age, sex, education, cognition, living alone/with someone, household economy as independent variables.

Qualitative content analysis

The data in Study IV, was analysed using a qualitative content analysis method inspired by Schreier (Schreier, 2012). This is a way to grasp the phenomenon of interest: the tablet PC and the communication application use by these frail older-adults. Content analysis is a tool to reduce material and describe data by focusing on selected aspects (Schreier, 2012). An inductive analysis of the content was used, so as to grasp the emergent results from the data (Creswell, 2013).

The analysis of the transcribed verbatim interviews was performed in several steps. The first was to read the interviews through several times in order to get an overview of the content. In the second step the text was segmented – concept-driven – from the interview guide and relevant to the aim of the Study: the older-adults feelings and experience of use of tablet PC and Skype. The concepts were the older-adults' use of the tablet, the communication application and being a frail user. Segments were selected, and then condensed. The third step was to go through the units and label them. The fourth step was to create subcategories from the labels. This process was data-driven (Schreier, 2012). The labels were thereafter grouped together into subcategories thematically. This process was repeated in loop several times, so as to avoid faults, and to make sure that the definitions of the selected segments truly fitted the subcategories. The final step was to group the subcategories into main categories (Schreier, 2012). Four main categories emerged from the text in the final step.

Table 1. The titles, samples, variables and methods used in all Studies I- IV

	STUDY I **Distribution of personality, individual characteristics and Internet use in Swedish older-adults**	**STUDY II** **Factors associated with change in Internet usage of Swedish older-adults (2004-2010)**	**STUDY III** **Factors influencing Internet usage in older-adults (65 years and above) living in rural and urban Sweden**	**STUDY IV** **Case management for frail older-adults through Tablet computers & Skype**
Sample	SNAC-B N=1406 ten age cohorts: 60-96 years of age	SNAC- B baseline =1406 & follow up= 848 ten age cohorts: 60-96 years of age	SNAC- all baseline N= 7181 ages 59-100	Äldrelots project N= 15 ages 69- 92
Variables	Personality FFM, Sense of Coherence, Life Satisfaction, Sex, age, education	Openness, Extraversion, sex, age, Education, Household economy, Cognition	Rural & urban living (2 definitions) Living alone/not, Cognition Sex, age, education, household economy	Feelings and experience of use of tablet computer and Skype
Methods	Mann Whitney, Kruskal Wallis, Spearman rho, chi-square, Logistic regression	Chi-square test Logistic regression	Logistic regression C statistic, VIF	Interviews Content analysis

ETHICAL CONSIDERATIONS

The protection of a participant's health, rights and privacy are an essential element when conducting research on human beings ("WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects," 2013). The aim, design and methodology in the Studies I-III were described in a protocol and approved by the Ethical Committees of the Medical Faculty Lund (LU dnr 650-00 and LU 744-00) and Karolinska Institute (KI dnr 01-114).

The collected data was treated confidentially. The privacy of the research subjects was protected for their integrity and so as to maintain their social, physical and mental well-being. It was important to have informed written consent, where each person could withdraw from the study at any time. A part of the SNAC questionnaires was sent to the participant's home and help was offered if they needed to complete the questionnaire. Some people were interviewed in person, in the older person's home or on neutral ground, where the interviewer was then aware of the ethical principles. The research team was available daily to answer questions over the phone. Code lists and questionnaires were kept separately and only available to the research team. Furthermore, all analyses were made on group level making it impossible to link the results to a specific individual.

The entire case management project obtained ethical permission from the University of Lund (LU Dnr 2012/228). This meant that the project adhered to the regulations set by the Declaration of Helsinki II. Interviews could, therefore, be conducted on these frail older-adults (Study IV).

Informed consent was obtained from each participant; both written information (via the letter) and oral information was given before starting the interview. The aim of the study, its procedure as well as the length, was explained by the main author; careful emphasis was placed on explaining how the recording of the interview and its data would be handled. In addition, it was decided that the case manager was to be present during the interviews, to put the frail older-adult at ease. The CM would function as a safety net so the older-adult would open up comfortably and talk during the interview.

FINDINGS

The findings of this thesis are presented through each determinant individually.

Psycho-social determinants

Study I

The sample in Study I was from baseline SNAC-B, with N= 1402. The mean scores of FFM, SOC and LSI-A with the total sample, sex, education, age and Internet use in the Swedish older-adult. This can be found in the Table 2 below:

Table 2: Mean scores of factors sex, education and age on FFM, SOC and LSI-A in a Swedish Study of older adults, SNAC Blekinge.

Abbreviations: FFM: five factor model: C: conscientiousness; N: Neuroticism; O: Openness; A: Agreeableness; E: Extraversion; SOC: Sense of Coherence; LSI-A: Life Satisfaction Index A. Education 1: did not finish secondary school; Education 2: completed secondary school; Education 3: higher education.

	FFM - N	FFM - E	FFM- O	FFM - A	FFM- C	SOC	LSI-A
Total sample	30.28	39.12	34.77	46.06	42.90	73.73	37.19
Woman	31.27	39.04	35.40	46.83	42.53	73.11	37.36
Man	28.84	39.50	34.35	45.41	43.44	74.44	36.96
Education 1	30.30	39.06	34.22	46.21	42.68	73.17	37.20
Education 2	29.87	39.36	35.62	45.96	42.89	73.74	37.42
Education 3	29.94	40.08	37.04	46.38	43.86	73.87	36.43
Age groups							
1: 60 & 66	29.75	40.93	36.12	46.38	44.06	74.18	36.84
2: 72 & 78	30.23	39.26	34.44	45.97	42.94	73.81	37.08
3: 81 & 84	29.93	38.09	34.43	46.12	42.54	73.11	37.73
4: 87 & 90	31.60	36.82	33.73	46.28	40.79	73.19	37.43
5: 93 & 96	31.10	37.40	33.65	46.10	40.80	75.18	35.68
Internet Users	29.74	40.38	36.32	46.02	43.24	72.44	36.42
Internet Non-Users	30.36	38.80	34.36	46.08	42.77	73.84	37.39

Scoring a high mean on either FFM, SOC or LSI-A- signifies a stronger tendency toward either personality trait, sense of coherence or well-being

Investigating the spread and differences between gender, men had a significantly lower mean score than women in neuroticism ($p < 0.001$), openness ($p < 0.01$) and agreeableness ($p<0.001$). This suggests that in this sample, the women were more neurotic, open and agreeable than the men. Men were significantly higher in conscientiousness ($p<0.05$) than women.

Education played a significant role within the openness trait ($p<0.001$). The more educated the people were the more open they were, where those with the highest education had a much higher mean than the total population.

Neuroticism was higher in the older age cohorts ($p < 0.01$). Extraversion was significantly lower in the older groups ($p < 0.001$) where the age group four scored lowest on this trait. Openness was lower in the older groups ($p < 0.001$), the age group five was the lowest in the total population. Conscientiousness was significantly lower with age ($p<0.001$).

Internet non-users had lower mean scores on the personality traits E, O and C and higher mean scores on N, A, SOC and LSI-A.

From the Mann-Whitney U test, Internet use appeared to vary with the personality. Where the results were significant, namely with extraversion, openness and LSI-A, these were then included in the logistic regression analysis along with sex, education and age. Extraversion, openness and LSI-A do not influence Internet usage.

Overall no psycho-social factors influenced Internet use.

Study II

Extraversion and openness, which were influential traits from Study I in the chi-square test, were deemed important to investigate in Study II. They are traits which could possibly influence whether the older-adult would start to use the Internet within a period of 6 years. The data was paired as the sample, consisted of both SNAC-B baseline data (from 2001-2004) and follow-up data (2004-2010). In the six-year follow-up there was a total ($N= 848$). After six years there was an increase in Internet use of 7.7%. 65 older adults started to use the Internet as opposed to 444 who did not.

The chi-square tests showed that scoring higher on the traits extraversion and openness did not statistically influence the older-adults who started to use the use the Internet. Therefore, these were not used further in any of the analyses.

Study IV

The results in Study IV were based on a content analysis of the interviews. One of the four categories was *impression and views on tablet/Skype*. This was a category that indicated two aspects, both advantages and potential future use and those who put themselves more at a distance to the technology. Those that indicated the advantages discussed the tablet PC as something which increased quality of life, considering it a clear advantage working both as a stimulus and as therapy.

From the category *learning experience of the frail older-adult* many had constructive experiences, where learning to use the tablet and Skype was engaging and leading to them wanting to learn more. Many were surprised at their own abilities, increasing interest in using these technologies more and also to learn more. Others just had a positive and fun experience. Some frail older-adults really had a sense of relief on two levels with the tablet use. One was that they claimed they finally understood what it was that others (grandchildren/children) were talking about with applications, Internet and tablet computers. The second was that the tablet PC was used as a sense of relief to divert their attention from their pain from one of the chronic illnesses, or if they could not sleep at night. Five out of the 15 cases clearly had an increase in well-being due to going online through the tablet PC.

Table: 2 PSYCHO-SOCIAL DETERMINANTS AFFECTING INTERNET USE

	Study I	**Study II**	**Study IV**
Sample	SNAC- B baseline =1406 ten age cohorts: 60-96 years of age	SNAC- B baseline =1406 & follow up= 848 ten age cohorts: 60-96 years of age	Äldrelots project N= 15 ages 69- 92
Variables	FFM, SOC, LSI-A	Openness, Extraversion with starting to use the Internet	Feelings and experience of use of tablet computer and Skype
Methods	Mann Whitney, Logistic regression	chi-square test	Interviews Content analysis
Results	significant from Mann Whitney: O, E and LSI-A with Internet Usage Logistic regression then showed no significant relationship between those psychosocial variables	no significant relationship between O & E and starting to use the Internet	2 Categories: impressions and views on tablet/Skype: increase well-being and working like therapy learning experience of the frail older adult: increase well-being

Abbreviations: FFM: five factor model: C: conscientiousness; N: Neuroticism; O: Openness; A: Agreeableness; E: Extraversion; SOC: Sense of Coherence; LSI-A: Life Satisfaction Index A. SNAC-B: Swedish National Study on Aging and Care- Blekinge.

Socio-demographic Determinants

Study I

This Study based on the sample of SNAC-B, had more females (N=727) than males (N=524) and more people in the younger age groups (60 – 84 years old) than in the older ones (87- 96 years old).

The chi-square tests revealed no significant differences in males and females using the internet. Higher educated individuals used the Internet the most. As age increased the percentage of Internet users decreased. Investigating the five age groups more specifically, the age groups one ($p<0.001$), two ($p<0.01$), three ($p<0.001$) and four ($p<0.001$), played a statistically significant role in Internet usage.

Age and education were analysed using a bivariate Spearman correlation and were highly significant ($p<0.001$) and inversely related.

The logistic regression investigated how sex, education, age, extraversion, openness and life satisfaction were related to Internet usage. Sex was not related to Internet usage at all. Those with middle education (who had at least finished secondary school) used the Internet more (OR= 3.215, $p<0.001$) than those with lower education. The higher educated used the Internet the most (OR=6.027, $p<0.001$), compared with the lower educated. In addition, low age was related to Internet usage (OR=1.080, $p<0.001$).

Study II

This sample consisted of both SNAC-B baseline data (from 2001-2004) and its follow-up data (2004-2010). The results that are presented are based on the pairing of the data. In the six-year follow-up there was a total N= 848.

The chi-square test indicated that males in significant numbers starting to use the Internet more often than females ($p < 0.05$); and those who were between the ages 60 and 80 ($p < 0.001$) started to use the Internet more often than those aged 81-96 years. Functional disability, household economy and education did not significantly relate to change in Internet usage.

The Spearman correlation test revealed small correlations between variables, yet all correlations between variables were 25% and under, therefore it appeared to be no problem with multicollinearity, as the correlations did not affect the standard error.

The variables that were univariately related to change in Internet use, cognition (will be mentioned more in the health determinant section), sex and age, were put into a logistic

regression analysis. Change in Internet use was observed within the total sample, with the three covariates. It shows how higher scores in cognition (OR= 1.379***; CI (1.137- 1.673)), being male (OR= 1.759*; CI (1.022- 3.029)), and lower in age (OR= 11.279***; CI (2.701- 47.104)), influenced the older-adult to start to use the Internet. Cognition and age were the stronger predictors in the equation of older-adults' Internet usage, compared to being male. However, lower in age showed an eleven times more likelihood of using the Internet.
A second regression analysis was done stepwise selecting only the younger older-adults, since they were more active Internet users. Scoring higher on cognition (OR= 1.363**; CI (1.122- 1.656)), influenced change in Internet usage by 36 %. Thereafter, when adding the first covariate, both cognition (OR = 1.371**; CI (1.126 -1.669)) and being male (OR = 1.768*; CI (1.016 -3.075)), significantly influenced whether younger older-adults begin to use the Internet. The last model shows that when adding age as a covariate, cognition was still significant yet not as much as before (OR= 1.252*; CI (1.024- 1.530)), sex fell out and age influenced Internet usage (OR=1.192***; CI (1.124- 1.264)). Being male no longer influenced Internet usage in the younger older-adults like it did with the oldest older-adults. Age was still significant yet not as strong a factor influencing Internet usage in the younger older-adults.

Study III

Three logistic regressions were conducted. The first investigated Internet use throughout Sweden, showing that older-adults used the Internet two times more if they were living in urban settings compared to smaller towns and rural areas (OR= 2.500; $p < 0.001$). The VIF and tolerance statistic were calculated and showed no multicollinearity. The C statistic for the model was quite low (0.61), which indicated that there are probably other confounders affecting Internet use and that it is not only a question of the size of the community in which one lives.
The second logistic regression confirmed this. All the socio-demographic variables were included in the logistic regression equation, as well as cognitive functioning (health determinant). The results indicated that all variables, except household economy, significantly increased Internet usage: being male (OR= 1.143; $p < 0.05$), more highly educated (OR= 1.762; $p < 0.001$), living with someone (OR= 1.784; $p < 0.001$), normal cognitive functioning (OR = 1.222; $p < 0.001$), lower in age (OR = 1.118; $p < 0.001$) and living in an urban environment – living within two km to a healthcare centre/shop (OR = 1.576; $p < 0.001$).

The C-statistic of 0.834 showed strong discrimination between variables suggesting that the model is good. The VIF was around 1 and the tolerance was above 0.10 for each variable.
The third logistic regression analysis conducted, investigated whether the participant lived more than two km to a healthcare centre /shop (*rural* living), and those who used the Internet contrary to those who did not. All six independent variables were investigated. The final model showed that higher education (OR= 1.368; $p < 0.05$) and lower age (OR=1.108; $p < 0.001$) were factors which made rural older-adults use the Internet. The c-statistic was 0.786, which indicates a reasonable model and there was no multicollinearity between variables as seen with the VIF close to 1 and the tolerance above 0.10.
In the fourth logistic regression analysis only urban Internet use was studied. This was based on the *urban* variable created (living within two km of a shop/ healthcare centre). Similarly all six independent variables were investigated with urban Internet use. The final model showed that more highly educated (OR= 1.813; $p <0.001$), living with someone (OR=1.860; $p < 0.001$), normal cognition (OR= 1.233; $p < 0.001$) and lower age (OR= 1.119; $p < 0.001$), were significant for the final logistic equation. Higher education and living with someone are almost twice as strong predictors of Internet use among older-adults in an urban environment. The model itself is good, with a c-statistic above 0.8.

Study IV

The results in Study IV did not specifically reveal differences in gender, education or whether they were living with someone or not. Yet these factors were also not specifically investigated in that Study (IV). All the participants in the study were living in rural areas. There were three socio-demographic determinants that emerged from the content analysis: cost, living alone/with someone and age.

From the category *Impressions and opinions on the tablet PC & Skype,* some frail older-adults felt that the cost was definitely an influential factor which would be a decisive factor in whether they would be using this technology after the try-out period. Others felt that this would only be a good ICT tool to have if they were living alone. This is a different finding from Study III, where the older-adults living with someone were the ones using the Internet significantly more than those living alone.
From the categories *Impressions and opinions on the tablet PC & Skype, and the learning experience of the frail older-adult,* it became clear that age was a strong factor in their way of using the tablet and Skype as well as their experience of use. Some claimed that the older

generation was just not as interested as younger people, where this was not for them at all; it was nice to try but they were not really interested. Some were not interested in emailing or messaging; they would much rather talk to the person face-to-face.

Age was also expressed through the category *Knowledge of ICT*, where the frail older-adults claimed that they did not get a computer because they were too old.

Table: 3 SOCIO-DEMOGRAPHIC DETERMINANTS AFFECTING INTERNET USE

	Study I	**Study II**	**Study III**	**Study IV**
Sample	SNAC- B baseline =1406 & follow up= 848, ten age cohorts: 60-96 years of age	SNAC- B baseline =1406 & follow up= 848, ten age cohorts: 60-96 years of age	SNAC- all baseline N= 7181, ages 59-100	Äldrelots project N= 15, ages 69-92
Variables	sex, age, education	Age, education, sex, Household economy	Rural & urban living (2 definitions), Living alone/not, sex, age, education, household economy	Feelings and experience of use of tablet computer and Skype
Methods	Mann-Whitney U, Kruskal Wallis, chi-square, logistic regression, Spearman rho	Chi-square test, Logistic regression	Logistic regression, C statistic, VIF	Interviews, Content analysis
Results	Edu. High: (OR= 6.087; p<0.001), Lower age: (OR=1.080, p< 0.001)	First regression: Normal cognition: (OR: 1,379; p < 0.001), **Being male (OR: 1,795; p < 0.05)**, Age (OR: 11.279; p<0.001); Second regression just with lower age groups (60-80 years old): cognition (OR: 1.252; p= 0.05) **age (OR: 1.192; p<0.001)**	urban* use two times more: **(OR: 2.656; p< 0.001)**; Older-adults use Internet if: male, highly educated, living with someone, normal cognition, low in age and urban living ; urban living (2km)**: highly educated, (OR: 1.813; p <0.001), living with someone(OR: 1.860; p <0.001), normal cognition (OR: 1.233; p <0.001) and lower in age (OR: 1.119; p <0.001); Rural living: highly educated (OR: 1.368; p <0.05), lower in age (OR: 1.108; p< 0.001)	3 Categories: learning experience of the frail older-adult (older generation not so keen); impressions and views on tablet/Skype (Cost influencing whether they would purchase a tablet, age influenced use, living alone); Knowledge of ICT: age influenced

SNAC-B: Swedish National Study on Aging and Care- Blekinge; Education high: some form of higher education; OR: odds ratios; significance set at p value ≤ 0.05;
Urban*: Big city Sweden (Malmö & Stockholm); Urban ** having less than 2 km to a healthcare centre; rural: having more than 2 km to a healthcare centre

Health determinants

IADL was used as a possible confounding factor in Study II, where it seemed an important factor to investigate whether someone would start to use the Internet or not. This was not a significant factor in the univariate analyses thus it was not pursued further.
Cognition was measured in both Studies II & III. Normal cognitive functioning does influence whether older-adults start to use the Internet (Study II) and also as seen in Study III, it is an influential factor where almost 20% more people with normal cognitive functioning are more likely to be using the Internet throughout Sweden. Furthermore, specifically if the older-adults were urban living and had normal cognitive functioning, this was a predictor in Internet use.

Study IV

The category *actual use*, contained partly problems encountered by the frail older-adult due to health. In five of the total 15 cases, the older-adults were in fact too weak and ill to be spending time learning the tablet PC and Skype. Some older-adults were too sick to learn. Difficulties with eyesight and reading text on the tablet were frequently mentioned. On the other hand, a Parkinson's patient was quite optimistic about the tablet, stating that whether it was the computer or tablet PC, he used one finger to type.

The category *learning experience of the frail older-adult*, had a section describing what it was to be part of the older generation, indicating how they needed more time to learn than someone else. Often it was a question of the older-adult needing more repetition as they were slower to understand due to the decrease in short-term memory retention with age. However, this is linked with both changing cognition and increasing age. Some commented on the fact that they needed to remember how to use it as it was not so evident for them. Some older-adults only ended up using the tablet PC and Skype with their CM. They would forget to log onto Skype, and actually found the whole process a bit strange.

Table: 4 HEALTH DETERMINANTS AFFECTING INTERNET USE

	Study II	**Study III**	**Study IV**
Sample	SNAC- B baseline =1406 & follow up= 848 ten age cohorts: 60-96 years of age	SNAC- all baseline N= 7181 ages 59-100 Rural & urban living (2 definitions)	Äldrelots project N= 15 ages 69- 92
Variables	Cognition ADL	Living alone/not, sex, age education, household economy	Feelings and experience of use of tablet computer and skype
Methods	Chi square test	Logistic regression C statistic, VIF	Interviews Content analysis
Results	**ADL not significant** **Normal cognition (OR: 1,379; p < 0.001)**, Being male (OR: 1,795; p < 0.05) Age (OR: 11.279; p<0.001) **cognition (OR: 1.252; p= 0.05)** age (OR: 1.192; p<0.001)	older adults use Internet if: male, more highly educated, living with someone, **normal cognitive functioning (OR: 1.222; p<0.001),** lower in age and living in an urban environment Those living urban and using the Internet: highly educated, living with someone, **normal cognition (OR: 1.233; p< 0.001)** and lower in age	2 Categories: Actual use (too weak to learn, difficulties seeing) learning experience of the frail older adult: (takes more time to learn, forgetting to use it)

OR: odds ratios; significance set at p value ≤ 0.05; Normal cognitive functioning between mean 27 ≤ score ≤ 30 (top score); I-ADL: Instruments assisted daily living

DISCUSSION

Results Discussion

The findings in this thesis are that the grey digital divide is still present today. There was only a 7.7% increase in use of the Internet by older-adults between the years 2004 and 2010, with some socio-demographic and health barriers affecting usage. Psycho-social determinants did not affect usage, however, by using the Internet well-being increased for a certain number of frail older-adults.

Investigating whether psycho-social factors affected older-adults' Internet usage was a different approach compared to other studies. Previous research has investigated the impact ICT has on older-adults, but the Study I investigated this the other way around, trying to provide a comprehensive view on psycho-social determinants and Internet use. Personality traits, SOC and life satisfaction, however, did not influence Internet use in older-adults. Older-adults are not evident users of the Internet, which could mean that online behaviour (usage or non-usage) maybe cannot be determined by personality traits. It is even debatable how much personality can be linked to Internet use (Correa et al., 2010; Ross et al., 2009). Perhaps it would be necessary to investigate more specific uses and online behaviour of older-adults to find patterns with personality traits. For example, a recent study indicated that older-adults who had personalities that made them open to experience, would explore different functions on smart phones and tablet technology (Zhou et al., 2013). The results in this thesis, however, indicated that an older-adults' personality trait was not correlated with Internet use, and scoring high on openness or extraversion were not related to starting to use the Internet over a period of six years.

Study I indicated that SOC was not such a strong measure for the selected population and that scoring high on SOC did not affect Internet use. It may, however, be that SOC could be increased by using the Internet, where being able to manage and cope with daily life and activities certainly could be strengthened by Internet use and Internet devices. In a study conducted on later-life computer learners, the results indicated that older-adults had a sense of being, belonging and becoming by incorporating ICT into their lives (Russell, 2011). There is a potential that by learning to use the Internet and feeling more included, even if it is on a basic level, that the components of SOC will increase.

Learning and seeing the potential of what the Internet was all about, increased the well-being of the older-adults in Study IV. They understood and felt part of the digital world; many claimed that it was such a stimulus and they experienced a huge sense of relief, even using the tablet PC like therapy. Many had a positive experience, creating a desire to learn more as they were also surprised at their own abilities. Understanding and using the Internet, was a strong trigger for some and made them consider purchasing a tablet PC. Previous research found that ownership of an ICT device for example, changes the attitude of older-adults where before that they did not see the benefits of the Internet nor felt any need for it (Wright, 2012). It should be noted that some frail older-adults from Study IV, felt that the Internet was not interesting. It is possible that this was correlated with higher in age, or feeling too weak to learn but such conclusions cannot be drawn from the content analysis. This suggests that an increase in well-being is individually based, which confirms earlier studies that indicated that it is unclear as to whether Internet use enhances well-being in older-adults (Xie, 2003). From Study I, it was found that LSI-A did not affect Internet use.

Age was throughout all studies a very strong indicator as to whether Internet was used or whether a person would start to use the Internet. With increasing age, there is less Internet use. The physical, psychological and social impacts on growing old are most likely the reasons why there is a negative relationship with aging and Internet use. The physical element has been discussed in research, where motoric malfunctions and cognitive declines are often reported as determinants, which need to be taken into account especially when designing for the older adult (Coleman, Gibson, Hanson, Bobrowicz, & McKay, 2010). Not being able to understand or grasp the rapid changes in technology will lead to people just avoiding those changes, or at least, not engage with them. Psychological and social aspects have also been investigated by others where Internet use has been correlated with a reduction in depression (Cotten, Ford, Ford, & Hale, 2012) and an increase in social contact through websites and emails (Milligan & Passey, 2011).

However, what is often neglected is the physical decline, which also impacts the person socially and psychologically. A more holistic approach to investigating Internet use by older-adults is, therefore, a suggestion. Solutions requiring Internet use by older-adults would benefit from focusing on supporting them along the three combined elements of aging: psychological, physical and social; catering more to the complexity of aging may lead to stronger interest by the older-adult. For example, understanding how an older person in fact uses a substitute such as a physical newspaper rather than an online version which can be read with a magnifying glass on a Tablet PC (Zhou et al., 2013). What is it that this person is not

enjoying with the technology? Is it just a question of habit or are there underlying factors such as a feeling of being a failure in misusing the technology? Could this then be remedied through a combined solution?

Education was an influencing factor on Internet use in the cross-sectional Studies I & III. A recent study investigating low-income homebound older-adults, found that those who had lower education had less money in their pension years making cost an influential factor in getting a computer and going online (Choi & Dinitto, 2013b). The study claimed that 16% discontinued using the Internet due to the cost and disability. What is interesting, however, is that in the longitudinal Study II, whether an older-adult would start to use the Internet was not linked at all with education. That variable fell out, which could suggest that today the social impact could have more to do with adopting the Internet rather than socio-demographic variables. A study on trends on the diffusion of Internet indicated that exposure was one of the most prominent factors in using and continuing using the Internet, as well as the diffusion process being social rather than individualistic (Kim, 2011).

As seen from Study III, there are two different profiles of Internet users whether they live urban or rural areas. The results showed that twice as many people used the Internet in urban areas. These people also lived with someone, were higher educated, younger and had normal cognitive functioning. The older-adults living rurally used the Internet if they were younger and higher educated. These findings are important to take into account for telemedicine, which promises better access to health care in rural areas, especially when resources of specialised doctors are needed.

IADL was not an influential factor in whether the older-adults would start to use the Internet or not. This is also confirmed in a recent cross-sectional study (Choi & Dinitto, 2013a), where the authors found that IADL impairments did not affect Internet use; whereas a person diagnosed with Alzheimer's disease (or other form of dementia) significantly lowered the chances of being an Internet user. This is similar to what was found in Studies II, III and IV. Normal cognitive functioning was necessary for starting to use the Internet, for using the Internet and especially if they were living in an urban setting. The fact that IADL was not a factor affecting whether one started to use the Internet in a period of six years, could be due to the sample used in Study II, which was taken from a mid-size town and rural Sweden; according to Study III, only education and age are factors, which influence Internet use in rural areas. However, IADL impairments refer to cleaning, preparing meals, doing laundry and grocery shopping. That some debilitation does not affect Internet use, can be seen as a

positive finding suggesting that the older-adult could learn and make use of the Internet especially in order to help or support any IADL impairment.

Including frail older-adults is rare when investigating new technology. They were also not represented in the Studies I-III, as they were part of the drop-out rates. Therefore, it was a strength to have them as participants in Study IV. From the results, being frail does affect an older-adults' use of the Internet. This gives an indication into the realistic possibilities of having these elderly look up health information online with the aim to increase their health. Research has suggested that looking up health information online will provide a mental and social support integrated in medical needs (Gattoni & Tenzek, 2010). The aim could be to achieve better health in old age, by gaining an understanding into the problem or condition. Yet if the older adult is too ill or frail, learning or using the Internet and Internet devices are not feasible.

Normal cognitive functioning was a strong factor, showing both correlational and causal relationships with Internet use (Studies II & III). Cognitive decline is difficult to investigate separately from age. An interesting aspect with the new aging society is that we are placing demands on older people to keep learning and staying active, where in fact the physical possibilities are not the same making learning new tasks more difficult.

It would, therefore, be beneficial to have a support system for older-adults when using the Internet or Internet devices. Some of the main findings of Study IV, were that the older-adults take more time to learn, needed more repetition and if the environment is not supportive (having someone to contact and speak with if something goes wrong), there will be less usage. A recent study created a very nice environment for older-adults to adopt new tablet technology, which they called socio-technical systems (Waycott et al., 2012). They provided some alternative facilitative elements which in turn helped the older-adults engage more; these were, for example, including the caregiver, having regular face-to-face social meetings with other learners and providing a support system through multiple communication methods (such as telephone or email).

Some suggest that involving younger people in the learning process, having intergenerational learning and working, would widen the e-Inclusion (Milligan & Passey, 2011). Having a positive experience provided by high quality training (with no ageist attitudes) could facilitate learning. It is important for the older-adult not to feel patronised; learning from a younger person can therefore be difficult. A good pedagogical approach adapted to teaching the older-adult is essential; the older-adult may then have it easier to establish trust in their own competence and in the technology itself. Other research has emphasised the importance of

older-adults feeling comfortable with new technology in order to adopt it (Heart & Kalderon, 2011).

The formal and informal caregivers are also important to consider in Internet use. If they are comfortable with ICT solutions, this can contribute to convince and ease the older-adult into using the Internet more. A recent study found that the impact children have on older-adults' use of technology is much bigger than expected (Fausset, Harley, Farmer, & Fain, 2013). This means that teaching the caregivers to be confident with new Internet solutions is equally important. Other studies have discussed that barriers within healthcare and telemedicine is often the lack of training of the healthcare provider in using the technology (Gattoni & Tenzek, 2010), which in turn makes it extremely difficult to then pass this on as a viable solution to an older-adult. The healthcare professionals are key actors in promoting the use of the technology.

When considering the older-adults as Internet users, the rapidly changing ICT environment must be kept in mind. The older-adults need to understand how the Internet really can fit into their lives (Coleman et al., 2010). By explaining and demonstrating ways to use the Internet, it may come across as more than just another good invention and something that could be really useful. Creating senior friendly content and having not only one design in ICT are ways to make older-adults see the benefits of use.

The rapid movement in technology needs to also be grounded in healthcare. New innovative ideas in tele-medicine have many barriers as implementing technological solutions and abiding to privacy laws (as patient information is involved), have more hurdles than expected. As it is today there is a discrepancy between the data they provide and the correct service responding to the monitoring (Brownsell, Bradley, Blackburn, Cardinaux, & Hawley, 2011). New working methods are needed, professional resistance needs to be dissipated and old working structures in healthcare need to be remodelled (Nilsson, Hofflander, Eriksén, & Borg, 2012). Setting up valuable solutions, such as having access to one's health care records and communicating more with healthcare providers through tele-conferencing, could improve the patient engagement in treatment and increase control over what happens to them (Choi & Dinitto, 2013b). These solutions may trigger an interest in older-adults to learn the Internet, but the barriers need to first be dealt with in healthcare.

Finally, ICT that functions well to begin with and with a clear understanding how it can benefit the user is important. Often older-adults tend to inherit older equipment passed down from children (Hanson, 2010), and they may not take the quickest Internet connection as it is also more expensive. The tablet PC was for some frail older-adults easy to learn and use, and

previous ICT experience was not necessary for using the tablet computer (Study IV). Touchscreen devices have been noted to reduce the performance gap of older-adults relative to traditional desktop setups (Findlater, Froehlich, Fattal, Wobbrock, & Dastyar, 2013). It is possible that ICT tools for self-management of health, and social support, could be facilitated if touchscreens are used. This also suggests that the digital divide could partly be associated with specific technologies rather than all Internet uses and practices (Milligan & Passey, 2011).

Methodological considerations

An important factor in research is to be solid in the use of methods so as to reach valid results. Some of the weaknesses and strengths of the results in this thesis are therefore addressed and evaluated in the quantitative data (Studies I-III), through reliability, internal, external, construct and statistical conclusion validity. For the qualitative data (Study IV) the trustworthiness of the data , namely the credibility, dependability and conformability (Guba & Lincoln, 1982), were assessed.

Reliability

Reliability often refers to the consistency of the measure, both within and over time (Rosnow & Rosenthal, 2005). The reliability of a study depends on whether an appropriate research design was chosen.

Two of the studies were cross-sectional, therefore, the dependability of the answers to the questionnaires are important to verify, as these cannot be verified through time. These can be measured by the Cronbach alpha. This was done for the internal reliability for the SOC, Life satisfaction and the FFM scale. A satisfactory alpha consists of a number between 0.7- 0.9 (Streiner & Norman, 1995). The Cronbach alpha in Study I was high for the FFM: 0.925 (and for each individual component: N 0.912; E 0.904; O 0.912; A 0.907; C 0.905). The Cronbach alpha for LSI-A was 0.87. However, the SOC had a low Cronbach α: 0.649, implying low internal consistency. This suggests that further investigation is needed in this psychometric measurement. It could be that the shortened scale may in fact not adequately capture the complexity of the three components for an aged population. It is not clear whether conducting a separate Cronbach's alpha on each component — manageability, meaningfulness and comprehensibility — would give a stronger indication as to what the SOC is measuring. Usually, however, is not recommended, as scoring high on one component and lower on another in fact may tend to balance themselves out in the scale (Antonovsky, 1993).

In Studies I-III logistic regressions were used. In Studies (I-II) a stepwise logistic regression was used, which is usually a method used for exploring data, establishing statistical inferences and creating models that are sometimes over-optimistic (Kirkwood & Sterne, 2003). However, the variables selected as independent variables were carefully chosen, and only those that were associated significantly with Internet use ($p< 0.05$) were entered. In addition, the samples in Studies I-II were quite large: in Study I (N= 1402) and Study II follow-up (N= 848). This could reduce the likelihood of misinterpretation, and in turn make the results more generalisable. The sample in Study III (7181), follows the same logic.

Study III used a backward logistic regression where at first all variables are included, leading to a final model with the significant variables. The C statistic was used in all the four regressions in Study III. It is an indication as to whether there is strong discrimination between variables (outstanding discrimination ≥ 0.9), so as to verify if the selected variables are in fact strongly affecting Internet use in older-adults or not. The results in Study III were in fact that rural or urban living was not enough to determine whether the older-adult was using the Internet or not, hence a reason to add other variables in the logistic equation.

Validity

Validity investigates how well the research design measures what it purports to measure (Rosnow & Rosenthal, 2005).

Internal validity refers to the extent to which the intervention or independent variables, rule out or makes it implausible that there are other explanations for the existing results (Kazdin, 2003).

A selection of variables was made within each study, which was believed to have a possible impact on Internet use. This was based on the literature of previous research conducted. However, this was also progressive from one study to the next, where possible confounders were discussed and then selected. From Study I for example, health seemed to be an important confounder to include. Incorporating this in Study II, led thereafter to investigating living location, which was included in Study III (rural or urban living). There are certainly other influential variables, such as access to the Internet or available support, which were not measured in this thesis.

The timing of measurement is important to take into consideration. This is a typical threat to internal validity. Administering the same questionnaires, at two different points in time, will most likely impact some results. History and maturation are two effects referring to the external and internal conditions occurring that can impact the results. Events that occur in daily lives may have an impact on how the respondent answers his or her questions. From the moment the person receives the questionnaire in the home to when they are being interviewed by a health care professional, may influence the answers. Maturation, which involves a person getting older, becoming more frail or ill, can have a strong impact on how they answer the questionnaires. In the longitudinal Study (II), the results evaluate the same number of people after a six-year gap. The answers to some questions may in fact differ, and have an indirect impact on the results. Yet it is important to note that due to the Study being anonymous and

following ethical guidelines, it would not be possible to specifically evaluate one person's change. Therefore, in turn it is also hard to evaluate how much internal validity is threatened through history and maturation.

Another threat to internal validity is attrition. This refers to the loss of subjects from a study, including those who do not respond, that die or who no longer want to participate (Kazdin, 2003). In Study II, from baseline to follow-up there were fewer respondents. This was due to censoring or death, which are normal happenings when studying older people in population-based studies. In Study I & III, there were 1/3 of the people who did not respond. The non-respondents were the frail older-adults, the older women and the oldest older-adults. The results may, therefore, not reflect and grasp the total population of older-adults, which could mean that the results are underrepresenting the number of older-adults that are not using the Internet.

There was one self-reported measures in Study I, namely LSI-A. This had no impact on Internet use. However, self-ratings could bias the results. Respondents may respond in a "socially desirable manner" which either over-or underestimates the answers (Rosnow & Rosenthal, 2005) and in turn may not be consistent over time linking back to maturation.

Threats to *external validity* are concerned with how much the results are generalisable beyond the sample, settings and conditions of the study. Furthermore, what is known as the reactive assessment, could be a factor affecting external validity as the older-adults feel, know and possibly behave in a certain way when they know they are being assessed (Kazdin, 2003). Partly, this is managed through the data collection process, which was done carefully, in different settings at times, and by different people. This was an attempt to create the most neutral environment possible. In the samples for the Studies I-III, they were randomly selected as representative of Swedish older-adults. This minimises the threat to external validity. Yet, in order to make this more generalisable to a broader world-wide population, comparative studies are needed. It may reflect a Western and European older-adult, as other national studies show similar results when it comes to age being a strong factor in Internet use.

Construct validity verifies what a test really is assessing, verifying the hypothetical linking of the independent and dependent variables (Rosnow & Rosenthal, 2005). Constructs are needed in research to have connections with what is being manipulated and done with theory so as to establish what is causing the effect and why (Kazdin, 2003). Therefore, a clear description of how the method is conducted is important.

The data collection in Studies I-III, was made via structured interviews and questionnaires, which were answered either in the person's home or in the research centre. The order of the questions and examinations shifted so as to minimise the risk of threatening the data collection procedure (Kazdin, 2003). Furthermore, the cleaning of the data suggested a quality assurance in the researcher's impact on the outcome. Before merging questionnaires from the different SNAC sites, in Study III, for example, cleaning and recoding was done so as to avoid any mistakes in the analyses. Meticulous attention was placed on pairing the longitudinal data from baseline and follow-up in Study II.

The selected variables were analysed and verified with *statistical conclusion validity*, which refers to the quantitative evaluations made that influence the conclusions reached (Kazdin, 2003). The tests were selected carefully to be able to answer to the research questions. The significance level was set at $p < 0.05$ in all studies, meaning that for each test the probability of falsely rejecting the null hypothesis (Type I error) was only 5%. The benefit of reporting the p-value is to indicate the role of chance on the observed effect. Yet in addition to that the confidence intervals (CI) were reported so as to verify the magnitude of the covariance. The CI provide an account of the interval in which the covariate falls, indicating that there is a 95 % chance that every sample collected would be within that interval (Field, 2005). The failure to reject a null hypothesis when it is false (type II error) was handled by including a large sample (especially Study III) and by increasing the precision of measurement (Kirkwood & Sterne, 2003) by merging of response alternatives for individual variables into more grouped analyses. This can be found in the Studies (I-III) with the age cohorts being reduced from ten groups to five (Study I) or two (Study II) groups; cognition being dichotomised at a cut-off point and personality traits E & O being dichotomised at their mode.

In order to increase statistical conclusion validity, correlations between variables need to be handled. The Spearman rho was calculated in Studies I-II, investigating any correlations between variables before plugging them into the logistic regression; numbers below 30 percent between variables confirm no multicollinearity. The VIF was calculated in Study III, where scores close to 1 verify that there is no multicollinearity.

Trustworthiness

An effort was made to ensure the trustworthiness of the data in Study IV. There are four criteria for establishing trustworthiness of qualitative data (Guba & Lincoln, 1982): credibility, transferability, dependability and confirmability.

Credibility

The credibility in qualitative studies involves several aspects: the entire preparation of the study, how it was conducted and finally how well it demonstrates the credibility of the findings (Graneheim & Lundman, 2004) – the truth of the data.

During the interviews, many questions remained rather closed, where the researcher was not able to open up the conversation with enough introductory or probing questions. This would have made the older-adult talk more and get a better flow in the interview. Another issue in the questioning were the leading questions, which in essence annulated some of the answers and were therefore not included in the analysis. It is possible that many responses from the older-adult were closed off by a false dichotomy (Kvale & Brinkman, 2009), was excluding a range of answers. Having said that, however, the author was clearly aware that the interview technique skewed the results in certain ways and that was tackled accordingly by excluding those answers in the analyses.

Transferability

Transferability can only be judged by the reader (Graneheim & Lundman, 2004). The selected population in this study was based on the CMs choice. The group itself can be considered heterogeneous; it was selected both purposefully and randomly. The purposeful selection may not influence the results in a negative way. If an older-adult had not been interested in using the tablet at all, there would not have been any possible results for the interview. The aim was to see what the older-adults thought of the tablet and its application; hence, the older-adults needed to try them out. It is, therefore, arguable whether there was selection bias.

The CM was present during the interviews, and even if briefed beforehand to be quiet, many interviews became group discussions. These dynamics may have distracted and influenced the answers of the older-adults due to the presence of the third person. Different personas affect the interview itself just by being present. The study would have to be conducted again in order to see whether the answers would be different in another setting, without the CM present.

Dependability

The criterion of dependability refers to the stability of the data (Polit & Beck, 2008) and can be tested through the systematic analysis. Careful attention was placed on understanding how to proceed and create a systematic analysis method in the research; choosing what could be included and keeping to the aim of the study. A coding frame was created, where units of data

were extracted and grouped into sub-categories, which thereafter were grouped into a mutually exclusive category (Graneheim & Lundman, 2004; Schreier, 2012). The aspect of time increased the dependability in this study, going back to the results of the analysis after a few days and still finding that the categories of the results were solid and functioning in the analysis. This felt like a strength of this study.

Confirmability

Discussing the categories with other members of the research team, added to the confirmability of the results found in this study. It took several rounds of discussion to arrive at agreements, where code names were changed and worked through. The categories have a number of quotations selected to back up the credibility of each category presented (Graneheim & Lundman, 2004).

CONCLUSIONS

The implications in this thesis are that the Internet and its devices are a solution for older-adults. From a gerontechnological perspective, the Internet can potentially play a part in allowing to age in place, where an older-adult can live at home as long as possible by compensating for age-related declines. Other applications are, for example, in preventing age-related decline, or facilitating participation in the digital economy and society.

However, the results of Studies I-IV indicate that the grey digital divide still creates differences in Internet use today. By conducting both qualitative and quantitative studies, a comprehensive view of this was obtained. There was only a 7.7% increase of Internet use by older-adults in six years (2004-2010). Older-adults who lived alone, were older in age, lived in a rural setting, were lower educated and with poor cognitive functioning were not Internet users. Two different profiles of older-adult Internet users were found, depending on whether they lived rurally or in an urban area. Well-being increased for some of the frail older-adults when they used the tablet PC and connected to the Internet, however psycho-social determinants did not affect Internet use.

As seen from the results of this thesis, there is still only a meagre intersection between technology and aging, where a number of elderly that are still ostracised from the digital society. This gap indicates that older-adults are not able to access many online services: governmental, healthcare websites, commercial and social media. A problem is the discrepancy between the fast developing technology and the users. Many older-adults see the potential of the Internet, for example, being connected online so they can speak with their grandchildren and follow them in the language and social manner of their grandchildren, (websites, applications, social media, etc.) (Nägle & Schmidt, 2012). Yet beyond that the benefits of using the Internet for an older person may still be unclear.

An effort in finding a digital appropriateness for older-adults may provide a change in the digital trend (Milligan & Passey, 2011). The understanding is that one needs to support the access to and use of the Internet for older people, by making it something they want to and see the point of using. The results in this thesis indicated that touchscreen devices were considered straightforward and easy to learn for older-adults; this could be a start.

If one wants to provide Internet solutions in healthcare for example then the socio-demographic and health determinants should be tackled. This combined with alternative solutions such as having “technical mediators” or a case manager helping, may be worth

investigating in future research. A support system could help trigger the older-adults' interest and facilitate their use of ICT.

FUTURE RESEARCH

Many e-health solutions are investigating their value from a health or a cost-effectiveness perspective. Having more qualitative studies, including the older-adults in the process and listening to their perspective is important. The oldest-old and frail older-adults should be included more in technological studies. They can then provide feedback from a user perspective and become acquainted with the technology. They are large consumers of healthcare; if ICT solutions are offered it will be important for the older-adults to understand the advantages this technology can offer, and less easily dismiss it.

Comparative studies, of mixed design, are important to provide confirmation (or not) of the gerneralisability of the findings. It would be valuable to place this research more within a European and Worldwide context.

Evaluating the well-being of the frail older-adults with a quantitative instrument, measuring the actual increase in well-being and by how many, could lead to alternative possibilities in use and other technology developments.

Future research should focus on building support platforms. It would be worth verifying if technical support increases trust in, and use of technology. The potential to increase independence and autonomy for the older-adult should also be emphasised. Lastly, good access to the Internet and easy to use devices, such as touchscreens, are important to provide (setting up government policies).

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Summary in Swedish/Svensk sammanfattning

Den demografiska förändringen kräver nya sätt att hantera samhällsstrukturer. De äldre i kommer i framtiden att utgöra en allt större andel av befolkningen jämfört med yngre grupper som är aktiva i arbetslivet. Detta innebär till exempel att det inom hälso-och sjukvård är nödvändigt med nya strukturer och metoder för att ge vård av god kvalitet.

Informations och kommunikationsteknik (IKT) (detta inkluderar Internet och Internet-enheter), upprätthålla goda möjligheter för den åldrande befolkningen att delta aktivt i samhällslivet. IKT är ett sätt att ersätta arbetskraft, och kan göra arbetet mer effektivt. IKT kan bidra till att skapa arbetstillfällen för äldre människor, som kan vara fysiskt mindre krävande som i sin tur kan få dem att delta i arbetslivet längre. IKT kan också bidra till att man har en bättre kontroll och övervakning av sin egen hälsa till exempel genom att leta upp och få upplysningar om sin hälsa via nätet.

Europeiska kommissionen har betonat vikten av ett aktivt åldrande som ett sätt att leva bättre under de senare levnadsåren. Detta innebär delvis att se till att äldre människor är anslutna och använder Internet, så att de blir en del av Internetsamhället.

Internet kan bidra till att öka sociala nätverk, vilket kan leda till välmående under de senare livsåren. Det har även ett värde, då äldre människor kan använda Internet för att kompensera för åldersrelaterade begränsningar. Men äldre vänjer sig vid Internet långsammare. Med stigande ålder finns det mindre Internetanvändare i synnerhet, i åldrarna 75 och uppåt.

Tidigare forskning har visat att många äldre inte anpassar sig på grund av bristande intresse eller att de inte ser nyttan av att lära sig att använda Internet. Många äldre människor saknar ekonomiska resurser för ny teknik som de är osäkra på hur man använder (och varför de överhuvudtaget borde använda det). Lägre utbildning, ålder, ensamboende, lägre kognitiv funktion och boende på landsbygd har satts i samband med mindre användning av Internet. Annan forskning, har tittat på fördelarna med Internet för äldre, till exempel ökad livstillfredsställelse. Nyare forskning har tittat på olika typer av spel som ett sätt att öka den kognitiva funktionen hos äldre människor.

Det främsta syftet med avhandlingen har varit att undersöka faktorer som påverkar Internet och IT-användning hos de äldre. Ett urval av psykosociala, sociodemografiska och hälsofaktorer undersöktes i samband med användandet av Internet. Intervjuer utfördes också med äldre för att få en fördjupad förståelse och insikt i vilka dessa faktorer skulle kunna vara. Fyra studier genomfördes. Studierna I- III, bestod av urval tagna från den svenska nationella

studien om åldrande och omsorg (SNAC). Detta är en longitudinell multicenter kohortstudie från fyra regioner runt om i Sverige, som inleddes (2001-2004) och pågår under de kommande trettio åren (Lagergren et al., 2004). Olika enkäter och intervjuer används för att undersöka psykisk och fysisk hälsa, åldersfördelning, kön, upplevd livskvalitet samt social och välfärdsstatus hos gruppen äldre. Testerna genomförs vart sjätte år i de yngre åldrarna (60-77 år) och vart tredje år från och med 78 års ålder (på grund av de upplevda psykiska och fysiskiska snabbare förändringarna hos den gruppen).

SNAC är en studie som har som mål att utöka kunskapen om vad den medicinska och funktionella statusen för äldre är, liksom deras behov av sociala och medicinska tjänster och identifiera eventuella brister i vården. Studierna I- II, har använt material från Blekinge, där studie I totalt har N = 1406 personer. Studie II, omfattade totalt N = 848 personer (grupp med sex års uppföljning). Studie III använde ett urval av N = 7181 personer från alla fyra undersökningsområdena som ingår i Sverige: Nordanstig, Skåne, Blekinge och Kungsholmen. Studie IV, använde ett urval av sköra äldre som ingick i projektet: Äldres Bästa i Blekinge och som ägde rum mellan 2010-2013. Projektet gav en Äldrelots till varje multi-sjuka äldre. Dessa äldre valdes in i Äldrelots projektet baserat på antalet intagningar på sjukhus under det senaste året (i Blekinge är det ca 490 svårt sjuka personer baserat på att 18 % av befolkningen är över 65). En lots tilldelades därefter till den äldre för tiden som projektet varade. En del av projektet innebar en test av användandet av en tablettdator (iPad / Android) och en kommunikationsapp, som ett sätt att kommunicera mellan lotsen och de äldre. 19 tablettdatorer fanns tillgängliga för projektet och delades ut under en testperiod på sex månader. Lotsen valde själva ut vilken äldre som skulle få prova denna nya teknik.

Studie I undersökte tio åldersgrupper (60-96 år) om följande potentiella faktorer påverkade de äldres Internetanvändning: Personlighetsdrag (neuroticism, öppenhet, extraversion, vänlighet och samvetsgrannhet), känsla av sammanhang, livstillfredställelse, ålder, utbildning och kön. Resultaten från denna studie visade att höga värden på vissa personlighetsdrag, god livstillfredsställelse och stark känsla av sammanhang inte visade några kopplingar till äldres Internetanvändning. Endast högre utbildning och lägre ålder var faktorer som påverkar äldres Internetanvändning.

Studie II undersökte tio åldersgrupper (60-96 år) vid två olika tillfällen (2004 och 2010). De faktorer som ålder, utbildning, kön, öppenhet, extraversion, hushållens ekonomi, kognitiv funktion och funktionshinder, undersöktes med förändring i användningen av Internet, speciellt om dessa faktorer bidrog till att de äldre börjat använda Internet under en sexårsperiod. Mycket få äldre började använda Internet: det var bara en ökad användning av

7,7 %. De faktorer som påverkade att börja använda Internet var yngre ålder, att vara man, och ha normal kognitiv funktion. Väljs bara den yngre åldersgruppen (åldrarna 60-80), var kön inte längre en påverkande faktor, men däremot var normal kognition och ålder påverkande faktorer om de började använda Internet.

Studie III undersökte internetanvändning av äldre i hela Sverige. Landsbygden (Nordanstig och Osby) jämfördes med medelstora städer (Karlskrona, Eslöv, Ystad och Hässleholm) och storstäder (Malmö och Stockholm). Det fanns två gånger fler internetanvändare i städer jämfört med landsbygden Sverige. Det visade sig att det inte var en tillräckligt förklarande modell med enbart landbygd och stad som påverkande faktorer på äldres Internetanvändning, därför undersöktes andra faktorer. Låg ålder, högre utbildning, att vara man, att bo med någon, att bo i en stad, att ha normal kognitiv funktion visade också starka samband med Internet användning.

En annan definition av stad och landsbygd användes också. Äldre som bor inom 2 km till en vårdcentral (stad) jämfört med de som bor längre bort än 2 km till en vårdcentral (landsbygd), hade två olika profiler. Äldre som lever i stadsmiljö använder Internet om de är yngre i ålder, högre utbildade, har normal kognitiv funktion och lever med någon. De äldre som lever i en lantlig miljö använder Internet om de är yngre och har högre utbildning.

Studie IV undersökte de multi-sjuka äldre's känslor och erfarenheter vid användningen av en tablettdator och Skype. 15 personer intervjuades i sina hem. Vid dataanalyserna framkom att det var med blandade känslor som de multi-sjuka äldre använde tablettdator och Skype. Många tyckte det var verkligen fantastiskt men några var fortfarande inte säkra på att det var något de kunde ha nytta av. Dessutom efterfrågades ett mycket starkare stödnätverk för att underlätta användningen av tablettdatorn. Slutligen är felfri teknik det som behövs, speciellt när användarna inte är tekniskt kunniga.

Resultaten från de fyra studierna, visar att det inte är psykosociala faktorerna som är avgörande för att inverka på huruvida de äldre använder Internet. Höga poäng på öppenhet och extraversion ger heller inga indikatorer på huruvida den äldre kommer att börja använda Internet. Man fann dock att välbefinnande ökade genom anslutning till Internet och med hjälp av en Tablettdator och Skype.

Att vara yngre i ålder var en mycket stark faktor i alla fyra studier om huruvida den äldre skulle använda Internet. Högre utbildning påverkade användningen av Internet, men det var inte en inflytelserik faktor för att börja använda Internet efter en period av sex år. Att bo med någon inverkade om de äldre använde Internet. Att bo på landsbygd eller stadsmiljö tydde på olika faktorer som påverkade de äldres internet användning. Funktionshinder och

hushållsekonomin påverkade inte användningen av Internet, vilket kan ses som ett positivt resultat.
Slutligen var hälsofaktorerna vid användningen av Internet ganska starka. Normal kognitiv funktion är en påverkande faktor i användningen av Internet hos äldre, och det var av signifikant betydelse om de skulle börja använda Internet. Dessutom använde den äldre som bodde i stadsmiljö sig av Internet om de hade normal kognitiv funktion. Det noterades också från studie IV att lära sig att använda tablettdator och Skype tog längre tid för äldre människor, och mer repetition behövdes. Att vara skör var också en stark faktor om huruvida den äldre skulle använda Internet; om de var för sjuka ville de inte lära sig eller ens försöka använda sig av tekniken.

Konsekvenserna av dessa resultat är att följande faktorer är indikatorer på icke-användning av IKT hos äldre: högre ålder, lägre utbildade, lever ensamma eller bor på landsbygden, lägre kognition och sköra. Bor den äldre på landsbygden eller i städerna finns det två olika profiler av internetanvändare. Detta ger till exempel en vårdgivare budskapet att användningen av Internet inte är given. För att en äldre person då till exempel skulle kunna ha fjärrövervakning hemma behövs en utbildning av den äldre personen i Internetanvändning. En lösning skulle vara skapandet av en stödplattform där äldre skulle kunna få hjälp att lära sig använda Internet och med ett stödsystem så att de vid behov kan få hjälp med tekniska frågor. Andra alternativa åtgärder kan vara att ha en person anställts som förmedlare för de tekniska behoven hos de äldre.
Det är viktigt att inkludera de äldre, i allt som rör Internet och kommunikation. Internet är inte bara ett generationsproblem utan en del av samhället idag och därför bör inte de äldre lämnas utanför. Tekniska framsteg sker snabbt och det blir mer och mer av ett behov för äldre att använda Internet även om deras syfte och mängden av användning kommer att skilja sig från yngre vuxna. Med detta sagt är många innovativa lösningar inte på plats ännu och det finns fortfarande en klyfta mellan de nya tekniska lösningar som tillhandahålls och en fungerande praktisk tillämpning. Det innebär att det fortfarande finns möjligheter att direkt hjälpa och utbilda äldre i att använda de IKT-lösningar som har utvecklas.

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ABSTRACT

The aim of the thesis was to investigate factors influencing ICT use by older-adults. A selection of psycho-social, socio-demographic and health determinants were investigated with Internet use. Data were collected through questionnaires (Studies I-III) and interviews (Study IV).

Univariate and multivariate analyses were conducted, investigating Internet use as a dichotomous variable, with the aforementioned factors. The results indicated that psycho-social determinants did not affect older-adults' Internet use (Study I). Scoring higher on the personality traits openness and extraversion did not affect whether the older-adults started to use the Internet (Study II). However, well-being increased for some frail older-adults when using the tablet computer and connected to the Internet (Study IV).

Some socio-demographic determinants affected Internet use. Being younger in age was a strong contributing factor in all four studies whether the older-adult would use the Internet. Higher education influenced Internet use (Study I & III), correlated with living in a rural or urban setting (Study III); yet education was not influencing whether they would start to use the Internet. Living alone was correlated with Internet use, especially if the older-adult lived in an urban setting (Study III). Functional disability and household economy did not affect Internet use.

Finally, the health determinants on Internet use were quite strong. Normal cognitive functioning influenced whether older-adults would start to use the Internet (Study II). The older-adult living in an urban environment, would use the Internet if they had normal cognitive functioning (Study III). It was noted also from Study IV that learning to use the Tablet PC and Skype took longer for older people and more repetition was needed. Being frail was a strong factor whether the older-adult would use the Internet. They would not want to learn or try to use the technology if they were too ill (Study IV).

The findings show only a small increase (7.7%) in Internet use by older-adults over time. The indicators of non-use are: higher in age, lower educated, living alone or rurally, lower cognition and frailty. There are two different profiles of rural and urban Internet users. These determinants along with an understanding of the use of technology and a good support system, are a few pillars in ICT adoption by older-adults. As ICT continues to develop as a means to provide better healthcare, it will be important to take into account the abovementioned indicators. In certain cases Internet use is not a given, which continues to exclude older-adults. Part of healthy aging is social participation; therefore, being connected and included in the digital society is important. Alternative and not only one design solutions should be explored in healthcare and by organisations, so as to cater to the heterogeneity of the aging population.

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