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**E-Health information seeking behavior of older Finnish
adults from the value-based care point of view**

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Abstract

Health information seeking behavior is a widely discussed topic in the field of information studies. However, the current study is about observing and evaluating the efficiency of health information seeking behavior through E-Health service and devices. The main reason that motivated the researcher to carry out the current research was high cost of healthcare services in Finland. It is expected that health information obtained through electronic or online sources would help people to improve their health conditions. Therefore, this thesis is an empirical study on observing E-Health information seeking behavior and evaluating the efficiency of E-Health service and devices. In order to estimate the efficiency of E-Health service and products, this study considered some criteria generated by previous studies. These criteria were employed in the current study as indicators of the health information seeking efficiency.

The current study developed a customized model of health information seeking behavior based on the general model of information seeking behavior. The model contains some further criteria to measure the efficiency of the information seeking process. The primary tool to collect data were a multiple-choice questionnaire. The questionnaires were distributed through two main methods, namely hard copy and online. The participants in this study were either Finnish older adults who were over 50 years old, or other persons who were responsible for providing health information for them.

The results of this study show that using E-Health service and products has neither a positive effect on improving the health condition of patients, nor does it motivate people to a healthier lifestyle, or make them feel more satisfied. However, it is expected that the results provide a framework for further studies to develop more efficient E-Health-related tools and services.

Keywords: Health information seeking behavior, older Finnish adults, E-Health services and devices

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1 Introduction

1.1 Area of research

Nowadays, countries have to deal with an aging population with numerous health-related needs. However, they have a limited capacity to provide healthcare facilities for the escalating demands of an aging population (Ahern, Kreslake, & Phalen, 2006). It should also be mentioned that Finland is considered as a country in which the population is widely spread out. Therefore, the demographical conditions of the country cause a serious barrier which makes providing adequate healthcare services for all parts of the country difficult. Moreover, it is predicted that the aging population will soar from 17.5% in 2010 to 28.8% by 2060 (OSF, 2015).

Two main points must be taken into consideration in order to cope with the above-mentioned challenges of the healthcare system in Finland. On the one hand, the authorities need to provide appropriate health services and products for these aging inhabitants. On the other hand, the efficiency of these practices must be evaluated to improve the quality of obtained health information. In this case, E-Health¹ is supposed to provide a promising solution from both the above-mentioned points of views.

E-Health is considered as a practical solution to channel health information to the patients. The main idea is to enable people to have active control over their health and well-being via information technology-based services and products (Rockmann & Gewalt, 2015). These emerging interactive technologies, so-called “E-Health”, were developed with the aim of health improvement and perfection of healthcare services (Ahern, Kreslake, & Phalen, 2006).

The area of this study goes along with two main fields of studies, including health informatics and health information seeking behavior. From a health informatics points of view, it is about using information technology systematically regarding E-Health service and products for public health practices, studies, as well as learnings (Yasnoff et al., 2000). Moreover, investigating when and how older Finnish adults seek health information through E-Health facilities is directly relevant to health information seeking behavior models. Therefore, it is not only research about information technology, but also related to information behavior science.

¹ In this master's thesis, “E-health” is considered as health information obtained through any e-health services or products available for people.

Here, E-Health can include a broad range of services and products, from online health information seeking to personal digital assistants or any other sort of mobile devices. Although these are in the process of development, evidence shows that there are massive novel projects and investments all around the world to support these innovative healthcare solutions. It is important to mention that apart from developing new technologies to share more health information among beneficiaries, it is crucial to analyze the outcome of the process.

Tu et al. (2015) stated that Accountable Care Organizations (ACO) are a new notion in the healthcare system. The main idea of ACO is to provide healthcare and improve patients' healthcare situations, while their healthcare expenses are reduced significantly. Accountable Care Organizations (ACO) have a similar aim with E-Health services and products. Also, Muhlestein et al. (2013) identified reducing healthcare costs and improving healthcare quality as one of the main components of ACOs. The aim above for ACOs is significantly similar to the E-healthcare target. More information about ACOs and value-based care is provided in the second chapter.

It is expected that E-Health projects can offer more convenient access, significantly lower expenses, less time to spend, and providing customized healthcare services. Therefore, E-Health could play a vital role in providing high-quality health services for a society with a high rate of aging people who have various medical and health needs. These health-related issues are ranging from cognitive function problems to impairment disorders (Baker et al., 2000).

On one hand, the main challenge here is related to the health information, which needs to be channeled toward the patients via different E-Health facilities. In this case, the term "health information exchange" needs to be taken into consideration. Health information exchange means using information technologies, products and services to transfer health-related information among different participants, such as healthcare providers and patients.

The main idea of this health information exchange through electronic services and devices is to boost the efficiency of health information transferring. Moreover, using these products and services for health information exchange will reduce administrative expenses, and it helps healthcare providers to diagnose diseases more efficiently (Gordon, Bernard, Salzman, and Whitebird, 2015).

On the other hand, studying health seeking information behavior will provide valuable information for future E- healthcare advances by companies, authorities and

other related groups. Furthermore, the process of health information sharing through E-Health must be evaluated from the starting point to the outcome of using such services and the whole process.

1.2 The motivation of the thesis

There are many studies conducted on health information seeking behavior of patients, ranging from social supplies of health information (Ginman et al., 2003) to participatory E-Health behaviors (Chen & Lee, 2014). However, there are two issues which are not covered in this field:

On one hand, the main gap is created either by focusing on Internet-based health information seeking (Chong and Theng, 2004; Kules and Xie, 2011; Chen and Lee, 2014; Kelly, Ziebland, and Jenkinson, 2015) or non-internet based channels (Younger, 2010; Eriksson-Backa, 2010). However, E-Health products and services are not limited to online-based health information. There are other services and products, ranging from wearable devices to Telehealth (Telehealth is described in chapter two). On the other hand, due to high health expenditure in Finland per capita with the upward trend from 3097.8 to 3650.9 million euro from year 2000 to 2015 (OECD, 2017)², the efficiency and effectiveness of the healthcare system need to be assessed and investigated.

Therefore, two questions should be posed as: 1. Does health information obtained from via E-Health services and products has any positive effect on reduction of their health-related problems? 2. Does health information which is provided for the patients via E-Health service and products reduce expenses of treatment?

Finally, this study covers both the above-mentioned vital points in a small-scale research in order to shed light on these important aspects of the field.

Previous studies have pointed out some critical issues related to defining, developing and implementing of E-Health tools and services (Eysenbach, 2000; Della Mea, 2001; Oh et al., 2005; Pagliari et al., 2005; Karppi et al., 2012; Boogerd et al., 2015). Regarding E-health services and facilities, different groups of beneficiaries should be taken into consideration. The following figure presents their relationship from a health information point of view:

² <http://stats.oecd.org/Index.aspx?DataSetCode=SHA#>

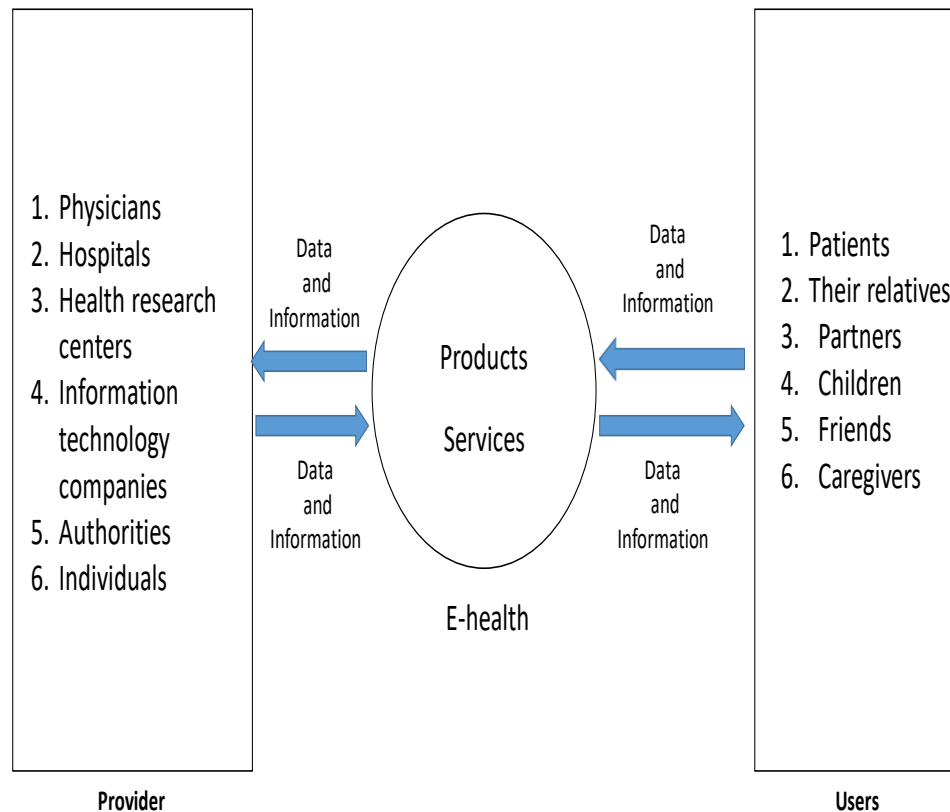


Figure 1 E-Health providers, services, and users (based on Karppi et al., 2012)

Figure 1 shows that E-Health information and data go in two directions, either from providers to patients or from patients to providers. Therefore, the information and data have a significant influence on efficiency and productivity of the E-Health system.

From older adults' point of view, this process will start when they need any kind of health information, and then it will be followed by searching different available sources or tools for related information. Health information seeking behavior is a hot topic in the healthcare field, and many researchers have conducted studies about it. This study concentrates on health information about any E-Health services and facilities that might be needed, searched, gathered, and used by older adults.

There are two most important factors that must be taken into consideration about E-Health information sharing. E-Health information sources, effectiveness and efficiency of E-Health information sharing are each considered a vital part of the system. Figure 2 shows the relationship between the factors above:

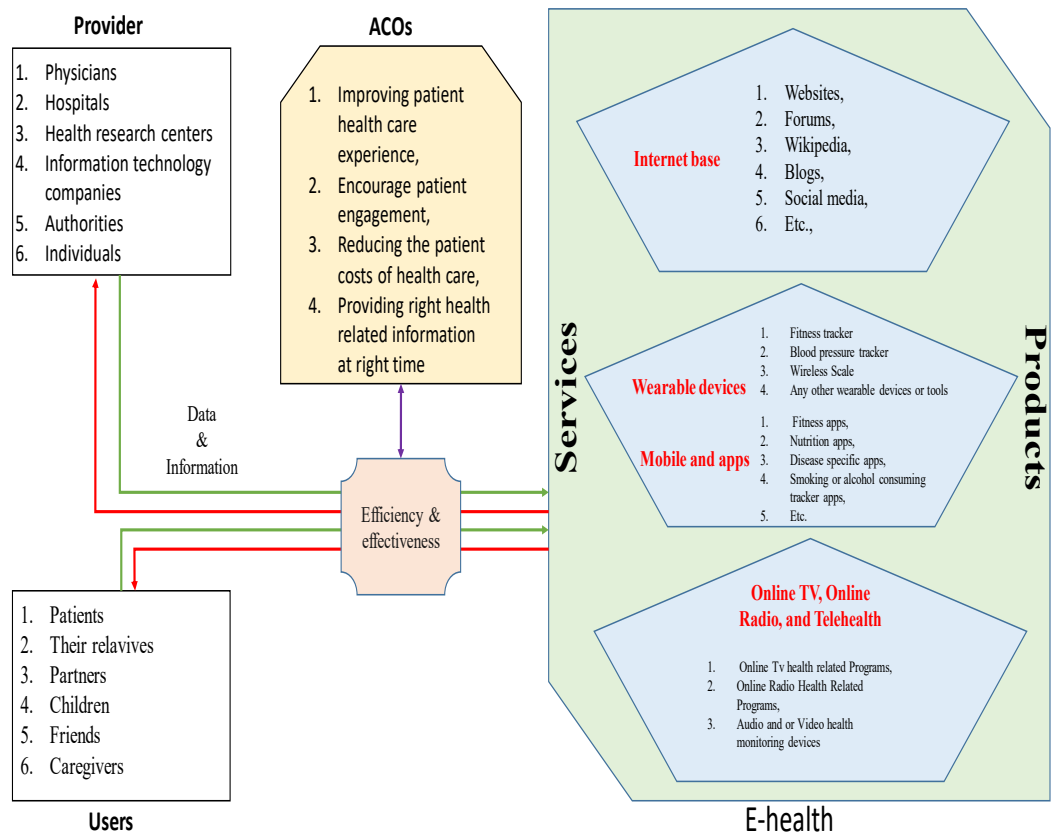


Figure 2 E-Health information seeking, sources, and investigating efficiency of the process (based on Karppi et al., 2012; and Tu et al., 2015)

The various E-Health products and services will be summarized and explained in the “E-Health products and services” section in Chapter 2.

1.3 The thesis model

As was mentioned earlier in the motivation of this section, it can be seen that health information is exchanged among various beneficiaries through E-Health services and products (Kaelber & Bates, 2007). Previous studies mention some key benefits of E-Health services such as “being more reliable”, “being less time consuming”, and they also provide a complete description of health information of patients’ medical history (Fontaine et al., 2010, Nissinen et al., 2016).

There might be some gaps between their received E-Health information and their real needs. Previous studies mention some key factors, such as gender differences (Fox, 2004), lack of support by information technology providers (Malinowsky, Nygård and Kottorp, 2014; Bujnowska-Fedak, 2014), sensitizing towards information technology (Männikkö-Barbutiu, 2002), content of information (Eriksson-Backa, Holmberg and Ek, 2016), ability to make use of web-based information (Chong & Theng, 2004), participatory E-Health behavior (Chen & Lee, 2014), trust to health information privacy

and accuracy (Eriksson-Backa, 2013), and lack of using library staff and even the library as a reliable health information source (Eriksson-Backa, 2010).

The model of this study is developed based on a health information seeking model and value-based care model. Figure 3 shows the model of the current study. More information about all factors are described in chapter two. However, in the following parts, the variables which are related to this model based on value-based care are displayed

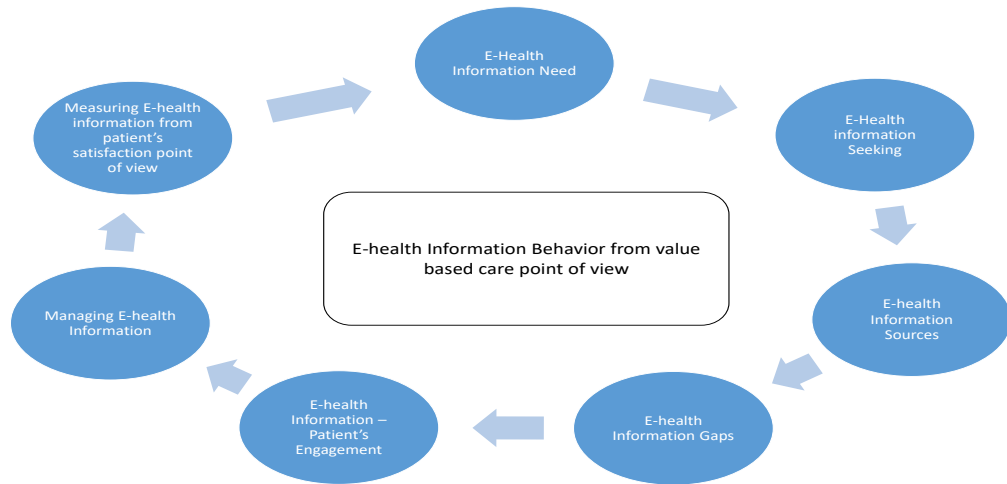


Figure 3 E-Health information behavior from a value-based care point of view

From an information behavior and information exchange point of view, the study takes factors such as gender, support by information technology providers, ability to make use of web-based information and trust into consideration. These important elements were considered in designing the questionnaire of the current study.

Braunstein (2016) mentions several factors, such as stratify risks³, engagement of patients, and managing care as other steps for analyzing ACOs. Therefore, they need to prioritize urgent treatment for patients to prevent the worst outcomes (Just, 2014). However, stratify risks factors, which are defined as prioritizing patients based on their health condition to high, moderate, and low health risk, are not taken into consideration in this study (Colorado Beacon Consortium, 2013).

According to Tran et al. (2014), factors such as demographic, social, mental and physical health conditions and administrative data of health service encounters must be taken into consideration to identify patients at the risk of self-harm behavior. The current

³ Stratify risks are related to patients who are at high risk and serious health challenges such as amputation, blindness or death (Braunstein, 2016).

research does not aim to address these factors. They need to be investigated from both patients and providers' perspectives, which are outside the scope of this study.

Moreover, patients who actively manage to gather health-related information of their health conditions are shown to have a better clinical outcome than those who are inactive regarding managing or collecting their health-related information (Barello et al., 2015 a, b). Schwappach (2010) asserts that the patients' engagement plays a vital role in improving the quality of care and increasing patient safety.

However, there might be some factors which have a significant effect on the above-mentioned process. With respect to E-Health information, some factors might be linked with easy/hard to use (Rockmann, 2015; Chew and Yuquian, 2015), health/internet literacy (Kules & Xie, 2011; (Eriksson-Backa, Ek, Niemelä and Huotari, 2012), ethics and quality of care (Bodkin & Miaoulis, 2007), acceptance of the services or tools by healthcare professional or older adults (Sezgin & Yildirim, 2014), lack of education, language barrier, communication skills, as well as cultural differences (Dutta, 2009; Eriksson-Backa, 2010; Eriksson-Backa, 2008; Khan and Arif, 2014) and privacy or confidence issues (Palsdottir, 2012).

In addition, the studies imply that older adults are able to gather E-Health information for their health information needs through different available sources. These various sources can be categorised into: websites (Kelly, Ziebland, and Jenkinson, 2015), weblogs (Chung & Kim, 2008), portals and forums (Eriksson-Backa, 2003), wearable devices (like sports trackers) (Hyrkkänen & Myllymäki, 2012) and virtual visit tools or Telehealth (Karppi et al., 2012).

Furthermore, the last step according to a value-based care⁴ method will be evaluating the outcome of this process. Naidu (2009) indicated that quality of healthcare services affects patients' satisfaction. Moreover, quality of healthcare services is very difficult to measure (Naidu, 2009). The main challenge of measuring healthcare services quality is caused by its nature. The measurement of healthcare quality needs a multi-disciplinary approach and it needs to take both patients and experts' perspectives into consideration.

An accountable care organization can improve patient healthcare experience, it can encourage patients to become engaged in the process of treatment. It can reduce the costs of healthcare and provide the right health information at the right time (Tu et al.,

⁴ Value-based care method is explained more in chapter 2.

2015). This study takes these issues into consideration. Therefore, the criterion of an ACO is to have access to the right E-Health information at the right time, with the lowest expenses. It also helps older adults to make use of health information in their health decision-making.

1.4 The aim of the thesis

Providing health services, especially in a country like Finland in which the population is widely spread out through the country, is expensive for the authorities (The Organization for Economic Co-operation and Development (OECD), 2015). Providing high-quality health services is difficult for the country when the demographic conditions are considered as common barriers for health providers in different parts of the country. Therefore, E-Health could play a vital role for older adults who are in need of high-quality health services.

Table 1 shows the upward trend of health expenses per capita from 2006 to 2015 in Finland⁵.

Table 1 Health costs per capita in Finland (Source: Health expenditure and financing: Health spending indicators)

Health spending			Total, US dollars/capita, 2006 – 2015							
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Health expenses per capita	2,769	2,942	3,218	3,336	3,403	3,606	3,759	3,891	3,870	3,984

A large number of studies have been carried out on health information and E-Health technology, varying from “health information contents” (Eriksson-Backa, Holmberg & Ek. 2016) to “support for E-Health facilities” (Barakat et al. 2013; Bujnowska-Fedak & Pirogowicz. 2014; De Veer et al. 2015). However, the aim of this thesis is to investigate E-Health information behavior of older adults while it takes some points of value-based care into consideration.

The main questions of this study are as follows:

1. What kind of health information obtained through E-Health services and products might be needed by older adults?
2. What kinds of E-Health information sources might be used by older adults?
3. What kind of challenges might older adults face when they use health information obtained through E-Health services and products?
4. To what extent are older adults satisfied with using health information obtained through E-Health services and products?

⁵ <https://data.oecd.org/healthres/health-spending.htm>

The results of previous studies indicate that apart from older adults who are looking directly for their health information needs, their family members, relatives, and caregivers might also help them to gather the relevant health information (Männikkö-Barbutiu, 2002; Chung & Kim, 2008; Eriksson-Backa, 2008; Barry et al., 2011; Palsdottir, 2012; Karppi et al., 2012). Therefore, in the questionnaire, an option was considered for relatives or those who are responsible to take care of older adults healthcare.

1.4 Structure of the thesis

This study is organized as follows:

1. First, the review of literature is presented. Previous studies are categorized based on the research model. It will consist of the following subsections:
 - ✓ E-Health information seeking,
 - ✓ E-Health information using,
 - ✓ E-Health vs. E-Health services and products (generally and specifically available in Finland),
 - ✓ Accountable care organization,
 - ✓ Accountable care organization and E-Health,
 - ✓ Accountable care organization and value-based care,
 - ✓ E-Health information behavior,
 - ✓ E-Health information need,
 - ✓ Health information motivators,
2. Then, the method of the research is explained.
3. After that, the practical framework of the research and customization of the main model and limitations will be presented. This section also shows the specifications of the study group, and any probable constraints and changes of the main factors of the research.
4. The results of statistical analysis are presented in the “Analysis and interpretation of results” section and it will be followed by a “discussion section” which aims to reflect the results of the study into the research framework.

1.5 Limitation of the thesis work

The following are the limitations of the current study:

- 1- Due to the small scale of the research, the results cannot be generalized to include the total Finnish older people E-Health information needs and their seeking trends. However, the results might provide a framework for further studies.
- 2- According to the time and research scale, this study has not investigated the demographic factors of the population which were considered and discussed in the previous studies.
- 3- Distance to the healthcare centers as a factor which has a significant effect on the quality and quantity of the healthcare services was not considered in the research project too (Currie, Philip, and Roberts, 2015). The reason is mainly related to the scale of this study, and it was not possible to include such a factor in the questionnaire.
- 4- As the ethics and quality of care (Bodkin & Miaoulis, 2007) are getting along with privacy and confidence (Palsdottir, 2012), this research mainly concentrates on the confidentiality and trust of E-Health information. It is notable that there might be some differences among ethical aspects of E-Health services and products with the privacy of information.
- 5- The aim of the study is to evaluate the needs and expectations of older adults from health information obtained through E-Health services and products. To do so, the other influential parties, including doctors and nurses (Younger, 2010), healthcare professional knowledge (Barakat et al., 2013), governments, cities, and municipalities (Mackiewicz, Rasmunssen, and Vienonen, 2012) were not examined. Although the study might give some suggestions and feedbacks for the organizations involved, further studies are strongly recommended to find more accurate results to promote strategies.
- 6- To measure the outcome of E-Health information behavior and a value-based care model, it seems necessary to collect patients' and providers' opinions (Naidu, 2009). However, the present study has just concentrated on patients' perspectives regarding seeking E-Health information.

1.6 Summary of the first Chapter

In the first chapter, motivation, model, aim, structure and limitation of the research were discussed. The central area of the study was focused on the health information behavior of older Finnish adults and their information behavior towards electronic and internet-based health information, and the study also examined patients' needs, available sources, challenges, and the efficiency of services.

Moreover, chapter 1 presents a developed research model based on the general health information seeking model and value-based care method. Both model and method will be discussed in detail in the second chapter. It is expected that this model opens a new horizon to evaluate efficiency and productivity of modern health information sources and it is also expected that such a model provides enough health information for patients and others that might benefit. Moreover, the limitation and some primary challenges of the research are discussed in this chapter.

2 Theoretical frameworks

Nowadays, providing healthcare facilities for a variety of people who are living in different parts of a city, or even a country, is considered a big challenge all around the world. The reason behind this might be due to the limitation of financial and medical sources that can provide appropriate healthcare facilities for the residents. In this case, development in information technology provides the opportunity of having virtual or electronic health services and products to cover this gap. Therefore, this part of the thesis will address topics like the health information seeking behavior models, the definition of E-Health services and products, and other related issues. Moreover, this chapter presents the results of relevant previous studies.

2.1 Health information seeking models

In order to provide a better understanding of various health information seeking models, it is a good idea to know more about health information seeking behavior. Lalazaryan & Zare-Farashbandi (2014) described it as any patients' activities that are related to seeking, obtaining, and making use of health information either regarding illnesses or treatments. In this case, E-Health information seeking behavior could be defined as any patients' activities that are related to searching, gathering, and handling health information through available E-Health services or products for the issues mentioned above.

Johnson (1997) developed a comprehensive model for information seeking which is composed of three elements, including antecedents' factors, information carrier factors, as well as information seeking actions. In this model, antecedents' factors are including background factors and personal relevance factors. Moreover, Longo et al. (2010) argued that having active or passive behavior in process on health information seeking has a significant effect on patients' satisfaction.

Health information seeking models were developed to analyze patients' health information seeking behaviors (Lalazaryan & Zare-Farashbandi, 2014). The Models have ranged from stress, appraisal, and coping theory (Lazarus & Folkman, 1984) to an expanded model of health information seeking behaviors (Longo, 2010).

According to Wilson's model of information behavior, health information seeking behavior consists of five steps, as follows (Wilson, 1997):

1. **Health information need:** this step is considered as the initiator for E-Health information seeking behavior from a value-based care point of view.

2. **The motivation for information need and use:** the motivation might be related to coping or stress theory. Lazarus and Folkman (1984) described coping or stress theory as a daily process which enables people to cope with pressure situations. Therefore, they consider the stress caused by environment as a motivator for seeking more health information (Wilson, 1997).
3. **Intervening factors:** these factors are regarded as important elements of information behavior of individuals. These factors have varied from demographics (sex, age, marital status, health status, educational background, interest and awareness about healthcare, etc.) to information source characteristics. Moreover, Wilson (1997) argued that other motivators could be considered based on reward/risk theory as well as social learning theory.
4. **Information-seeking:** in this step, the actual information seeking happens. However, Wilson (1997) described people's reactions toward information seeking as passive attention, passive search, active search, and ongoing search.
5. **The last step is processing information and making use of it:** this step from a value-based care point of view is whether patients were able to obtain their needed health information and make use of it or not.

Among the aforementioned health information seeking models, Longo et al. (2001) provided a conceptual framework for patients' use of health information. Longo et al. (2001) considered four influential elements for the model: "context characteristics and personal", "non-hierarchical types of healthcare information", "using health information by considering the information types", and finally "measuring patients' outcomes". Figure 4 shows the aforementioned health information seeking model in detail.

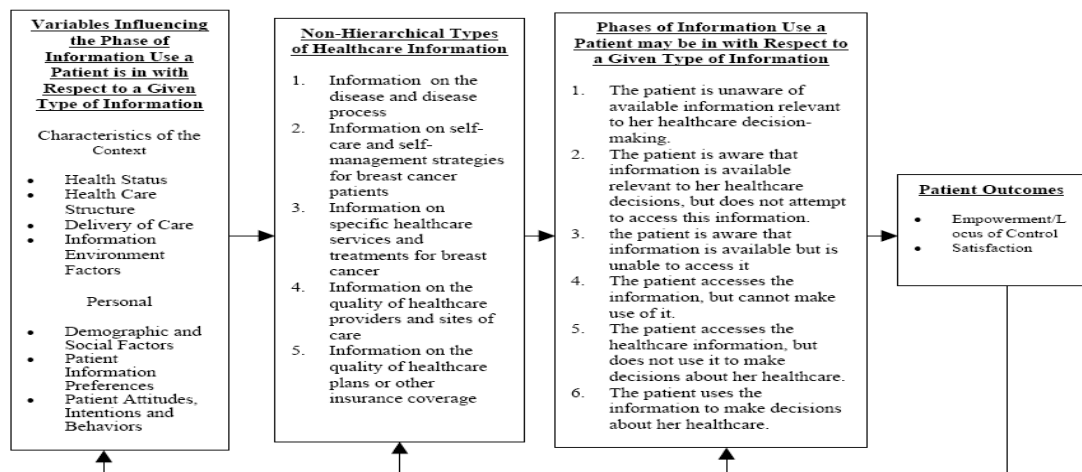


Figure 4. Conceptual framework for patients making use of healthcare information (Longo et al., 2001)

By juxtaposition of the components of study models shown in Figure 4 and Figure 5, Longo et al. (2001) provided the similar strategy from value-based care point of view and health information seeking behavior from the patient's perspective.

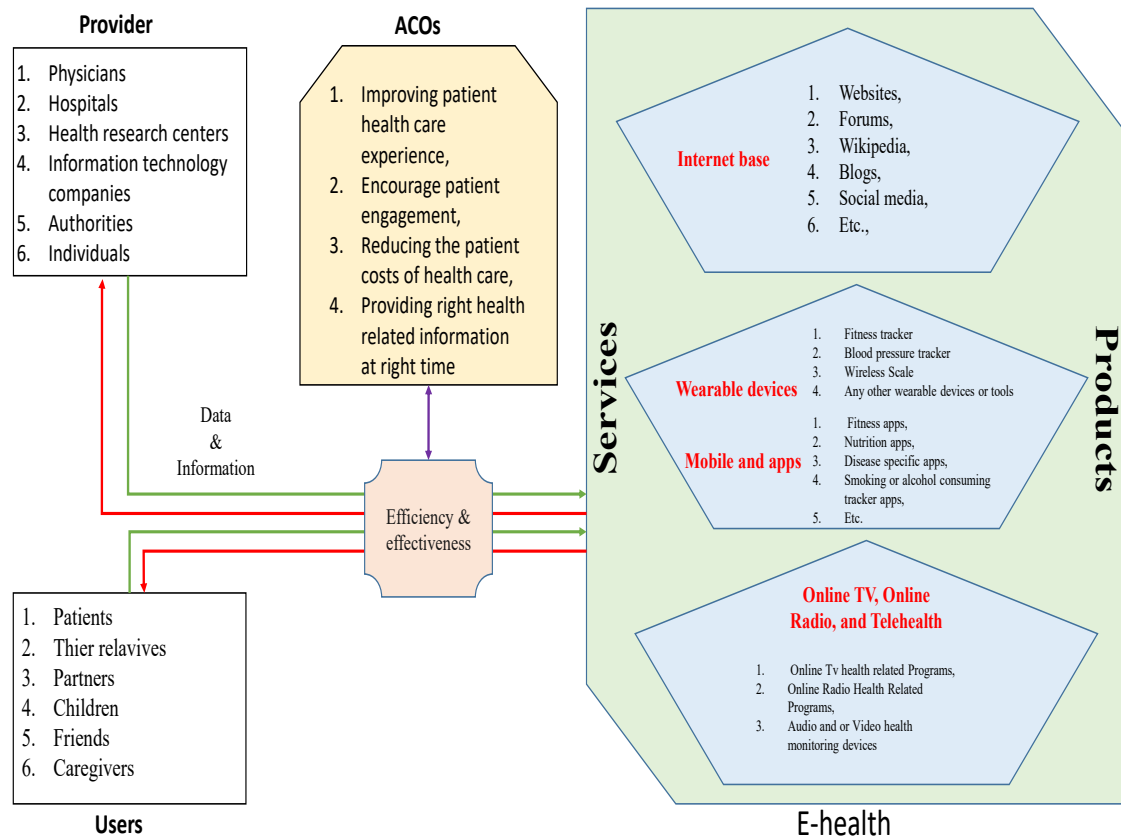


Figure 5 E-Health information seeking, sources, and investigating efficiency of the process (based on Karppi et al., 2012; and Tu et al., 2015)

Therefore, it is expected that the results of this study provide a comprehensive and valuable model for investigating patients E-Health information seeking behavior. There are some related terms for the aforementioned models which are needed to be covered, as follows:

- ✓ **Active or passive information seeking:** Passive information seeking strategy is not considered as an important observation, while active information seeking is important. Active information seeking is composed of asking health-related questions, observing the others, and seeking health-related information either in the form of printed or online materials (Johnson, 1997).
- ✓ **Information avoidance and the non-seeker:** Non-health information seekers are described as people who are less likely to approach other people and ask for health-related information support. Moreover, non-health information seekers do not feel

they need health information apart from that which is provided by healthcare professionals (Johnson, 1997).

Manfredi et al. (1993) added that non-health information seekers do not show a tendency to engage in any health-related decision-making activities. However, Manfredi et al. (1993) argued that health information seekers are willing to be involved more in health information seeking activities, their treatment process, as well as keeping their knowledge about medical information up-to-date. Furthermore, Treiman and Squiers (2005) mentioned that non-health information seekers might be able to turn to information seekers under particular circumstances.

- ✓ **Health anxiety:** Lucock and Morley (1996) considered two main reasons for health anxiety as health concerns in illness or health issues conditions, as well as the high probability of a health problem occurring. Owens et al. (2004) argued that this may cause a bias of concentrating on negative health information; therefore, health anxiety as an exaggeration of negative health information will happen.

2.2 Health information use

Based on the definition of using information by Joo (2007), using health information can be described as processing and utilizing of health information in order to meet patients' health information needs. Moreover, considering Eriksson-Backa's (2010) definition of health information literacy, using E-Health information can be defined as evaluating, understanding and making use of health-related information which is collected through E-Health products and services in the process of making appropriate health decisions.

Chung & Kim (2008), in their study, reported that elderly adults who suffer from cancer believe that blogging activity could be a remedy for their emotion management and health information sharing.

Previous studies about using three main social medias as means for healthcare communication showed that:

- a) **Facebook** plays a significant role in raising awareness, funding, as well as social support for concerns about various cancers (Bender et al., 2011).
- b) **Twitter** is mainly used by patients and healthcare professionals for increasing their health-related knowledge and exchanging health information about any specific health concerns (Antheunis et al., 2013).

- c) **LinkedIn** is used by healthcare experts as a communication means between colleagues and media for marketing their health-related services (Antheunis et al., 2013).

Eriksson-Backa, Ek, Niemelä, and Huotari (2012) pointed out that the motivation factor plays a significant role in enabling elderly adults to make use of health information. Thus, the factors can be categorized as interest, seeking activities, as well as self-rated health. Moreover, they add that being more active in seeking for health-related information means the person is more confident in his/her own skills.

Kim & Park (2012), and Sun et al. (2013) explain four factors including performance expectancy, effort expectancy, social influence, as well as facilities conditions which have significant effects on the intention of the user to employ health information. Table 2 presents a definition of the factors mentioned above.

Table 2 Influential factors on personal intention to make use of health information (Kim & Park (2012), and Sun et al. (2013))

Factor	Definition
Performance expectancy	<ul style="list-style-type: none"> It is described as the degree of individual beliefs that using health information or healthcare system will help them to cope with their health problems (Kim & Park, 2012; Sun et al., 2013). It is good to mention that according to McCormick (2014), the degree of ability to making use of health information might be under the influence of religious or spiritual beliefs of patients.
Effort expectancy	The degree of using health-related information easily is considered as effort expectancy (Kim & Park, 2012; Sun et al., 2013).
Social influence	<ul style="list-style-type: none"> It is related to the personal understanding of the importance of other people beliefs on his health information or healthcare use (Kim & Park, 2012; Sun et al., 2013). According to Johnson (1997), interpersonal health information ways including face to face, or conversational communication with friends, family or healthcare professionals have a significant influence on patients' health information seeking or using activities.
Facilities conditions	The efficiency of Internet which is identified as a catalyzer for using E-Health services or products (Kim & Park, 2012; Sun et al., 2013).

2.3 E-Health and E-Health products and services

Eysenbach (2000) described E-Health as any health services or information that can be oriented or enhanced via the internet and related information technologies. Moreover, he argued that E-Health has three dimensions which are called, “medical informatics”, “public health”, and “business”. Furthermore, Della Mea (2001) added that E-Health has a significant relationship with commerce and economics.

With this regard, information technology will play the role of mediator. They are responsible for providing required information technology systems and facilities. They help to gather and transfer health-related information among patients and healthcare providers. Consequently, health providers would be able to provide better healthcare for particular remote areas and rural regions, as well as for a whole country or even for the whole world (Boogerd et al., 2015).

Several researchers pointed out that there is a lack of a clear and uniform comprehensive definition of E-Health and its related terms (Oh et al., 2005; Pagliari et al., 2005). To investigate this problem, Pagliari et al. (2005) conducted a comprehensive review of the definition of E-Health. They mentioned that most of the previous definitions of E-Health have just concentrated on the functional scope of it instead of any specific applications of E-Health facilities.

Pagliari et al. (2005) revised the definition of E-Health offered by Eysenbach (2000) and provided a more accurate description of E-Health. They defined it as “an emerging field related to medical informatics by which the internet and related technologies organize and deliver health services and information” (p 9).

Moreover, Pagliari et al. (2005) argue that E-Health is not only about a technical development, but also provides a new method of working out health information. Furthermore, it changes patients’ attitudes, communications, and ways of thinking. There are various E-Health products and services available in the healthcare markets. E-Health products and services are ranging from electronic health record devices to healthcare information systems. Figure 6 represents various categories of E-Health products and services which are mentioned in different studies.

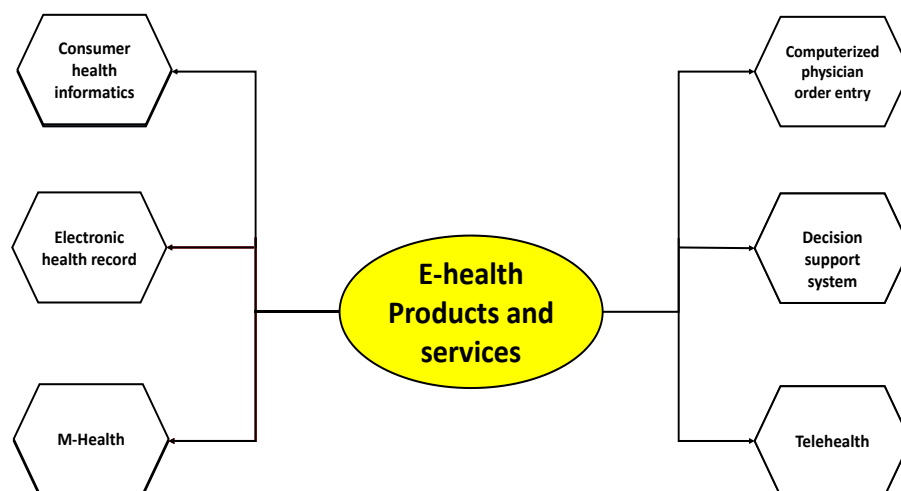


Figure 6. E-Health products and services

In order to better understand the advantages and disadvantages of E-Health products and services, the following parts will define and explain each of them:

Consumer health informatics

Consumer health informatics is defined as a process of analyzing patients' health information needs, developing a new way of sharing the required health information, as well as developing new models for future improvement in medical information systems (Eysenbach, 2000, p1713). It is expected that the final products of these services facilitate managing, sharing, and controlling health information through these current E-Health services (Zayas-Cabán & Dixon, 2010).

One example of such services, which was developed in Finland, is called health kiosks. Wunker (2013) mentioned that a modern health kiosk could provide a broad range of health-related services from a simple measuring of weight or height, to vision testing. Patients can connect to healthcare professionals via live video conferences to receive medical assistant. Figure 5 shows an actual health kiosk.



Figure 7. Health kiosk (KIOSK Information Systems, 2017⁶)

Although some of these services, such as Ylöjärvi health kiosk and Lahti health kiosk, are available in different cities in Finland, they are not very popular. Finnish health kiosks can provide different health information, and medical examinations; however, practically there is no evidence that they are successful in action (Sarolahti, 2009; www.sitra.fi).

⁶ <http://kiosk.com/market-solutions/healthcare-kiosk>

Electronic health record (EHR)

The electronic health record is considered as an electronic tool for gathering health information and data from different origins (Hoerbst & Ammenwerth, 2010). Electronic medical records systems are available in Finland as a platform called “Kanta” (Bos, 2006). National data system services for healthcare services, pharmacies and citizens are responsible for keeping the maintenance of the system for citizens (Kansallinen Terveysarkisto, 2016). Linder et al. (2007) mentioned that electronic health record has the ability to provide a sustainable improvement in the quality of medical care for patients. It is expected that this system will organize and save health information about patients’ medical and health history in which healthcare providers and users can easily access them through information technology services and devices (Finla Työterveys Oy, 2016).

Mobile Health (m-Health)

Mobile health provides health information regarding monitoring and sharing through various mobile-based devices and applications (Kay, Santos, and Takane, 2011). There are no specific categories for these mobile health applications and devices, however, they have a broad range of simple fitness tracker devices and alcohol consuming mobile tracker apps (Liu et al., 2011; Ventola, 2014). Healthy Kuopio Health Account is one of the health applications developed in Finland. The primary use of this application is to collect and manage health information of patients (Holopainen, 2015). Table 3 shows the most common m-Health applications:

Table 3. The most common m-Health applications

Title	Comment
Medical ID	A mobile application which records patients’ emergency contacts and health information, like birth date, height, and blood type.
Disease-specific apps	Mobile applications for tracking or monitoring healthy diet or similar reasons based on a particular illness
Eye tester apps	Testing eyes and vision quality
Medical educational apps	Mobile applications allow users to keep their knowledge updated with healthcare news, disease, and other related information
Fitness apps	Mobile applications for maintaining a fitness regimen and a healthy diet
Health mobile vault (Microsoft)	A trusted mobile app for people to gather, store, use, and share health information online
Nutrition mobile apps	Mobile application developed in order to give advice about getting the right amount of exercise and sleep, as well as eating a balanced diet
Smoking cessation mobile apps	Mobile apps let users pick their own motivational picture and read messages of support from the community. Track their cravings and how many times they end up smoking, then watch their progress over time.
Alcohol consuming tracker mobile apps	Mobile applications which track users’ alcohol consumption, drinks diary or blood alcohol content calculator

Computerized physician order entry (CPOE)

U.S. Department of Health and Human Services (2016) described CPOE as entering medical information and instructions of patients through an electronic information technology-based system. However, the department mentioned that using this system starts by prescribing medical treatments, then by controlling and entering the system, and finally, giving medical instructions.

Centricity Critical Care Clinisoft is an example of this system available in Finland. The Clinisoft application is described as a comprehensive hospital health information system, in which patients and their laboratory results will be provided for healthcare professionals for any future investigations and prescriptions (Colpaert et al., 2006)

Clinical decision support system

Clinical decision support system is a decision-making support system regarding software and applications for healthcare professionals (Shortliffe & Cimino, 2006). Furthermore, the system is responsible for knowledge or information sharing that is related to medical information for the clinical decision-making process. Duodecim Medical Publications developed such a system which is available also in Finland under the name of “Evidence-Based Medicine Electronic Decision Support”.⁷

Telehealth

McLean & Sheikh (2009) define Telehealth as providing customized and personalized healthcare services and products for the patients from a distance. Sood et al. (2007) argued that Telehealth is composed of three steps: patients’ health-related data, and transferring them to the healthcare professionals, and receiving experts feedbacks. Figure 6 shows an actual Telehealth system.

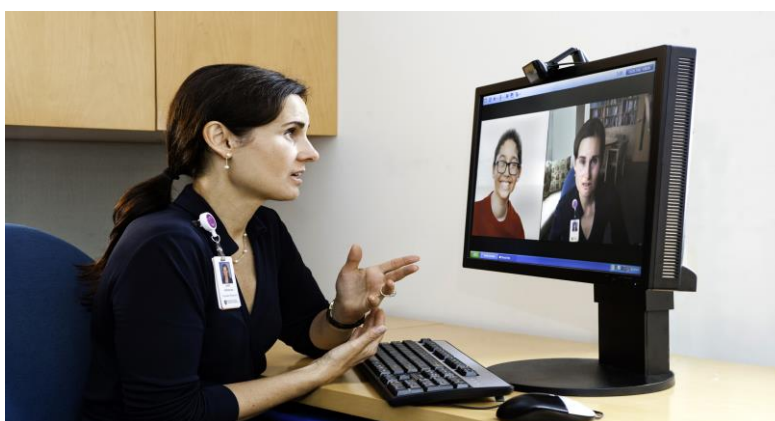


Figure 8 example of Telehealth (Massachusetts General Hospital, 2015)⁸

⁷ <http://www.duodecim.fi/english/products/ebmeds/>

⁸ <http://www.massgeneral.org/about/newsarticle.aspx?id=5188>

McLean, Protti, and Sheikh (2011) mentioned that Telehealth technology had two main systems. Telehealth technology is either real-time health information sharing (such as telephone and video conferencing between a patient and a healthcare professional) or sharing the history of recorded health information among healthcare professionals for more medical analysis.

There is a list of merits considered for using such a system ranging from decreasing patients' expenses to early detection of a disease (McLean, Protti, and Sheikh, 2011). Table 4 presents a summary of the definition, examples, and merits of Telehealth system:

Table 4. An overview of the definition, examples, and benefits of Telehealth system (McLean & Sheikh, 2009; Reponen, 2012; McLean, Protti, and Sheikh, 2011)

	Definition	Examples	Benefits
Telehealth	Telehealth provides customized and personalized healthcare services and products for the patients from a distance (McLean & Sheikh, 2009)	<ol style="list-style-type: none"> 1. video conference between patient and healthcare professional (Reponen, 2012) 2. distance health education system (Reponen, 2012) 3. Patient monitoring system from a distance (Reponen, 2012) 4. distribution of electronic patient record documents (Reponen, 2012) 	<ol style="list-style-type: none"> 1. Allows patients to be cared for in their preferred location, typically at home. (McLean, Protti, and Sheikh, 2011), 2. Provides, patients' education and support for preventive care (McLean, Protti, and Sheikh, 2011), 3. Videophone or web-based clinical consultations (McLean, Protti, and Sheikh, 2011), 4. Proactive education and support, such as via web forums (McLean, Protti, and Sheikh, 2011), 5. Allows greater opportunities for continuity of care with the same clinician and more frequent assessments (McLean, Protti, and Sheikh, 2011), 6. Reduces costs to patients by obviating the need for time off school or work and for travel (McLean, Protti, and Sheikh, 2011).

2.4 Accountable care organization

The notion of providing high-quality care and being more cost efficient at the same time seems to be a global issue nowadays. In this case, Accountable Care Organizations (ACOs) are a typical representative of this trend regarding providers, and are more responsible for and the cost and the quality of healthcare for their target population.

However, there is no umbrella definition for ACOs. Therefore, Tu et al. (2015) considered three different definitions for accountable care organization as follows:

- I. At an organizational level, ACOs are defined as an organization seeking accountable care, adopting financial accountability for the healthcare requirements of any particular residents, and managing required healthcare of the people across the healthcare chain.
- II. ACOs also asserted that cooperation among healthcare providers and the utilization of emerging health information technology can reduce healthcare expenses and improve quality.
- III. The last description of ACOs can be simplified to an outcome-oriented healthcare delivery system, as well as a significant reform of payment systems for its related expenses.

The Center for Medicare & Medicaid Services (2015) defined accountable care organizations as some doctors, hospitals, and other healthcare providers who are freely altogether working to provide high-quality care services for their patients. Moreover, the main idea of this collaboration is providing the right care for the patients at the right time, while also trying to reduce any unnecessary reproduction of services and avoiding any medical errors. Tu et al. (2015) described the aims of ACOs as follows:

- I. To boost the patient care experience,
- II. To enhance the patients' health,
- III. To reduce the per capita expenses of healthcare as the leading force for healthcare system delivery and change in payment.

A successful ACO is defined as an organization which takes three key points into consideration as follows: individual preference, engaging patients in decision-making about their healthcare options, as well as making sure patients and all healthcare providers have access to the right health information at the care point (Tu et al., 2015).

2.5 Accountable care organization and E-Health

The aim of ACOs is significantly similar to E-Health and related services, as means developed to cope with patients' needs and expectations. Providing E-Health and related services is especially important for countries with a lower population density and patients living widely spread through the country.

Finland, as an innovative country, has to face numerous challenges and the required allocation of funds from the government is high, in order to provide the services (Braunstein, 2016).

There are several potential advantages in developing healthcare systems like ACOs. They range from patients' to healthcare providers' points of view. On the one hand, improving residents' health, better patient quality of care with lower cost, focusing on the patient, and providing two ways for communication between patients and physicians are considered some of the benefits of ACOs for patients (Ortiz et al., 2013; Ringquist, 2014). On the other hand, increasing efficiency and profitability for healthcare providers, reducing readmission of patients, and changing the healthcare expenses to more fee-for-service to fee-for-value direction are also expressed as some merits for healthcare providers using such a system (Ringquist, 2014; Bresnick, 2013).

Finally, there are some barriers to developing an ACO system, such as anticipation of losing autonomy of healthcare provider, inadequate capital for information technology improvements, and payment structure or financing the healthcare project (Ortiz et al., 2013). Table 4 shows some of the merits and barriers for ACOs.

Table 5 Advantages and Disadvantages of ACOs (Ringquist, 2014; Bresnick, 2013; Ortiz et al., 2013)

	benefits	drawbacks
ACOs	Improving patients' health	Anticipation of losing autonomy of healthcare provider
	Better patient quality of care with lower cost	
	Focusing on the patient	Payment structure or financing the healthcare project
	Providing two ways for communication	
	Increasing efficiency and profitability for healthcare providers	Inadequate capital for information technology improvements

2.6 Accountable care organization vs. Value-based care

"Value-based care" is descriptive of the design of the original scheme for accountable care organizations (ACOs) described by Berwick (2011). The main idea of these organizations is to provide better patient health experience while also being more cost effective. In other words, the value-based system is a practice to achieve and maintain good health, which is considered less costly than dealing with poor health (Porter, 2009).

Berwick (2011) considered six steps from a data point of view for establishing a successful value-based care. Figure 7 shows the steps above from a data perspective. This study describes these steps from a health information point of view to cope with these research targets.

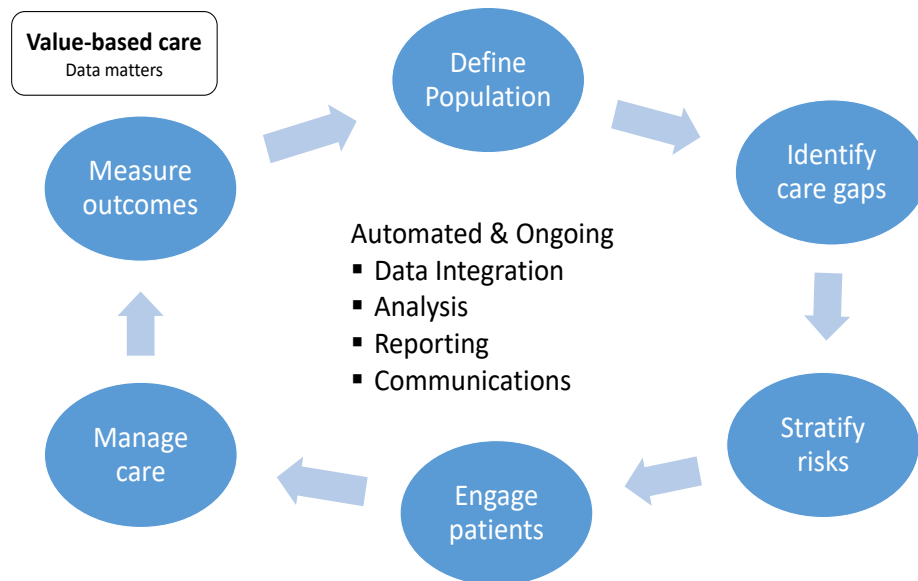


Figure 9. Value-based care – Data Matters (Braunstein, 2016)

In the following parts, each element of a value-based care model presented in figure 7 will be described

2.6.1 Defining population

Defining population starts with recognizing society background information. In this case, the previous studies about healthcare information behavior investigated the relationship between some residents’ background information and their health information seeking.

There are many demographic factors which are mentioned in previous studies as influential elements on health information seeking behavior. Treiman and Squiers (2005), and Rutten, Squiers, and Hesse (2006) categorized population factors into three main groups including demographic, psychological and health indicators.

The main demographic factors which are mentioned in the previous papers are as follows: sex, age, marital status (Currie, Philip, and Roberts, 2015), health status (Ginman et al., 2003), educational background (Palsdottir, 2003), interest and awareness about healthcare (Gietzelt, 2001), current self-rated health and different dimensions of health information literacy (Eriksson-Backa, EK, Niemelä and Huotari, 2012), and using E-Health facilities (Cherry, 2002; Jones and Fox, 2009; Zickuhr, and Madden, 2012; de Veer et al., 2015).

Moreover, Eriksson-Backa et al., (2012) pointed out that health information behavior regarding information needs, information seeking, as well as using information depends on both demographic and motivation factors, such as people’s health situation and education level.

The results of previous studies about the correlation between demographic factors and health information seeking of older adults are summarized in the E-Health information seeking section.

2.6.2 Identify care gaps

From a health information point of view, this subcategory is connected to any probable gaps between received healthcare by older adults and their real needs. The main possible care gaps which are mentioned in the previous studies are as follows:

1. The distance between healthcare center in the rural area of the country with patients houses. (Currie, Philip, and Roberts, 2015),
2. The different attitudes of people toward health information seeking, which is recognized in previous studies as different gender preferences (Fox, 2004),
3. Whether users of E-Health services and products receive some technical support by information technology providers or not will influence the efficiency of the system. (Malinowsky, Nygård, and Kottorp, 2014; Bujnowska-Fedak, 2014),
4. Another important element is related to the acceptance degree of the population towards using information technology. It is also defined as sensitizing towards information technology (Männikkö-Barbutiu, 2002),
5. Content of information and degree of complexity to understanding by target population can also have significant effect on patients' satisfaction or use of the healthcare facilities (Eriksson-Backa, Holmberg and Ek, 2016),
6. Whether patients can use easily web-based health information or not is a matter of concern (Chong and Theng, 2004),
7. One of the factors which might have influence on patients' care gap is related to providing the opportunity for patients to participate in their health information seeking process (Chen and Lee, 2014),
8. The last point is related to privacy, trust and related concerns which might have an effect on quality of care. For instance, Taha et al. (2009) argued about reliability of the health information, and being cheated or taken advantage of online, as well as potential violations of privacy or confidentiality (Taha et al., 2009; Wagner et al., 2004; Eriksson-Backa, 2008; Yan, 2010; Ybarra and Suman, 2008).

2.6.3 Stratify risks

Just (2014) defined stratify risk for value-based care organizations as high-cost patients who need intense healthcare services and attention. For instance, a patient with heart failure is considered as high-risk for readmission (Just, 2014).

Colorado Beacon Consortium (2013) categorized risk-stratify patients into high, moderate and low health risk categories. Moreover, risk stratification is related to utilizing healthcare facilities and resources to prioritize the needs of patients in the whole population of a country (Colorado Beacon Consortium, 2013).

From the health information point of view, stratify risk could be related to collecting patients' health information via various E-Health tools in order to minimize medical errors and resources that are spent for the same reason on the patients in healthcare centers (Shekelle, Morton, and Keeler, 2006).

2.6.4 Engaging parties

The main parties from a VBC point of view are health providers, insurance companies or payers on one side, and patient on the other side. Moreover, a team of professionals such as the physicians, medical assistants, and in some cases, pharmacists are involved (Brown and Crapo, 2014).

Also, from the health information point of view, various studies have been conducted on different participants, including patients' relatives (Palsdottir, 2012), doctors and nurses (Younger, 2010), healthcare professionals (Barakat et al., 2013), governments and cities and municipalities (Mackiewicz, Rasmunssen, and Vienonen, 2012) and the Baltic Region Healthy Cities Association (Mackiewicz, Rasmunssen, and Vienonen, 2012). Therefore, previous studies argued about the significant role of various participants in the processes of healthcare; however, this study is not covering this significant point and will leave the door open for future studies in this area.

2.6.5 Managing care

Managing care is about how healthcare organizations manage and provide high-quality healthcare services with low-cost expenses, while their aim is a high level of satisfaction for their patients. In this case, the healthcare providers must take the results of the previous cycles of this process into consideration.

This step from the E-Health information point of view would be about how older adults can gather health information through electronic health information sources and manage their health information needs.

These different sources can be websites (Kelly, Ziebland, and Jenkinson, 2015), weblogs (Chung and Kim, 2008), portals and forms (Eriksson-Backa, 2003), wearable devices (like sports trackers) (Hyrkkänen, and Myllymäki, 2012), or some information technology-based services and devices that are related to virtual doctor visits tools (Karppi et al., 2012).

2.6.6 Measuring the outcome

Measuring the outcome is an essential part of any organization process to estimate their performance and adjust their strategies and process in order to cope with their targets. In this case, healthcare organizations which want to implement an optimized practice based on a value-based care model need to evaluate their performance and take any needed action into consideration.

From the E-Health information point of view, this step is really hard to evaluate and it needs comprehensive investigation from both patients and healthcare professionals to realize the actual performance of the healthcare services and products (Naidu, 2009).

2.7 E-Health information behavior

When it comes to E-Health information behavior, there are some terms that should be defined and explained. This part of the thesis is composed of the definition of information, information need, information seeking, using information as well as other related factors to the information. All of the aforementioned terms are also reviewed from a health to E-Health information point of view.

2.7.1 Health information and E-Health information

This part of the second chapter aims to explore various aspects of health information and E-Health information. First of all, there is a need of defining what health information is. Drucker (1998) mentioned that information is data that have been organized for a particular reason. In this case, health information can be defined as a collection of data related to health and healthcare.

This information includes medical information, medicines and merits and demerits of them, checking or monitoring health status, and any other health-related information. Moreover, Lewis, Urquhart, and Rolinson (1998) defined health information as any information-related terms between health education and health promotion.

Elliot (1994) categorized health information from a woman's perspective into five groups as follows:

1. information related to specific diseases or conditions;
2. information related to results of recent health research;
3. information about lifestyle advice;
4. information explicitly mentioned by the National Health Service;
5. and health information details related to the possibility of obtaining further health information.

Figure 10 shows a summary of health information terms, examples and sources.

	Definition	Examples	Sources
Health Information	collection of data related to health and health care (Drucker, 1998)	medical information	Electronic
	any information related terms between health education and health promotion (Lewis, Urquhart, and Rolinson, 1998)	medicines and merits and demerits of them	non-electronic sources
		checking or monitoring health status	
	any other health related information		

Figure 10. Health information summary

2.7.2 Health information sources

Health information can be available in different forms and sources. Palsdottir (2012) added that people from various social groups also have different behavior toward making use of available health information sources. However, this study categorized the health information sources generally as electronic and non-electronic sources.

According to Eysenbach (2000), and Ball & Lillis (2001) E-Health information can be defined as any health-related information accessible or available through internet or high-tech related tools, ranging from the internet to mobile-based health information sources.

However, sources such as published books, journals, articles (Eriksson-Backa, 2010), healthcare professionals (doctors, nurses, and other related professionals) (Younger, 2010; Barakat et al., 2013), as well as family members, friends, relatives, or even caregivers can be categorized as non-electronic health information sources (Palsdottir, 2012).

Figure 11 shows various health information sources based on electronic and non-electronic criteria. More details about each of the categories are also presented in the following parts of this section of the thesis.

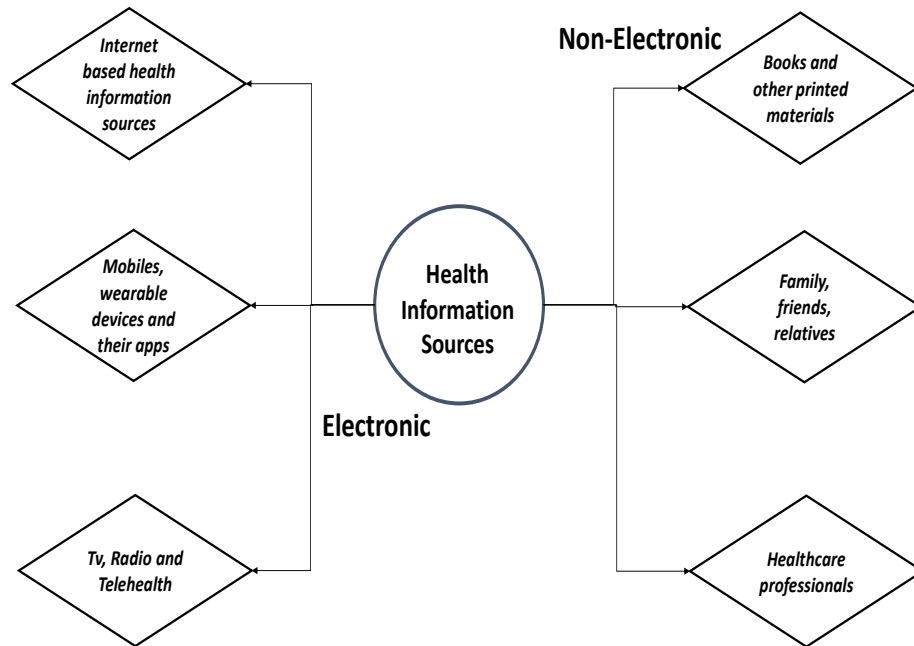


Figure 11. Health information: Electronic vs. Non-electronic sources

Non-electronic health information sources:

Non-electronic health information sources can be categorized into three main groups, including books and other printed materials, family, friends, and relatives, as well as healthcare professionals. However, some studies mentioned that awareness and knowledge are correlated to understanding and making use of health information, and they have an effect on the ability of patients to use health information obtained from various sources.

There is a term, “health literacy,” for which various definitions have been offered. The main idea of the aforementioned term is the ability or the capacity of individuals to gather, investigate, understand and make use of basic health information and services in their health decision-making (Ratzan & Parker, 2000). E-Health literacy is related to using information technology for the above-mentioned process (Eng, 2001). However, this study does not take these points into consideration. In the following parts, the results of previous studies about the above-mentioned category of non-electronic health information sources are presented.

- **Books and other printed materials:** Palsdottir (2003) said that people have to rely on directly gaining experience as a source of information, and the process of learning

and using of that information will be time-consuming. Moreover, she pointed out that reading, observing or listening to others can be the main source of health information. Furthermore, personal experience and other people's experiences could be another category of health information sources (Pálsdóttir, 2003).

Some older studies also mentioned that the library could be one of the main health information sources for Australian elderly adults (Williamson, 1998, 1999). However, Su and Conway (1995) listed the library as the second least helpful source for health information seeking. Eriksson-Backa (2008), and Eriksson-Backa, Ek, Niemela, & Huotari (2012) asserted that health information with medications in terms of prescriptions or any sort of leaflets including patient information could be considered as a reliable health information source.

Eriksson-Backa (2008) argued that although libraries are considered an important source for health information, people visit them to some extent for general information purposes rather than health-related information. Moreover, a recent study on health information seeking behavior of elderly Finns showed that information attached to medical packages, pharmacy staff, as well as healthcare professionals were considered the most trusted health information sources (Eriksson-Backa, 2013).

➤ ***Family, friends, and relatives:*** Fox (2011) stated that many people, while having a health problem, tend to ask their family members or friends for support and advice. In this regard, Fox and Duggan (2014) pointed out that almost 70 % of the elderly adults who are suffering from one or more chronic health conditions receive health information or health support from their family members or friends.

Moreover, the results of Fox and Duggan's (2014) study revealed that almost 30 % of those people receive health information or health support from other people who have the same health issues. Pálsdóttir (2011) mentioned that it is really important for both the elderly adults and their relatives to know about the latest health information discoveries as soon as possible.

Furthermore, Pálsdóttir (2011) argued that elderly people are supported by their relatives in terms of informal health information needs and support. The relatives also tend to transfer their health-related information to the aforementioned people (Pálsdóttir, 2012 a, b).

Pálsdóttir (2011, 2012 a, b) remarked that relatives play different assistant roles for elderly adults, including helping to seek health information, providing

useful health information and guidance in interpreting the health information. Moreover, Fox (2011) defined the term “Peer-to-peer healthcare” as online peers whom the elderly adults have, particularly in the case of rare health problems.

- **Healthcare professionals:** There is no doubt that healthcare professionals such as physicians, healthcare providers, or pharmacists are the preferred sources of health information for patients (Taha et al., 2009; Renahy et al., 2008; Given et al., 2007; Morey, 2007). With regard to healthcare professionals as health information source, Fox and Duggan (2014) identified that 81% of the elderly adults with chronic health problems obtain their health information, healthcare, or health support from physicians or other healthcare professionals.

Eriksson-Backa (2008) reported that elderly Swedish-speaking Finns’ preferred source of health information is medical expertise; especially, when either they or their spouse face a health problem. Moreover, she stated that this source of health information might be problematic due to its dependency on visiting healthcare centers, feeling of weakness, lack of time, as well as the confusion that is caused by facing different types of health information (Eriksson-Backa, 2008).

Electronic health information sources:

There is no specific definition for E-Health products and services; however, Malinowsky, Nygård, and Kottorp (2013) consider them as any services or products with the aim of providing easier access to health information and self-health management. Electronic health information sources are defined as easy access to low-cost means of health information sharing and gathering.

The internet is considered a speedy and convenient source for health information sharing, as well as an efficient tool for managing care (Rideout et al., 2005). There is not a limited or specific category for E-Health products or services. In this case, different researchers mentioned various kinds of them.

E-Health products or services are composed of online health guides, e-prescriptions (Jung and Loria, 2010), disease management support (Hall, Stellefson, and Benhardet (2012), internet-based sources (Jung and Loria, 2010; Vanagas and Klimaviciute-Gudauskiene, 2012; Van Deursen, 2012), and mobile phones and their applications (Hall, Stellefson, and Benhardet, 2012). However, the current study categorizes them into three main sections including internet-based health information

sources, mobiles, wearable devices, and their related apps, and TV, radio, and Telehealth.

It is worth mentioning that there are some barriers towards using E-Health technologies such as individual capabilities, preferences, and the lack of awareness of the potential online health information.

They can be used as supplementary health information sources (Younger, 2010); however, they should not be substituted with main health information sources (Currie, Philip, and Roberts, 2015).

➤ ***Internet-based health information sources:*** Health information websites such as Medline Plus⁹ (Kules and Xie, 2011), WebMD, MedHunt¹⁰ (Bodkin & Miaoulis, 2007), homepages run by individuals (Barry et al., 2011), online newspapers and magazines, online support groups or portals (Eriksson-Backa, 2003), blogs (Chung and Kim, 2008), Facebook (Chen & Lee, 2013), Twitter and other related social media sites (Eriksson-Backa, Holmberg and Ek, 2016) are the main categories of Internet-based health information sources (Barry et al., 2011).

Results of various studies show that E-Health technologies are used mainly by the elderly adults who are living alone (Currie, Philip, and Roberts, 2015). Moreover, from the healthcare professionals' points of view, Bodkin & Miaoulis (2007) mentioned that roughly three-quarters of medical science specialists use the internet for their medical practice.

➤ ***Mobiles, wearable devices, and their related apps:*** Health information system (HIS) is considered as health service applications and technologies which provide an appropriate forum for communication and processing of health-related issues (Haux, 2006). Sezgin and Yildirim (2014) argued that providing health services on the mobile platform in terms of mobile applications is regarded as promising technological development.

On the one hand, Nah, Siau, and Sheng (2005) and Sarker and Wells (2003) mentioned that benefits such as reachability, accessibility, and ability to perform efficient health information sharing were brought about by the technology mentioned above in HIS. On the other hand, Repacholi (2001) and Independent Expert Group on Mobile Phones (2000) showed that there are some risks related to obtaining

⁹ MedlinePlus is a website provide health-related information governed by United States National Institutes of Health (Kules and Xie, 2011)

¹⁰ They are two famous American websites which provide online health information.

health-related information from mobile devices in terms of accuracy and other related issues.

The mobile health (M-health) is defined as any health services channeled to the patient through a mobile communication device (Weinstein et al., 2014). These devices can be wireless patient monitoring devices, smartphones or tablet computers. Weinstein et al. (2014) mentioned that due to mass marketing for smartphones, mobile health received more attention from both health providers and patients. For instance, improvement in mobile health-related applications encouraged more patients' engagement in mobile health information seeking. Moreover, Weinstein et al. (2014) considered advantages such as real-time self-monitoring by patients, as well as direct health information delivery from patients to healthcare experts.

- ***TV, Radio, and Telehealth:*** TV and radio are considered two of the most important sources of health information sharing (O'keefe, 1998). Moreover, Williamson (1998,1999) pointed out that TV and radio are among the most frequently used health information sources of elderly Australians.

Apart from the sources above, there is an umbrella term, so-called "Telehealth" (Oh et al., 2005; Augusto, 2012). Glascock and Kutzik (2012) described Telehealth technologies as facilities that provide distance health monitoring and consulting for patients.

Some benefits and some limitations have been identified for Telehealth technologies. On the one hand, enhancing independence and autonomy are some merits of the technologies for the elderly adults, their routine tasks and everyday home activities (Ludwig et al., 2012). On the other hand, the main barriers to using these technologies for the elderly adults include stigma (feeling the shame of having a specific illness), access, as well as related expenses (Barlow et al., 2007 and Botsis & HarTVigsen, 2008).

First of all, the results of a survey of sources of health information seeking show that: elderly Singaporean adults use TV (90%), newspapers (85%), radio (60%), family members and friends (57.5%), paper-based sources (45%), and clubs and social learning (22.5%) as their informal information sources (Chong and Theng, 2004). In this case, Männikkö-Barbutiu (2002) describes social learning as organized efforts in order to encourage elderly adults to learn how to use a new technology.

Secondly, formal health information sources such as libraries, Internet-based health information sources, as well as healthcare professionals, are used as last

options by the aforementioned people (Chong and Theng, 2004). Finally, Karppi et al. (2012) believe that virtual doctor appointments or virtual home visits play a significant role in the healthcare system of rural areas. Moreover, Karppi et al. (2012) mentioned that the afore-mentioned system needs to be developed in order to facilitate and guarantee access to appropriate healthcare for all residents.

2.7.3 Health information need

Derr (1983) & Wilson (1997, 2000) said that information need is a situation in which a particular information contributes to achieving an absolute or certain information target. In this case, “health information needs” can be described as a means by which specific health information is provided to help patients overcome health problems.

Bates (2010) defines health information need as a way by which human beings interact with information. To be more precise, it is about how people seek and utilize information. There are different reasons why people need health information, and it is varying from patients' to healthcare professionals' points of view.

On the one hand, Younger (2010), in his study, mentioned that doctors and nurses need health information for primarily patient care and continuing professional development. On the other hand, Cherry (2002) showed that the elderly adults need more health information related to community-based services when they have caregivers, personal assistance needs for transportation or other related issues. Figure 12 shows a summary of E-Health information need.

	Definition	Examples: healthcare professionals'	Examples: patients
E-health information need	A situation in which a specific health information contributes to achieve of a health problem or any other health information related aims (Derr, 1983; Bates ,2010)	Primarily patient care (Younger, 2010)	Prevention or treatment of a specific illness (Su and Conway,1995)
			Nutrition (Moreover, Su and Conway,1995)
		Continuing professional development (Younger, 2010)	Exercise (Moreover, Su and Conway,1995)
			community-based services (Cherry, 2002)

Figure 12. E-Health information need from patients and healthcare provider point of view (Derr, 1983; Bates,2010; Younger, 2010; Su and Conway,1995; Cherry, 2002)

2.7.4 Health information motivators

Johnson (1997) categorized five main motivators for health information need and health information seeking, and they have varied from obtaining general knowledge to making room for improvements in communications with healthcare providers.

Figure 13 shows all the motivators according to Johnson (1997). Van der Molen (2000) believed that apart from medical information needs, patients might have social, emotional, or psychological requests.

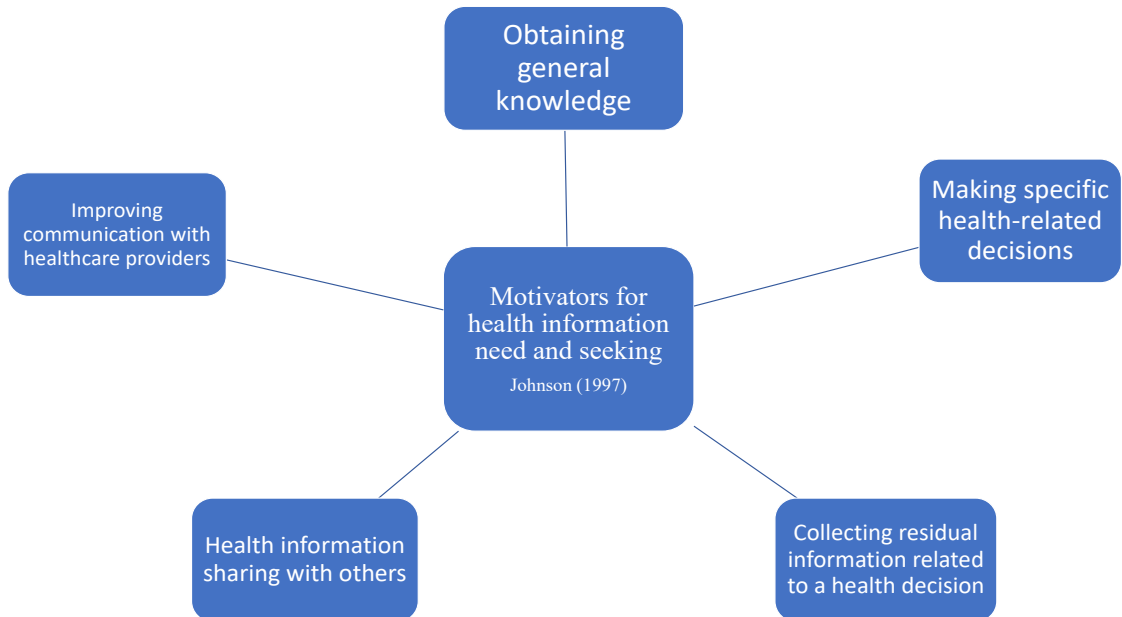


Figure 13. Five motivators for health information need and seek (Johnson, 1997)

Making an umbrella category for health information need could be possible by generalizing health information need according to a report issued by National Cancer Institute as follows:

1. Information related to a particular health problem,
2. Treatment-related illness,
3. Health diagnostic information,
4. Recovery from illness information,
5. Surveillance health information,
6. Coping information such as emotional reactions and supports, ...,
7. Interpersonal or social health-related information,
8. Financial and legal health-related information,
9. Medical system information such as information about various healthcare providers and any related information,

10. health-related information about body image or sexual information (Treiman and Squiers, 2005).

When it comes to elderly adults, the health-related information patterns might have some changes according to the physical and mental needs (Rutten et al., 2005). Elderly adults expected to require more information related to the health and healthcare (Given et al., 2007; Williamson, 1999; Williamson and Asla, 2009). In this case, Williamson (1999) reported that elderly Australians put more priority on health information than income and finance.

Su and Conway (1995) argued that elderly Chinese immigrants in the United States are more concerned about health-related information on prevention or treatment of a particular illness and pursued some information about nutrition and exercise. Similarly, Eriksson-Backa (2010) identified health issues as the primary motivator for senior Swedish-speaking Finns for seeking health information.

2.7.5 Health information seeking

Case (2007) defines information seeking as a conscious activity to gain information in order to cope with a need or a gap in personal knowledge. Regarding health information seeking, it can be described as any conscious activity to obtain health information through various health information sources. Therefore, health information seeking is composed of two main parts: health information need and health information sources.

Taha et al. (2009) point out that the majority of online health-related information seeking is about illness or medical conditions (approximately 90%), information related to healthcare experts, hospitals or similar health information (roughly 85%), nutrition (about 80%), insurance and prescription medicines.

Campbell and Wabby (2003) sort out the primary online information seeking into five categories including information related to specific health conditions, medicine information, health aids, treatments, and vitamins. However, Houston and Allison (2002), in their study, found that health information seeking about a particular illness is the primary online information seeking activity.

2.7.6 Health information seeking and demographic factors

The results of previous studies about health information seeking and demographic factors are categorized and presented as follows:

- ✓ **Age:** Rideout et al. (2005) in their study discovered that elderly adults mainly search for health information that is related to a particular illness or health condition. They

explore available treatments, compare prescription medicine expenses, seek for various health providers, or follow health policy debates.

Eriksson-Backa (2003), in a study that conducted about young adults, found that younger respondents are more active than the older ones on health information seeking activities. In this case, it is good to mention that the results of previous studies show that younger people are more interested in the search for health information compared to older adults.

- ✓ **Sex:** Tu & Hargraves (2003) and Viswanath & Ackerson (2011) found that women are more interested in seeking health information compared to men. Moreover, Pálsdóttir (2003) asserted that females are more likely to consider health information useful compared to their male partners. However, Chong & Theng (2004) reported that senior male adults tend to gain health information from formal sources more than females.

Eriksson-Backa (2003) in her study about who might use the internet as the health information source reported that male Finns are more interested in seeking health information in newspapers, while Finnish women tend more to search for health information via online discussion forums.

- ✓ **Marital status:** Currie, Philip, and Roberts (2015) reported that elderly adults who live alone, suffer from chronic pain, and are living in rural areas of the country are more likely to use E-Health services and products for their health information seeking activities. However, they added that although the aforementioned people are more interested in using these sorts of health information services, they like to have face-to-face visits with healthcare professionals along with these services. Miaoulis, Gutman, and Snow (2015) reported that inside of a family, women have more significant roles regarding collecting health information and decision-making of their families
- ✓ **Education:** Pálsdóttir (2003), on research about Icelandic citizens' information behavior, reports that the education level has a significant effect on information seeking behavior of people. Moreover, Pálsdóttir (2003) adds that the educational level has more effect on women's health information seeking behavior compared with men's.

On the one hand, Dobransky & Hargittai (2012) and Renahy et al. (2010) report that there is not a significant difference between education level or different

social class and their online health information seeking activities. On the other hand, Thackeray et al., (2013) and De Veer et al. (2015) found that having lower levels of income or education has a significant impact on citizens' health information seeking activities. Health information seeking means consulting with websites, healthcare experts, health organizations, or reading about available treatments.

In short, results of the recent studies in Finland show that there is a significant relationship among health conditions, the level of education, and seeking for health information among elderly Finns (Eriksson-Backa, 2013).

- ✓ **Health status:** Tu & Hargraves (2003) conducted research about information health behavior of people with chronic health problems. They reported that people with these health problems tend to seek health information more than the other patients.

On the one hand, Cotton & Gupta (2004) commented that healthier and happier people are more likely to seek for health-related information via the internet. On the other hand, Mesch et al. (2012) & Renahy et al. (2010) found that having a poor health situation is connected with having more health-related information seeking activities online, or participating in more online support groups (Chou, Hunt, Beckjord, Moser, and Hesse, 2009).

On the other hand, Cherry (2002) acknowledged that elderly patients with transportation problems most probably seek for health information related to community-based services. Furthermore, a recent study on health information seeking behavior of elderly Finns shows that illness would increase health information seeking activities and cause people to figure out more information about the treatment of their health issues (Eriksson-Backa, 20013). Moreover, Eriksson-Backa (2003) carried out a study about health information sources and reported that pregnant women or people with diabetes tend to use more internet or discussion forums as their health information sources.

- ✓ **Ethical group:** Viswanath & Ackerson (2011) explored that racial or ethnic majorities are more likely to seek health information online compared to racial or ethnic minorities. Furthermore, they point out that social determinants including race, ethnicity, as well as social class, have a significant effect on people's attitudes about health information needs, seeking information, processes, as well as making use of them (Viswanath & Ackerson, 2011).
- ✓ **Income level:** The previous studies point out that people with higher income are more likely to seek health information compared with other groups (Tu & Hargraves, 2003).

With this regard, Gietzeit (2001) reported that elderly Australians with lower income, that are geographically or socially isolated, immobile, disabled or having any other significant health issues are less expected to seek health information.

- ✓ **Interest or awareness:** Gietzeit (2001), on research about using a computer and the internet among elderly adults living in Sydney, found that in contrast with public beliefs the aforementioned people are not unfamiliar with these technologies. However, he believes that most of these people might be unaware of available health information, services or how they can use them.

On the one hand, Rockmann & Gewald (2015) state that even though elderly adults can make use of available E-Health facilities, they tend to resist or have anxiety towards these new technologies. On the other hand, they report that the fast rate of changing of these modern technologies might not be supported with the elderly adults' mental models.

Finally, De Veer et al. (2015) report that interest of elderly adults has a significant influence on their use of E-Health facilities. They added that having a positive attitude toward being easy to use or being useful has a great degree of influence of the use of E-Health services by elderly citizens (De Veer et al., 2015).

- ✓ **Using E-Health facilities:** Cherry (2002) stated that previous experiences about using any health-related services and awareness have an effect on elderly adults' health information seeking and using behavior.

Malinowsky, Nygård, and Kottorp (2014) believe that apart from providing easy access to E-Health facilities for elderly adults, they need to have appropriate support to understand and use these technologies.

- ✓ **Religion:** Although there is no specific research about influence of religion or spiritual beliefs on health information seeking, Puchalski (2001), McCormick et al. (2012), and McCormick (2014) reported that religious or spiritual beliefs of the patients have a significant influence on their healthcare-related activities, varying from health information seeking to employing it.

McCormick (2014) pointed out that taking into account patients' spiritual and religious beliefs with considering boundaries of medical ethics might have positive effects on patients' engagement in their healthcare process.

- ✓ **Language:** Chong & Theng (2004) reported that there is a significant relationship between English language proficiency and health information seeking activities of senior people.

Dutta (2009) argued that wrong language, especially for health information seeking of rural populations, is a significant language barrier. Moreover, it is mentioned that the language barrier has more negative effect on health information seeking activities of people who particularly live in regions where there is not one local language but several ethnic groups' languages with different dialects (Dutta, 2009).

2.8 Summary of the second chapter

The second section covered health information seeking models and related variables. These models developed to analyze information seeking behavior of patients towards health-related issues. The chapter explained some possible reasons for health information seeking, and the barrier for making use of it, as well as the attitude of patients toward this process. After that, the section followed by defining E-Health and various available sources of E-Health information.

The results of previous studies in this chapter showed that apart from non-internet-based health information and internet-based sources, other groups of E-Health information sources were not examined in the previous studies. Therefore, chapter 2 argued about wearable health information devices, mobile health-related applications, TV, radio as well as Telehealth, which are considered current health information sources.

After that, the missing point of previous studies in this field was the lack of ways to measure the efficiency of the process of health information seeking and making use of the collected health information. Therefore, accountable care organizations and value-based care models were described as examples for improving efficiency and effectiveness of healthcare systems. The chapter was followed by describing elements of the value-based care model. These factors of the VBC model were included to define the population, to identify care gaps, to engage parties, to managing healthcare and to measure the outcome.

In a nutshell, the chapter summarized the results of previous studies regarding why patients need health information. Chapter 2 explains how patients seek health information and also mentions some of the challenges they face. Finally, some criteria to measure the performance of the process of health information seeking and its usage based on previous studies are presented.

3 Methods

3.1 Approach to Research

This chapter will explain how the questionnaire was developed and how the quantitative method was employed to analyze the data. The results will show the older Finnish adults' E-Health information seeking behavior, as well as their satisfaction toward using these services.

3.2 Terminology of research

The study was conducted with older Finnish adults who are living in Finland. Like the previous studies (see for example, Chong and Theng, 2004; Fox, 2004; Eriksson-Backa, Ek, Niemela & Huotari, 2012; Eriksson-Backa, K., 2013; Zickuhr & Madden, 2013; Chew & Yuqian, 2015), the participants of the current research were adults aged more than 50 years old. They were living in Finland.

The quick review of previous studies reveals that only a few studies have been conducted on health information seeking behavior through various E-Health information sources. For instance, there are only a few previous studies about the attitudes of patients about using Telehealth. The current study follows an explorative research approach offered and used by Stebbins (2001). This research approach will help researchers gain more background information, clarify the concepts, and answer the current study research questions. Finally, it is expected that the results show the possible solutions and answers to the research questions.

The explorative research study was conducted via quantitative analysis methods. To do so, a questionnaire with multiple-choice questions was employed. The results of previous studies showed that in some cases family members, relatives or caregivers provide health information for senior residents (Männikkö-Barbutiu, 2002; Chung & Kim, 2008; Eriksson-Backa, 2008; Barry et al., 2011; Palsdottir, 2012). Therefore, the questionnaire had an option for this group of the elderly, and they could answer the questions on behalf of their family.

3.3 Designing the questionnaire

The questionnaire (see Appendix A) was developed based on the research questions and a similar questionnaire prepared by Eriksson-Backa (2010) and Hyppönen (2014). Moreover, the questionnaire is a self-administered questionnaire which was developed based on experts' opinions (including my supervisors). The questionnaire of the current study comprised five sections, as follows:

3.3.1 Section 1: Demographic information

From the perspectives of value-based care and health information seeking behavior, it is crucial to understand the socioeconomic profile of older adults (Braunstein, 2016; Longo et al., 2001, 2010). Therefore, the socioeconomic information of older adults can make an appropriate base for future development in E-Health products and services (Vasoo, Ngiam, and Cheun, 2002).

The demographic information part of the questionnaire is composed of seven questions out of eleven significant factors related to the population profile. These background profiles include information about gender, educational background, marital status, the location of living (city name, and type of neighborhood), working situations, income level, and current health status.

The other factors like, such as the influence of religions, language barriers, attitudes and ethnicity on using E-Health services or products, due to the limitations of the current study, were not taken into consideration. Moreover, the interest or awareness of patients toward using E-Health products and services was asked in section four of the questionnaire.

Moreover, the questionnaire asks whether the person who was filling out the form is the older Finnish adult or someone else who is filling out the form on behalf of him/her (his/her family members, relatives, or caregivers).

3.3.2 Section 2: Health information need

This part of the questionnaire is about relevant health information to older adults. According to Derr (1983) & Wilson (1997, 2000), people seek information for certain reasons or aims. Therefore, this part of the questionnaire was composed of six questions out of ten significant factors related to health information need based on the results of previous studies. These health information needs include information related to a particular health problem, treatment-related illness, health diagnostic information, information related to recovery from illness, surveillance health information, and coping information such as emotional reactions and supports (Treiman and Squiers, 2005).

The current study also did not take into consideration other health information such as interpersonal or social health-related information, legal or financial health-related information, medical system information, and health information related to body image or sexual information.

3.3.3 Section 3: Sources of E-Health information seeking

Longo, et al. (2010) argued that factors such as patients' attitude and preference, as well as information environment, have a significant impact on health information seeking activities of patients. However, the main purpose of this study was to investigate older adults' health information seeking behaviors, and to investigate their challenges to make use of the health information collected through E-Health sources available in Finland.

As chapter two categorized electronic health information sources into three sections (figure 2), the questionnaire also followed the same structure. Therefore, in E-Health information sources were included internet-based health sources, wearable devices, mobile and their related apps, as well as TV, radio, and Telehealth. In this study, Telehealth is considered as any means of audio and video health monitoring devices. Consequently, this part of the questionnaire was composed of some questions related to E-Health products and services available in Finland which might be used by the older Finnish adults.

These E-Health information sources include internet-based health information sources (websites, weblogs, and forums), electronic health record (Kanta), Telehealth (video conference, distance health education system, patients' monitoring devices), and mobile health (such as wearable devices and mobile applications).

The other E-Health products and services which are mainly used by healthcare providers, such as computerized physician order entry (Centricity Critical Care Clinisoft), Clinical decision support system (EBMeDS), and E-Prescribing (Nation-wide electronic prescription center), were not included in this study. Moreover, this research did not include consumer health informatics tools such as health kiosks available in healthcare facilities, hospitals, as well as some shopping centers, due to the lack of popularity of them in Finland.

3.3.4 Section 4: Possible gaps or challenges in the process of E-Health information seeking

Wilson (1997) categorized problems that are related to health information seeking into three parts including demographic factors, interest and awareness and factors that are related to information sources characteristics. Among these elements, demographic factors are asked in the first section of the questionnaire.

Therefore, this part of the questionnaire is focused on challenges related to a characteristic of E-Health information sources. The following issues were considered in developing the questionnaire:

1. Having technical support by information technology providers while using E-Health products or services (Malinowsky, Nygård, and Kottorp, 2014; Bujnowska-Fedak, 2014),
2. Whether health information obtained through E-Health sources increases patients' access to health information needs and expectations or not. In other words, does it serve well the purpose of health information sharing? (Männikkö-Barbutiu, 2002),
3. Having easy-to-understand health information content in E-Health sources (Eriksson-Backa, 2008, 2010),
4. Finding E-Health information useful (Chong and Theng, 2004),
5. Being able to participate in their health information seeking process (such as corresponding to health information provider) (Chen and Lee, 2014),
6. Reliability (trust) of E-Health information from patients' point of view (Taha et al., 2009).

The above questions had some follow-up options such as being cheated or taken advantage of online (Taha et al., 2009), and privacy or confidentiality concerns (Taha et al., 2009; Wagner et al., 2004; Eriksson-Backa, 2008; Yan, 2010; Ybarra and Suman, 2008). Therefore, the questionnaire had some follow-up questions to consider the aforementioned concerns as follows:

7. Providing easy access to health information sources or not?
8. Being able to easily make use of health information through E-Health sources (Gatto & Tak, 2008).
9. Providing cheap (not costly) source of health information through E-Health sources for patients,
10. Ability to understand when to stop seeking for health information (MacCrimmon & Taylor, 1976 as cited in Johnson, 1997)

The other challenges mentioned by Rideout et al. (2005) toward E-Health products and services include inaccurate or incomplete information and doubt in the source of information. Due to the limitation of the scale of this study, these challenges were not taken into consideration.

3.3.5 Section 5: Measure the outcome of E-Health information seeking

The last part of the questionnaire was composed of some questions related to the efficiency of health information seeking in action. According to Naidu (2009), it is really difficult to estimate the efficiency of health information seeking. However, the current study considered criteria such as patient satisfaction after using E-Health services and products as indicators to estimate the efficiency of health information sharing. This section of the questionnaire is composed of some questions related to patients' satisfaction toward using E-Health products and services. They are as follows:

1. The degree of satisfaction by using E-Health services and devices for health information need. (Männikkö-Barbutiu, 2002)
2. Feeling or observing changes in health situation after using E-Health services or products. (Männikkö-Barbutiu, 2002)
3. Feeling or observing improvement in healthcare experience. (Männikkö-Barbutiu, 2002)
4. Whether the E-Health facilities or services encouraged patients to engage more in their healthcare activities or not. (Männikkö-Barbutiu, 2002)
5. Observing any reduction in patients' expenses related to their healthcare. (Männikkö-Barbutiu, 2002)
6. Whether the system was able to provide right health information at the right time, or not? (Tu et al., 2015)

The above questions were asked through Likert scale questions.

3.4 Sample selection

The sample for this study consisted of older Finnish adults aged 50 and above who lived in Finland. Furthermore, according to the results of the previous studies, the questionnaire also had an option for people who are taking care of health-related needs of older adults to fill out the form on their behalf.

The survey used a convenience sampling method in which the sample was selected randomly from available sources for the researcher (Neuman, 2002). However, the process of selecting the channels were chosen via consulting with experts, namely the supervisors of this thesis. There were two channels for collecting data:

- The first channel was approximately 60 printed questionnaires distributed among teachers and personnel of Åbo Akademi University namely, the Faculty of Social Sciences, Business and Economics, and the International office.

- The second was in the form of an online questionnaire distributed through social media (Facebook), as well as academic and personal email addresses, and a personal network of researchers among older Finnish adults or the people who can fill out the form on behalf of them.

3.5 Pilot Survey

A pilot study was conducted to be sure that the questionnaire was clear and the questions easy to understand. The object of this step was to examine whether the survey is too long, easy to follow and able to encourage respondents to participate in the study. In this case, consulting with my supervisors and using the recent questionnaire structure conducted in Finland was the basis of this study questionnaire.

Therefore, the final version of the questionnaire was customized and edited based on the research questions and consultation with experts regarding clarity and following the targets. Moreover, the questionnaire was modified through an in-depth discussion about each and every section of the questionnaire with the experts. Furthermore, all the sentences, paragraphs, and words were carefully chosen in the questionnaire.

3.6 Data analyzing method

Descriptive statistical methods were used to analyze the data collected through the research questionnaire. Moreover, Microsoft Excel was used to categorize and summarize the data. Finally, SPSS version 24 (2016) was used to analyze the data. The results of the customized questionnaire were analyzed by using a frequency statistical test, as well as a Pearson Chi-Square test and Likelihood ratio for testing independence. Consulting with experts resulted in considering missing data in the incomplete questionnaires. Due to the small scale of this study, the researcher preferred to use the incomplete data due to challenges related to data gathering and asking the older adult to fill out the forms.

First of all, a chi-squared test was used to compare the variables above in terms of recognizing possible correlation. Moreover, the main idea of this method is to understand whether distributions of categorical variables were recognizable from each other or not (Bagdonavičius, Julius, and Nikulin, 2011). The main reason behind choosing this method is based on the nature of collected data which was mainly nominal or ordinal not scale. Consequently, the descriptive approach as well as a descriptive method of data analyzing was used to analyze the results.

Then, assumptions of the Chi-square for independence were taken into consideration. For instance, McHugh (2013) mentioned that “the value of the cell expected should be 5 or more in at least 80% of the cells, and no cell should have an expected of less than one” (p.144). After that, due to the amount of missing data as well as the low scale of this study, Likelihood Ratio was used to calculate any statistical correlation in the case of valuation in any assumption of the Chi-square test.

Finally, if the results of the abovementioned steps showed any correlation among variables, a frequency test was used to recognize in-deep correlation among the variables. In the following parts, the results of each correlation are presented and investigated in detail.

3.7 Summary of the third chapter

This section covered the methodology and approach used to conduct the research. First, the chapter mentioned that this study followed an explorative approach for conducting the study. Due to the limitation of the survey, some E-Health services offered by wearable devices and mobile applications, as well as telehealth that were investigated in previous studies were not considered and mentioned in the questionnaire.

On the one hand, the process of developing the research questionnaire, as well as each factor related to it was described. Therefore, five main parts including demographic information, health information needs, the source of health information seeking, any probable gaps or challenges in the process of health information seeking, as well as how older adults could make use of this health information were included in the questionnaire. The data were collected through a paper-based questionnaire and an online version with the help of Facebook and email. Moreover, the chapter mentioned that the sample consisted of older adults who are living in Finland, and the data were mainly collected through teachers and personnel of Åbo Akademi University, namely the Faculty of Social Sciences, Business and Economics, and the International office.

Finally, a pilot study and data analyzing method were the latest points of this chapter. Therefore, the chapter provided details about implementing the descriptive statistical method of data analysis, as well as using expert opinion in this process. Furthermore, SPSS and Microsoft Excel were used to analyze the data.

4 Analysis and interpretation of results

This section represents the analysis and interpretation of the results. The data were collected through distributing online or paper-based questionnaires. First, this chapter presents demographic information of participants. Then, it continues with measuring and explaining the reliability of the instrument. Finally, the chapter presents the results of the data analysis.

4.1 Demographic information of the participants

Both the online questionnaire and paper version were filled and returned by a total of 53 respondents. Approximately 85% of the participants were older Finnish adults and 15% were people who completed the questionnaire on behalf of the older Finnish adults. In order to present a better understanding of the profile of participants, the questionnaire collected more detailed information about them. The respondents were significantly more female (69.8%) than male (26.4%); however, approximately 4 % of respondents preferred not to answer the question about gender. Table 6 shows the demographic information about participants' gender.

Table 6 Demographic information statistics – participant gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	37	69.8	69.8	69.8
	Male	14	26.4	26.4	96.2
	Prefer not to answer	2	3.8	3.8	100.0
	Total	53	100.0	100.0	

Among the respondents, 32 % said that they have a university level education background and 24.5 % selected the “other” option in the questionnaire, in which they mainly wrote "Ph.D.". Moreover, 77.4% of the respondents noted that they live with their spouse/partner or relative/friends and 22.6% of people stated that they live alone.

The respondents were from various parts of the country, from the southern part, like Turku, to the northern part, such as Oulu. Helsinki and its metropolitan area, and Turku and its neighboring cities provided approximately 74 % of the total participants. It is interesting to mention that some answers were received from the countryside and small cities, such as Pargas and Asikkala with approximately 2% and 4 % of the total obtained answers respectively. Importantly, three-fourths of the respondents were living in cities, and the rest in the countryside and small towns, i.e. approximately 17% and 12% respectively.

Working status and total income level per year showed that 71.7 % of the participants were not retired yet and 77.4 % of the total participants were earning more than 36,000 euro per year. Furthermore, the number of people who are retired but working was almost the same as the retired participants of this research (approximately 15% and 13% respectively). Table 9 shows the demographic information about participants' working status and total income level per year.

Table 7. The demographic information about participants' working status and total income level per year

Working status		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	13.2	13.2	13.2
	No	38	71.7	71.7	84.9
	I am retired, but I am still at work	8	15.1	15.1	100.0
	Total	53	100.0	100.0	

Total income level per year		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15,000 euro or less	3	5.7	5.7	5.7
	between 15,000 to 25,000 euro	5	9.4	9.4	15.1
	between 25,000 to 36,000 euro	4	7.5	7.5	22.6
	36,000 euro or more	41	77.4	77.4	100.0
	Total	53	100.0	100.0	

The last question related to background information of the respondents was about rating their current health situation. The results indicated that almost a majority of the respondents mentioned good or fairly good (52.8% and 20.8% respectively) health condition, while only 19% and 7.5% of the total obtained answers showed average or poor health status respectively.

4.2 Reliability of the research structure

In this part of chapter 4, the reliability of each section of the study questionnaire is examined and presented. Cronbach's Alpha is the right criteria to measure the internal consistency of the items that form each part of this study. According to Bland and Altman (1997), if the results of Cronbach's Alpha for each section of the research questionnaire is greater than 0.7, it indicates the reliability of the study, and the items forming that section have a coherent internal consistency. Table 8 shows the Cronbach's Alpha for each section of the research questionnaire.

Table 8. Cronbach's Alpha for each section of the research questionnaire

	Cronbach's Alpha	N of Items
E-Health information needed	0.818	9
E-Health information sources	0.86	25
challenges of using E-Health information	0.936	58
satisfaction by using E-Health services and products	0.701	7

As Table 8 shows, each section of the research questionnaire has met the required value of Cronbach's Alpha. However, the section related to challenges of using E-Health information and satisfaction by using E-Health services and products showed the highest and lowest values of Cronbach's Alpha respectively.

In the current research, Cronbach's Alpha is employed as an indicator for testing reliability of the questionnaire. Table 9 shows the Cronbach's Alpha for the whole of the research questionnaire.

Table 9. Cronbach's Alpha for the whole the research questionnaire

		N	%
Cases	Valid	7	13.2
	Excluded ^a	46	86.8
	Total	53	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.918	107

As Table 9 shows, the whole research questionnaire has met the required value of Cronbach's Alpha with 0.918, which means the study questionnaire has high reliability.

4.3 Analysis of the research questions

This study has investigated four main areas of older Finnish adults' E-Health information seeking behavior. The four main areas are as follows: E-Health information need, E-Health information sources, E-Health information challenges and E-Health information outcome. The following sections show the results of the statistical analyses of the above-mentioned variables on E-Health information processes.

4.3.1 Demographic background & E-Health information needs

In this part of the data analysis, the correlation among independent demographic variables and E-Health information need is investigated. The results of statistical tests showed that among nine variables related to E-Health information need, only five had a correlation with four demographic variables. They are as follows:

1. Educational level:

The educational level had a correlation with "When my spouse or someone else close to me does not feel well/fall ill" when Chi-square is 9.178 with 0.027 as P-value. This result was also confirmed with a Likelihood Ratio test, with 0.02 as asymptotic significance (df) which is in the acceptable range from 0.01 to 0.05.

Moreover, the results of a frequency test showed that respondents with “University/University of applied science” knowledge, with the frequency of 32 from the total 53, has the highest correlation with “When my spouse or someone else close to me does not feel well/fall ill”. After that, the respondents who mentioned “other” as their education level had a frequency of 10 and valid percent 76.9 took the second position in terms of correlation. Table 10 shows the results of the frequency test for the variables above. It needs to be mentioned that all the respondents wrote Ph.D. level study for the option above.

Table 10. Frequency test for When my spouse or someone else close to me does not feel well/fall ill and Education level

the highest level of education			Frequency	Percent	Valid Percent	Cumulative Percent
Elementary and/or Intermediate school	Valid	Yes	4	100.0	100.0	100.0
		No	3	75.0	75.0	75.0
Upper secondary or Vocational school, Institute	Valid	No	1	25.0	25.0	100.0
		Total	4	100.0	100.0	
		Yes	32	100.0	100.0	100.0
University/University of applied science	Valid	Yes	10	76.9	76.9	76.9
		No	3	23.1	23.1	100.0
Other	Valid	Total	13	100.0	100.0	

2. Marital status

Marital status had a correlation with, “When I have seen a doctor, and want to know more about my condition, treatment or medication” when Chi-square is 6.924 with 0.031 as P-value. Also, it had a correlation with, “When there are media reports about health risks that make me worried or curious” (Chi-square 10.393 with 0.006 P-value). Moreover, this result was confirmed by a Likelihood Ratio test with asymptotic significance 0.04 and 0.014 for the variables above respectively.

Moreover, the results of the frequency test showed that respondents who live with their spouse/partner with the frequency of 34 out of 53 and valid percent of 89.5 have the highest correlation with, “When I have seen a doctor, and want to know more about my condition, treatment or medication”. Also, the similar results for, “When there are media reports about health risks that make me worried or curious” with the frequency of 37 and valid percent of 97.4 has the highest correlation with “lives with spouse/partner”. Tables 11 and 12 show the results of the frequency test for the variables above.

Table 11. Frequency test for When I have seen a doctor, and want to know more about my condition, treatment or medication and Marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Yes	7	58.3	58.3	58.3
		No	5	41.7	41.7	100.0
		Total	12	100.0	100.0	
Together with spouse/partner	Valid	Yes	34	89.5	89.5	89.5
		No	4	10.5	10.5	100.0
		Total	38	100.0	100.0	
Together with relative/friends	Valid	Yes	3	100.0	100.0	100.0

Table 12. Frequency test for When there are media reports about health risks that make, me worried or curious and Marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Yes	8	66.7	66.7	66.7
		No	4	33.3	33.3	100.0
		Total	12	100.0	100.0	
Together with spouse/partner	Valid	Yes	37	97.4	97.4	97.4
		No	1	2.6	2.6	100.0
		Total	38	100.0	100.0	
Together with relative/friends	Valid	Yes	3	100.0	100.0	100.0

3. Name of the municipality

The name of the municipality had a correlation with “When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional” (Chi-square 23.603 with 0.023 P-value). Furthermore, the result was also confirmed with a Likelihood Ratio test, with 0.046 as asymptotic significance (df) which is in the acceptable range from 0.01 to 0.05.

Table 13. Frequency test for When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional and Name the municipality

Name the municipality			Frequency	Percent	Valid Percent	Cumulative Percent
Asikkala	Valid	Yes	1	100.0	100.0	100.0
Espoo	Valid	Yes	4	80.0	80.0	80.0
		No	1	20.0	20.0	100.0
		Total	5	100.0	100.0	
Helsinki	Valid	Yes	9	90.0	90.0	90.0
		No	1	10.0	10.0	100.0
		Total	10	100.0	100.0	
Jyväskylä	Valid	Yes	1	100.0	100.0	100.0
Lahti	Valid	Yes	3	100.0	100.0	100.0
Lohja	Valid	Yes	1	100.0	100.0	100.0
Oulu	Valid	Yes	1	50.0	50.0	50.0
		No	1	50.0	50.0	100.0
		Total	2	100.0	100.0	
Parainen	Valid	No	2	100.0	100.0	100.0
Pori	Valid	Yes	1	50.0	50.0	50.0
		No	1	50.0	50.0	100.0
		Total	2	100.0	100.0	
Tampere	Valid	No	1	100.0	100.0	100.0
Turku	Valid	Yes	18	90.0	90.0	90.0
		No	2	10.0	10.0	100.0
		Total	20	100.0	100.0	
Vantta	Valid	Yes	4	100.0	100.0	100.0
Vassa	Valid	No	1	100.0	100.0	100.0

Table 13 shows the results of the frequency test for, “When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional” and “Name the municipality” as an independent demographic variable. Moreover, the results of the frequency test showed that respondents who were living in major cities, such as Helsinki and Turku, (frequency of 9 and 18 out of 53 respectively) had the highest correlation with “When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional”.

4. Type of neighborhood

Type of neighborhood had a correlation with the following statement in the questionnaire: “When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional” (Chi-square 6.393 with 0.041 P-value). Also, it had a correlation with “When I want to find other people with a similar illness like me for emotional sharing or health information sharing” (Chi-square 8.635 with 0.013 P-value). Moreover, this result was confirmed by a Likelihood Ratio test with asymptotic significance 0.05 and 0.013 for the variables above respectively. Finally, the results of the frequency analysis show that respondents who were living in a city (frequency of 28 and 34 out of 53) had the highest correlation with the aforementioned dependent variables respectively (see Tables 14 & 15).

Table 14. Frequency test for When I want to find other people with similar illness like me for emotional sharing or health information sharing and Type of neighborhood

Type of neighborhood			Frequency	Percent	Valid Percent	Cumulative Percent
City	Valid	Yes	28	73.7	73.7	73.7
		No	10	26.3	26.3	100.0
		Total	38	100.0	100.0	
Countryside	Valid	Yes	4	44.4	44.4	44.4
		No	5	55.6	55.6	100.0
		Total	9	100.0	100.0	
Small town	Valid	Yes	1	16.7	16.7	16.7
		No	5	83.3	83.3	100.0
		Total	6	100.0	100.0	

Table 15. Frequency test for When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional and Type of neighborhood

Type of neighborhood			Frequency	Percent	Valid Percent	Cumulative Percent
City	Valid	Yes	34	89.5	89.5	89.5
		No	4	10.5	10.5	100.0
		Total	38	100.0	100.0	
Countryside	Valid	Yes	5	55.6	55.6	55.6
		No	4	44.4	44.4	100.0
		Total	9	100.0	100.0	
Small town	Valid	Yes	4	66.7	66.7	66.7
		No	2	33.3	33.3	100.0
		Total	6	100.0	100.0	

4.3.2 Demographic background & E-Health information sources

This section presents the results of statistical tests about using various E-Health information sources by either older adults or another person who is responsible for providing their health information. The E-Health information sources can be divided into four categories including Internet-based sources, wearable devices, mobile and mobile applications, as well as TV, radio, and audio or video health monitoring devices.

1. Internet-based health information sources

The results of the statistical tests show that among seventeen variables related to Internet-based health information sources, only three had a correlation with two demographic variables. On the one hand, there was a significant correlation between respondents' gender and "The websites of your local, municipal healthcare & social welfare services" (Chi-square 15.443 with 0.017 as P-value). This result was also confirmed by a Likelihood Ratio test (0.01 as asymptotic significance (df) which is in the acceptable range from 0.01 to 0.05).

Table 16. Statistical analyzing among demographic variables and internet-based health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Social Media		The websites of your local, municipal healthcare & social welfare services		Google or some other search engine	
Gender						
Female	Chi-square	5.06	Chi-square	15.443	Chi-square	7.146
Male	(P-value)	0.75	(P-value)	0.017	(P-value)	0.521
Prefer not to answer	Likelihood Ratio	5.53	Likelihood Ratio	16.746	Likelihood Ratio	7.545
	Asymptotic Significance	0.70	Asymptotic Significance	0.01	Asymptotic Significance	0.479
Marital status						
Alone	Chi-square	11.61	Chi-square	8.69	Chi-square	14.224
Together with spouse/partner	(P-value)	0.17	(P-value)	0.19	(P-value)	0.076
Together with relative	Likelihood Ratio	15.01	Likelihood Ratio	7.63	Likelihood Ratio	18.016
	Asymptotic Significance	0.05	Asymptotic Significance	0.27	Asymptotic Significance	0.021

After that, marital status had a significant correlation with using social media and Google, or some other search engine (Chi-square 11.61 & 14.224 with 0.17 & 0.076 as P-value respectively). These results were also confirmed by a Likelihood Ratio test (0.05 & 0.021 as asymptotic significance (df) which is in the acceptable range from 0.01 to 0.05 (see Table 16)). Moreover, the results of a frequency test show that female respondents with the frequency of 15 (rated "often" or "sometimes" in the Likert scale had the highest

correlation with using “The websites of your local, municipal healthcare and social welfare services”.

Finally, using social media as a health information source had a significant correlation with the respondents who said they were living with a spouse/partner. It had a frequency of 14 (rated “often” or “sometimes” in Likert scale) and a cumulative percentage of 48.30. However, using Google or some other search engine significantly correlated with the respondents who mentioned they were living with a spouse/partner (frequency of 19 (rated “always”, “often” or “sometimes” in Likert scale) and cumulative 65.5%). See tables 17, 18 and 19.

Table 17. Frequency test for using “The websites of your local, municipal healthcare and social welfare services” as internet-based health information sources and gender

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Female	Valid	Often	3	8.1	16.7	16.7
		Sometimes	12	32.4	66.7	83.3
		Rarely	2	5.4	11.1	94.4
		Never	1	2.7	5.6	100.0
		Total	18	48.6	100.0	
	Missing	0	19	51.4		
Total			37	100.0		
Male	Valid	Often	2	14.3	28.6	28.6
		Sometimes	1	7.1	14.3	42.9
		Never	4	28.6	57.1	100.0
		Total	7	50.0	100.0	
		Missing	0	7	50.0	
	Total			14	100.0	
Prefer not to answer	Valid	Never	2	100.0	100.0	100.0

Table 18. Frequency test for using social media as internet-based health information sources and Marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Often	4	33.3	36.4	36.4
		Sometimes	5	41.7	45.5	81.8
		Never	2	16.7	18.2	100.0
		Total	11	91.7	100.0	
		Missing	0	1	8.3	
	Total			12	100.0	
Together with spouse/partner	Valid	Always	5	13.2	17.2	17.2
		Often	3	7.9	10.3	27.6
		Sometimes	6	15.8	20.7	48.3
		Rarely	6	15.8	20.7	69.0
		Never	9	23.7	31.0	100.0
		Total	29	76.3	100.0	
	Missing	0	9	23.7		
Total			38	100.0		
Together with relative/friends	Valid	Often	1	33.3	33.3	33.3
		Rarely	1	33.3	33.3	66.7
		Never	1	33.3	33.3	100.0
		Total	3	100.0	100.0	

Table 19. Frequency test for using Google or some other search engine as internet-based health information sources and Marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Often	5	41.7	45.5	45.5
		Sometimes	5	41.7	45.5	90.9
		Never	1	8.3	9.1	100.0
		Total	11	91.7	100.0	
	Missing	0	1	8.3		
	Total		12	100.0		
Together with spouse/partner	Valid	Always	9	23.7	31.0	31.0
		Often	4	10.5	13.8	44.8
		Sometimes	6	15.8	20.7	65.5
		Rarely	4	10.5	13.8	79.3
		Never	6	15.8	20.7	100.0
		Total	29	76.3	100.0	
	Missing	0	9	23.7		
	Total		38	100.0		
Together with relative/friends	Valid	Often	1	33.3	33.3	33.3
		Rarely	1	33.3	33.3	66.7
		Never	1	33.3	33.3	100.0
		Total	3	100.0	100.0	

2. Using wearable devices as health information sources

The results of statistical tests show that among five main categories related to wearable devices as health information sources, only three had a correlation with three demographic variables. On the one hand, there was a significant correlation between the respondents and using “Fitness trackers” or “Blood pressure monitoring devices” as their E-Health information sources (Chi-square 11.543 & 12.751 with 0.021 & 0.013 as P-value respectively). This result was also confirmed by a Likelihood Ratio test (0.019 and 0.008 as asymptotic significance (df) respectively) (see Table 20). After that, education level had a significant correlation with using “Blood pressure monitoring devices” (Likelihood Ratio 21.86 with 0.039 as asymptotic significance (df) (see Table 20)). However, this result was not confirmed with Chi-square due to a violation in one of the assumptions of the test.

On the other hand, there was a significant correlation among type of neighborhood and using “Fitness trackers” or “Blood pressure monitoring devices” (Likelihood Ratio 16.366 and 19.096 with 0.037 and 0.014 as asymptotic significance respectively (see Table 20)). Finally, working status had a significant correlation with using “Any other wearable devices or tools” (Chi-square 11.355 with 0.003 as P-value). This result was also confirmed by a Likelihood Ratio test (8.694 and 0.013 as asymptotic significance (df) respectively (see Table 20)).

Table 20 Statistical analysis of demographic variables and using wearable devices as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Fitness tracker		Blood pressure monitor		Any other wearable devices or tools	
Answering questionnaire as						
The older Finnish adult On behalf of them	Chi-square	11.543	Chi-square	12.751	Chi-square	0.513
	(P-value)	0.021	(P-value)	0.013	(P-value)	0.474
	Likelihood Ratio	11.771	Likelihood Ratio	13.687	Likelihood Ratio	0.908
	Asymptotic Significance	0.019	Asymptotic Significance	0.008	Asymptotic Significance	0.341
The level of education						
Elementary and/or Intermediate school Upper secondary or Vocational school, Institute University/University of applied science Other	Chi-square	13.111	Chi-square	19.868	Chi-square	2.727
	(P-value)	0.361	(P-value)	0.070	(P-value)	0.436
	Likelihood Ratio	16.439	Likelihood Ratio	21.86	Likelihood Ratio	2.518
	Asymptotic Significance	0.172	Asymptotic Significance	0.039	Asymptotic Significance	0.472
Type of neighborhood						
City Countryside Small town	Chi-square	13.94	Chi-square	17.297	Chi-square	2.802
	(P-value)	0.083	(P-value)	0.027	(P-value)	0.246
	Likelihood Ratio	16.366	Likelihood Ratio	19.096	Likelihood Ratio	2.714
	Asymptotic Significance	0.037	Asymptotic Significance	0.014	Asymptotic Significance	0.257
Currently retired						
Yes No I am retired, but I am still at work	Chi-square	11.171	Chi-square	7.939	Chi-square	11.355
	(P-value)	0.192	(P-value)	0.439	(P-value)	0.003
	Likelihood Ratio	12.601	Likelihood Ratio	9.117	Likelihood Ratio	8.694
	Asymptotic Significance	0.126	Asymptotic Significance	0.333	Asymptotic Significance	0.013

In order to understand correlation among dependent and independent variables from the results above, some frequency tests were also taken into consideration. First of all, the results of the frequency analysis show that older adults and people who live in cities (frequency of 21 and 17 (rated “always”, “often” or “sometimes” in Likert scale) from total 53) had the highest correlation with using “Fitness tracker” as wearable health information sources (see Table 21 and 22).

Table 21. Frequency test for using fitness tracker as wearable health information sources and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
Finnish adult	Valid	Always	8	17.8	17.8	17.8
		Often	2	4.4	4.4	22.2
		Sometimes	11	24.4	24.4	46.7
		Rarely	7	15.6	15.6	62.2
		Never	17	37.8	37.8	100.0
		Total	45	100.0	100.0	
On behalf	Valid	Often	3	37.5	37.5	37.5
		Rarely	1	12.5	12.5	50.0
		Never	4	50.0	50.0	100.0
		Total	8	100.0	100.0	

Table 22 . Frequency test for using fitness tracker as wearable health information sources and type of neighborhood

Type of neighborhood			Frequency	Percent	Valid Percent	Cumulative Percent
City	Valid	Always	6	15.8	15.8	15.8
		Often	3	7.9	7.9	23.7
		Sometimes	8	21.1	21.1	44.7
		Rarely	3	7.9	7.9	52.6
		Never	18	47.4	47.4	100.0
		Total	38	100.0	100.0	
Countryside	Valid	Often	2	22.2	22.2	22.2
		Sometimes	3	33.3	33.3	55.6
		Rarely	3	33.3	33.3	88.9
		Never	1	11.1	11.1	100.0
		Total	9	100.0	100.0	
Small town	Valid	Always	2	33.3	33.3	33.3
		Rarely	2	33.3	33.3	66.7
		Never	2	33.3	33.3	100.0
		Total	6	100.0	100.0	

After that, the results of the frequency test show that older adults with a university degree, and people who live in cities (frequency of 21, 18 and 18 rated “always”, “often”, “sometimes or “rarely” in Likert scale) had the highest correlation with “Blood pressure monitoring devices“ as wearable health information sources (see Table 23, 24 and 25). Finally, there were only a few retired older adults (the frequency of 3 out of 38) who mentioned that sometimes they would use other wearable devices or tools as wearable health information sources (see Table 26).

Table 23. Frequency test for using blood pressure monitoring devices as wearable health information sources and educational level

the highest level of education			Frequency	Percent	Valid Percent	Cumulative Percent
Elementary and/or Intermediate school	Valid	Always	1	25.0	25.0	25.0
		Sometimes	2	50.0	50.0	75.0
		Rarely	1	25.0	25.0	100.0
		Total	4	100.0	100.0	
Upper secondary or Vocational school, Institute	Valid	Always	1	25.0	25.0	25.0
		Rarely	2	50.0	50.0	75.0
		Never	1	25.0	25.0	100.0
		Total	4	100.0	100.0	
University/University of applied science	Valid	Always	6	18.8	18.8	18.8
		Often	4	12.5	12.5	31.3
		Sometimes	6	18.8	18.8	50.0
		Rarely	2	6.3	6.3	56.3
		Never	14	43.8	43.8	100.0
		Total	32	100.0	100.0	
Other	Valid	Often	1	7.7	7.7	7.7
		Sometimes	3	23.1	23.1	30.8
		Never	9	69.2	69.2	100.0
		Total	13	100.0	100.0	

Table 24. Frequency test for using blood pressure monitoring devices as wearable health information sources and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
Finnish adult	Valid	Always	8	17.8	17.8	17.8
		Often	2	4.4	4.4	22.2
		Sometimes	11	24.4	24.4	46.7
		Rarely	5	11.1	11.1	57.8
		Never	19	42.2	42.2	100.0
		Total	45	100.0	100.0	
On behalf	Valid	Often	3	37.5	37.5	37.5
		Never	5	62.5	62.5	100.0
		Total	8	100.0	100.0	

Table 25. Frequency test for using blood pressure monitoring devices as wearable health information sources and type of neighborhood

Type of neighborhood			Frequency	Percent	Valid Percent	Cumulative Percent
City	Valid	Always	6	15.8	15.8	15.8
		Often	3	7.9	7.9	23.7
		Sometimes	8	21.1	21.1	44.7
		Rarely	1	2.6	2.6	47.4
		Never	20	52.6	52.6	100.0
		Total	38	100.0	100.0	
Countryside	Valid	Often	2	22.2	22.2	22.2
		Sometimes	3	33.3	33.3	55.6
		Rarely	3	33.3	33.3	88.9
		Never	1	11.1	11.1	100.0
		Total	9	100.0	100.0	
Small town	Valid	Always	2	33.3	33.3	33.3
		Rarely	1	16.7	16.7	50.0
		Never	3	50.0	50.0	100.0
		Total	6	100.0	100.0	

Table 26. Frequency test for using any other wearable devices or tools as wearable health information sources and working status

Working status			Frequency	Percent	Valid Percent	Cumulative Percent
Yes	Valid	Sometimes	3	42.9	60.0	60.0
		Never	2	28.6	40.0	100.0
		Total	5	71.4	100.0	
	Missing	0	2	28.6		
	Total	7	100.0			
No	Valid	Sometimes	1	2.6	4.5	4.5
		Never	21	55.3	95.5	100.0
		Total	22	57.9	100.0	
	Missing	0	16	42.1		
	Total	38	100.0			
I am retired, but I am still at work	Valid	Never	3	37.5	100.0	100.0
		Missing	0	5	62.5	
		Total	8	100.0		

3. Using mobile applications as health information sources

The results of statistical tests show that among nine variables related to mobile applications as health information sources, only three had a correlation with two demographic variables.

On the one hand, there was a significant correlation between respondents' marital status and "health mobile vault" and "smoking cessation mobile apps" as health information sources (Likelihood Ratio 5.67 and 6.457 with 0.05 and 0.04 as asymptotic significance (see Table 27)). After that, working status had a significant correlation with using eye tester apps as health information sources (Chi-square 11.969 with 0.018 as P-value). These results were also confirmed by a Likelihood Ratio test (0.05 as asymptotic significance (df) (see Table 27)).

Table 27 Statistical analyzing among demographic variables and using mobile applications as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Eye tester apps		Health mobile vault (Microsoft)		Smoking cessation mobile apps	
Marital status						
Alone Together with spouse/partner Together with relative	Chi-square	3.31	Chi-square	4.15	Chi-square	5.135
	(P-value)	0.507	(P-value)	0.13	(P-value)	0.077
	Likelihood Ratio	3.502	Likelihood Ratio	5.67	Likelihood Ratio	6.457
	Asymptotic Significance	0.478	Asymptotic Significance	0.05	Asymptotic Significance	0.04
currently retired						
Yes No I am retired, but I am still at work	Chi-square	11.969	Chi-square	1.798	Chi-square	4.451
	(P-value)	0.018	(P-value)	0.407	(P-value)	0.108
	Likelihood Ratio	9.374	Likelihood Ratio	1.722	Likelihood Ratio	4.127
	Asymptotic Significance	0.05	Asymptotic Significance	0.423	Asymptotic Significance	0.127

Concerning correlation among dependent and independent variables from the results above, some frequency tests were also taken into consideration. First of all, the results of the frequency analysis show that older adults who are living with either their spouse/partner or their relative/friends (frequency of 9 and 8 (rated "rarely" in Likert scale) from total 38) had the highest correlation with using "health mobile vault (Microsoft) and smoking cessation mobile apps" as their health information sources (see Table 28 and 29). Finally, almost all older adults who are at work now mentioned that they never used any eye tester apps as their health information sources (see Table 30).

Table 28. Frequency test for using health mobile vault (Microsoft) as mobile application health information sources and marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Never	5	41.7	100.0	100.0
	Missing	0	7	58.3		
	Total		12	100.0		
Together with spouse/partner	Valid	Rarely	7	18.4	38.9	38.9
		Never	11	28.9	61.1	100.0
		Total	18	47.4	100.0	
	Missing	0	20	52.6		
Total			38	100.0		
Together with relative/friends	Valid	Rarely	2	66.7	66.7	66.7
		Never	1	33.3	33.3	100.0
	Total		3	100.0	100.0	

Table 29. Frequency test for using smoking cessation apps as mobile application health information sources and marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Never	7	58.3	100.0	100.0
	Missing	0	5	41.7		
	Total		12	100.0		
Together with spouse/partner	Valid	Rarely	6	15.8	28.6	28.6
		Never	15	39.5	71.4	100.0
		Total	21	55.3	100.0	
	Missing	0	17	44.7		
	Total		38	100.0		
Together with relative/friends	Valid	Rarely	2	66.7	66.7	66.7
		Never	1	33.3	33.3	100.0
	Total	3	100.0	100.0		

Table 30. Frequency test for using eye tester apps as mobile application health information sources and working status

Working status			Frequency	Percent	Valid Percent	Cumulative Percent
Yes	Valid	Sometimes	1	14.3	20.0	20.0
		Rarely	2	28.6	40.0	60.0
		Never	2	28.6	40.0	100.0
		Total	5	71.4	100.0	
	Missing	0	2	28.6		
	Total		7	100.0		
No	Valid	Rarely	1	2.6	4.5	4.5
		Never	21	55.3	95.5	100.0
		Total	22	57.9	100.0	
	Missing	0	16	42.1		
	Total		38	100.0		
I am retired, but I am still at work	Valid	Never	3	37.5	100.0	100.0
	Missing	0	5	62.5		
	Total		8	100.0		

4. Online TV, radio, audio and video as health information sources

The results of statistical tests show that among three main categories of variables related to Online TV, radio, audio and video monitoring devices as health information sources, only two main types had a correlation with two demographic variables.

On the one hand, there was a significant correlation between respondents' gender and "Online TV health-related programs" as health information sources (Chi-square 16.113 with 0.013 as P-value respectively). Furthermore, the same result was also confirmed by a Likelihood Ratio test (14.936 and 0.021 as asymptotic significance (df) respectively (see Table 31)). Next, marital status had a significant correlation with using audio or video health monitoring devices as health information sources (Chi-square 5.65 with 0.05 as P-value). These results were also confirmed by a Likelihood Ratio test (0.032 as asymptotic significance (df) (see Table 31)).

Table 31. Statistical analyzing among demographic variables and Online TV, radio, audio & video monitoring devices as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Online TV health-related programs		Audio or video health monitoring devices	
Gender				
Female				
Male	Chi-square	16.113	Chi-square	1.137
Prefer not to answer	(P-value)	0.013	(P-value)	0.566
	Likelihood Ratio	14.936	Likelihood Ratio	1.558
	Asymptotic Significance	0.021	Asymptotic Significance	0.459
Marital status				
Alone				
Together with spouse/partner	Chi-square	6.172	Chi-square	5.65
Together with relative	(P-value)	0.404	(P-value)	0.05
	Likelihood Ratio	7.871	Likelihood Ratio	6.88
	Asymptotic Significance	0.248	Asymptotic Significance	0.03

After that, the correlation among correlated dependent and independent variables with some frequency tests were also taken into consideration. On the one hand, the results of the frequency analysis show that female respondents (frequency of 13 (rated “often”, “sometimes” and “rarely” in Likert scale) from total 22) had the highest correlation with using “Online TV health-related programs” as their health information sources (see Table 33).

Finally, the majority of older adults who were living with their spouse/partner (frequency of 23 out of 38) mentioned that they never used any audio or video health monitoring devices as their health information sources (see Table 32).

Table 32. Frequency test for using audio or video health monitoring devices as health information sources and marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Never	8	66.7	100.0	100.0
	Missing	0	4	33.3		
	Total		12	100.0		
Together with spouse/partner	Valid	Rarely	6	15.8	26.1	26.1
		Never	17	44.7	73.9	100.0
		Total	23	60.5	100.0	
	Missing	0	15	39.5		
	Total		38	100.0		
Together with relative/friends	Valid	Rarely	2	66.7	66.7	66.7
		Never	1	33.3	33.3	100.0
	Total		3	100.0	100.0	

Table 33. Frequency test for using Online TV health-related programs as health information sources and gender

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Female	Valid	Often	3	8.1	13.6	13.6
		Sometimes	5	13.5	22.7	36.4
		Rarely	5	13.5	22.7	59.1
		Never	9	24.3	40.9	100.0
		Total	22	59.5	100.0	
	Missing	0	15	40.5		
	Total		37	100.0		
Male	Valid	Rarely	3	21.4	33.3	33.3
		Never	6	42.9	66.7	100.0
		Total	9	64.3	100.0	
	Missing	0	5	35.7		
	Total		14	100.0		
Prefer not to answer	Valid	Often	2	100.0	100.0	100.0

4.3.3 Demographic background and challenges of using E-Health information

This section presents the results of statistical tests about challenges of using various E-Health information sources experienced by respondents to the questionnaire. The challenges of using E-Health information sources were divided based on the nature of each E-Health source into either eight or nine main categories. They are as follows: serve their purpose, easy to use, easy to access, cheap to access or use, possibility of participating in health-related concerns (through calling or sending email, etc. for my questions or concerns), trustability of the health information, usefulness of health information (save money, time, provide useful information), supportability, and understanding when to stop seeking for health information. In the following parts of this section, the results of correlation tests, as well as frequency examination about the variables above, will be presented.

1) Challenges related to using Internet-based health information sources

The results of statistical tests show that among nine variables related to challenges of using internet-based health information sources, only three had a correlation with three demographic variables.

On the one hand, there was a significant correlation between respondents' opinion about "Online services are cheap to access or use" (Likelihood Ratio 8.761 with 0.033 as asymptotic significance) (see Table 34). After that, working status had a significant correlation with the possibility of participating easily in online health information discussions (Chi-square 15.501 with 0.017 as P-value respectively). Also, the same result was also confirmed by a Likelihood Ratio test (0.018 as asymptotic significance (df)) (see Table 34).

Finally, income level had a significant correlation with challenges related to trustability of online health information sources (Chi-square 25.703 with 0.012 as P-value).

The result of a Likelihood Ratio test (20.61 and 0.05 as asymptotic significance (df)) confirmed the above-mentioned correlation (see Table 34).

Table 34. Statistical analyzing among demographic variables and challenges related to using Internet-based health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Cheap to access or use		Participate easily		Trust	
Answering questionnaire as						
The older Finnish adult	Chi-square	6.871	Chi-square	2.811	Chi-square	1.339
On behalf of the them	(P-value)	0.076	(P-value)	0.422	(P-value)	0.855
	Likelihood Ratio	8.761	Likelihood Ratio	4.18	Likelihood Ratio	2.27
	Asymptotic Significance	0.033	Asymptotic Significance	0.243	Asymptotic Significance	0.686
currently retired						
Yes	Chi-square	2.674	Chi-square	15.501	Chi-square	3.446
No	(P-value)	0.849	(P-value)	0.017	(P-value)	0.903
I am retired, but I am still at work	Likelihood Ratio	3.986	Likelihood Ratio	15.291	Likelihood Ratio	4.95
	Asymptotic Significance	0.679	Asymptotic Significance	0.018	Asymptotic Significance	0.763
Total income level per year						
15,000 euro or less than	Chi-square	3.679	Chi-square	7.712	Chi-square	25.703
between 15,000 to 25,000 euro	(P-value)	0.931	(P-value)	0.563	(P-value)	0.012
between 25,000 to 36,000 euro	Likelihood Ratio	4.21	Likelihood Ratio	9.02	Likelihood Ratio	20.61
36,000 euro and higher than that	Asymptotic Significance	0.897	Asymptotic Significance	0.435	Asymptotic Significance	0.05

Correlation among correlated dependent and independent variables with some frequency tests were also taken into consideration. On the one hand, the results of frequency analysis show that respondents (frequency of 19 (rated “slightly disagree” and “very disagree” in Likert scale) from total 27) had the highest correlation with “Online services are cheap to access or use,” as their challenges related to using Internet-based health information sources (see Table 34).

However, other Finnish older adults, with the frequency of 14, mentioned “Online services are cheap to access or use” as one of their challenges related to using Internet-based health information sources. Therefore, it can be concluded that a majority of respondents did not believe using online services as health information sources are cheap to access or use (frequency of 33% and cumulative percent 89.2) (see Table 35).

Table 35. Frequency test for challenges related to online services as cheap to access or use and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
Finnish adult	Valid	Strongly Agree	4	8.9	10.8	10.8
		Neutral	14	31.1	37.8	48.6
		Slightly disagree	18	40.0	48.6	97.3
		Very disagree	1	2.2	2.7	100.0
		Total	37	82.2	100.0	
	Missing	0	8	17.8		
	Total		45	100.0		
On behalf	Valid	Neutral	5	62.5	100.0	100.0
	Missing	0	3	37.5		
	Total		8	100.0		

On the other hand, the majority of older adults who were employed (frequency of 19 out of 30) mentioned that they have a neutral idea about “participating easily in online health information discussions” item (see Table 37). However, the other respondents who were employed, with the frequency of 9 out of a total of 30 respondents, mentioned (rated “strongly agree” and “agree” in Likert scale) that they had a positive idea of “participating easily in online health information discussions”. Therefore, it can be concluded that participating in online health information discussions was not a significant challenge for working older Finnish adults (see Table 36).

Table 36. Frequency test for challenges related to participating in online health information discussions and working status

Working status			Frequency	Percent	Valid Percent	Cumulative Percent
Yes	Valid	Strongly Agree	2	28.6	28.6	28.6
		Agree	1	14.3	14.3	42.9
		Neutral	1	14.3	14.3	57.1
		Slightly disagree	3	42.9	42.9	100.0
		Total	7	100.0	100.0	
No	Valid	Strongly Agree	2	5.3	6.7	6.7
		Agree	7	18.4	23.3	30.0
		Neutral	19	50.0	63.3	93.3
		Slightly disagree	2	5.3	6.7	100.0
		Total	30	78.9	100.0	
	Missing	0	8	21.1		
	Total		38	100.0		
I am retired, but I am still at work	Valid	Neutral	5	62.5	100.0	100.0
	Missing	0	3	37.5		
	Total		8	100.0		

Finally, similar to results mentioned above, the majority of the older Finnish adults who earn more than 36,000 euro per year (frequency of 19 out of 34) indicated that they have a neutral idea about trusting online health information sources (see Table 34). However, the other respondents with the same income level per year, with a frequency of 8 respondents, mentioned (rated “slightly disagree” and “very disagree” in Likert scale) that they had a negative idea about it.

Consequently, it can be concluded that trusting online health information sources was recognized as a significant challenge for the older Finnish adults with high-income level per year (see Table 37).

Table 37. Frequency test for challenges related to trust online health information sources and income level

Total income level per year			Frequency	Percent	Valid Percent	Cumulative Percent
15,000 euro or less than	Valid	Strongly Agree	1	33.3	100.0	100.0
	Missing	0	2	66.7		
	Total		3	100.0		
between 15,000 to 25,000 euro	Valid	Neutral	1	20.0	33.3	33.3
		Slightly disagree	2	40.0	66.7	100.0
		Total	3	60.0	100.0	
	Missing	0	2	40.0		
Total		5	100.0			
between 25,000 to 36,000 euro	Valid	Slightly disagree	1	25.0	25.0	25.0
		Very disagree	3	75.0	75.0	100.0
		Total	4	100.0	100.0	
36,000 euro and higher than that	Valid	Strongly Agree	4	9.8	11.8	11.8
		Agree	3	7.3	8.8	20.6
		Neutral	19	46.3	55.9	76.5
		Slightly disagree	4	9.8	11.8	88.2
		Very disagree	4	9.8	11.8	100.0
		Total	34	82.9	100.0	
	Missing	0	7	17.1		
Total		41	100.0			

2) Challenges related to using wearable devices as health information sources

The results of statistical tests showed that among nine variables related to challenges of using wearable devices as health information sources, only three had a correlation with two demographic variables. On the one hand, there is a significant correlation between respondents and “wearable devices are cheap to access or use” and “receiving enough support while using wearable devices” as health information sources (Likelihood Ratio 9.392 and 10.663 with 0.05 and 0.031 as asymptotic significance) (see Table 38).

After that, gender had a significant correlation with “wearable devices are easy to access” as health information sources (Chi-square 16.157 with 0.04 as P-value). These results were also confirmed with a Likelihood Ratio test (0.027 as asymptotic significance (df)) (see Table 38).

Table 38. Statistical analyzing among demographic variables and challenges related to using wearable devices as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Easy to access		Cheap to access or use		Support while I used wearable devices	
Answering questionnaire as						
Finnish adult	Chi-square	1.026	Chi-square	7.568	Chi-square	12.017
On behalf	(P-value)	0.906	(P-value)	0.109	(P-value)	0.017
	Likelihood Ratio	1.57	Likelihood Ratio	9.392	Likelihood Ratio	10.663
	Asymptotic Significance	0.814	Asymptotic Significance	0.05	Asymptotic Significance	0.031
Gender						
Female	Chi-square	16.157	Chi-square	8.057	Chi-square	12.226
Male	(P-value)	0.04	(P-value)	0.428	(P-value)	0.141
Prefer not to answer	Likelihood Ratio	17.335	Likelihood Ratio	6.952	Likelihood Ratio	9.583
	Asymptotic Significance	0.027	Asymptotic Significance	0.542	Asymptotic Significance	0.295

In order to understand the correlation among dependent and independent variables, some frequency tests need to be conducted. First of all, the results of the frequency analysis show that older adults (frequency of 23 (rated “slightly disagree” and “very disagree” in Likert scale) from total 37) had the highest correlation with “wearable devices are cheap to access or use” (see Table 39). However, the other respondents (frequency of 15, rated “strongly agree” and “neutral” in Likert scale, from total 37) had the second highest correlation with “wearable devices are cheap to access or use”, as their challenges related to using wearable devices as health information sources. Therefore, it can be concluded that a majority of the respondents did not believe using wearable devices is cheap to access or use (see Table 39).

Table 39. Frequency test for challenges related to wearable devices are cheap to access or use and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
The older Finnish adult	Valid	Strongly Agree	3	6.7	8.1	8.1
		Neutral	12	26.7	32.4	40.5
		Slightly disagree	21	46.7	56.8	97.3
		Very disagree	1	2.2	2.7	100.0
		Total	37	82.2	100.0	
	Missing	0	8	17.8		
Total			45	100.0		
On behalf of them	Valid	Neutral	5	62.5	100.0	100.0
	Missing	0	3	37.5		
	Total		8	100.0		

Table 40. Frequency test for challenges related to receiving support while using wearable devices and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
The older Finnish adult	Valid	Strongly Agree	3	6.7	8.1	8.1
		Agree	1	2.2	2.7	10.8
		Neutral	27	60.0	73.0	83.8
		Slightly disagree	2	4.4	5.4	89.2
		Very disagree	4	8.9	10.8	100.0
		Total	37	82.2	100.0	
	Missing	0	8	17.8		
	Total		45	100.0		
On behalf of them	Valid	Neutral	4	50.0	80.0	80.0
		Slightly disagree	1	12.5	20.0	100.0
		Total	5	62.5	100.0	
	Missing	0	3	37.5		
	Total		8	100.0		

Secondly, the majority of older adults (frequency of 31 out of 37) mentioned that they have a neutral answer for the positive opinion on receiving enough support while using wearable devices as health information sources (see Table 40). However, the other respondents (frequency of 6 (rated “slightly disagree” and “very disagree” in Likert scale) from total 37) had a negative idea about receiving enough support while using wearable devices as health information sources. Therefore, it can be concluded that receiving enough support while using wearable devices was not a significant challenge for older adults (see Table 40).

Table 41. Frequency test for challenges related to wearable devices are easy to access and gender

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Female	Valid	Strongly Agree	1	2.7	3.4	3.4
		Agree	3	8.1	10.3	13.8
		Neutral	19	51.4	65.5	79.3
		Slightly disagree	4	10.8	13.8	93.1
		Very disagree	2	5.4	6.9	100.0
		Total	29	78.4	100.0	
	Missing	0	8	21.6		
	Total		37	100.0		
Male	Valid	Strongly Agree	1	7.1	9.1	9.1
		Neutral	9	64.3	81.8	90.9
		Slightly disagree	1	7.1	9.1	100.0
		Total	11	78.6	100.0	
	Missing	0	3	21.4		
	Total		14	100.0		
Prefer not to answer	Valid	Agree	1	50.0	50.0	50.0
		Slightly disagree	1	50.0	50.0	100.0
		Total	2	100.0	100.0	

Finally, similar to results mentioned above, the majority of the female respondents (frequency of 23 out of 29) indicated that they have varied from a neutral to a positive idea about “wearable devices are easy to access” (see Table 41). However, the other female respondents (frequency of 6 (rated “slightly disagree” and “very disagree” in Likert scale) from total 29) had a negative idea about it. Consequently, it can be concluded that wearable devices were not recognized as a significant challenge for female Finnish older adult respondents (see Table 41).

3) Challenges related to using mobile applications as health information sources

The results of statistical tests show that among nine variables related to challenges of using mobile applications as health information sources, only three of had a correlation with two demographic variables.

First of all, there was a significant correlation between respondents' opinion about "mobile applications are cheap to access or use" and "receiving enough support while using mobile applications" as health information sources (see Table 42). After that, the gender of respondents had a strong correlation with their opinion about "mobile applications are easy to access" as health information sources)Chi-square 16.16 with 0.04 as P-value). These results were also confirmed with a Likelihood Ratio test (0.027 as asymptotic significance (df)) (see Table 42).

Also, the correlation among dependent and independent variables through frequency tests was analyzed. Firstly, the results of the frequency analysis show that respondents had the highest correlation with "mobile applications are cheap to access or use" and "receiving support while using E-Health mobile applications", as their challenges related to using E-Health mobile applications (see Tables 43 and 44).

Secondly, the majority of the female respondents (frequency of 25 out of 29 with cumulative percent of 86.2) mentioned that they have various opinions ranging from neutral to the negative about "mobile applications are easy to access" (see Table 45).

Table 42. Frequency test for challenges related to" mobile applications are cheap to access or use" and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
The older Finnish adult	Valid	Strongly Agree	3	6.7	8.1	8.1
		Agree	1	2.2	2.7	10.8
		Neutral	13	28.9	35.1	45.9
		Slightly disagree	18	40.0	48.6	94.6
		Very disagree	2	4.4	5.4	100.0
		Total	37	82.2	100.0	
	Missing	0	8	17.8		
On behalf of them	Total		45	100.0		
	Valid	Neutral	5	62.5	100.0	100.0
	Missing	0	3	37.5		
	Total		8	100.0		

Table 43. Frequency test for challenges related to receiving enough support while using E-Health mobile applications and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
The older Finnish adult	Valid	Strongly Agree	3	6.7	8.1	8.1
		Agree	7	15.6	18.9	27.0
		Neutral	17	37.8	45.9	73.0
		Slightly disagree	8	17.8	21.6	94.6
		Very disagree	2	4.4	5.4	100.0
		Total	37	82.2	100.0	
	Missing	0	8	17.8		
	Total		45	100.0		
On behalf of them	Valid	Strongly Agree	2	25.0	40.0	40.0
		Neutral	1	12.5	20.0	60.0
		Very disagree	2	25.0	40.0	100.0
		Total	5	62.5	100.0	
		Missing	0	3	37.5	
Total		8	100.0			

Table 44. Frequency test for challenges related "mobile applications are easy to access" and gender

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Female	Valid	Agree	4	10.8	13.8	13.8
		Neutral	18	48.6	62.1	75.9
		Slightly disagree	5	13.5	17.2	93.1
		Very disagree	2	5.4	6.9	100.0
		Total	29	78.4	100.0	
		Missing	0	8	21.6	
Total		37	100.0			
Male	Valid	Strongly Agree	3	21.4	27.3	27.3
		Neutral	7	50.0	63.6	90.9
		Slightly disagree	1	7.1	9.1	100.0
		Total	11	78.6	100.0	
		Missing	0	3	21.4	
Total		14	100.0			
Prefer not to answer	Valid	Agree	1	50.0	50.0	50.0
		Slightly disagree	1	50.0	50.0	100.0
		Total	2	100.0	100.0	

Table 45. Statistical analysis of demographic variables and challenges related to using mobile applications as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Easy to access		Cheap to access or use		Support	
Answering questionnaire as	Chi-square	(P-value)	Chi-square	(P-value)	Chi-square	(P-value)
The older Finnish adult	1.026	0.906	7.568	0.109	12.017	0.017
On behalf of them	1.57	0.814	9.392	0.05	10.663	0.031
Gender						
Female	16.157	0.04	8.057	0.428	12.226	0.141
Male	17.335	0.027	6.952	0.542	9.583	0.295
Prefer not to answer						

4) Challenges related to using online TV health-related programs as health information sources

The results of statistical tests show that among nine variables related to challenges of using online TV health-related programs as health information sources, only two had a correlation with two demographic variables.

On the one hand, there was a significant correlation between respondents' tendencies and "Online TV health-related programs are cheap to access or use" as health information sources (Chi-square 8.129 with 0.043 as P-value). These results were also confirmed with a Likelihood Ratio test (0.019 as asymptotic significance (df)) (see Table 46). On the other hand, working status had a significant correlation with "ability to participate (through calling or sending email, etc. for my questions or concerns) easily with Online TV health-related programs" as health information sources (Chi-square 17.105 with 0.009 as P-value). These results were also confirmed with a Likelihood Ratio test (0.013 as asymptotic significance (df)) (see Table 46).

Table 46. Statistical analyzing among demographic variables and challenges related to using online TV health-related programs as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Cheap to access or use		Participate easily	
Answering questionnaire as				
The older Finnish adult	Chi-square	8.129	Chi-square	3.062
On behalf of them	(P-value)	0.043	(P-value)	0.382
	Likelihood Ratio	9.916	Likelihood Ratio	4.331
	Asymptotic Significance	0.019	Asymptotic Significance	0.228
currently retired				
Yes	Chi-square	3.056	Chi-square	17.105
No	(P-value)	0.802	(P-value)	0.009
I am retired, but I am still at work	Likelihood Ratio	4.124	Likelihood Ratio	16.091
	Asymptotic Significance	0.66	Asymptotic Significance	0.013

Furthermore, some frequency tests were conducted to investigate the correlation among dependent and independent variables. Firstly, the results of the frequency analysis show that there is the highest correlation between respondents' tendencies with "Online TV health-related programs are cheap to access or use". Furthermore, they claimed that using online TV health-related programs is cheap to access or to use (see Table 47). Secondly, the results show that the majority of the older Finnish adults who are currently working (frequency of 24 out of 25 with cumulative percent of 96.0) have opinions ranging from neutral to very positive about the ability to

participate easily in online TV health-related programs as health information sources (see Table 48).

Table 47. Frequency test for challenges related “Online TV health-related programs are cheap to access or use” and Finnish older adults or people who were taking care of their health information needs

Answering questionnaire as			Frequency	Percent	Valid Percent	Cumulative Percent
The older Finnish adult	Valid	Strongly Agree	4	8.9	12.9	12.9
		Neutral	10	22.2	32.3	45.2
		Slightly disagree	16	35.6	51.6	96.8
		Very disagree	1	2.2	3.2	100.0
		Total	31	68.9	100.0	
	Missing	0	14	31.1		
Total			45	100.0		
On behalf of them	Valid	Neutral	5	62.5	100.0	100.0
	Missing	0	3	37.5		
	Total		8	100.0		

Table 48. Frequency test for challenges related to participating (through calling or sending email, etc. for my questions or concerns) easily with online TV health-related programs and working status

Working status			Frequency	Percent	Valid Percent	Cumulative Percent
Yes	Valid	Strongly Agree	2	28.6	28.6	28.6
		Agree	1	14.3	14.3	42.9
		Neutral	1	14.3	14.3	57.1
		Slightly disagree	3	42.9	42.9	100.0
		Total	7	100.0	100.0	
No	Valid	Strongly Agree	1	2.6	4.0	4.0
		Agree	6	15.8	24.0	28.0
		Neutral	17	44.7	68.0	96.0
		Slightly disagree	1	2.6	4.0	100.0
		Total	25	65.8	100.0	
	Missing	0	13	34.2		
Total			38	100.0		
I am retired, but I am still at work	Valid	Neutral	4	50.0	100.0	100.0
	Missing	0	4	50.0		
	Total		8	100.0		

5) Challenges related to using online Radio health-related programs as health information sources

The results of statistical tests show that among nine variables related to challenges of using online radio health-related programs as health information sources, one had a correlation with one demographic variable. The results show there was a significant correlation between “marital status” and “online Radio health-related programs are easy to access” as health information sources (Chi-square 12.896 with 0.045 as P-value (see Table 49).

Table 49. Statistical analysis of demographic variables and challenges related to using online radio health-related programs as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Easy to access	
Marital status		
Alone	Chi-square	12.896
Together with spouse/partner	(P-value)	0.045
Together with relative	Likelihood Ratio	12.768
	Asymptotic Significance	0.047

Moreover, the results of the frequency test show that respondents who live with their spouse/partner have the highest correlation with “online radio health-related programs are easy to access” and their challenges were to use online radio health-related programs as health information sources (see Table 50).

Table 50 . Frequency test for challenges related to” online radio health-related programs are easy to access” and marital status

Marital status			Frequency	Percent	Valid Percent	Cumulative Percent
Alone	Valid	Neutral	4	33.3	40.0	40.0
		Slightly disagree	4	33.3	40.0	80.0
		Very disagree	2	16.7	20.0	100.0
		Total	10	83.3	100.0	
	Missing	0	2	16.7		
	Total		12	100.0		
Together with spouse/partner	Valid	Agree	2	5.3	8.0	8.0
		Neutral	19	50.0	76.0	84.0
		Slightly disagree	4	10.5	16.0	100.0
		Total	25	65.8	100.0	
	Missing	0	13	34.2		
	Total		38	100.0		
Together with relative/friends	Valid	Agree	1	33.3	33.3	33.3
		Neutral	2	66.7	66.7	100.0
		Total	3	100.0	100.0	

6) Challenges related to using audio or video health monitoring devices as health information sources

The results of statistical tests show that among nine variables related to challenges of using audio or video health monitoring devices as health information sources, only two had a correlation with three demographic variables. On the one hand, there was a significant correlation between “working status” and “receiving enough support while using audio or video health monitoring devices” as health information sources (Chi-square 15.398 with 0.052 as P-value). These results were also confirmed by a Likelihood Ratio test (0.044 as asymptotic significance (df)) (see Table 51).

On the other hand, total income level and current status of health had a significant correlation with “usefulness of audio or video health monitoring devices” as health information sources (Chi-square 15.381 and 23.605 with 0.017 and 0.005 as P-value respectively). These results were also confirmed by a Likelihood Ratio test (0.014 and 0.02 as asymptotic significance (df) accordingly) (see Table 51).

Also, some frequency tests were conducted to investigate correlation among correlated dependent and independent variables. Firstly, the results of the frequency tests show that older adults who were not retired had the highest correlation with “receiving support while using audio or video health monitoring devices”, as their challenges related to using audio or video health monitoring devices (see Table 51). This result means

respondents were not satisfied with receiving enough technical support while they were using audio or video health monitoring devices.

Table 51. Statistical analysis of demographic variables and challenges related to using audio or video health monitoring devices as health information sources via Chi-square & Likelihood Ratio

Demographic Variables	Useful (save money, time, provide useful information)		Support	
currently retired				
Yes	Chi-square	2.146	Chi-square	15.398
No	(P-value)	0.906	(P-value)	0.052
I am retired, but I am still at work	Likelihood Ratio	3.407	Likelihood Ratio	15.892
	Asymptotic Significance	0.756	Asymptotic Significance	0.044
Total income level per year				
15,000 euro or less	Chi-square	15.381	Chi-square	11.640
between 15,000 to 25,000 euro	(P-value)	0.017	(P-value)	0.168
between 25,000 to 36,000 euro	Likelihood Ratio	15.87	Likelihood Ratio	10.482
36,000 euro or more	Asymptotic Significance	0.014	Asymptotic Significance	0.233
Current status of health				
Good	Chi-square	23.605	Chi-square	19.673
Fairly good	(P-value)	0.005	(P-value)	0.074
Average	Likelihood Ratio	19.634	Likelihood Ratio	18.886
Fairly Poor	Asymptotic Significance	0.02	Asymptotic Significance	0.091
Poor				

Table 52. Frequency test for challenges related to "receiving support while using audio or video health monitoring devices" and working status

Working status	Frequency	Percent	Valid Percent	Cumulative Percent	
Yes	Valid	Strongly Agree	1	14.3	20.0
		Neutral	4	57.1	80.0
		Total	5	71.4	100.0
	Missing	0	2	28.6	
		Total	7	100.0	
No	Valid	Strongly Agree	1	2.6	4.0
		Agree	1	2.6	4.0
		Neutral	18	47.4	72.0
		Slightly disagree	2	5.3	88.0
		Very disagree	3	7.9	100.0
		Total	25	65.8	100.0
	Missing	0	13	34.2	
		Total	38	100.0	
I am retired, but I am still at work	Valid	Strongly Agree	1	12.5	25.0
		Very disagree	3	37.5	75.0
		Total	4	50.0	100.0
	Missing	0	4	50.0	
		Total	8	100.0	

Secondly, the results demonstrate that a majority of older adults with a yearly income level over 36,000 euro (frequency of 26 out of 28) have opinions varying from neutral to very negative about the ability to find audio or video health monitoring devices useful (see Table 52).

Finally, similar to the above-mentioned results, the majority of the older Finnish adults with self-rated good current health status (frequency of 13 out of 20) mentioned that they have a neutral idea about the ability to find audio or video health monitoring

devices useful (see Table 53). However, the other respondents with self-rated good current health status had a negative idea about it. Consequently, it can be concluded that audio or video health monitoring devices were recognized as a significant challenge for older adults with self-rated good current health status (see Table 53).

Table 53. Frequency test for challenges related to “audio or video health monitoring devices are useful (save money, time, provide useful information)” and income level

Total income level per year			Frequency	Percent	Valid Percent	Cumulative Percent
15,000 euro or less	Missing	0	3	100.0		
	Valid	Slightly disagree	1	20.0	50.0	50.0
		Very disagree	1	20.0	50.0	100.0
		Total	2	40.0	100.0	
	Missing	0	3	60.0		
Total		5	100.0			
between 25,000 to 36,000 euro	Valid	Slightly disagree	1	25.0	25.0	25.0
		Very disagree	3	75.0	75.0	100.0
		Total	4	100.0	100.0	
36,000 euro or more	Valid	Agree	2	4.9	7.1	7.1
		Neutral	20	48.8	71.4	78.6
		Slightly disagree	1	2.4	3.6	82.1
		Very disagree	5	12.2	17.9	100.0
		Total	28	68.3	100.0	
	Missing	0	13	31.7		
Total		41	100.0			

Table 54. Frequency test for challenges related to “audio or video health monitoring devices are useful (save money, time, provide useful information)” and current health status

Current status of health			Frequency	Percent	Valid Percent	Cumulative Percent
Good	Valid	Neutral	13	46.4	65.0	65.0
		Slightly disagree	1	3.6	5.0	70.0
		Very disagree	6	21.4	30.0	100.0
		Total	20	71.4	100.0	
		Missing	0	8	28.6	
Total		28	100.0			
Fairly good	Valid	Agree	2	18.2	22.2	22.2
		Neutral	6	54.5	66.7	88.9
		Slightly disagree	1	9.1	11.1	100.0
		Total	9	81.8	100.0	
	Missing	0	2	18.2		
Total		11	100.0			
Average	Valid	Neutral	1	10.0	25.0	25.0
		Very disagree	3	30.0	75.0	100.0
		Total	4	40.0	100.0	
	Missing	0	6	60.0		
Total		10	100.0			
Poor	Valid	Slightly disagree	1	25.0	100.0	100.0
		Missing	0	3	75.0	
	Total		4	100.0		

4.3.4 Demographic background and satisfaction by using E-Health services and products

This section presents the results of statistical tests regarding the general satisfaction of respondents about using various E-Health services or products. The criteria for general satisfaction of using various E-Health services or products were divided into six main categories including:

- General satisfaction of using one of the E-Health services or products

- Observing positive changes in their health situation by using one of the E-Health services or products
- Observing improvement in their health status by using one of the E-Health services or products
- Being motivated for a healthier lifestyle by using one of the E-Health services or products
- Observing a reduction in their health-related expenses by using one of the E-Health services or products
- Ability to find the right health information or support at the right time by using one of the E-Health services or products

In the following parts of this section the results of correlation tests, as well as frequency examination about the variables mentioned above, will be presented. On the one hand, there was a significant correlation between “working situation” and “finding the right health information or support at the right time by using one of the E-Health services or products” as one of the general satisfaction criteria (Likelihood Ratio 16.655 with 0.034 (df)) (see Table 55).

On the other hand, current health status had a significant the correlation with “observing a reduction in health-related expenses” (Chi-square is 21.836 with 0.039 as P-value). These results were also confirmed by a Likelihood Ratio test (0.042 as asymptotic significance (df)) (see Table 55).

Furthermore, some frequency tests were conducted to investigate correlation among dependent and independent variables. Firstly, the results of the frequency tests show that respondents who were not retired had the highest correlation with “finding the right health information or support at the right time by using one of the E-Health services or products”, as their general satisfaction related to using E-Health services and products (see Table 56).

Table 55. Statistical analyzing among demographic variables and general satisfaction by using E-Health services and products via Chi-square & Likelihood Ratio

Demographic Variables	Observed reduction in health-related expenses		Could find the right health information or support at right time	
Currently retired				
Yes	Chi-square	3.889	Chi-square	14.767
No	(P-value)	0.867	(P-value)	0.064
I am retired, but I am still at work	Likelihood Ratio	5.42	Likelihood Ratio	16.655
	Asymptotic Significance	0.712	Asymptotic Significance	0.034
Current status of health				
Good	Chi-square	21.836	Chi-square	17.296
Fairly good	(P-value)	0.039	(P-value)	0.139
Average	Likelihood Ratio	21.587	Likelihood Ratio	17.459
Fairly Poor	Asymptotic Significance	0.042	Asymptotic Significance	0.133
Poor				

Secondly, the majority of older adults who had good health (the frequency of 19 out of 24) mentioned that they had observed a reduction in their health-related expenses by using one of the E-Health services or products (see Table 57).

Table 56. Frequency test for general satisfaction related to finding the right health information or support at right time by using one of the E-Health services or products and working status

Working status			Frequency	Percent	Valid Percent	Cumulative Percent
Yes	Valid	Strongly Agree	1	14.3	14.3	14.3
		Agree	1	14.3	14.3	28.6
		Neutral	5	71.4	71.4	100.0
		Total	7	100.0	100.0	
No	Valid	Strongly Agree	6	15.8	20.0	20.0
		Agree	10	26.3	33.3	53.3
		Neutral	5	13.2	16.7	70.0
		Slightly disagree	8	21.1	26.7	96.7
		Very disagree	1	2.6	3.3	100.0
		Total	30	78.9	100.0	
	Missing	0	8	21.1		
Total	38	100.0				
I am retired, but I am still at work	Valid	Neutral	2	25.0	40.0	40.0
		Slightly disagree	2	25.0	40.0	80.0
		Very disagree	1	12.5	20.0	100.0
		Total	5	62.5	100.0	
	Missing	0	3	37.5		
Total	8	100.0				

Table 57. Frequency test for general satisfaction related to generally observing reduction in their health-related expenses by using one of the E-Health services or products and current health status

Current status of health			Frequency	Percent	Valid Percent	Cumulative Percent
Good	Valid	Strongly Agree	5	17.9	20.8	20.8
		Agree	2	7.1	8.3	29.2
		Neutral	12	42.9	50.0	79.2
		Slightly disagree	3	10.7	12.5	91.7
		Very disagree	2	7.1	8.3	100.0
		Total	24	85.7	100.0	
	Missing	0	4	14.3		
	Total	28	100.0			
Fairly good	Valid	Agree	1	9.1	11.1	11.1
		Neutral	2	18.2	22.2	33.3
		Slightly disagree	4	36.4	44.4	77.8
		Very disagree	2	18.2	22.2	100.0
		Total	9	81.8	100.0	
	Missing	0	2	18.2		
	Total	11	100.0			
Average	Valid	Neutral	2	20.0	28.6	28.6
		Slightly disagree	4	40.0	57.1	85.7
		Very disagree	1	10.0	14.3	100.0
		Total	7	70.0	100.0	
	Missing	0	3	30.0		
	Total	10	100.0			
Poor	Valid	Strongly Agree	2	50.0	100.0	100.0
	Missing	0	2	50.0		
	Total	4	100.0			

5 Discussion

This chapter aims at interpreting the results of the data analysis and searching for the answers to the research questions. Moreover, the results of the current study will be thoroughly compared with previous studies. Finally, this chapter presents some recommendations for E-Health service or product providers, healthcare providers and the research centers for any future and further studies or improvements of services.

5.1 Conclusion and answering research questions

This study has investigated four main issues and found some important information about the efficiency and effectiveness of E-Health services and products. The main purpose of this study was to deliver health information to patients through E-Health. Therefore, the current study was conducted as a small-scale research in order to examine health information behavior of older adults. In the following parts, the results and main research questions will be discussed

- **What kind of health information obtained through E-Health service and products might be needed by older adults?**

On the one hand, the results of the current study show that respondents who were living with their spouse or someone else close to them needed more health information when there was a media report about health risks or they visited a doctor, and wanted to know more about it.

Moreover, the results show that people who are more educated and have earned a degree at university are more likely to seek health information, particularly those who live with a spouse or someone else who is close to them.

On the other hand, the result shows that people who live in big cities, such as Helsinki and Turku, tend to have more health background information when they want to visit a healthcare professional. Furthermore, the respondents who live in cities, compared to those who live in the countryside or small towns of Finland, reported the same tendencies for seeking health information. Moreover, living in cities correlated with seeking for emotional support as the primary reason for health information seeking.

Previous studies reported that when there is some news about new and special diets, or a sudden outbreak of a disease reported in media, people become motivated to seek health information. However, the results of the current study do not confirm such findings. (Elliot, 1994; Derr, 1983; Wilson 1997, 2000; Treiman and Squiers, 2005).

- **What kinds of E-Health information sources might be used by older adults?**

When it comes to E-Health information sources, older Finnish adults tend to use internet-based sources and wearable devices, mobile applications, online TV, radio, and Telehealth (see chapter 2, section 2.3).

First of all, the results show that female older respondents use more reliable online health information sources, such as the legitimate website of local, municipal healthcare organizations. Moreover, respondents who were living with their family said social media, as well as search engines, provide much of their internet-based health information. In this case, most of those who were not retired mentioned that social media and Internet-based search engines are more convenient for them to discuss their health-related concerns with other people, while they lead a busy life.

Secondly, a considerable number of older adults pointed out that they use fitness trackers more than other wearable devices for their health information collecting activities. However, the more educated of older adults reported that they use more complicated devices, such as a blood pressure tracker instead. Also, in comparison, respondents who were living in cities used blood pressure and fitness trackers more than those respondents who were living in the countryside or small towns. Moreover, retired participants show more motivation for using any other wearable devices, and this might be due to the fact that they are more curious or have more free time to seek various wearable E-Health equipment.

Thirdly, older adult participants who were living with a spouse or someone else close to them reported that they use a mobile application to keep track of their health information and also to quit smoking (namely mobile health vault and smoking cessation mobile applications). It should also be mentioned that an eye tester mobile application was a common source of obtaining health information for older adults who were currently at work and might need to check their eyesight.

Finally, using online TV health-related programs was more common among female older adults than among male older adults. Additionally, the results show that living with a spouse or a next of kin encouraged the patients to be more interested in using E-Health audio and video devices as their health information source. However, this result is not generalizable due to the limited number of respondents of this study.

- **What kinds of challenges might older adults face when using health information obtained through E-Health service and products?**

Previous studies have identified various problems that exist due to the nature of E-Health service and products (MacCrimmon & Taylor, 1976 as cited in Johnson, 1997; Männikkö-Barbutiu, 2002; Chong and Theng, 2004; Rideout et al., 2005; Eriksson-Backa, 2008; Ybarra and Suman, 2008; Gatto & Tak, 2008; Taha et al., 2009; Yan, 2010; Chen and Lee, 2014; Malinowsky, Nygård, and Kottorp, 2014; Bujnowska-Fedak, 2014; Eriksson-Backa, Holmberg, and Ek, 2016).

First of all, the results show that the older Finnish adults believe that Internet-based health information, wearable devices, as well as online TV health-related programs are not cheap and cannot be accessed easily. Moreover, they mentioned that mobile health applications are comparably cheaper to access or to use. However, older adults said that they could participate in the health-related discussion (through calling or sending email, etc.) easily with online TV health-related programs.

Moreover, the female older adults said that wearable devices are easy for them to access, which means they could afford to buy or use wearable devices without any significant challenges. On the contrary, they argued about the devices being easy to access for mobile health-related applications. Moreover, those who are living with either their spouse or someone close to them mentioned that online radio health-related programs were not easy for them to access.

With regard to technical support while using E-Health-related services and products, the majority of older adults were satisfied, particularly when they use wearable devices or mobile applications. However, respondents who were not retired yet emphasized the importance of receiving enough support while using audio or video health monitoring devices. Moreover, some of them mentioned in the feedback portion of the questionnaire that they are not very familiar with the possibility of using audio or video health monitoring devices (Telehealth).

The respondents who earned more than 36,000 euro per year mentioned two main points about E-Health services and products. First of all, they have serious doubts about the reliability of online health information sources. After that, the same group of older adults, as well as older adults with a good health situation, did not find audio or video health monitoring devices useful (save money, time, provide valuable information).

- **To what extent are older adults satisfied with using health information obtained through E-Health services and products?**

Finally, measuring the outcome of health information seeking behaviour shows that retired older adults were satisfied with using E-Health services and products for their health information needs. For example, they were able to find the right health information or receive enough support at the right time while they were using E-Health services or devices. Moreover, the respondents with good health stated that, on the whole, they observed a reduction in their health-related expenses by using one of the E-Health service or products.

The results do not demonstrate a positive effect of using E-Health services or products on improving health, nor does it motivate older people to lead a healthier life or make them feel satisfied.

5.2 Reflecting results in previous research (theoretical framework and literature review)

This study offers a model based on a value-based care point of view to track health information behavior of older Finnish adults. According to the VBC method and accountable care organization structure, it was expected that E-Health products and services could facilitate providing health information for older Finnish adults. The main purpose of this study was to understand whether E-Health services and products are able to provide high-quality health information reasonably priced for older Finnish adults, or not. The following parts of this section compare the results of the current study with previous ones, and it also offers some recommendations.

First of all, results of previous studies reported that family members, relatives and some other groups of people might provide health information for older adults (Männikkö-Barbutiu, 2002; Chung & Kim, 2008; Eriksson-Backa, 2008; Barry et al., 2011; Palsdottir, 2012). However, the current study, due to the limitations of the research, did not explicitly examine this issue. The majority of previous studies have reported that the internet is the primary source of health information seeking and sharing. In this case, the merits and demerits of various online health information sources were explored in previous studies, such as Medline Plus (Kules and Xie, 2011), WebMD, MedHunt (Bodkin & Miaoulis, 2007), personal home pages (Barry et al., 2011), online news and journals, portals (Eriksson-Backa, 2003), weblogs (Chung and Kim, 2008), and social media (Chen & Lee, 2013; Eriksson-Backa, Holmberg and Ek, 2016).

However, the results confirm that even if older adults have options to choose from various E-Health services and devices, they tend to use more physical devices such as fitness trackers. This tendency might be due to the fact that Finns value physical activities, especially jogging and daily workout (Hu et al., 2004). Moreover, similar to previous studies (Tu & Hargraves, 2003; Viswanath & Ackerson, 2011), the current study also shows that female older adults are more active in using E-Health information sources, such as the internet, TV, radio, and audio & video monitoring devices. In contrast to the results of a study by Chong & Theng (2004), the results of the current study show that the female participants were more interested in seeking health information from more reliable internet-based sources compared to the male respondents.

Eriksson-Backa (2013) discussed the relationship between the level of education and health information seeking among elderly Finns. The current study has also investigated this relationship and found that there is a relationship between educational level and using wearable E-Health devices. Similarly, Thackeray et al., (2013) and De Veer et al. (2015) report that a lower level of education has an effect on health information seeking activities, especially with regard to types of advanced health information sources. This means that people who have a lower educational level are more likely to be reluctant to use E-Health information services and products.

People who live with their spouses or someone else close to them show more interest in using social media, mobile applications, online TV, radio and audio and video monitoring devices compared to other participants. Moreover, the group of older adults who were living with their spouses or someone else close to them acknowledged that their interests in obtaining more health information increases when they want to see a doctor, or if there is some special news about health problems shown in the media.

The type of neighborhood and particular features of the city also affect choosing health information sources. Dutta (2009) pinpoints that the language barrier and characteristics of rural populations play a role in people's decisions regarding obtaining health information sources. Some respondents of the current study who were Swedish speaking Finns said that they prefer to obtain health information in Swedish. Moreover, they pointed out that they prefer fitness trackers and blood pressure trackers to obtain health information, so based on these findings and to develop further E-Health products, the emphasis should be placed on such wearable devices and also particular attention should be paid to providing more language options.

Moreover, retired older adults reported that they are also interested in using other wearable devices. One reason for that is that Finnish people value creativity, curiosity and an independent lifestyle and these facilities make their life more convenient (Hu et al., 2004).

5.3 Reflecting results in previous research (Value-based care (VBC))

The goals of VBC, as mentioned in chapter two, are to provide high-quality healthcare, reduce patients' health expenses, and maintain a good health situation (Porter, 2009). To do so, six steps were defined to establish a successful value-based care (Berwick, 2011). Therefore, the following part is going to compare the results of the current small-scale study with the VBC model.

- The first goal of the VBC method is to improve the quality of healthcare. McGlynn (1997) reported that patients see the quality of care as an important criterion, and for them it means meeting their healthcare needs.

In the current study, quality of healthcare is considered as quality of health information which is obtained from E-Health sources. In the current research, ten criteria such as “being easy to use”, or “cheap to access”, etc were considered to measure the quality of health information obtained from E-Health sources. (Männikkö-Barbutiu, 2002; Chong and Theng, 2004; Eriksson-Backa, 2008, 2010; Gatto & Tak, 2008; Taha et al., 2009; Malinowsky, Chen and Lee, 2014; Nygård, and Kottorp, 2014; Bujnowska-Fedak, 2014).

From the quality of health information point of view, respondents reported that wearable devices meet two criteria such as “easy to access” and “receiving support”. Moreover, a mobile application was recognized by participants as “cheap to access or use”, and they can easily get support when facing a problem. On the other hand, respondents who were not retired said that they easily use online health-related discussions and online TV health-related programs because they have access to computers, mobiles or tablets when they work, and they are able to share their health-related concerns online

- The second goal of VBC method is to reduce patients' health costs. Since the current study was conducted in a small scale, its results do not present a general and whole picture of older adults' preferences and opinions about E-Health sources. However, the results show that only participants with good health observe a reduction in their

health-related expenses. It is strongly recommended to conduct a comprehensive study on using E-Health services and devices in order to investigate this issue.

- The third goal of the VBC method is to **maintain a good health situation**. This goal was not examined directly in study. However, the results of the study show that fitness trackers and mobile applications were the most common E-Health means among participants.
- The fourth goal of the VBC method consists of **six steps which are considered to establish successful value-based care**. The research questionnaire of the current study was to develop a model based on the VBC model and health information seeking behavior. The questionnaire was composed of five main sections varying from demographic background information to the measuring of the outcome.

The results of the current study show various demographic background seeking methods for different types of health information. Moreover, some E-Health sources were most popular among respondents, while some of them were scarcely known. After that, the majority of the participants were concerned about receiving support or participating in their health information related activities through E-Health sources. Finally, measuring the outcome of the process, based on the VBC model, can be employed to evaluate the performance of health information sharing through E-Health sources. According to VBC, E-Health sources must facilitate health information sharing among different beneficiaries. Moreover, the actual results of health information sharing are needed to decrease health-related expenses of participants of any healthcare activities. These participants, on one hand, are healthcare providers, and are patients as the main beneficiaries of E-Health service and products on the other hand.

Further studies can be conducted to accomplish two goals regarding future E-Health services and products. The first goal is to provide a better way to share health information, and the second one is to find a way to reduce health-related expenses. This analysis would help researchers and health providers understand real healthcare information needs of patients and it also helps develop better healthcare services and products to meet their needs.

5.4 Future research

It is expected that using E-Health services and products provides six benefits (Männikkö-Barbutiu, 2002; Tu et al., 2015) for older adults. These benefits were described in chapter 2, which is called satisfaction criteria for the current research model. However, only older adults who had a good health condition confirmed one of the advantages of using these services and devices, which is a reduction in their health-related expenses. The results show that most of the E-Health services and devices have not been developed based on what people really need. Moreover, according to the number of challenges that respondents pointed out in the survey, the format of health information sharing was not easy for them to understand. Finally, one reason for this might be the fact that these services are not able to provide healthcare information that Finnish people really need. The following are some suggestions that may help researchers to conduct further studies in the field of health information behavior.

First of all, it is required to conduct more studies in order to understand what different users of E-Health services and products expect and need. In this case, having some interviews with both healthcare providers and patients from a varying age range might be a good idea. After that, it is essential to understand what factors can facilitate using these products and services. It is crucial to understand how the health information should be transferred to these two major groups. In this regard, the format of health information presented can be one of the missing factors in the process of health information sharing and exchange. Format means in what form the information is presented to the users, including texts, charts, audio or video, or any other forms. Finally, further studies can be conducted to explore more about formats of presenting and sharing health information among healthcare providers, patients and other related beneficiaries.

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8 Appendices

Appendix A: Questionnaire:

This is a master's thesis study for information and knowledge management program at Åbo Akademi University by Hamed Ahmadinia under supervisory of Gunilla Widén, Kristina Eriksson Backa, and Isto Huvila. It is about understanding what kind of electronic health information older Finnish adults need, seek, and use. E-Health here means any electronic services or tools which are used for finding health information. These electronic health services or devices can be just a simple internet search for any health information such as a treatment or using a wearable device to check blood pressure, blood sugar, and so on.

Finally, this study aims to understand whether this type of health information can increase older Finnish adults' health situation or their satisfaction of healthcare facilities and services. If you are more than **50 years old and live at your own home** or if you are **taking care of an older Finnish adult who is more than 50 years old and lives in his/her own home**, I would like to ask you to answer this questionnaire.

Your answers to this questionnaire will help develop more efficient E-Health-related tools and services by healthcare professionals, organizations, research centers, and authorities in the future. Please answer the questions by ticking the box which best matches your situation or opinion, or by writing down your answer on the line provided. Answering this questionnaire will take **approximately 30 minutes**. If you have any questions, feel free to contact us: Hamed.ahmadinia@abo.fi or gwidén@abo.fi

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1. I am answering this questionnaire as:

- a Finnish adult aged 50 years or older
- on behalf of an older Finnish adult, because I am the person who is taking care of him/her health-related needs

2. Are you:

- Female
- Male
- Prefer not to answer

3. What is your highest level of education:

- Elementary and/or Intermediate school
- Upper secondary or Vocational school, Institute
- University/University of applied science
- Other, what? _____

4. Do you live:

- Alone
- Together with spouse/partner
- Together with relative/friends

5. Where do you live?

Name the municipality _____

6. Which type of neighborhood do you live in?

- City Countryside Small town

7. Are you currently retired?

- Yes No I am retired, but I am still at work

8. In which group would you consider your total income level per year (from all sources)?

- 15,000 euro or less than between 15,000 to 25,000 euro
 between 25,000 to 36,000 euro 36,000 euro and higher than that

9. How would you describe your current status of health?

- Good Fairly good Average Fairly Poor Poor

10. In which situations do you feel a need for health-related information?

situation	Yes	No
When I do not feel well/fall ill		
When my spouse or someone else close to me does not feel well/fall ill		
When I am about to undergo treatment or surgery		
When I want to know whether I need to see a doctor or not		
When I am about to visit a healthcare professional and want to have some background information helping me to talk to the professional		
When I have seen a doctor, and want to know more about my condition, treatment or medication		
When I want to make changes e.g. to my diet and/or lifestyle		
When there are media reports about health risks that make, me worried or curious		
When I want to find other people with similar illness like me for emotional sharing or health information sharing		

11. How much do you use the following E-Health wearable devices or smart watches (the brand is not important)?

title	comment	Always	Often	Sometimes	Rarely	Never
Fitness tracker	Any devices with possibility of internet connection					
Blood pressure monitor	Any devices with possibility of internet connection					
Glucose monitoring system	Any devices with possibility of internet connection					
Wireless scales	Any kind of scales with possibility of internet connection					
Any other wearable devices or tools	Any devices with possibility of internet connection					

12. What is your opinion on wearable devices or smart watches, if you have never used any of the devices in question 11, proceed to question 13 (the brand is not important)?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
wearable devices serve their purpose well					
wearable devices are easy to use					
wearable devices are easy to access					
wearable devices are cheap to access or use					
I found that I can trust wearable devices as healthcare information device					
I found wearable devices useful (save money, time, provide useful information)					
I got enough support while I used wearable devices					

13. How much do you use the following E-Health websites, blogs?

title	comment	Always	Often	Sometimes	Rarely	Never
Terveyskirjasto.fi	Health Library - reliable information about health					
Sosiaaliportti	National Institute of Health and Welfare, THL					
Päihdelinkki.fi	A comprehensive website for drugs and addictions					
Pienipaatospaivassa.fi	Finnish Heart Association					
Palveluvaaka.fi	Search, compare and evaluate the social and health					
Parastapalvelua.fi	Welfare services for the customers' benefits					
Hyvis.fi	A reliable, experts inspected about the well-being and health					
Omakanta.fi	My Kanta, a portal where your electronic prescriptions and consents for information disclosure are stored					
Suomi.fi	Services for Citizens					
Suomi24.fi	Using as a discussion forum					
Wikipedia	free online encyclopedia, created and edited by volunteers around the world and hosted by the Wikimedia Foundation.					
Social Media	Such as Facebook, Twitter, Google +, etc.					
The Web sites of your local, municipal healthcare and social welfare services						
The Web sites of patient associations and organizations						
Blogs, other discussion forums and other similar sources of information about the experiences of other patients						
Drug databanks by pharmacies, etc.						
Google or some other search engine						

14. What is your opinion on E-Health websites, blogs, forums, if you have never used any of the devices in question 13, proceed to question 15?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
Online services serve their purpose well					
Online services are easy to use					
Online services are easy to access					
Online services are cheap to access or use					
I could participate easily with online health information discussions					
I found that I can trust online health information sources					
I found the online services useful (save money, time, provide useful information)					
I got enough support while I used online health information services					
I easily understood when to stop health online health information seeking					

15. How much do you use the following E-Health mobile applications (the brand is not important)?

title	comment	Always	Often	Sometimes	Rarely	Never
Medical ID	A mobile application which records users' emergency contacts and health information like your birth date, height, and blood type.					
Disease-specific apps	Mobile applications which help you to track or monitor your healthy diet or similar reasons based on a specific illness such as diabetes, ...					
Eye tester apps	Testing your eyes with mobile application					
Medical educational apps	Mobile applications allow users to keep up with <i>medical</i> news and disease and condition information					
Fitness apps	Mobile applications for maintaining a fitness regimen and a healthy diet					
Health mobile vault (Microsoft)	a trusted mobile application for people to gather, store, use, and share health information online					
Nutrition mobile apps	Mobile application developed in order to give advice about getting the right amounts of exercise and sleep, as well as eating a balanced diet					
Smoking cessation mobile apps	Mobile applications let users pick their own motivational picture and read messages of support from the community. Track their cravings and how many times their end up smoking, then watch their progress over time.					
Alcohol consuming tracker mobile apps	Mobile applications which track users' alcohol consumption, drinks diary or blood alcohol content calculator					

16. What is your opinion on mobile applications, if you have never used any of the mobile applications in question 15, proceed to question 17 (the brand is not important)?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
E-Health mobile applications serve their purpose well					
E-Health mobile applications are easy to use					
E-Health mobile applications are easy to access					
E-Health mobile applications are cheap to access or use					
I could participate or share my concerns easily with E-Health mobile applications providers or other users					
I found that I can trust E-Health mobile applications					
I found the E-Health mobile applications useful (save money, time, provide useful information)					
I got enough support while I used E-Health mobile applications					

17. How much do you use the following E-Health information sources?

title	comment	Always	Often	Sometimes	Seldom	Never
Online TV health-related programs	Educational, consulting or any sort of Finnish Online TV programs					
Online Radio health-related programs	Educational, consulting or any sort of Finnish Online Radio programs					
Audio or video health monitoring devices	Any sort of video conference or audiovisual monitoring devices for monitoring your health by healthcare professionals					

18. What is your opinion on the online TV health-related programs, if you have never used any TV health-related program, proceed to question 19?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
Online TV health-related programs serve their purpose well					
Online TV health-related programs are easy to use					
Online TV health-related programs are easy to access					
Online TV health-related programs are cheap to access or use					
I could participate (through calling or sending email, etc. for my questions or concerns) easily with Online TV health-related programs					
I found that I can trust Online TV health-related programs					
I found Online TV health-related programs useful (save money, time, provide useful information)					
I got enough support while I watched Online TV health-related programs					
I easily understood when to stop seeking for health information while I watched Online TV health-related programs					

19. What is your opinion on online Radio health-related programs, if you have never used any Radio health-related program, proceed to question 20?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
online Radio health-related programs serve their purpose well					
online Radio health-related programs are easy to use					
online Radio health-related programs are easy to access					
online Radio health-related programs are cheap to access or use					
I could participate (through calling or sending email, etc. for my questions or concerns) easily with Radio health-related programs					
I found that I can trust online Radio health-related programs					
I found online Radio health-related programs useful (save money, time, provide useful information)					
I got enough support while I listened to online Radio health-related programs					
I easily understood when to stop seeking for health information while I listened to online Radio health-related programs					

20. What is your opinion on Audio or video health monitoring devices, if you have never used any audio or video health monitoring devices, proceed to question 21?

statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
Audio or video health monitoring devices serve their purpose well					
Audio or video health monitoring devices are easy to use					
Audio or video health monitoring devices are easy to access					
Audio or video health monitoring devices are cheap to access or use					
I could participate (through calling or sending email, etc. for my questions or concerns) easily share my concerns while I used Audio or video health monitoring devices					
I found that I can trust audio or video health monitoring devices					
I found audio or video health monitoring devices useful (save money, time, provide useful information)					
I got enough support while I used audio or video health monitoring devices					

21. What is your opinion on the following statements?

Statements	Strongly Agree	Agree	Neutral	Slightly disagree	Very disagree
Generally, I feel satisfied when using one of the E-Health services or products					
I observed positive changes in my health situation by using one of the E-Health services or products					
I observed improvement in my health situation by using one of the E-Health services or products					
I got motivation to have healthier lifestyle by using one of the E-Health services or products					
Generally, I observed reduction in my health-related expenses by using one of the E-Health services or products					
Generally, I think I could find the right health information or support at right time by using one of the E-Health services or products					

22. Feel free to write any comments about this questionnaire.

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Thank you very much for completing this questionnaire!

Appendix B: Demographic information of the participants:

		Frequency	Percent	Valid Percent	Cumulative Percent	
Answering questionnaire as	Valid	The older Finnish adult	45	84.9	84.9	84.9
		On behalf of them	8	15.1	15.1	100.0
		Total	53	100.0	100.0	
Gender	Valid	Female	37	69.8	69.8	69.8
		Male	14	26.4	26.4	96.2
		Prefer not to answer	2	3.8	3.8	100.0
		Total	53	100.0	100.0	
Education	Valid	Elementary and/or Intermediate school	4	7.5	7.5	7.5
		Upper secondary or Vocational school, Institute	4	7.5	7.5	15.1
		University/University of applied science	32	60.4	60.4	75.5
		Other	13	24.5	24.5	100.0
		Total	53	100.0	100.0	
Name the municipality	Valid	Asikkala	1	1.9	1.9	1.9
		Espoo	5	9.4	9.4	11.3
		Helsinki	10	18.9	18.9	30.2
		Jyväskylä	1	1.9	1.9	32.1
		Lahti	3	5.7	5.7	37.7
		Lohja	1	1.9	1.9	39.6
		Oulu	2	3.8	3.8	43.4
		Parainen	2	3.8	3.8	47.2
		Pori	2	3.8	3.8	50.9
		Tampere	1	1.9	1.9	52.8
		Turku	20	37.7	37.7	90.6
		Vantta	4	7.5	7.5	98.1
		Vassa	1	1.9	1.9	100.0
		Total	53	100.0	100.0	
Type of neighborhood	Valid	City	38	71.7	71.7	71.7
		Countryside	9	17.0	17.0	88.7
		Small town	6	11.3	11.3	100.0
		Total	53	100.0	100.0	
Working status	Valid	Yes	7	13.2	13.2	13.2
		No	38	71.7	71.7	84.9
		I am retired, but I am still at work	8	15.1	15.1	100.0
		Total	53	100.0	100.0	
Total income level per year	Valid	15,000 euro or less than	3	5.7	5.7	5.7
		between 15,000 to 25,000 euro	5	9.4	9.4	15.1
		between 25,000 to 36,000 euro	4	7.5	7.5	22.6
		36,000 euro and higher than that	41	77.4	77.4	100.0
		Total	53	100.0	100.0	
Current status of health	Valid	Good	28	52.8	52.8	52.8
		Fairly good	11	20.8	20.8	73.6
		Average	10	18.9	18.9	92.5
		Poor	4	7.5	7.5	100.0
		Total	53	100.0	100.0	