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Wearable Devices Supporting Chinese and Finnish People to Take Care of Health

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Abstract

With the rapid development of ICT technology in the past few years, ICT has been starting to take care of health problems, and increasingly numerous companies are committed to expand the field of health, in order to make people healthier. In fact, there are several different ways that ICT helps people on health, some ICT technologies are used to diagnose morbidities, some ICT technologies concentrate on curative machines, while some others contribute to support people to take care of health. However, limited research has studied how ICT support people to take care of health, and wearable in particular. This paper analysis the influence of wearable devices, which are not medicines and can not cure the sickness. What a wearable device can probably do is telling users about some basic indexes, supervise people to take care of heath and help them to get away from sicknesses. As a kind of precautions, wearable device plays an important role in the life of its users, this paper examines how wearable devices support people to take care of health through the data source from the research that this qualitative study used interviews to gather data, analysing interviewees' personal experiences and opinions about wearable devices. The results show that wearable devices support Chinese people and Finnish people in different ways.

Keywords

Wearable device, ICT, Health care, Qualitative Research

Foreword

This paper consumed a lot of interviews, in the process of writing this paper, I interviewed 15 people, some of which have been interviewed for not only once, but twice, even a third time. So, this is a good opportunity now to be thankful for them, as it is listed here alphabetically according to their names: Chen Xin, Student in The University of Oulu; Erik Aalto, Student in The University of Oulu; Huang Chao, Student in Wuhan University; Huang Yan, Student in Wuhan University; Jori Karppinen, Engineer in CloudAsset Company; Juhana Heikkala, Civil Engineer in Finland; Juho Kupiainen, Student in the University of Oulu; Rao Zhiwei, Student in Shanghai Jiaotong University; Wu Qi, Student in The University of Oulu; Xiong Xiaoxiao, Student in The University of Oulu; Zeng Zhengyang, Student in the National University of Singapore; Zhao Jun, Former Senior Architecture Manager in Intel; Zhou Xing, Student in University of Chinese Academy of Sciences; Zhu Mo, Student in The University of Oulu; as well as some anonyms. Thanks for all of their contributions to this paper.

At the same time, this paper was written under the supervise of Professor. Raija Halonen, who instructed me a lot and helped me a lot.

Hopefully this paper will serve its readers, contribute to readers and help readers to solve problems. More importantly, the constructive comments are warmly welcomed with pleasure by liangshulang@hotmail.com

Liang Shulang

Oulu, August, 19, 2016

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1. Introduction

This paper concentrates on wearable device and works on finding whether wearable devices are truly helpful to support people to take care of health, discovering the ways that wearable devices help users to improve the health conditions, additionally, features that people truly need in wearable devices are discussed in this paper, as well as those features that people are using the most frequently in wearable devices.

At the beginning of the popularity of wearable devices, wearable devices were attempted to be used as a new method to manage information, such as receiving messages, tracking positions, scanning QR codes, or something else. Gradually, wearable devices were discovered to be an excellent choice to be applied to manage people's bodies information. As a result, more and more companies did research on this and finally invented some personally used wearable devices like a band and a watch. (Billinghurst & Starner, 1999.)

With the unbelievable development of ICT these years, it is quite necessary to learn to use information and communication technologies (Selwyn, 2004). ICT have been also participating and playing an important role in health domain, as a result, health problem is on longer only a matter in curative domain (Chetley, Davies, Trude, McConnell & Ramirez, 2006). ICT contains for example, software, hardware including wearable devices (Rhodes, 1997), which all significantly contribute to help people to be healthier and change the way to keep healthy (Kawarasaki, Sato & Yoshida 2012). Being healthy have so many different means in different situations, on the one hand, it is always expected to recuperate our health as soon as possible after being sick, in this case, ICT contributes to invent curative apparatuses, which assist when treating. On the other hand, once people feel uncomfortable and go to the hospital, various machines that use ICT technologies would help doctors to improve both the accuracy and the efficiency of diagnosis (Lucas, 2008). In addition, everyone wants not to be sick, so that people should take care of their health all the time in case. In this case, ICT supports people to take care of health as well, and wearable device is particularly a good choice to supervise our health conditions by ourselves. (Fensli, Gunnarson, & Gundersen, 2005.)

However, there are still not many research that studied about the effect of wearable devices for people's health conditions in detail. Only few research examined the ways that people use wearable devices in daily life. Also, a comparison between different countries' situations could be hardly seen. And it is still not sure that weather the using and popularity of wearable devices in a country improve the health conditions of people there. In addition, it should be known (but currently unknown) that would wearable devices supervise or motivate people to do exercises to take care of health.

As a student who is from China and studying in Finland, as well as big fan of sports, it is always found that many of Finns have a smart band or watch with them when swimming, running, and it seems that those who have a wearable devices wear it all the day. However, the percentage of people who have at least one wearable device in China is dramatically lower as what is seen. After all, in some developed countries, encouraging people especially older people to use information and communications technologies has been seen as a very important mission of the society. (Selwyn, Gorard, Furlong & Madden, 2003.) So, how do wearable devices support Chinese people to take care of health is still a question, and this is also the main question that this study mainly responses.

However, there are another three additional research questions in this paper, they are: Do those who use wearable devices feel better in their daily life? In which way wearable devices help people to take care of health? What do people expect wearable devices to be in the future?

This is a qualitative study of phenomenological, and data was gathered by interviews, fifteen people who have used wearable device for a long time were interviewed in total, participants are all from Finland and China respectively, the reason why it was set like this is that as a Chinese and a student that is studying in Finland, the differences of habits have been found, trying to explore correspondingly different results and the related reasons. Interviewees were asked about some prepared questions that based on the current knowledge about wearable devices, as well as some questions about their own experiences of using wearable devices.

This paper mainly answered the influence of wearable devices nowadays, pointing out the positive effect of wearable devices for people and the ways that wearable devices provide motivations to people to do exercise. The questions about what kinds of features that people want to see in the wearable devices in the future have also been answered by this paper, as well as those kinds of bio-signals that people want to get by using wearable devices.

In this paper, Chapter 2 is a literature review, which discusses the current research results that related to this paper, in detail, just what we already know in this area. Chapter 3 shows the research methods, including how interview questions were set and the application of the research methods. Chapter 4 see the findings of this study, including some of the records in interviews, the data I got is also analysed in this Chapter. Chapter 5 indicates a discussion between my own study and earlier studies, the limitation of this study is also discussed in this Chapter. Chapter 6 concludes this study.

2. Literature Review

Literatures that contributed to this study can be divided into three parts, literatures about the definitions of wearable devices, literatures about the functions of wearable devices, and literatures about health problems. These literatures mainly show what are wearable devices, what can wearable devices do, and what are current people's health problems respectively.

Billingham and Starner (1999) already indicated that wearable devices are new ways to manage information, the wearers are the information gathering and filtering device, and the wearable devices are just responsible for storing the data and retrieval them, predicting that a new generation of wearable devices may look very much like eyeglasses or even an ordinary jacket. And wearable devices can be anything from small machines to bulky computers, wearable devices need to achieve some standards, it must be mobile, which means that a wearable device must go with users now and then, going wherever its wearer goes, secondly, wearable devices must be able to provide possibilities to exploit the intimated relationships between human, computers, and environments. (Billingham & Starner, 1999.)

A little bit earlier, Rhodes (1997) illustrated five features that wearable devices should have, the biggest difference between wearable devices and other computers is that a wearable can be used at anytime such as walking or just moving around, which differs from both desktops and laptops. Wearable devices should try to make users' hands be free, which means that wearable devices need to minimize the typing up of a user's hand. Then, every wearable device has a sensor for the physical activities, for example, GPS sensor, camera sensor, or microphones sensor. Wearable devices have to transit information to its users as soon as possible, or even immediately if needed. Finally, wearable devices should be able to work all the time and be chargeable.

Billingham, Bowskill, Dyer and Morphett (1998) discussed the features of a wearable communication space, saying that a wearable device needs high quality audio communication. they also defined how wearable devices combined with PCs as it is described in Figure 1.

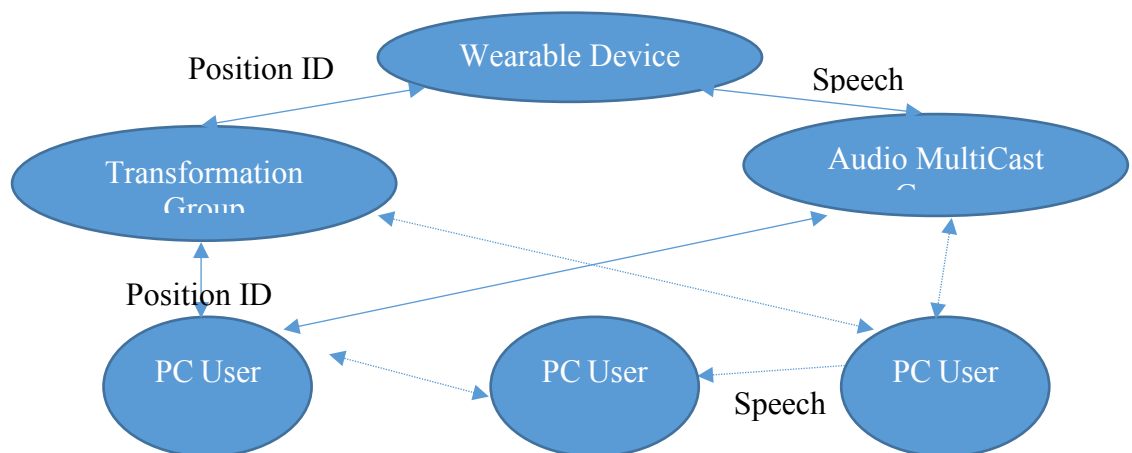


Figure 1. A wearable device connects to PCs (Bowskill et al., 1998).

Figure 1 actually tells about how information is connected between wearable devices and PC users, with which we may have a basic understanding of wearable devices.

Even earlier, wearable devices have been indicated as new systems that can significantly enhance the ease of collaborative work, in detailed, empirical studies showed that collaborative wearable systems are able to improve the working efficiencies within an organization, because it spreads organizational expertise among workers, and makes it faster to access the data when solving problems, and also helps the organization to improve memory in a technical way (Siegel, Kraut, John, and Carley, 1995). On the contrary, Billinghurst and Starner (1999) worried that the social acceptability might be one of the obstacles of wearable devices to widespread use.

If there is an agreement, Billinghurst et al. (1998) defined wearable devices as a computer that is combined with the personal space of the user. They believed that a wearable device is typically thought of a belt, a wireless communication hardware, and an input device, in some configurations and applications, wearable devices have significantly improved users' performances, dramatically reducing the time of working tasks.

Feiner, MacIntyre, Hollerer and Webster (1997) pointed out that wearable devices support people to interact with the world, and it is an optimal way to overlay textual information on automatically recognized objects. Similarly, Fujii, Takahashi, Hachisuka, Terauchi, Kishi and Ssaki (2005) discussed that wearable devices use human's bodies as transmission channels.

When it comes to the combinations between wearable devices and smartphones, Watanabe, Kawarasaki, Sato and Yoshida (2012) illustrated that wearable devices contribute to the development of heart disease monitoring, especially the alerting system with smartphone. Similarly, Fensli et al. (2005) had the same opinions about the wearable devices' contribution to heart disease, illustrating that wearable devices help people to supervise something like heart rate all the day, the data can be provided directly from the patient to the doctor via internet. In addition, patients themselves can also download the data from the internet server, the processes they described is like Figure 2.

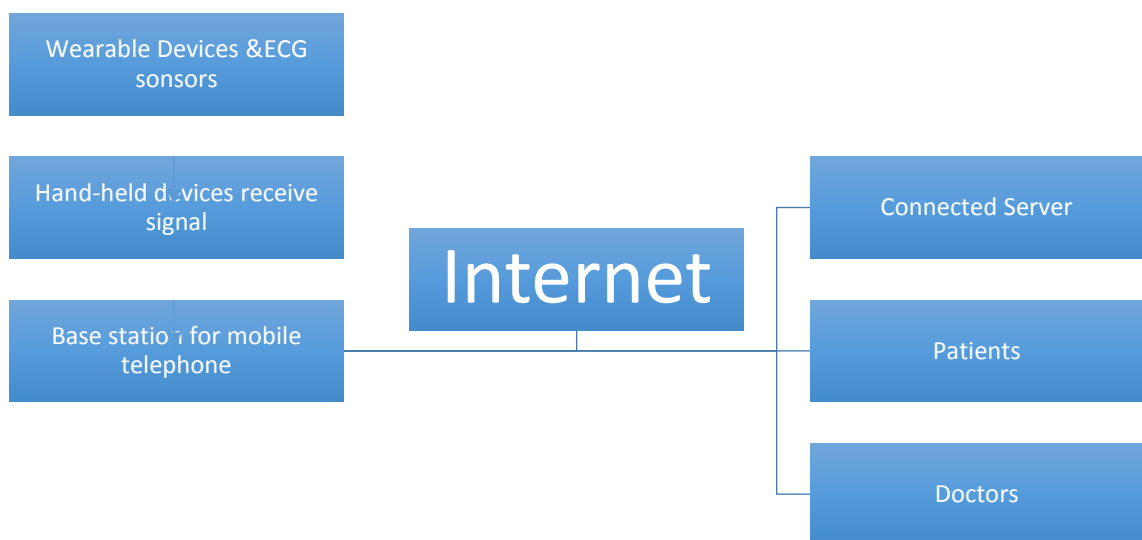


Figure 2: Processes of data, from wearable devices to users (Fensli et al., 2005).

Figure 2 informs the relationship of wearable devices and patients, as well as doctors, by connecting via internet, patients and doctors are possible to interact with each other by

using wearable devices, and Figure 2 provides one of the contribution of wearable devices that help to take care of health.

Martin, Jovanov, and Raskovic (2000) found the differences between medical purpose applications of wearable computing and normally used wearable computing applications in several aspects, the user interaction would be very much limited, it should be working all the time with enough battery, and signal processing should be mentioned as well.

However, Konstantas (2009) indicated that a MobiHealth system is enough to be able to monitor patient health conditions and give treatment suggestions, aiming at giving patients a more effective health care, while it is urgent to solve the problem that there should be an optimal platform to support the service.

Differently, Gurrin, Qiu, Hughes, Caprani, Doherty, Hodges and Smeaton (2013) discussed that smartphones have been used as platforms for wearable devices using in health research. Life-log data of participants would be automatically transformed to the smartphone and analysed. Smartphone platforms are ubiquitous and smartphones are hopeful to be good choices for a new generation of wearable sensing devices, especially in health research (Gurrin et al., 2013).

Similarly, Lam, Wong, Wong, Wong and Mow (2009) indicated that platforms that can be used with wearable sensors should be able to support different types of sensors, and they would better be portable to multiple Oss, more importantly, platforms should support the updates of software, and be smart, intelligent to control. A monitoring process is also given by Lam et al. (see Figure 3)

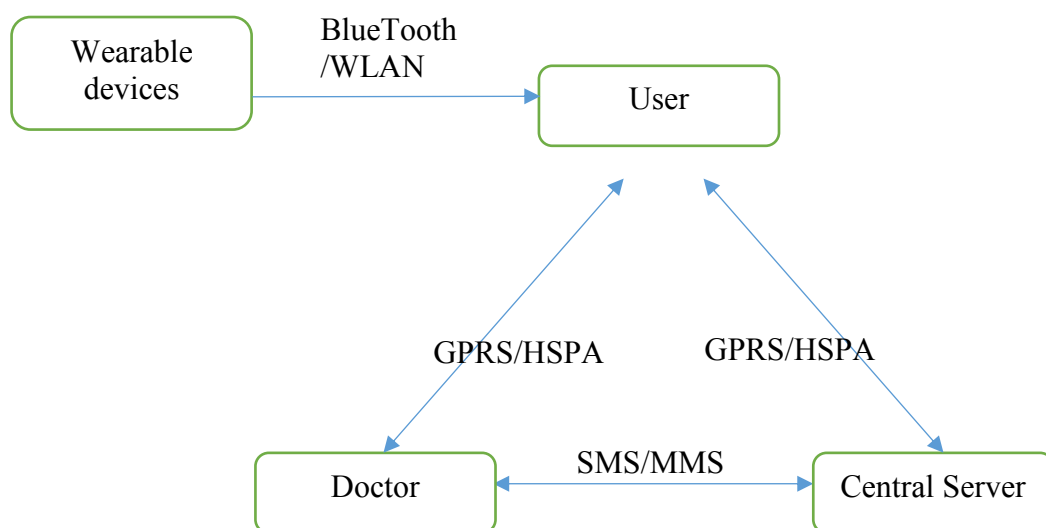


Figure 3: Monitoring the data transferring from wearable devices (Lam et al., 2009).

Figure 3 indicates the data transferring from wearable devices somehow, there are several different wireless communication technologies can be used here, by choosing the optimal one, wearable devices communicate with users and doctors, central server. Figure 3 helps to understand more about wearable devices.

When comparing wearable devices to smartphones, Case, Burwich, Volpp, and Patel (2015) indicated that two third of American adults have smartphones, however, less of them have wearable devices, which take advantages in the accuracy of getting data. For example, they proved that some wearable devices are more accurate in counting the steps

trial than smartphones, while some kinds of wearable devices have lower accuracies, they counted steps by observations and compared all the data from different devices, results are shown here as Table 1.

Table 1: Accuracy of wearable devices and smartphones (Case et al., 2015).

Devices	Observed Steps	Results
Galaxy S4 Apps	500	About 460
	1500	A little bit less
IPhone 5S Apps	500	About 520
	1500	A little bit more
Nike FuelBand	500	About 380
	1500	Much less
Jawbone UP24	500	About 475
	1500	Almost 1500
FitBit Band One & Zip	500	About 500
	1500	Almost 1500
Digi-Walker SW-200	500	About 505
	1500	Almost 1500

According to Table 1, there are accuracy differences between smartphones and wearable devices, some even show significant differences. In addition, different kinds of smartphones have different accuracies the same, as well as different kinds of wearable devices. Table 1 may help to understand the selection of people between smartphones and wearable devices.

On the other hand, Sun, Fernstrom, Jia, and Hackworth (2011) had a positive attitude about the feasibility of wearable devices analysing diet, saying that it would be possible to use wearable devices to do objective dietary assessment in the not distanced future with further technological development. Two years later, O'Loughlin, Cullen, McGoldrick, Connor, Blain, and O'Malley (2013) pointed out that wearable devices like wearable camera help to improve the accuracy in analysing dietary situations, giving suitable suggestions to users about how much food to eat, and how much water to drink per unit day.

Also, Doherty et al. (2013) indicated that wearable devices like wearable camera contribute a lot in health care, by identifying kinds of life behaviours, wearable cameras observes and make it possible to self-report. However, experiments showed that only about 29% participants said it was easy to live with a wearable camera, while nearly half of people thought that wearing a wearable camera is somewhat difficult, other 14% saw it a difficult style, and even still 7% felt very uncomfortable with wearing a wearable camera. (Arab, Estrin, Kim, Burke, & Goldman, 2011.)

Oliver and Mangas (2006) discussed about HealthGear, which is a real-time wearable system for monitoring and analysing physiological signal. A normal procedures of the transmission of data was given like Figure 4.

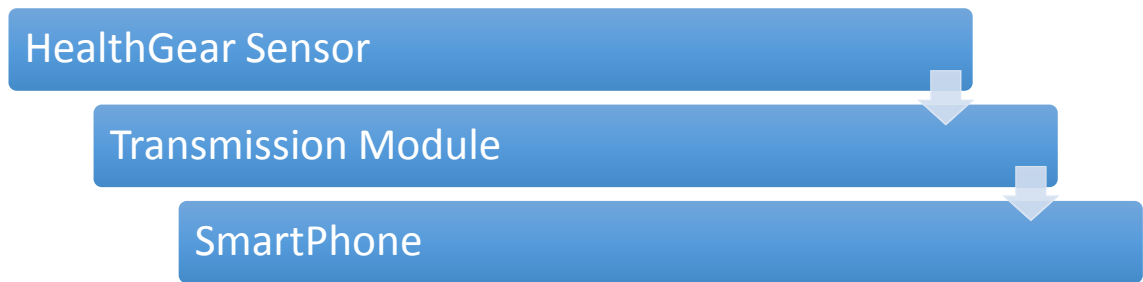


Figure 4: Transmission of HealthGear (Oliver & Mangas, 2006).

Figure 4 shows how a wearable device communicate with smartphone, with a transmission module, data is transferred from wearable devices to smartphones.

In detail, Pantelopoulos and Bourbakis (2010) discussed how all types of body signals be measured by wearable devices, like it is described in Table 2.

Table 2. Bio-signals supervised by wearable devices (Pantelopoulos et al. 2010).

Body Signals	Worn Places	Measure
ECG	Chest/Skin	Supervise the activity of the heart
Blood Pressure	Arm	Supervise the arteries
Respiration rate	Pulse	Supervise the oxygenation amount
Heart rate	Pulse	Supervise the cardiac cycle
Perspiration	Skin	Supervise the sweat glands
Heart sounds	Chest	Supervise the phonocardiograph
Blood glucose	Strip-based	Supervise the amount of glucose
Body movements	Accelerometer	Supervise the movements of bodies

Table 2 describes several kinds of bio-signals that we can get from wearable devices, in fact, different users have different kinds of requirements, accordingly, different wearable devices have different functionalities.

Moreover, Cheng, Tsai, Lu, and Yang (2004) designed a wearable shirt, which is able to get biological signals and analyse them intelligently. Similarly, Lueck (2003) analysed that the health care cost saw a dramatically increase, which was the most serious one in the last 10 years.

Similarly, Bend (2004) figured out that information and communication technologies do provide the patient-centered care with high qualities. Using information and communications technologies has been seen as an unseparated part in many areas and many core activities, and using information and communication technologies is likely to make the use of resources significantly better. Also, information and communication technologies has been defined to be a crucial role in health care sector which can improve

people's health conditions while at the same time, connecting people each other. (Chetley et al., 2006.)

Furthermore, Ojo (2006) indicated that in some areas like Africa, the uses of information and communication technologies brought lots of benefits in the areas of for example medical information, data exchanging, treatment, internal and external collaboration between local medical experts and their colleagues abroad.

In detail, Kendall and Lissauer (2003) described several characteristics of a patient centred care with high qualities, as they are summarised:

1. Safe and effective: Health care should be based on the latest information so that it can be made sure to help patients without any harmful aspects.
2. Promoting health and wellbeing: A patient-centred health care should be able to promote health and wellbeing, letting people know that preventing ill health is also an important part.
3. Integrated and seamless: As a patient-centred health care, people's social and emotional aspects should all be taken into account. Not only their own physical problems and medical problems, but also those of their family and community if possible.
4. Informing and empowering: A patient-centred health care should provide patients high quality information and make sure that would be helpful to peers.
5. Timely and convenient: A patient-centred health care should be very convenient to use and make information delivered in time.

Similarly, Report of the Health ICT Industry Group (2009) showed that in modern health care system, in order to delivery a better patient experience, reduce unplanned demands, and give the staff a more impressive working environment, the information and communication technologies have been exploited to achieve the following results: A better patient care, which is safe and effective. Share information among providers, and reduce the risk of patient harm. More efficient care processes, which is timely and efficient. Provide more accesses to reduce the patients' waiting times. A sustainable health care, which is equitable and patient-centred. Patients can have their own empowerment in their own care activities.

Additionally, wearable devices enhanced our life qualities (Park & Jayaraman, 2003). They indicated that wearable technologies are playing important roles in solving the challenges of current Healthcare: Lack of consistent and high-quality medical health care to all people, which leads that more and more people dead because of medical errors. A huge amount of cost was spent in health care in these decade of years, which is even 13.3% GDP in 2000, and 14.1% GDP in 2001 in the world. People truly need an early precaution, which is significantly beneficial for many of highly incidence health conditions like heart disease. The health care nowadays is looking forward to a more functional one.

In addition, Park and Jayaraman (2003) also pointed out some advantages of wearable devices, their assume can probably solve some of the challenges: Using wearable devices reduce the high cost of health care maintaining. Wearable devices make it possible to care for people as many as possible at anywhere, and at anytime. Wearable devices provide a prevention for people and help them save the expenditures of treatment. Park and

Jayaraman (2003) concluded that if people all use wearable devices as a precaution, the length of hospital stay would be significantly reduced.

Nevertheless, Ahmad, Hudak, Bercovitz, Hollenberg, and Levinson (2006) argued that some physicians show negative attitudes about information and communication technologies in health care, finding out that internet-based information would probably mislead patients, and bring confusions and distress or even make patients misunderstand as self-treatment or self-diagnose seems a good choice when feeling uncomfortable, which is actually harmful to patients. As a result, a part of physicians felt unconfident and unprepared about information and communication technologies in health care. (Chetley et al., 2006.)

Similarly, the access to information is not meaningful at all unless there is a full information chain, otherwise information would make no sense to the development of health care (Panir, 2011).

Spelmezan Schanowski, and Borchers (2009) illustrated that wearable devices are new ways to assist students during sports training and to enhance their learning experiences. They also recommended to research a wearable system for accurately tracking the relative position and orientation of body parts using magnetic fields. And wearable devices are highly employed in real world, and are now ubiquitous (Michahelles, Cramer, & Schiele, 2005).

Pirkel, Stockinger, Kunze, and Lukowicz (2008) indicated that posture and motion of bodies are parts of important components from many human activities, positioning technology is one of the basics of wearable devices. For example, in our daily physical activities, we stretch the legs, we flex the legs, we shift weight to two feet, we lean upper body here and there, we turn upper body to both of the sides and et al. (Spelmezan et al, 2009.)

Moussavi, Chatterji, Verdes, Tandon, Patel and Ustun (2007) suggested that activity troubles and emotional problems affect people's health condition more seriously when comparing to other symptoms, the impacts of them are. (see Figure 5)

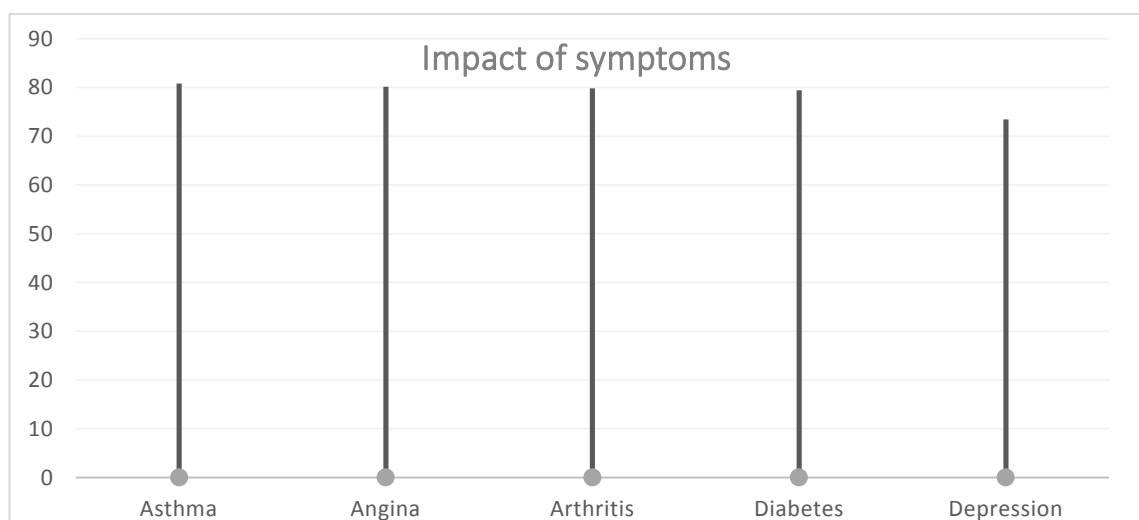


Figure 5. Health scores under different symptoms respectively (Moussavi et al., 2007).

Figure 5 compares the influences of asthma, angina, arthritis, diabetes, depression to people's health, according to which arthritis shows a considerable harm. Lower straight

lines mean unhealthier conditions, being older indicates decreased status of health, and it is worth mentioning that women have unhealthier status in average. (Moussavi et al., 2007.)

In summary, information and communication technologies have both direct benefits and indirect benefits on health care (Report of the Health ICT Industry Group, 2009), as it can be seen in Table 3.

Table 3. Direct benefits of ICT in health care.

Direct benefits	Descriptions
Adverse Drug Events	Reduce the outpatients prescriptions errors
Hospital Acquired Infection	Reduce hospital acquired infection
Process Improvement	Reduce the inpatients medication errors
Home Health Monitoring	Increase the feasibilities of home health care
Secondary Care Integration	Electrical medical records
Healthcare Operational Efficiencies	Increase the efficiency of health care
Diagnostics	Help to diagnose
The Individual	Motivate to manage chronic conditions

Table 3 suggests the direct benefits of information and communication technologies in health care, which helps to know parts of wearable ICT contributions to health care, defining information and communication technologies can do in health care.

Table 4. Indirect benefits of ICT in health care.

Indirect benefits of ICT in health care
Change the processes in health cares
Make the ability of analysing stronger
Improve the perception of people to take care of health

To differ from Table 3, Table 4 identifies the indirect benefits of information and communication technologies in health care, where different viewpoints can be seen about what ICT can do.

Liu (2012) identified several different variables to examine health conditions of a country, such as life expectancy, baby infant mortality, under-five mortality rate, and et al., life expectancy is one of the most important aspects.

Salomon, Wang, Freeman, Vos, and Flaxman (2013) indicated that in 2010, the life expectancies of Finnish males and females are 76.8 years old and 83.3 years old, while in China, the situation seems worse, the life expectancies of Chinese males and females are 72.9 years old and 79.0 years old in average. Even though these two countries are all healthy, Finland sees a more positive condition than China when comparing the life expectancies.

Penedo and Dohan (2005) discussed that doing exercises, such as physical activities have many benefits on not only physical health but also mental health. People who have a regular habit of doing exercise show better physical conditions, including a better

health-related quality of life in general, a better functional ability, as well as better mood situations.

Besides, Cotman, Berchtold and Christie (2007) the health of people's brain benefits from exercises in many different aspects, and many body mechanisms are improved by doing exercises: Enhancing learning and plasticity: doing exercises help to make people adopt to unfamiliar environments better and easier, and give exercisers capabilities to decline negative physical and mental reactions. Protecting the neuro: doing exercises effects to protect people's brain from getting injury, especially some neurodegenerative diseases. Therapeutic in protecting the depression: doing exercise helps people to get away from bad moods and mental problems, maintaining people's brains and making people healthier.

Also, Callaghan (2004) examined that doing exercises is a way to prevent disease, promote health and well-beings. Evidences showed that exercise benefits to mental health, reducing the extent of anxiety, depression, and some else negative moods, exercise is a kind of neglected intervention in mental health care sometimes (Callaghan, 2004).

Similarly, Hayes and Ross (1986) illustrated that those who do more physical exercises have higher levels of health conditions and better psychological well-beings than those who do less exercises.

Taimela, Viikari, Porkka, Dahlen (1994) discussed the influence of sports in children and young adults, finding that enthusiasm about sports helps to reduce the cardiovascular risk in young Finnish study. And due to some political reasons, and some reasons of interests, sports movement have been especially configured in separate places for workers (Heinilä, 1989).

However, Zi-Zhong (2003) illustrated that because of different cultures and ecosystems, China has a different culture in sports to the West. And China needs to study the west best and at the same time abundant the worse from the West when recreating a new sports culture in China. Similarly, sports industries should be responsible for the cultivation of sports in China, in order to improve the heath status of Chinese and find talents in China, it is also important to held some competitive events to attract more people to take part in. (HongYan, 2002.)

On the other hand, the data of more than 60 countries between 2000 and 2009 from the World Bank showed that information and communication technologies have been playing an important role to improve the people's health conditions in a country's perspective. And it is found that information and communication technologies contributed a lot on dramatically decreasing baby infant mortality and increasing the life expectancy. The configuration of information and communication technologies has been proven to be a useful way to improve the people's health level in some counties (Liu, 2012).

In fact, Selwyn, Gorard, Furlong and Madden (2003) argued that there are still a lot of people who do not use information and communications technologies, and their reasons are various, main reasons are like: too old, not needed, incapability to use ICT, no access and something like that. The respective percentage are described as Figure 6.

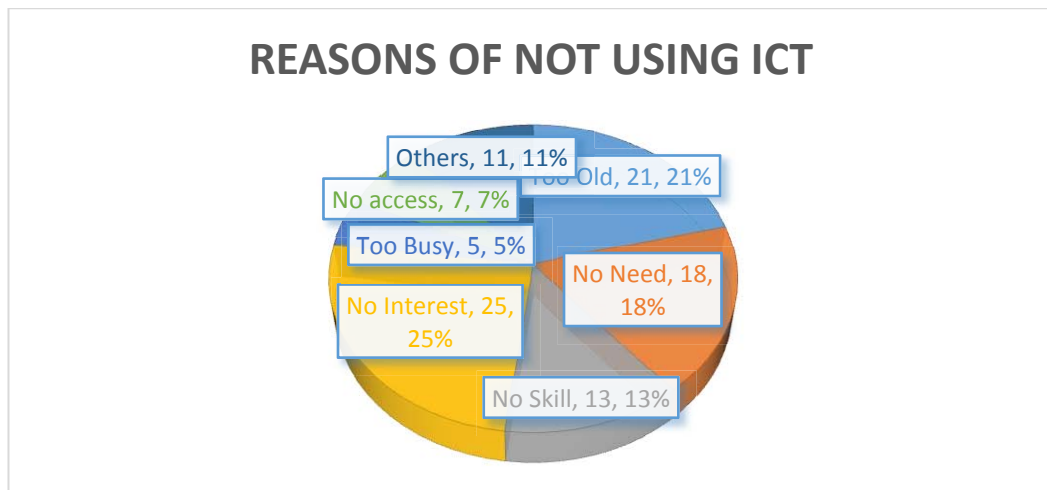


Figure 6. Reasons of people that do not use ICT (Selwyn, Gorard, Furlong & Madden, 2003).

Figure 6 shows that the most people do not use information and communication technologies because of no interest, then, too old, and no need are two of the considerable reasons. However, there are a little people who do not use information and communication technologies because they are too busy. Besides, no skill is also an important reason of why people do not use ICT.

3. Methodology

In this Chapter, the methodologies of this studies are discussed, the reasons why this research method was selected are explained, and the processes how the research method was applied are illustrated as well. There are several parts in this Chapter.

3.1 Research Method

The research method in this study is qualitative research. in detail, it was phenomenological qualitative study, in which interviews were used to gather data. Section 3.1 is an introduction about qualitative research, and phenomenological qualitative study in particular. The application of the research methods will be introduced in Section 3.2.

3.1.1 Qualitative research

Qualitative research has purposes as following: understanding what people are thinking and what they are saying or doing, understanding social or cultural problems, understanding what happens and the related reasons somehow. The research problem of qualitative research should be a real-life problem. (Lanamaki, 2016)

In addition, Yin (2015) summarized illustrative variations in qualitative research, as they are listed in the following table:

Table 5. Different kinds of qualitative research and descriptions (Yin, 2015).

Illustrative Variations	Description
Action research	Studies the adoption of being a role or a collaboration
Case study	Studies the case in real-world context
Ethnography	Studies people's norms, rituals and routines in detail
Ethnomethodology	Studies the methods of the understanding of ethnography
Feminist research	Studies the relations that can affect research findings
Grounded theory	Studies natural occurrences and social behaviors by grounded categories and concepts
Life history	Studies person's life story
Narrative inquiry	Studies by narrative renditions
Participant-observer study	Studies field-based research
Phenomenological study	Studies human events and understands the events

This study was actually a phenomenological one, which concentrates on human events, the experiences of using wearable devices and this study also aims at understanding the events by studying how wearable devices support people to take care of health. Details about phenomenological study will be discussed in the next sub-section.

The normal model of what a qualitative study should do is suggested (Flick, 2016).



Figure 7: The model of qualitative research (Flick, 2009).

Philosophical assumption: a theoretical framework has been applied in this study to help to collect data, as well as analyzing data, which contributed a lot to the conclusion and the discussion as well.

Research design: There are three features that need to be considered in a qualitative research when designing the research: a topic, how to collect data, and where to collect data, in this study, the topic is wearable devices supporting people to take care of health, data was gathered by interviews, and aimed participants are those who use wearable devices and are big fans of sports.

Data collection technique: Data was gathered by 15 interviews in this study, participants are from both Finland and China, details about data collection will be introduced in the sub-section 3.1.3.

Data analyzing: Interpreting and concluding are parts of ways to analyze qualitative data (Yin, 2015). Both of them were used to analyze the data in this qualitative research. Details about data analyzing will be illustrated in the sub-section 3.1.4.

Presenting results: The results of this study were showed narratively, by using quoted passages in some Chapters, data was interspersed, also, some tables as well as figures were also used to describe the interviews.

3.1.2 Phenomenological study

The purpose of a phenomenological study is to know more about a phenomenon by understanding what people think and what actors are feeling in some cases, phenomenological research concentrates on the “depth” of information and perceptions. (Lester, 1999). Groenewald (2004) stated that in phenomenological research, the key word is “describe”, the aim of researchers who do phenomenological research is to describe the studied phenomenon as accurately as possible. As one of the best ways in this type of study (Davidson, 2000), in phenomenological study, individual researchers “hold explicit beliefs”, which means that the research preliminary focuses on gathering data in the perspectives of participants in the research about the phenomenon and contributions (Mounton & Marais, 1990).

The processes of a phenomenological study are somewhat similar to typical qualitative study, several aspects such as a brief introduction, the methods, the analyzing, the reporting, are discussed in the following table:

Table 6: Some aspects of a phenomenological study (Lester, 1999).

Aspects	Descriptions	Citations
Similarities	Phenomenological research has many same parts to other typical qualitative, for example ethnography	Husserl, 1970
Methods	Many different methods can be used in phenomenological research, such as interviews, conversations, observations, action research	Gordon, 1969
Analysis	One big problem in phenomenological research is the large amount of interview notes, as well as records, sometimes records are linked, but sometimes are not. Two ways are discussed	Hycner, 1985 Lester, 1999
Reporting	Phenomenological studies should have more detailed comments about different situations than what are claimed for normal survey researches, factors are important according to different points of the report. In addition, transparency is very important in reporting results.	Lester, 1999
Findings	Findings are related to the topics and themes, if there were participants, the findings here should be very much faithful to them, insofar as possible, some edits are needed. More importantly, in an ethical issues perspective, something like misrepresenting, distorting or deleting arbitrarily are absolutely forbidden.	Plummer, 1983
Discussion	Researchers need to make an interpretation or give the linkages related to the researches themselves and previous ones. According the the findings, researchers can make tentative theories about what has been clearly discussed, what assumptions have been made, and what need to be done in the future.	Lester, 1999
Issues	One big issue is that sometimes people are not understanding what it is, what it is expected them to do for qualitative research. And there are also some confusions in sampling, it should be made sure that the results should be statistically reliable.	Glaser and Strauss, 1967 Lester, 1999

Phenomenon: Accordingly, in this paper, the phenomenon is that increasingly numerous people are using wearable devices, some people use wearable devices to support to take care of health.

Methods & Analysis: The method in this phenomenological study is interview as I mentioned before, in addition, interview data was recorded with interview transcripts by listening to the audio records of every interviewee, after totally understanding what participants said.

Reporting & Findings: Reports were made by documents with quotes transparently, some conversations were cited and some tables are summarized, details can be found in Chapter 4 Results.

Discussion & Conclusion: Personally I prefer a conclusion rather than issues in this paper, stating what were found by this study, and illustrating what are still need to be researched in the future is suggested in Chapter 5, discussion is mainly defined according the linkage of my study and previous ones.

3.1.3 Data gathering

Interview

One or several data gathering techniques should be used in a research method, for instance, interviewing, participant observation, using existing materials and et al., data gathering selecting should depend on four issues, what is optimal too the research question and topic, what is suitable for the specific research method, as well as the availability of data, and researchers own skills. In qualitative research, interviewing is the one that have been used the most, which helps us to listen and direct. The aim of an interview is to know interviewee's own behavior, attitudes, norms, etc. (Arto, 2016). As a result, 15 interviews have been done in this study. Similarly, Yin (2015) discussed these different data collection methods for qualitative research:

Table 7: Different data collection methods comparison (Yin, 2015).

Data collection methods	objects	Examples
Interviewing	Both verbal and body languages	When we need to know about people's behavior or action, kind of explanation.
Observation	Gestures, interactions, actions, scenes and the physical environment	When we need to know the coordination between two people, kind of spatial arrangement.
Materials	Personal documents, materials, et al.	All of the titles, texts, dates, et al.
Feeling	Sensations	When we need to know for example it is cold or warm in a place, and the time, or want to know about whether people are comfortable or not.

The method that this study used to gather data was interviews, in particular, it was qualitative interviews, all interviews have an interaction between the participant and me, before the interview, several questions were listed and asked according to the answers of participants; secondly, responses were elicited from interviewees by me; then, all of the interviews were not uniform. More importantly, as a phenomenological qualitative study, all the questions in interviews are based on previous literatures, details about the questions set will be discussed in the next part and particular questions will be argued in the Section 3.2.2, as well as an appendix in final.

In normal interviews, questions are set by interviewers themselves, as a result, research would be very much like a survey, while in a phenomenological qualitative study, additionally data is needed to study, as a result, it was a big challenge to understand interviewees life styles, due to the reason that this study is about health, the participants' basic information including age, background, even health conditions and et al., are all needed to be known, details about the participants selection will be discussed in Section 3.2.1.

As a phenomenological qualitative study, literatures were also reviewed before doing interviews in order to prepare for the questions, consequently, interviews were done via different ways like face to face interviews and telephone interviews according to the situations, certainly, getting familiar with participants was also one of the important part of the processes, reservations were inevitable, the whole interviewing processes can be seen in Figure 8.



Figure 8: Interviewing processes in this study.

Interviews were done via both face to face methods and telephone interviews, due to the reason that there are no significant differences between face to face interviews and telephone interviews, sometimes telephone interviewing makes good effects and always be successful in qualitative research, as a result, telephone interviewing is very helpful in research, and quite suitable for those group or individuals who have less incomes (Sturges & Hanrahan, 2004). A discussion about telephone interviews can be seen as following table:

Table 8: Advantages and disadvantages of telephone interviews (Sturges & Hanrahan, 2004)

Telephone interviewing	
Advantages	Disadvantages
<ol style="list-style-type: none"> 1. For those sensitive topics, some participants may not want their personal information like names, ages to be exposed in research, in case of this kind of embarrassing, a telephone interviews would be more effective to know what participants truly think of. 2. For those participants who are not willing or not possible to take part in face to face interviews, a telephone interviews may probably bring potential participants, which would probably provide very useful information to the research. 3. For the interview safety, the safety in a research has not been discussed frequently, however, safety of interviewers is crucial and can not be ignored, non face to face contact may guarantee the safety of both interviewer and interviewee, more importantly, interviewees would voice out and feel more free to talk anything they want to share. 4. For both the money and time cost, telephone interviewing helps to save money and times, but every telephone interview should mention about the quality. 5. For the records, telephone interviewers do not really need to look at participants, as a result, interviewers can concentrate on recording what participants are saying. 	<ol style="list-style-type: none"> 1. In some cases, especially when the interviews need to take care of the participants' expressions, telephone interviewing seems to be limited, undoubtedly, telephone interviews would reduce the abilities of some participants in a certain extent. 2. Telephone interviews also cost, those who want to do telephone interviews should be very familiar with local cellphone network ownership and know aspects about the paperwork. 3. Telephone interviewing is also limited to get some cues from the eyes of participants, as well as some verbal cues, something like hesitating, sighs, or something others, which are actually very important for interviewers. 4. Additional questions are needed to be asked to interviewees according to their reactions, while in a telephone interview, it is not that possible to explore what participants are thinking and what should be asked as additional questions. 5. Certainly, the voice definitions in telephone interviews can hardly be on par with the voice definitions in face to face interviews, even though they are acceptable nearly all the time

Telephone interviews were used a lot in this study due to the reason that more than half of the interviewees of this study were from China and located in China, so that the best choice would be telephone interviews, besides, for those participants who were in Finland, telephone interviews were accepted by some of the participants, which stated that

telephone interviews might help them to save much time. One of the biggest problems of telephone interviews is that there are some features combined with some tables and figures in interview that need to be seen by interviewees, as a result, in every telephone interview, tables and figures were sent to participants in advance if necessary, as a result, face to face interviewing is the way that I personally prefer in this study.

Face to face interviews in this study can also be divided into individual interviews and focus group interviews. Individual interviews were hold one by one between the participant and me, focus group interviews mean that several participants were sitting together with a same given topic, similar criteria, experiences and etc. of different participants could be known via a focus group interview, and different opinions were also discussed in group interviews, and some relationships and interactions were illustrated via focus group interviews (Rabiee, 2004).

Questions formulating principles

As a phenomenological qualitative study, questions in interviews were all based on reviewed literatures, generally, the processes of formulating interview questions is showed (see Figure 9).

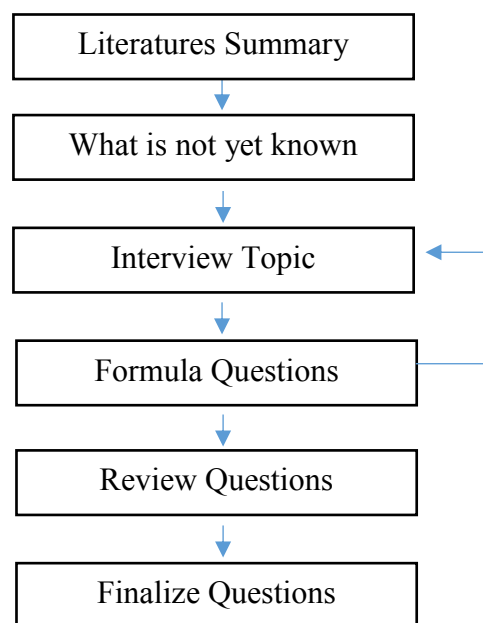


Figure 9. Processes of formulating interview questions (Turner, 2010).

And according to the questions rules (Turner, 2010), all the interview questions in this study obeyed principles as following:

1. There were not very general questions that hard to be answered in interview, and all of the question were made to be easy to understand.
2. There were not leading questions that lead interviewees to answer what is not they truly think, all of the questions were made to be objective and open.
3. Even though there are some technical terms in interview question here and there, they were all explained clearly when interviewing.

4. There are not ambiguities that make interviewees puzzled in interview questions, all of the language using were made sure to be pure and native.
5. There were not individual questions that are not related in interview questions, all of the questions were related and some of them were asked in a follow-up way.
6. There were not interpreting questions in interviews like “Do you mean?”, all participants’ own opinions were respected.

As a result, 22 questions in total were prepared in this study, including 5 basic questions and 17 additional questions, questions were asked accordingly rather than one by one. 22 questions were related to 22 different parts of aspects, which were all concerning information and communication technologies as well as wearable devices. The application of the questions formulating principles is discussed in Section 3.2.2, in which 22 topics are described and explained. Specific questions can be seen in Appendix A.

3.1.4 Data analyzing

After gathering the data by interviews, data was analyzed by disassembling and reassembling, which are two of the methods to analyze qualitative data (Yin, 2015). Qualitative data in this study was sophisticated and need to be concluded or interpreted, however, interviewing questions in this study can be classified and what every interviewee answered actually also need to be classified. In a word, the recursive relationship between them are as following:

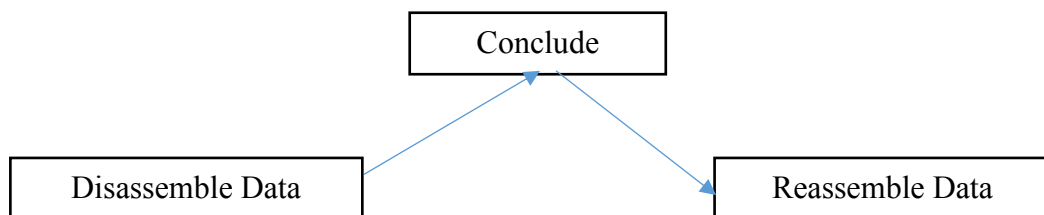


Figure 10: Recursive relationships in analyzing qualitative data (Yin, 2015).

Disassembling:

In this study, data was disassembled by coding, in most qualitative research, the qualitative data is always delivered in form of opinions, viewpoints, explanations, objects and et al., which contain different specifications, and each item will be unique (Yin, 2015). In this study, for example, most of the questions were concerning different aspects and got positive answers, or alternatively negative answers. As a result, positive answers were all marked as positive with corresponding topic, as well as negative answers with corresponding topic.

The purpose of marking data is to make them more conceptual and easy to be recognized, items with same marks would be seemed to be similar and could be used to compare. Items with mark also enable to sort the data more efficient. In particular, when it is needed to divide data into several groups, marks of those data contributed a lot.

Reassembling:

After disassembling data, data became clearly marked and easy to be found, after which data was classified and sorted by topic, consequently, in different question topics,

dissimilar kinds of answers could be illustrated. Nevertheless, when analyzing data, it was important to analyze both similar situations.

Reassembling was done differently according to the situations, after which data was designed to whole new arrays (actually new tables), new arrays helped to summarize the data. Creating a two-dimensional matrix is the simplest and most common way to make qualitative data reassembling (Yin, 2015). In this study, reassembling matrix had one dimension that is sorted by topics and the other one of dimension was hierarchized context of the alphabetically sorted interviewee's opinions. Reassembling played a very important role in analyzing qualitative data in this study.

Generally, the processes of analyzing data in this study is showed (see Figure 11).

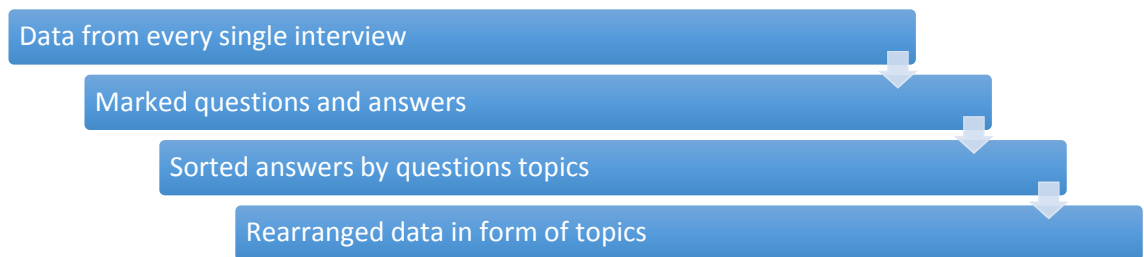


Figure 11: Analyzing data processes.

The following trail table would probably be helpful to understand about the whole data analyzing processes:

Table 8: Examples of disassembling and reassembling data.

Disassembling			
Phases	Mark 1	Mark 2	
Interviewee 1 showed positive attitudes on the future development of wearable devices	Future	Positive	
Interviewee 2 felt uncomfortable when sleeping with wearable device	Usability	Negative	
Interviewee 3 saw wearable device a new trend to supervise health	Supervise health	Positive	
...	
Reassembling			
Marks	Interviewee 1	Interviewee 2	Interviewee 3
Future	Positive	xxx	xxx
Usability	xxx	Negative	xxx
Supervise health	xxx	xxx	Positive
...

Details about the findings are discussed in Chapter 4.

3.2 Application of the research methods

Qualitative research was used in this study due to the reason that this paper mainly answers “what” people think about wearable devices and using wearable devices, “how” wearable devices support people to take care of health, “why” people use wearable devices. As a result, the processes of this study is related to the processes of a common qualitative research. This Section mainly describes the processes of applying the research methods, including the processes to select participants and the principles to set the questions in interviews.

3.2.1 Participants selections

15 people were interviewed in this study, and before interviews, it was an important process to select suitable participants to take part in this research, without which this study would become convinced and empirical.

Part of the participants should be from Finland, and another more than half of the participants should be from China. And participants should have knowledge of information and communication technologies, while at the same time, use information and communication technologies very often.

1. Participants should have used at least one kind of wearable devices for a quite long period, having own experiences on using wearable devices. In addition, participants should be enthusiastic about doing exercise and have good habits on daily sports.
2. It would be better if I am familiar with the participants, knowing their life style and some of habits. And good English skills were required for participants, because all of the interviews were undoubtedly taken in English.

Table 9: The age & gender distributions and interview methods of interviewees.

Interviewees		Interviewees	
Age&Gender&From	Interview Method	Age&Gender&From	Interview Method
23, Male, China	Face to face	24, Male, China	Telephone
24, Female, China	Face to face	24, Male, China	Telephone
46, Male, China	Face to face	27, Male, Finland	Face to face
24, Male, China	Face to face	47, Male, Finland	Face to face
24, Male, China	Face to face	35, Male, Finland	Face to face
25, Female, China	Telephone	24, Female, Finland	Face to face
24, Male, China	Telephone	25, Male, Finland	Telephone
24, Male, China	Telephone		

Accordingly, for those Chinese interviewees, it was great honor to be able to invite some of my friends, some of which are studying in Finland, some others are master degree student in China, while there were also professionals took part in. On the other hands, for the Finnish participants, suitable participants were found in the swimming center, as well as those who run outside due to the reason that they were big fans of exercise and those who wear a wearable device were discussed to take part in this research. The age and gender distributions and the respective interview method are showed in Table 9.

3.2.2 Questions in interviews

As a phenomenological qualitative study, all the questions in interviews were based on current studies, according to which it was clear that what have been known and what have not yet been known, questions were about to be divided into several different topics, which were concerning different part of problems that need to be explored respectively, all the questions topics and corresponding inspiration resource are as following:

The definition of a wearable device (Rhodes, 1997): this topic of question contributed to understand what should a wearable device be like in people's eyes, this was actually a basic part of every interview, relating to their opinions about both wearable devices and information and communication technologies.

Wearable devices are new ways to manage information (Billinghurst & Starner, 1999): this topic of question concentrated on people's expectation of wearable devices, it was wondered that whether wearable devices will be new ways to manage information, replacing those old technologies.

Alerting system development (Fensli et al., 2005): this topic of question aimed at discussing people's opinions about whether wearable devices are able to alert them sometimes. Alerting people is one of the methods to support people to take care of health, by which people would be able to know more about their health conditions.

Details about participants' wearable devices (Oliver & Mangas, 2006): different kinds of wearable devices have different kinds of functions and good at different fields, some wearable devices are experts on supervising the heart rate, while some others have accuracies on counting how many steps that people work, and so on.

The assistances of wearable devices (Spelmezan et al., 2009): wearable devices were indicated to be ways to assist people, as a result, it is wondered that by what mechanism that wearable devices do assist people to take care of health.

New features of wearable devices (Bowskill et al., 1998): increasingly numerous features are going to be developed on wearable devices, some of which are truly needed by people, this topic of questions contributed to know what features people truly need.

The relation ship between wearable devices and diseases (Callaghan, 2004): it is puzzled that would wearable devices be able to supervise diseases for users? On the other hand, would wearable devices be able to help doctors to diagnose diseases? If yes, that would possible to mean that wearable devices can support people to take care of health.

The comparison between smart phones and wearable devices (Case et al., 2015): nowadays, more and more apps about fitness and health have been developed on smartphones so that many people chose to use smartphones in stead of wearable. This

topic of questions helped to know people's opinions about the selection of products, as well as both advantages and disadvantages of smart phones and wearable devices.

Comfortable feelings about wearable devices (Billinghurst & Starner, 1999): comfortable or not is an important problem when people using wearable devices for a long time, if the answer is yes, it would be wondered that whether the participants wear it all the day. If the answer is no, it would be wondered that what kind of changes the participant expect.

Possibilities of analyzing the diet of people (Sun et al., 2011): eating diet probably plays an important role in being health, the possibilities of wearable devices to analyze diet have been warmly argued, so it is wondered that if it is possible, would wearable devices be more popular?

Bio-signals from bodies (Pantelopoulos et al. 2010): several different bio-signals that wearable devices can get from people's bodies were given in a table to be taken priorities by participants, bio-signals like heart rate, perspiration, blood pressure, etc. help people to know how good or bad their health conditions are.

Collaboration and effectiveness on wearable devices (Siegel et al., 1995): wearable devices were illustrated to be able to improve collaboration and effectiveness, so it can be imagined that one day, doctors all use wearable devices on working, it would be significantly effective to help patients, which is also an incredible way to support people.

Life quality enhancement (Park & Jayaraman, 2003): health is a crucial part of high quality life, once the health conditions of people have been guaranteed, their life qualities would also be improved correspondingly, this topic of question helped to know that whether people think wearable devices enhanced their life qualities.

Wearable device a systematic intervention (Callaghan, 2004): intervention can not be ignored in taking care of health, if some of the assumptions bellow have been agreed, it would be wondered that whether wearable devices can provide good interventions for people to take care of health especially in some emergency cases.

Security problems of wearable devices (Pirkl et al., 2008): many wearable devices allow to get the locations of people by using GPS, some people argued that it would be helpful, while some people stated that it would not be safe if the data can not be protected well. The perspectives of people were needed to be known.

Supervision and motivation of wearable devices to do exercises (Cotman, Berchtold & Christie, 2007): in some wearable devices, people were asked to set an aim in daily exercises, probably it motivates people to do exercise but it can not be ensued, participants were asked about this topic of question to show their own experiences.

The use of ICT (Gorard, Furlong & Madden, 2003): information and communication technologies were more and more popular in our daily life, however, the reasons of using information and communication technologies seemed to be various and the reasons of not using information and communication technologies were also need to be discussed.

The information confusion in ICT (Ahmad et al., 2006): information and communication technologies were proven to be capable, nevertheless, it was also worried by some doctors that information and communication technologies especially the use of network made some information confusions, which would be harmful for patients, this topic of questions were also asked to interviewees.

Good health care (Kendall & Lissauer, 2003): a good health care is significant for people to take care of health, and the aspects a good health care should have were asked to participants, some examples were given to interviewees and interviewees could also point out their own ones in interviews.

Those were all the topics that the interview in this study centered, detailed questions can be found in appendix A, which show the questions list and contain all the tables that have been used in interviews.

4. Findings

In this Chapter, the processes of interviews are partly recorded, and the results of interviews are discussed. Before every interview, each interviewee has been asked for a permission to show their name and viewpoints in this paper, otherwise the viewpoints owners would be replaced by anonyms.

All of the interviews were recorded in this research, and in order to intuitionistic know the result and simply find the different viewpoints of different interviewees, interviews results were summarized somehow, data was reassembled, interview questions were transferred to some marks, which are easy to understand, answers of interviewees were summarized to one word or two words, which helped a lot to find those who have different opinions to others. On the other hand, interviews result of both Chinese and Finnish were divided and summarized respectively, then they were analyzed together. The whole reassembling interviews results summary can be seen in Appendix.

Use frequency of information and communication technologies:

Nine of ten Chinese interviewees use information and communication technologies everyday, except one who use them frequently. All of five Finnish interviewees use ICT every day.

Wearable devices manage information:

Most of Chinese interviewees thought that wearable devices were truly new ways to manage information and share information. However, one of the Chinese interviewees stated a neutral viewpoint and the other one had no idea. One of five Finnish interviewee states a neutral opinion here.

The limitation of sharing should be considered, for example, audio data, video data can hardly be transferred via wearable devices nowadays. That is a kind of limitation of wearable devices (Interviewee 3, male, 46 yrs., China).

It can not be completely agreed, wearable devices have many limitations, after all, wearable devices can hardly manage some kinds of information (Interviewee 15, male, 25 yrs., Finland).

Wearable devices assist daily life:

Almost every Chinese interviewee showed positive attitudes on this point, nevertheless, there was one of all who showed a negative opinion about this. And all Finnish interviewees showed positive attitudes in this topic.

It was feeling not good with accessory, even though I had one wearable devices, it was just a try, I do not think it assisted me a lot in my daily life, after using that wearable device, I personally do not like it very much (Interviewee 4, male, 24 yrs., China).

Wearable devices mainly helped to receive messages, and rings as well, in addition, wearable devices could also be used as an alarm clock, and of course I used it for some exercises purposes (Interviewee 10, male, 24 yrs., China).

Wearable devices assisted not directly, which means that wearable devices assisted me by assisting training, in other words, training made me healthier, and wearable devices supported me to do training (Interviewee 12, male, 47 yrs., Finland).

Improve collaboration and effectiveness:

Nearly half (six of ten) of Chinese interviewees supported this viewpoint, and two people did not support this viewpoint, the rest ones had no idea. A Finnish interviewee found out a negative opinion on this point, and an other Finnish felt neutral.

It can hardly be agreed that collaboration and effectiveness can be such easily improved simply by wearable devices, different people have different working habits, I mean that some people prefer to use modern tools, while some others prefer classical methods (Interviewee 1, male, 24 yrs., China).

I can not agree that collaboration and effectiveness can be improved by wearable devices, one of the reasons is that not everyone has a wearable device, it is not that popular to use wearable devices to do something other than exercise purposes (Interviewee 7, male, 24 yrs., China).

Perhaps wearable devices do improve something sometimes, but I still do not think that wearable devices really improve collaboration or effectiveness, because I think that both collaboration and effectiveness are possibly to be improved only by people themselves (Interviewee 14, female, 24 yrs., Finland).

Wearable devices alert diseases:

Almost all Chinese interviewees thought that wearable devices are possible to alert diseases, except one who did not think so. However, no Finnish interviewee discussed a positive opinion in this topic, as three of five had no idea, one had a negative attitude, the rest one said neutrally.

Personally I think that only those wearable devices that are more capable can possibly help to alert diseases, the wearable device I am using can not supervise the heart rate or something, as a result, I do not think every wearable device is able to alert disease (Interviewee 10, male, 24 yrs., China).

Sometimes wearable device alert to do some exercises, after sitting too long time, wearable device always try to alert me, at the time that it alerted me, I truly felt a little uncomfortable, I do not know weather it is a kind of diseases alerting (Interviewee 5, male, 24 yrs., China).

It is doubted that wearable devices can be used to monitor diseases, for simple uses like doing training, it was quite reliable, but normal wearable devices are not accurate enough to be used for medical purposes, it is even very dangerous (Interviewee 12, male, 47 yrs., Finland).

Compare to smart phones:

When comparing wearable devices to smartphones, only two Chinese interviewees indicated that they prefer smartphones rather than wearable devices, additionally, three of ten indicated their preference of both smartphones and wearable devices, some of who stated that smartphones and wearable devices should be used together. One of Finnish

interviewees preferred wearable devices, one preferred smartphones, the rest ones liked both of them.

Smartphones (and the apps) and wearable devices actually have their own advantages as well as disadvantages, for smartphones, almost everyone has one, and they can implement any apps they want and normally do not need to buy something others. On the other hand, wearable devices seem more professional, especially for those exercises purposes (Interviewee 2, female, 24 yrs., China).

It depends on what I use them for, if I am only going for step counting, smartphones are totally enough to count the steps, the errors sometimes occur but it is acceptable. Once I need to do something more, for example the heart rate supervising, then more accuracy would be needed, at this time, sensors decide the accuracy (Interviewee 3, male, 46 yrs., China).

Wearable devices are more accurate in the most cases, but due the size of wearable devices, many limitations can be seen on wearable devices, it is not possible to show the same amount of information than showing on the smartphone, in my eyes, wearable devices are mainly responsible for collecting data, while smartphones see more important to show information. In a word, wearable devices and smartphones should be combined and used together (Interviewee 6, female, 25 yrs., China). Similarly, Xiong (2016) argued that wearable devices have advantages on accuracy, but smartphones are better on visualization.

The apps on smartphones change all the time, I always feel refreshed so I prefer to use smartphone to do training, additionally, smartphones have more features and the point is that there are many apps in the market, we can choose what we like and suitable ones (Interviewee 15, male, 25 yrs., Finland).

The opinion is that wearable devices and smartphones would better be connected to use, that is why most current wearable devices should be connected to smartphones to successfully implement, and update later (Interviewee 12, male, 47 yrs., Finland).

Usability of wearable devices:

Most of Chinese interviewees felt great or at least ok when wearing wearable devices, and only two Chinese interviewees illustrated that they did not really like to wear all the day. On the other hand, only one of five Finnish interviewees felt good, the rest four all did not wear all the day.

It tells the time, it tells how many calories I cost per day, it is sometimes an alarm clock, it receives messages, and rings, I just do not want to leave wearable devices for a long time, it truly benefits me a lot, and it made my works easier and definitely more effective (Interviewee 8, male, 24 yrs., China).

Wearable devices as a precaution of diseases:

One of ten Chinese interviewees did not trust that wearable devices can be used as a precaution of diseases, and neutral opinions appeared on this topic. To my surprise, all of Finnish interviewees had no idea in this topic.

It does not consider the differences between individuals, what I mean is that different people have different body conditions, and also symptoms will also show differences

when people get ill. As a result, wearable devices can hardly know exactly whether it is a illness or not (Interviewee 4, male, 24, China).

Requirements of a good health care:

When it comes to the requirements that a good health care should require, several examples were listed for interviewees to consider, safe and effective, promoting health and wellbeing, integrated and seamless, informing and empowering, timely and convenient. Different interviewees showed interests on all of listed points or part of them. Safe and effectiveness has been selected to be the most important one. Timely and convenient health care has also been discussed to be very important.

Wearable devices analyze diet:

For Chinese interviewees, negative attitudes occupied the most percentage on this topic, most of Chinese interviewees discussed that it is not possible or not reliable, some people could not believe it while some others expected it in the short future. Also, a Chinese interviewees discussed a neutral opinion. For Finnish interviewees, two of them believed it and one of them did not believe it, the rest two felt neutral.

It is not positive that wearable devices are able to analyze diet, it concerns the architecture of human's bodies, and sometimes concerns even the organs, as a machine that only touches the appearance of bodies, wearable devices can hardly know the details of what people have eaten, or what people still need to eat, that is the problem (Interviewee 9, male, 24 yrs., China).

Technologies can make anything, and it would be so good if one-day wearable devices are possible to analyze people's diet, it would be worth to buy one soon if it happens (Interviewee 11, male, 27 yrs., Finland).

New features of wearable devices:

Different people have different expectations on wearable devices. Audio controlling was expected by many interviewees. On the other hand, one of Finnish interviewees pointed out that wearable devices should be able to take the weather condition into account.

Wearable devices track locations:

Nobody totally against wearable devices to track users' locations, most interviewees agreed wearable devices to track their locations, and some of them hold a neutral opinion.

It also depends on the situations, if the wearable devices try to track the locations by a legal way, it would definitely ok, but the security of data is the biggest problem, as a result, it would be better it wearable devices set this feature as an optional feature, those who need and agree can open it, the rest can choose to mute. For exercises purposes, tracking locations obviously may help to increase the accuracy of counting how many kilometers the user has walked, for security problems, tracking locations may expose where the user is (Interviewee 3, male, 46 yrs., China).

Tracking locations sometimes are very helpful to me, every time I go running, I always record the trails on the map, that motivates me to finish the aim, after doing exercises I am able to know the trails today, which is exceedingly interesting (Interviewee 8, male, 24 yrs., China). If there is an agreement, Huang (2016) indicated that wearable device can help users to show their running trails to friends, which motivates a lot.

It depends, people definitely need this feature but they I do not use it all the time, for example, when I do exercises sometimes I post something on social medias and I want to let my friends know about the location, however, if I am tracked all the time I would feel very dangerous (Interviewee 15, male, 25 yrs., Finland).

Wearable devices get bio-signals:

Wearable devices contribute data by getting various bio-signals from people's bodies, for examples ECG, blood pressure, respiration rate, body movements, which have been selected by interviewees to be the most useful ones. Besides, respiration rate, heart rate, perspiration, heart sounds, blood glucose have all been expected by at least some interviewees.

Wearable devices cause information confusions:

Information confusion is a big problem in information and communication technologies, wearable device is not an exception. Only one of interviewees did not agree with this, two of interviewees showed neutral opinions. The rest agreed with that. Most of Finnish interviewees agreed that wearable devices may provide information confusion.

Not good systems make wrong data, it is a part of quality, before going to sale, companies should guarantee the accuracy to an acceptable level, for exercises using, few confusions do not make serious troubles, but for medical using, every data should be very accurate (Interviewee 3, male, 46 yrs., China).

Wearable devices may not provide serious information confusion, once a wearable device is invented and created, it should not have problems like information confusion anymore (Interviewee 12, male, 47 yrs., Finland).

Wearable devices supervise people:

Nine of ten Chinese interviewees supported this viewpoint, while the rest one holds a neutral opinion, most people thought that wearable devices can supervise people now and then. And all five Finnish interviewees stated that wearable devices can supervise people.

Wearable devices helped people to know something about the bodies, such as working steps, and sleeping quality, then I can do something correspondingly, sleep more or do more exercises, this is actually a kind of supervision (Interviewee 10, male, 24 yrs., China).

As a programmer, I sit all the time there coding, a wearable device supervised me to do exercises every one hour, without the wearable device I would probably forget to do like that (Interviewee 5, male, 24 yrs., China).

I am a big fan of social media, in particular the most popular social media in China, WeChat, in WeChat there is a feature that all of the friends records how many steps they walked in a day and make competition to be the winner, this truly motivates me to walk more, the what the wearable device helped me is that wearable devices help to count more steps, I do not need to bring my smartphone with me all the time, a wearable device is enough, and it was much more convenient (Interviewee 2, female, 24 yrs., China).

At the beginning I implemented my wearable device, I was asked to set a target calorie for every day to cost, after that, a progress bar on the screen reminds me how much calories I should consume at any moment, the amount of calories is always transferred to the

kilometers of running, or the meters of swimming and so on (Interviewee 7, male, 24 yrs., China).

I used wearable devices to do training when I was losing weight. As a result, I could clearly see how much calorie I have cost and how much more I need to cost. Wearable device recorded the whole training processes and contributed a lot to my health (Interviewee 12, male, 47 yrs., Finland).

With a wearable device I did exercises more efficiently, in other words, wearable device may supervise me to do exercises (Interviewee 14, female, 24 yrs., Finland).

Wearable devices enhance life quality:

Almost every interviewee identified that wearable devices enhanced their life quality. Only one identified as nope.

Not only wearable devices, but also information and communication technologies have enhanced my life quality, wearable devices helped me to take care of health by supervising me, and in fact, wearable devices helped me to know more about myself. Also, it was a capable tool that made my life easier (Interviewee 3, male, 46 yrs., China).

Personally I think that health condition is a very important part of life quality, as the wearable devices contributed to take care of health, wearable devices really did something to enhance my life quality, with a wearable device, I feel more positive to do exercises and have a happier life (Interviewee 6, female, 25 yrs., China).

The contribution of wearable devices in Finland and China:

Finns used wearable devices earlier and more often than Chinese, and the average health level of Finns is higher than Chinese, most people (both Finns and Chinese) thought that it is due to the reason of environment, only few people though that the enthusiasm of doing exercises made sense.

Undoubtedly, those who like doing exercises will be healthier than those who do not like doing exercises, but it is still hard to say that exercises are the most important element or not. Personally I think that clean air, food and water are the most important reasons (Interviewee 10, male, 24 yrs., China).

Wearable devices contribute, not only by supervising people to take care of health and do exercises, but also by using wearable devices for medical purposes, making a comprehensively healthier health condition of a nation should require all of these: people take more care of health, ease to know about health conditions easier, quick and safe to get treatment, more effective to link patients' information (Interviewee 3, male, 46 yrs., China).

In this problem, wearable devices could help to improve the health conditions, but it takes a long time to see the effect, wearable devices give information about bodies, that is crucial for people to take better care of health, taking more care of health of course make people healthier (Interviewee 11, male, 27 yrs., Finland).

The viewpoint is that wearable device not only enhanced the life quality, but also did something else, for health purposes, wearable devices supported people to take care of health to enhance their life quality, but in other fields, wearable can contribute more (Interviewee 15, male, 25 yrs., Finland).

5. Discussion

Findings show that different people use wearable devices in different ways, expecting wearable devices to do different things. Finnish people do many exercises with or without wearable devices, it is not the wearable device that brings them to sports or motivates them to do exercises. In other words, Finnish people see wearable devices as an assistant of their life, they trust in wearable devices but do not rely on it too much. Chinese people always become more motivated after using a wearable device, they may see wearable device more like a motivation. In addition, many apps and social medias that can be combined with wearable devices to use also make them do something exercises more positively.

Both Finnish people and Chinese people have many expectations to wearable devices. It could be seen that people do expect that wearable devices could be more capable and are able to make more contributions. People expect wearable devices to be used more often not only personally, but also in hospitals. Having a better health care system would significantly help people to take care of health. Wearable devices are expected by people to play an important role for medical purposes.

Prior studies contributed a lot to this study, firstly, interview questions were all based on the information that is provided by prior studies. Prior literatures told about what is a wearable device, what can a wearable device do, some interactions as well as some differences between wearable devices and smartphones, bio-signals that can be gotten by wearable devices, the relationship between doing exercises and being healthy, what should a good health care system should look like, direct and indirect benefits of ICT in health care, reasons of people use ICT or not, and et al. These all made my study empirical and go more smoothly.

However, my study solved some problems that prior studies did not solve. It was defined that what people always do with wearable devices when doing exercises, it was compared what people think about wearable devices and smartphones and their using habits, it is selected that what bio-signals people want to see in wearable devices, it was indicated that what is more important in a good health care, it was discussed about for instance the opinions of the wearable devices features in people's eyes.

Most importantly, prior research illustrated only the uses of wearable devices, and the benefits of doing exercises for health, while did not identify the helps of wearable devices that how people use wearable devices to do exercises and the reasons why wearable devices are truly helpful, which are all identified in this paper.

Q1: What can people do with wearable devices & What do people do with wearable devices.

Billingham and Starner (1999) indicated that wearable devices were new ways that could be used to manage information of people's bodies. Chetley et al. (2006) argued information and communication technologies have been increasingly important in health domain, ICT can do more and more things for health purposes. ICT is able to support people to take care of health, and wearable device is absolutely a good choice to supervise the health conditions by people themselves.

Similarly, Doherty et al. (2013) discussed that wearable devices contribute a lot in health care. For example, health gear monitors and analyses physical signals as a real-time wearable system (Oliver & Mangas, 2006). Cheng (2004) found out a wearable shirt, which is able to get bio-signals and analyse those data smartly. Spelmezan et al. (2009) illustrated that wearable devices are new ways to assist students to do exercises and sports trainings, enhancing their learning experiences.

This study also indicates that people think that wearable devices are new ways to manage information, people all use ICT very frequently, in most people's eyes, wearable devices are very much like watches, or bands, for those who use wearable devices for health purposes, most people use wearable devices to count steps, calculate calories, a few people use wearable devices to monitor some big-signals like heart rates.

Q2: Which features do wearable devices have & Which features do people need.

Rhodes (1997) figured out several features that wearable devices have, wearable devices should have sensors for physical activities. On the other hand, Fensli et al. (2005) pointed out that wearable devices have contributions on heart disease monitoring. In particular, the alerting systems with smartphones can help significantly to the development of heart disease monitoring (Watanabe et al., 2012). In addition, Pantelopoulos et al. (2010) illustrated some types of big-signals that can be measured by wearable devices, such as ECG, blood pressure, respiration rate, heart rate, perspiration, heart sound, blood glucose, body movements.

However, wearable devices take advantages in the accuracy of getting data when comparing to wearable devices (Case et al, 2015). And wearable devices are always used better when using together with smartphones (Gurrin et al., 2013).

This study shows that people use the body movement bio-signals the most often, most people need as many features as possible, but the most popular ones that have been expected by the most people are ECG, heart rate, and blood pressure. Furthermore, people prefer to use wearable devices together with their smart phones, some people use wearable devices to collect data, and show data on smartphones.

Q3: Wearable devices support people & How do wearable devices support.

Taimela et al. (1994) figured out that enthusiasm of exercises helps to keep health by reducing the cardiovascular risk for young persons. In people's daily life, people stretch the legs, flex the legs, shift weight to duo feet, lean upper body here and there, turn body to both of the sides, this are all body movement (Spelmezan et al, 2009). And wearable devices can also play an important role in building a good health care system, providing a safer and effective health care for patients, enhancing life qualities (Kendall & Lissauer, 2003; Report of the health ICT industry group, 2009; Parl & Jayaraman, 2003).

This study figures out that wearable devices support people to take care of health not only by supervise people to take care of health, but also by helping people to do exercises. This study also finds out that people think that their life qualities have been enhanced after having a wearable device. In addition, most of people believe that wearable devices can contribute considerably to build a good health care system.

6. Conclusion

This Chapter concludes similar and different viewpoints of both Finnish and Chinese interviewees: information and communication technologies are widely used by both Finnish and Chinese, people's first impression of wearable devices should be very much like a watch, a band, or a belt and wearable devices have been widely accepted to be new ways to manage information. People feel that wearable devices were helpful in daily life, but people are not very sure about whether wearable devices improve collaboration or effectiveness. Smartphones have been indicated to be a good choice even when comparing to wearable devices for health purposes and smartphone and wearable devices have been expected to be used together. Various kinds of expectations of wearable devices in the future were made by people, however, analyzing diet is still a challenge in their eyes. Security problems are worried by people when using wearable devices, the security of using wearable device itself and the information confusion that provided by wearable devices have all been considered. In addition, wearable devices have been stated to supervise people and enhance people's life quality.

Several differences between Chinese opinions and Finnish opinions have been illustrated as well:

1. Chinese people show positive attitudes that wearable devices are able to alert diseases, while Finnish people show neutral attitudes. Chinese people trust wearable devices more than Finnish people. Moreover, Chinese people feel not bad about wearable devices can be used as a precaution of disease, while Finnish people feel much more careful.
2. For those who have wearable devices, Chinese owners wear more often than Finnish people, Chinese people prefer to wear all the time, while Finnish people prefer to wear when doing exercises.
3. Good environments like fresh water, fresh air are the most important aspects of keeping healthy in Chinese people's eyes, on the other hand, a good life style, doing more suitable exercises have been indicated by Finnish people to be the most important aspects to keep healthy.
4. Chinese people see wearable devices more like a new toy that can improve their motivations to take care of health, nevertheless, Finnish people see wearable devices more like a new tool that supervises them more than motivating them.

In a word, wearable devices support people to take care of health by different ways for different people. This research also indicates how wearable devices support Chinese people to take care of health:

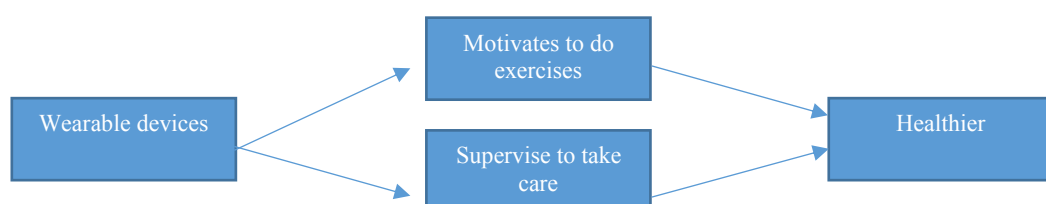


Figure 12: Wearable devices support Chinese people indirectly.

As what Figure 12 shows, wearable devices actually do not support Chinese people to take care of health directly, and wearable devices can not make people healthier in a direct way. Wearable devices give Chinese more motivations to do exercises somehow, then, doing more exercises may improve people's health conditions. On the other hand, wearable devices give Chinese people more opportunities to know about their health and take care of their health, for example by providing users the data of their own sleeping qualities. People are possible to do something to take care of their health according to the provided data.

On the other hand, wearable devices support Finnish people to take care of health in a simpler way:

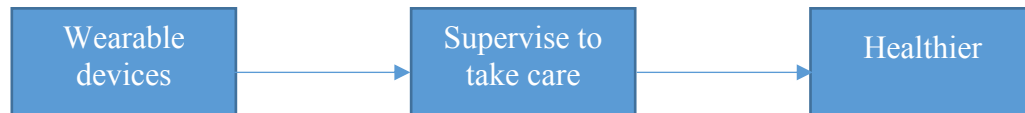


Figure 13: Wearable devices support Finnish people more simply.

Figure 13 argues that differ from Chinese people, Finnish people feel wearable devices more like a tool, which supervise them to take care of health. No Finnish interviewees show that they got more motivated after having a wearable device. As a result, it is hard to say that wearable devices can also motivate Finnish people to take care of health. The only proven thing is that wearable devices truly helped Finnish people to supervise.

6.1 Limitation of this study

There are still some limitations in this study:

1. Only Chinese people and Finnish people were interviewed in this study, which causes a limitation of data width, more nationalities were not included in this study, and more comparisons were not made in this study.
2. Also, only people who are interested in wearable devices took part in this study, in order to have a better understand of wearable devices, those who are not interested in wearable devices should have been interviewed as well, this limitation also reduces the data width.
3. Most of selected interviewees in this study have similar ages, which may cause that age may be also one of the reasons that they had similar opinions in this study, younger people as well as elder people should have been included to this study to enhance the data width.
4. As a qualitative study, more questions about interviewees' own life should have been asked to interviewees, in this research, interview questions were all about information and communication technologies and wearable devices, which causes the limitation of data depth.
5. The motivation of this study is that it is found that Finnish people use wearable devices more than Chinese people, however, this is no reference can show this fact and support this point, an additional research should have been done in advance to provide a proven viewpoint.

6.2 Future work

In the future, more studies are recommended to be done in three following fields: first, in this study, it is indicated that wearable devices can also contribute a lot to create a good health care system, which would definitely help a lot to support people to be healthier, and helping to create a good health care system may be an other important indirect way of wearable devices to support people to take care of health, a future study can be done in this topic. Second, in this study, wearable devices have been defined only as a training watch, a sports band, a exercise belt or something like that, but wearable devices contain much more than these devices, for example smart glasses, more studies can be done on wearable devices like smart glasses to indicate whether a pair of smart glasses can support people to take care of health. Finally, this is a qualitative study, which concerned more about people's detailed opinions and what people think, a quantitative study is also warmly recommended, more quantitative data may help to know people's basic situations better and can help to collect more general ideas.

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Appendix A Questions in Interviews

Basics:

1. Basic information (Age, Background, ...)
2. Definitions (In your eyes, what should a wearable device like)
3. Habits in doing exercise (How often, duration....)
4. Experiences in using wearable devices (Reasons of purchasing, what is that ...)
5. Attitudes about the advantages of sports and health

Additional:

1. Do you use information and communication technologies in daily life? How often? Or Why not?
2. Many years ago, wearable devices have been indicated to be new ways to manage information, now, how do you think?
3. Do you think wearable devices assist you in daily life, how?
4. Do you think wearable devices improve the collaboration or effectiveness, how?
5. Do wearable devices alert you sometimes? Do you think wearable devices are able to alert diseases, how?
6. Smartphones nowadays also have features or apps about health, how do you compare smart phones and wearable devices? (Functions, accuracy...)
7. How are you feeling when wearing a wearable device, do you wear it all the day?
8. As we know, preventing ourselves is an important part of being healthy. Do you think a wearable device is a kind of precaution of sickness? Do you think wearable devices improve the perception to take care of health?
9. A good health care with high qualities is also crucial, how do you think about these aspects that a good health care requires:

Aspects	To what extent do you agree or disagree
Safe and effective	
Promoting health and wellbeing	
Integrated and seamless	
Informing and empowering	

Timely and convenient	
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10. How would you think if wearable devices are able to analyse your diet?
11. What other features do you think a wearable device should have, but your device do not have? (How about audio controlled)
12. Wearable devices recognize activities, such as steps counting, how do you think, will you agree if wearable devices are able to track your positions and locations.
13. If one day, wearable devices can get bio-signals from your body, what do you expect them to be? (what signals?)

Bio-signals	Do you like?
ECG	
Blood Pressure	
Respiration rate	
Heart rate	
Perspiration	
Heart sounds	
Blood glucose	
Body movements	

14. Some people think that the uses of ICT (information and Communication Technologies) may probably bring information confusion, how do you think?
15. Do wearable devices help you and supervise you to do exercise? How?
16. How did wearable devices enhance your life quality?
17. Finns seem to have a better health condition than Chinese, and it seems that the percentage of people who have a wearable device in Finland is much more than that in China, do you think these two features are related?

Appendix B Reassembling interviews results (Chinese part)

Marks	Interviewee1	Interviewee2	Interviewee3	Interviewee4	Interviewee5	Interviewee6	Interviewee7	Interviewee8	Interviewee9	Interviewee10
Use frequency	Everyday	Everyday	Frequent	Everyday	Everyday	Everyday	Everyday	Everyday	Everyday	Everyday
Manage information	Positive	Positive	Neutral	Positive	Positive	Positive	Positive	No idea	Positive	Positive
Assist daily life	Positive	Positive	Positive	Negative	Positive	Positive	Positive	Positive	Positive	Positive
Improve collaboration	Negative	No idea	Positive	Positive	Positive	Positive	Negative	Positive	Positive	No idea
Alert disease	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Negative	Positive	Positive

Compare to Smart phones	WD	Both	Both	WD	SP	Both	SP	WD	WD	WD
Usability	Positive	Negative	Positive	Negative	Positive	Positive	Positive	Positive	Positive	Positive
Precaution of diseases	Neutral	Positive	Positive	Negative	Positive	Positive	Positive	Positive	Positive	Positive
Requirements of good healthcare	No idea	All	All	All	All	Some of	All	All	Some of	All
Analyse diet	Positive	Negative	Neutral	Negative	Positive	Negative	Positive	Negative	Negative	Positive
New features	Analyse diet	Audio control	Ease to use	Mind control	Audio control	Emotion features	Audio control	Heart rate	ECG	Audio control

Tracking locations	Positive	Positive	Neutral	Positive	Neutral	Positive	Neutral	Positive	Neutral	Positive
Bio-signals	Some of	Some of	All	All	All	Some of	All	Some of	Some of	Some of
Information confusions	No idea	Agree	Neutral	Agree	Disagree	Agree	Agree	Neutral	Agree	Agree
Supervise people	Neutral	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Enhance life quality	Positive	Positive	Positive	Negative	Positive	Positive	Positive	Positive	Positive	Positive

Appendix C Reassembling interviews results (Finnish part)

Marks	Interviewee1	Interviewee2	Interviewee3	Interviewee4	Interviewee5
Use frequency	Everyday	Everyday	Everyday	Everyday	Everyday
Manage information	Positive	Positive	Positive	Positive	Neutral
Assist daily life	Positive	Positive	Positive	Positive	Positive
Improve collaboration	Positive	Positive	Positive	Negative	Neutral
Alert disease	No idea	Negative	No idea	No idea	Neutral
Compare to Smart phones	WD	Both	Both	Both	SP
Usability	Positive	Negative	Negative	Negative	Negative
Precaution of	No idea	No idea	No idea	No idea	No idea

diseases					
Requirements of good healthcare	All	Some of	All	Some of	Some of
Analyse diet	Positive	Positive	Neutral	Neutral	Negative
New features	Audio controlled	Weather condition	Audio controlled	Audio controlled	Audio controlled
Tracking locations	Positive	Positive	Neutral	Positive	Neutral
Bio-signals	All	All	Some of	Some of	All
Information confusions	Agree	Disagree	No idea	Agree	Agree
Supervise people	Positive	Positive	Positive	Positive	Positive
Enhance life quality	Positive	Positive	Positive	Positive	Positive

Appendix D. An explanation of reassembling interviews results

Marks	Definitions	Explanations		Marks	Definitions	Explanations	
Use frequency	How often interviewees use ICT and wearable devices	Everyday 14	Interviewee uses ICT and wearable devices everyday	Requirements of good health care	How many of them do interviewees think should be important to a good healthcare	All 9	Interviewee thinks that all of the given selections should be important to a good healthcare

					according to the given selections (Safe and effective, Promoting health and wellbeing, Integrated and seamless, Informing and empowering, Timely and convenient)	Some of 5	Interviewee thinks that some of the give selections should be important to a good healthcare, or interviewee does not understand some of the given selections
		Frequent 1	Interviewee uses ICT and wearable devices very frequently			No idea 1	Interviewee thinks that all of the given selections should be important to a good healthcare
Manage information	To what extent interviewees think wearable devices are new ways to manage information	Positive 12	Interviewee agrees that wearable devices can be new ways to manage information or interviewee thinks wearable devices do not make any sense.	Analyze diet	To what extent interviewees think wearable devices are possible to analyze diet or how do people think about this feature	Positive 6	Interviewee agrees that wearable devices are possible to analyze diet or interviewee holds positive attitudes
		Negative 0	Interviewee does not really think that wearable devices can be new ways to manage information			Negative 6	Interviewee does not really think that wearable devices are possible to analyze diet or interviewee thinks it is not needed

		Neutral 2	Interviewee thinks that it depends or interviewee feels hesitating			Neutral 3	Interviewee thinks that it depends or interviewee feels hesitating
		No idea 1	Interviewee has no idea in this field, or interviewee had never think about this question			No idea 0	Interviewee has no idea in this field, or interviewee had never think about this question
Assist daily life	To what extent interviewees think wearable devices are possible to assist people's daily life	Positive 14	Interviewee agrees that wearable devices are possible to assist people's daily life.	New features	What kinds of features do interviewees expect wearable devices to have while their own devices do not have	Audio control, ease to use, mind control, emotion features and et al.	Different interviewees show different opinions here.
		Negative 1	Interviewee does not really think that wearable devices are possible to assist people's daily life or interviewee thinks wearable devices do not make any sense.				
		Neutral 0	Interviewee thinks that it depends or interviewee feels hesitating				

		No idea 0	Interviewee has no idea in this field, or interviewee had never think about this question				
Improve collaboration	To what extent interviewees think wearable devices are possible to be used to improve collaboration	Positive 9	Interviewee agrees that wearable devices are possible to be used to improve collaboration	Tracking locations	To what extent interviewees agree their locations to be tracked by wearable devices	Positive 9	Interviewee agrees to use wearable devices to track their locations or interviewee is willing to use this feature
		Negative 3	Interviewee does not really think that wearable devices are possible to be used to improve collaboration or interviewee thinks wearable devices do not make any sense.			Negative 0	Interviewee feels worried to use wearable devices to track their locations or interviewee is not willing to use this feature
		Neutral 1	Interviewee thinks that it depends or interviewee feels hesitating			Neutral 6	Interviewee thinks that it depends or interviewee feels hesitating or interviewee does not care
		No idea	Interviewee has no idea in this field, or			No idea	Interviewee has no idea in this field, or

		2	interviewee had never think about this question			0	interviewee had never think about this question
Alert disease	To what extent interviewees think wearable devices are possible to give people alerts when there are diseases	Positive 9	Interviewee agrees that wearable devices are possible to give people alerts when there are diseases	Bio-signals	How many of listed bio-signals do interviewees think should be possible to be got by wearable devices(ECG, Blood Pressure, Respiration rate, Heart rate, Perspiration, Heart sounds, Blood glucose, Body movements).	All 7	Interviewee thinks that all of the listed selections should be good choices
		Negative 2	Interviewee does not really think that wearable devices are possible to give people alerts when there are diseases or interviewee thinks wearable devices do not make any sense.				
		Neutral 1	Interviewee thinks that it depends or interviewee feels hesitating			No idea 0	Interviewee thinks that some of the listed selections should be good choices, or interviewee does not understand some of
		No idea 3	Interviewee has no idea in this field, or interviewee had never think about this question				

							the listed selections
Compare to smart phones	Which one do interviewees prefer when comparing smart phones and wearable devices for health purposes	WD 6	Interviewee prefers to use wearable devices for health purposes	Information confusion	To what extent interviewees think that ICT sometimes provides information confusion	Disagree 2	Interviewee does not think that ICT sometimes provides confusion or interviewee think it can be solved well
		SP 3	Interviewee prefers to use smart phones for health purposes			Agree 9	Interviewee worries that ICT sometimes provides confusion or interviewee thinks that it has not been solved well
		Both 6	Interviewee uses both of wearable devices and smart phones for health purposes or interviewee thinks they should be used together			Neutral 2	Interviewee thinks that it depends or interviewee feels hesitating or interviewee does not care
						No idea 2	Interviewee has no idea in this field, or interviewee had never think about this question

Usability	How do interviewees feel when wearing wearable devices, comfortable, uncomfortable or something?	Positive 9	Interviewee feels comfortable when wearing wearable devices or interviewee always wears wearable devices for a long time	Supervise people	To what extent interviewees agree that wearable devices truly supervise people to take care of health	Positive 14	Interviewee agrees that wearable devices truly supervise people to take care of health or they benefited a lot from wearable devices
						Negative 0	Interviewee does not agree that wearable devices truly supervise people to take care of health or they benefited a little from wearable devices
		Negative 6	Interviewee feels uncomfortable when wearing wearable devices or interviewee seldom wears wearable devices for a long time			Neutral 1	Interviewee thinks that it depends or interviewee feels hesitating or interviewee does not care
						No idea 0	Interviewee has no idea in this field, or interviewee had never think about this question

Precaution of disease	To what extent interviewees think wearable devices are possible to be a kind of precaution of diseases	Positive 8	Interviewee agrees that wearable devices are possible to be a kind of precaution of diseases	Enhance life quality	To what extent interviewees agree that wearable devices truly enhance people's life qualities	Positive 14	Interviewee agrees that wearable devices truly enhance people's life qualities or they feels much better after using wearable devices
		Negative 1	Interviewee does not really think that wearable devices are possible to be a kind of precaution of diseases or interviewee thinks wearable devices do not make any sense.			Negative 1	Interviewee does not think that wearable devices truly enhance people's life qualities or they feels almost the same after using wearable devices
		Neutral 1	Interviewee thinks that it depends or interviewee feels hesitating			Neutral 0	Interviewee thinks that it depends or interviewee feels hesitating or interviewee does not care
		No idea 5	Interviewee has no idea in this field, or interviewee had never think about this question			No idea 0	Interviewee has no idea in this field, or interviewee had never think about this question

