COPENHAGEN BUSINESS SCHOOL

MASTER THESIS

Digital self-tracking: exploring the user expectations, experiences and trust in off-the-shelf heart rhythm monitoring devices

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Abstract

Atrial fibrillation (AF) is one of the major health challenges amongst the Norwegian population from the age of 65. The present process for having your heart checked in Norway, is a cumbersome and slow process as the system works today. Also, the equipment is too complicated and need professional guidance for use. The off-the-shelf heart rhythm monitoring device, the AppSens smart sensor, aim to change the way of detecting atrial fibrillation, especially silent AF. The population and the health care system are becoming more digital and technological. Self-tracking is an emerging trend that affects almost all areas in our society, also the in health-care sector. In order to research how users' perceive these off-the-shelf monitoring devices, a research question has been created. The question has been split into three sub questions regarding the *expectations*, *experience* and *trust* the interviewees have towards the device, to help me grasp a broader understanding of the end user's perceptions. This research has been conducted on participants in the AppSens clinical trial. I see them as important research objects since they are interacting with the device. My research findings provide a deeper understanding of the thoughts of AppSens potential end user.

Acknowledgment

The last six months have been both challenging and rewarding. Choosing this research topic, digital self-tracking, has provided me with a whole new insight in the innovation of health care, and especially on off-the-shelf heart rhythm monitoring devices. First, I want to thank my supervisors, Till Winkler and Mads Bødker. Thank you for supporting and advising me throughout this project. Your guidance has been very helpful and provided me with an academic path to follow. Second, I want to thank AppSens for trusting me and providing me an interesting research topic. Also, thank you for your great cooperation. Further, I want to thank the participants in the clinical trial who also participated in my research. Last, but not least, a special thanks to my dear family and friends for all the support you have given me during this project. I am truly grateful for all of you.

Thank you so much.

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1.0 INTRODUCTION

A general introduction of atrial fibrillation (AF) will be presented, followed by a more specific introduction of AF in Norway, how it is diagnosed per today and the consequences of AF. Thereafter will an introduction to the AppSens Smart Heart Sensor will be presented, followed by an elaborated explanation of the intended use of the device. Further, the research question will then be given an introduction and presented. Then a delimitation of the thesis will be clarified in order for the reader to better understand the scope of the thesis. At the end of this chapter, the research background and motivation will be presented.

1.1 Atrial fibrillation

A normal heart rhythm is called a sinus rhythm, and it starts in the sinus node that is in the right atrium of the heart. The electrical system of the heart provides a regular and normal heart rhythm. These normal rhythms can in some conditions be overridden by other rhythms, and the most common is atrial fibrillation. This leads to an irregular and rapid electrical activity in the anterior chamber which again lead the anterior chamber to contract irregular and rapid, this is visualized in figure 1 below. It also causes the main chambers of the heart to pump irregularly, but not in the same speed as the anterior chambers contract. Initially appears AF with repeated seizures, but can become permanent after a while. It can also just occur as single episodes, and it is normal after or during an operation, or with acute disease (Istad & Elling, 2014).

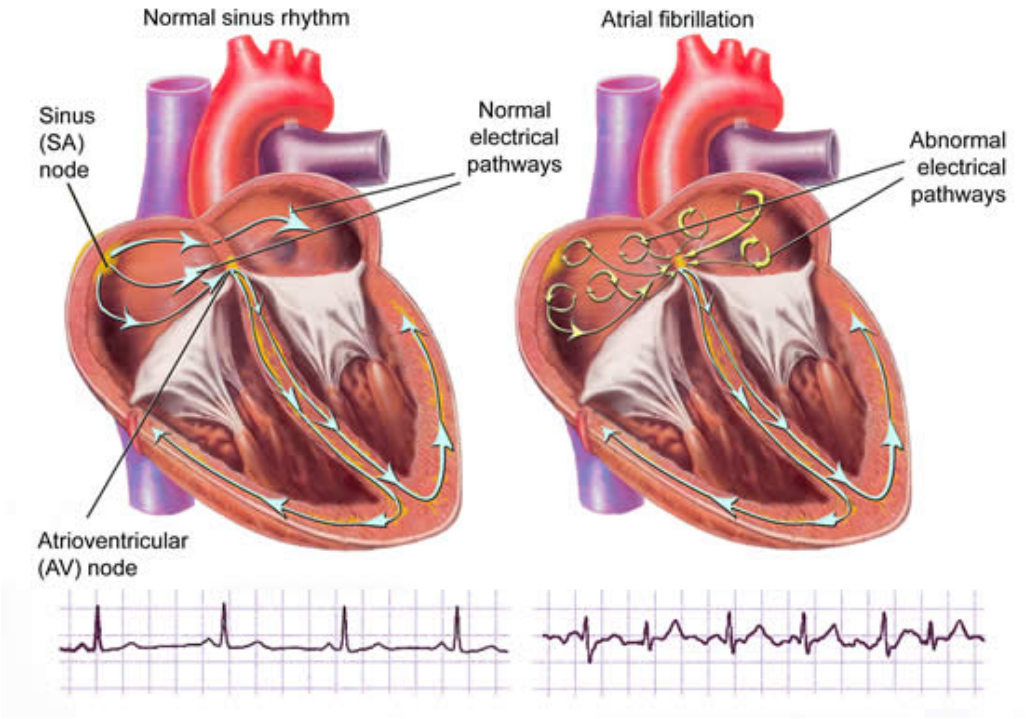


Figure 1: Normal sinus rhythm vs atrial fibrillation (Hamilton Cardiology Associates, n.d.)

Atrial fibrillation is caused because the heart`s anterior chamber has expanded, which leads to a change of the structure of the chamber. The anterior chamber wall normally consists of elastic tissue, but by AF has this been partly replaced by connective tissue. This is less elastic and the function is poorer than what the ventricles normally need when they contract. The most common reason for expansion and change in the chamber is high blood pressure, but other factors like smoking, eating a lot of unhealthy food, too little exercise or extreme exercise and other diseases also have major impacts on the heart walls (Istad & Elling, 2014). Also, sometimes the reason for AF are not known. It may lead to a stroke because the contraction fails. One example, imagine you have a sponge and you want to get all the water out of it. If the squeeze is not good enough, there will still be water left inside. It works the same way with the heart, if the contraction is too uneven or too fast this will lead to that the blood is not completely squeezed from the atria into the chamber. If this happens, there is a chance that the blood will be coagulated. This coagulation may later be pumped into the circulation and up to the brain, this may block the supply of blood to the brain from an

artery, and cause a stroke (Hamilton Cardiology Associates, n.d.). From the age of 65, the occurrence is more frequent (AppSens, 2018).

1.1.1 Atrial fibrillation among the Norwegian population

Atrial fibrillation is one of the biggest reasons for stroke, as it causes 1/3 of the total number of strokes. Also, the outcomes of strokes caused by AF are more severe. In Norway, approximately 10,000 people have a stroke every year, where 3,000 of them are caused by AF (Nasjonalforeningen, 2018) (AppSens, 2018). Estimated from the number of people living in Norway above the age of 65, probably 150,000 of them have AF, but 1/3 are not aware of their condition because symptoms are not always present, referred to silent AF. Also, atrial fibrillation is easy to discover on ECG, but this again is dependent on that you have flicker when the ECG is being performed (Skar, 2016).

A so-called "opportunistic screening" is now recommended by European guidelines from the age of 65. This implies that all patients above this age that visit their GP should for example get ECG checked or have their heart rate checked by pulse palpation (Indremedisineren, 2018). A stroke seen in an economical view is extremely costly, it is estimated that each stroke patient costs the government 800,000 NOK each year. It is also a heavy burden both physically and mentally for the patient and the next of kin. If a person from the age of 65 is paying a visit to their GP and the GP wants to find out whether the patient is at risk of AF, the doctor can, if they have, perform an ECG. The standard procedure at the GP is to get an ECG with a length of 30 seconds. Otherwise, the doctor has to request an appointment at the hospital. Since the equipment is so expensive, it's only the specialists that have access to it, and therefore there will be a waiting line, unless you're seriously ill (AppSens, 2018).

The population in Norway are now 5 328 212. Out of this, 579 695 people are in the age group from 67 to 79 years old (Statistisk Sentralbyrå, 2019). There have never been so many

elderly people in the population before. What determines the age of a population is how many that are born, how many that will emigrant and immigrant and how high the life expectancy is. Fewer born, fewer emigrants and immigrants and a high life expectancy will provide an old population. High life expectancy is present in the Norwegian population and the population tends to get older, and research shows that this will continue. By 2040 it is predicted that there will be approximately 1.4 million in the age group 67 to 79 years. The expected remaining life is approximately 21.6 years for women and 19 years for men, for today's 65 years-olds. By 2040 this will have increased to 22.3 years for men and 24.2 years for women (Rogne & Syse, 2017).

In this project, I will look at AppSens wireless ECG. It works in that way that the consumer buys it directly at the pharmacy or online without a prescription from the doctor. In short, the consumer will wear the wireless ECG, and this will send analyzed data to an app that the consumer must download to his/her smartphone. The ECG will monitor the patient for at least two days, but it can monitor up to seven days. When this period is over, the consumer will after three days receive an answer from the cardiologist whether they have AF or not. If AF is found, they have to seek their GP and begin treatment. This ECG is, according to AppSens, a cheaper and "easier-to-use" solution for the consumer. They want the consumer in the middle. With their device, they want to reduce the waiting time, provide quick answers and not the least prevent more strokes caused by AF. By detecting undetected AF, it can annually prevent between 700-1500 strokes (Skar, 2016). How the sensor works and the intended use is broader elaborated in the following sections 1.2 and 1.2.1.

1.2 The AppSens Smart Heart Sensor

The AppSens Smart Heart Sensor is a new Norwegian concept for silent atrial fibrillation detection. The innovation project has originated from the University of Agder and Sørlandet Hospital Arendal. The concept consists of a disposable one-time-use patch and a multiple

use smart ECG electrode, a medical grade smartphone app and a secure medical back-end cloud service with web-based health staff interface, the device is depicted in appendix 1. The web-based health staff is a service to be purchased additionally, which provides a faster respond on the analyzed data by a cardiologist. This easy-to-use wearable device with long term ECG monitoring that can diagnose arrhythmias automatically, has the possibility to change the approach to screening for AF in the community. The concept is displayed in figure 2.

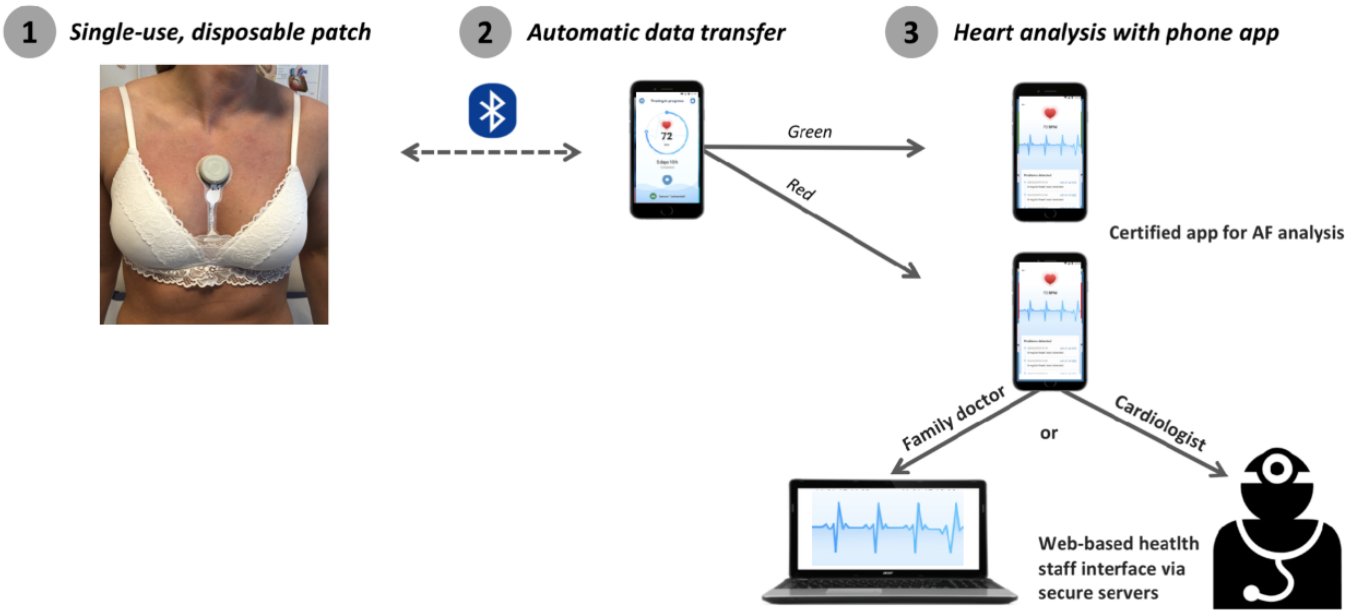


Figure 2: The AppSens Smart Heart Sensor concept (AppSens, 2018)

The AppSens Smart Heart Sensor is a new wireless ECG concept based on traditional Holter recording technology. The sensor records 1-lead ECG with reliable P-waves. The sensor has a robust construction that is supposed to be used under normal daily working conditions, even to be used under sport activities. The medical graded plaster material has a guaranteed time of use for 72 hours without giving any skin irritations. In order to reliably detect ECG signals also under sport activities, the sensor is protected from unwanted electromagnetic influence which normally occurs from clothing rubbing against the sensor surface. This shielding protection is an AppSens owned patented technology (US 2010/0256474 A1).

The AppSens sensor also have a specially developed antenna construction for transmitting electromagnetic signals from the body-worn sensor to the patient's smartphone, based on patented principles (WO 2009/038470 A!). A medical grade smartphone application (APP) is developed on basis of requirements for medical software (MDD 93/42/EEC and MEDDEV 2.1/6). This app will be downloaded to the user's smartphone and will automatically connect to the sensor using low energy Bluetooth (BLE) communication according to the Continua Guidelines. The software in the sensor contains algorithms for AF analysis and will forward, through the app, detected episodes of arrhythmia ECG-recordings to a secure medical cloud.

1.2.1 Intended use

Persons at risk of Atrial Fibrillation (AF) should according to international guidelines undergo regular check for possible detection of AF-episodes. Such tests will normally require recordings of ECG-signals and corresponding analyses for possible arrhythmias or AF-episodes. Today, this procedure is normally carried out at a hospital or specialist doctor offices.

The AppSens AF-sensor is developed as a medical diagnostic tool for self-test of possible Atrial Fibrillation. When introducing the AppSens AF-sensor to the market, such tests can be carried out by citizens as a self-test procedure. The sensor can be bought at the local pharmacy, a web-shop or similar without any need of a doctor's prescription, and the user can start up the AF-detection test period without any support from medical personnel. It will be placed onto the user's chest and continuously record ECG-signals with automatic analyzing of possible AF-episodes. Upon detection of an AF-episode, 1 minute of ECG recordings will be transferred to an app on the user's smartphone, and automatically be forwarded to a secured cloud-service for storage. Here, the web-based health staff interface can, if the consumer chooses to purchase this service, examine the findings and give a

recommendation for treatment. The user can from the app have an overview of the test and find information of detected AF-episodes.

The user can wear the sensor for a test period of 2-7 days with continuous ECG-recordings. During this test period, the user can perform normal daily activities including physical activity and training sessions and can at any time take a shower without the need of removing the AF-sensor. At the end of the test period or at any desired time, the user can download a secured PDF-report as a diagnostic report based on findings from analyzing the ECG-signals. Upon the user's request, this test-report can be supplemented with a cardiologist's evaluation of the findings, the web-based health staff.

1.3 Research question

The purpose and aim of this study is to investigate how people perceive new self-tracking technology as a tool for testing themselves for atrial fibrillation, and in this case, off-the-shelf heart rhythm monitoring devices. Based on this has the following research question emerged:

> *What perceptions do users of an off-the-shelf heart rhythm monitor device have before and after using the device?*

To be able to answer this research question, have I chosen to split it into these three following sub questions:

1. What expectations do users of an off-the-shelf heart rhythm monitoring device have before using it?
2. What experiences do users of an off-the-shelf heart rhythm monitoring device have after using the device?
3. What trust do users of a device for heart rhythm monitoring have in the device?

In the research have the AppSens Smart Heart Sensor (hereafter the AppSens sensor) been used as the off-the-shelf heart rhythm monitoring device in order to investigate the perceptions, expectations, experiences and trust the users have before and after testing out the device.

1.4 Delimitation

I found it necessary to limit the scope of the thesis, in order to keep focus on the area of interest in the research.

- Initially I created a problem statement and three research questions, they can be found in Appendix 13 *Information letter to the interviewees*. But into the process I found them too broad and out of the scope and the area AppSens wanted me to research, and therefore saw the need for narrow the scope even further.
- The focus then in this research has been to investigate the perceptions users have of an off-the-shelf heart rhythm monitoring device. To answer the perceptions of the users in both the clinical test and in the interviews, only the AppSens sensor has been used.
- The AppSens smart sensor system is also referred to as “The AppSens sensor”, “the sensor” and “the device” throughout the project.
- To keep the focus on answering the research question, I saw it necessary to split the main question into three subjects: 1. *expectation*, 2. *experience* and 3. *trust*.
- The design, the financial aspect, and how the technology of the AppSens sensor works have been excluded from this research because I see this as a AppSens responsibility and out of the scope.
- Also, an environmental and sustainable discussion has been excluded. Initially this was supposed to be a part of the thesis. Due to limitations of space, and that it is outside the scope of this research, I chose to exclude it.
- The context of this research is limited to Norway, because Norway is where AppSens will first launch their product and since they are a Norwegian based company who wanted me to investigate on their potential end users.

- The interviewees in this thesis will also be referred to as participants since they participated in a clinical trial while I interviewed them, and since AppSens made me a member of their research team.

1.5 Research background and motivation

The consequences of strokes are severe, and they heavily affect the patient, relatives and the society (Nasjonalforeningen, 2018) (AppSens, 2018). I am educated as a nurse, and I have seen those consequences on a close hold, but also as a private person within my own family. Even though an "opportunistic screening" are recommended from the age of 65, by the European guidelines, there are still too many strokes (Indremedisineren, 2018). I find it strange that there is so little focus on atrial fibrillation, in relation to what the outcome of a stroke can be. For some years now in Norway, there have been a broad focus on cervical cancer. Women from the age of 25 are offered a free screening test, and there has been a major focus on this in the media and by the health care sector. The reason for this is that the symptoms are often not present and the consequences could be fatal if the disease comes too far without treatment. The purpose of screening the population is to prevent cervical cancer that affects women of all ages (Kreftregisteret, 2018). It is interesting that the same screening program does not appear for atrial fibrillation as there are so many strokes annually, and that European guidelines recommend it (Indremedisineren, 2018).

A reason why the numbers of strokes are still too high, could be that not all 65 years old get an ECG offer when they are visiting their GP, or that the technology used today to detect atrial fibrillation, is outdated and in need for new solutions. The two most common ECG tests used in Norway today, offer either a test that lasts for 30 seconds, or a wearable device, Holter, but both tests are sensitive for too much activity and noise (AppSens, 2018). When thinking of how far the technology at other areas has come today, this is not good enough in an innovative perspective. Therefore, I find it interesting to research upon human adoption and a solution on how to, in a better way, prevent atrial fibrillation. The AppSens smart sensor system could

be the solution for detecting atrial fibrillation, and especially silent AF. The company, AppSens, have asked me to do research on the questions I have listed in this master thesis because they have too little data on the user experience. Furthermore, how the `potential consumer` perceive their product before launching it on the market.

2.0 LITERATURE REVIEW

The following section presents the literature review for this thesis. The chapter is divided into three parts, with sub-items for each topic. The first part is literature regarding self-tracking. Then in the second, literature regarding user experience are elaborated, and as this research concerns potential consumers from the age of 65 which is referred to as seniors/elderlies, literature regarding technology and elderlies has been reviewed in this user experience section. The third part contains literature about protection of health-related data.

2.1 Self-tracking

Self-tracking is an emerging trend which involves individuals adopting one or more tools to collect personal data about themselves. The reason for this is to gain self-knowledge which may lead to a change in how they behave and live their lives (Li, Dey, & Forlizzi, 2010). Self-tracking also includes diary writing and life-logging, but new technology makes it possible to gather even more comprehensive personal data than before, since the tools enable the user to measure and track data more advanced. An example of this is a person with diabetes who can measure the blood sugar level and get the answer right away, this allows the person to always have control. Other examples of self-tracking are sleep, workouts, food consumption and steps (Sjöklint, Constantiou, & Trier, 2015).

Already in the eighteenth-century Benjamin Franklin, a US congressman, tracked his habits and time to see if he managed to live up to his values, or *virtues* as he called them, using paper and pen to keep track (Neff & Nafus, 2016). The most regular definition of self-tracking found in literature, here cited by Lupton (2018), self-tracking is: "*a form of personal knowledge creation*" (Lupton, 2018, p. 1). For centuries, self-tracking has had, and still has, a

central role in healthcare and health promotion. This is because people are concerned with their bodily sensations and functions. Furthermore, they also pay attention to body weight, exercise and diet to achieve and maintain a good health or to manage disease and illness (Lupton, 2018). However, in 2007, a new term “quantified self” was invented by Gary Wolf and Kevin Kelly, two *Wired* magazine editors, to describe how digital self-tracking has become a part of our everyday lives. Before this, the term “lifelogging” was much used. Ever since the personal computer emerged, lifelogging attracted researchers especially within the human-computer interaction (HCI) field (Lupton, 2017).

It is predicted that by 2020, chronic diseases will worldwide account for almost 75% of all deaths. Therefore, prevention will have a central role on the health agenda. Cloud health intelligence has already evolved to a big extent and will keep evolving in the future. New digital technologies allow for self-tracking in new ways. These are among others; wearable technology such as smartwatches and glasses, mobile diagnostics and apps, and work as resources to our own health in our daily lives. In 2012, it was sold approximately 8.3 million smart watches, fitness trackers and smart glasses. The sales jumped almost 300% in wearable technology (Global Influences , n.d.). Mobile health apps also known as mHealth apps, is a fast expanding area in the self-tracking technology field. In 2018, there were over 318,000 mHealth apps available worldwide on the top app stores. This is almost double the number of available apps compared to 2015, which means that more than 200 apps were added every day. The increased adoption of smartphones is the major factor to why the mHealth market is growing and expanding. Furthermore, the massive investment in the digital health market is also an important factor (Liquid State, 2018). Numbers from 2017 predicted that the mHealth app market would globally in 2018 have a value at US$28.320 billion. Whereas in 2023 is it expected to reach close to US$102.35 billion (Research and Markets, 2017).

According to a research done by Accenture (2018)[1], it shows that consumers are more willing to use wearable technology instead of using websites. Even though websites are the most commonly used technology, the usage has more or less since 2016 remained stable. Research shows that there is an increasingly use in self-service digital health tools among consumers, which goes beyond the "regular" websites. Tools like wearable technology, social media, usage of mobile, online communities, smart scales and electronic health records (EHRs) and so on, as shown in the figure 3 below, are often referred to as Internet of Health Things (IoHT) (Safavi, Webb, & Kalis, 2018). Kalis & Wisdom (2017) states that to improve quality of care, access to health, operational efficiency and consumer experience, IoHT can be leveraged. They define IoHT as: "*the integration of the physical and digital worlds through objects with network connectivity in the healthcare industry. IoHT transforms raw data into simple, actionable information and communicates with other objects, machines or people"* (Kalis & Wisdom , 2017, p. 3).

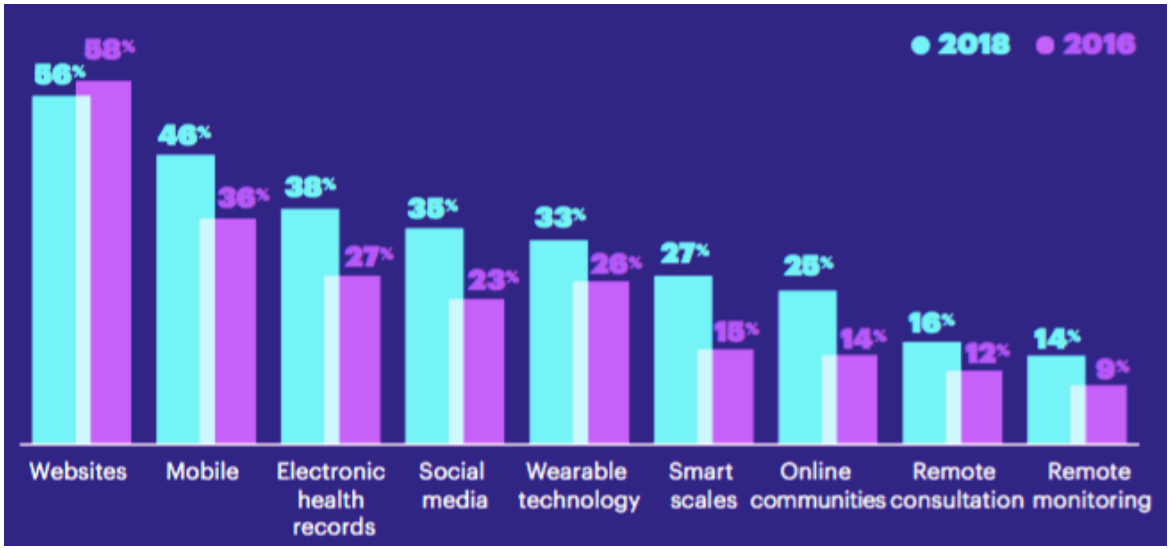


Figure 3: The usage of technology among healthcare consumers (Safavi, Webb, & Kalis, 2018)

[1] Accenture commissioned a seven-country survey of 7,905 consumers aged 18+ to assess their attitudes toward healthcare technology, modernization and service innovation (Safavi, Webb, & Kalis, 2018, p. 12).

2.1.1 Adoption and acceptance of technology

The two words *acceptance* and *adoption* are often used interchangeably when it comes to technology, and it is important to distinguish between the two. Acceptance of technology is understood as an attitude towards technology where the user is influenced by different factors. Adoption on the other hand, is a process which starts out with the user becoming aware of the technology, and in the end the user will embrace it and make full use of it. If a user buys a new technology but does not accept it, full adoption will necessarily not happen, this is where acceptance plays a significant role (Renaud & Biljon, 2008).

According to a study accomplished by Godoe & Johansen, *Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept* (2012), the results imply that innovativeness and optimism influence perceived ease of use and usefulness. Furthermore, the results indicates that when adopting new technology, both system specific dimensions and personality dimensions are two major factors (Godoe & Johansen, 2012). When talking about adoption, it means that a person does something differently than before, e.g. perform and acquire a new behavior or purchase a new product. The key is that the person self must perceive the product, idea or behavior as innovative (LaMorte, 2018).

For a technology to be used and of value for the user, it has to be accepted and adopted. Through time, several adoption and acceptance models have been developed, and are available in the field of Information Systems (IS) (IGI Global, n.d.). Within IS research, a variety of theoretical perspectives have been used to understand both the use and the adoption of technology. Sjöklint et al. (2015) states that: "*Research on self-tracking through wearable technologies falls into the stream of IS research on user behavior*" (Sjöklint et al., 2015, p. 2). Furthermore, they also acknowledge that it is important to use existing research when explaining the individual determinants when it comes to adoption and use of technology. But, they also highlight that wearable technology is a much more complex

process because it involves personal data, the person self will directly experience the technology and not least the interplay of the device (Sjöklint et al., 2015).

2.1.2 Senior Technology Acceptance & Adoption Model

The Senior Technology Acceptance & Adoption Model (hereafter STAM) was initially proposed in the research by Renaud & Biljon (2008). They investigated seniors and their acceptance and adoption of technology, more specific mobile technology (Renaud & Biljon, 2008). STAM is based on Fred Davis model, the Technology Acceptance Model (TAM), which he developed in 1989. It is one of the most frequently used theories in research in order to predict acceptance and use of technology and information systems by individual users (Surendran, 2012). Furthermore, TAM is used to explain the ease of use, the intentions of adoption and focusing on the user's perceptions of the performance of a technology (Sjöklint et al., 2015). The model was initially designed to explain behavior on computer usage (Godoe & Johansen, 2012). STAM on the other hand is aimed only at seniors and how they adopt and accept technology (Renaud & Biljon, 2008). As focus is on seniors as the potential consumer, this model was chosen for this research.

STAM consists of different components that explain and affect seniors` acceptance or rejection of the technology. This model is used as a framework for the interview design, though some changes are made in the model in order to make a better fit for this research, the model is visualized in figure 4. The original model can be found in appendix 2. Social influence/user context have been excluded. The reason for this is that the interviewees were invited to be a part of the clinical trial, and it would therefore be difficult to measure the social influence/user context which would have been more relevant if they went and bought the device themselves. Trust has been added as a component because I see this as one of the most fundamental factors in order for the elderlies to accept and adopt the technology. Also, some elderlies have barriers towards technology because of general skepticism, fear and a lack of confidence in use of technology (Spreicer, 2011).

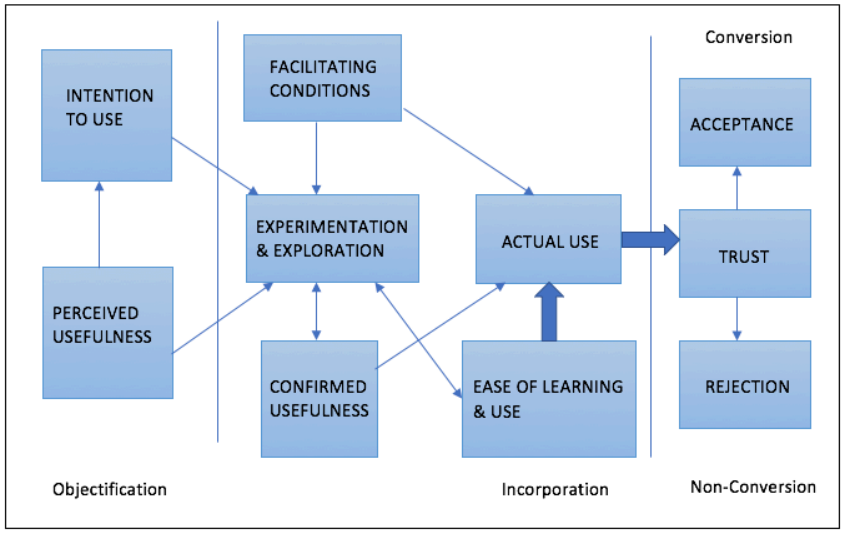


Figure 4: Own elaboration of the STAM model based on the STAM model by Renaud & Biljon (2008)

An elaborated explanation of the components of the model will follow below, based on how Renaud & Biljon (2008) explain them in their study, and also explained by how I have incorporated them throughout the interviews:

- **Intention to use**: is influenced by user context and perceived usefulness. In this research, the user context has been excluded due to the fact that the interviewees were invited to the clinical trial and did not purchase the sensor by their own will or desire.

  Subjects covered here are if the participants have tracked their own health before, if they have taken an ECG test before and what could have potentially triggered them to take one.

- **Perceived usefulness**: originates from the TAM model by Davis (1989), and are understood here as to what point a person believes that by using a certain product or service will improve their performance. It also aligns with "*compatibility and relative advantage innovation*" attribute by Rogers.

  Under this part, the interviewees were asked about their expectations for the clinical trial, about wearing the device for several days, if they thought it could prevent them

in their everyday life in any way. Also, what they would do with their results if the sensor detects something.

- **Trust**: originally, this is not a part of the STAM model, but it is in this research an important aspect in order to better understand first of all if potential consumers trust the device, but also to understand how to gain their trust. This was applied in both the first and the second round of interviews. In the second this is "disguised" under confirmed usefulness.
  The interviewees were asked in the first round whether or not they trusted that the device would be capable of detecting AF, and if they trusted this device as much as a normal ECG monitor. In the second round, they were asked if they could fully trust the device to give correct information regarding their hearth rhythm.

- **Facilitating conditions**: this component has not been well explained by Renaud & Biljon (2008). I have chosen to include GDPR here because this was also wished to be researched upon by me.
  In this subject, which was the last topic in the first round of interviews, they were asked if they knew the GDPR law, and if they felt they were provided enough information about what would happen to the data the sensor collected during the clinical trial. Further, I wanted to know their thoughts on that the data would be stored in a cloud, and lastly if they had any concerns related to if the data were to be misused or misplaced.

- **Experimentation and exploration**: here the user starts using the actual technology and a first impression of "ease of use" is created. The experiences that are being created here will further lead into "confirmed usefulness".
  Here the interviewees were asked first of all how the clinical trial went, if the device

lived up to their expectations and if they had any concerns if they were to do the test by themselves.

- **Confirmed usefulness**: this is investigating the usefulness the technology has for the person, also in relation to the features the person is able to use and learn how to use.
  As mentioned under the trust topic, the interviewees were asked if they trusted the device to detect AF. Further, what they thought about getting their results on the app instead of in person by a doctor, and lastly if they believed that the consumer pathway could be simplified with AppSens.

- **Actual use**: the actual use is being indirectly predicted of the experimentation, the outcome of this**.** Further, it also leads to the ease of learning and use, and this in combination with facilitating conditions predicts the actual use.
  Here I asked what they thought about the user friendliness, if they felt safe, if it restricted them in their everyday lives, and if they would use the cardiologic service AppSens will provide in the app, if the sensor detected something.

- **Ease of learning and use**: this is the result of "perceived ease of use". The conclusion regarding ease of use is being directly influenced by the experimentation and exploration component. Whereas other models do not include this aspect it is of major importance that this senior model does, as elderly people often fear failure and have difficulty in learning how to use a device.
  Unfortunately, the app was not fully developed during the clinical trial, it was just a demo app so I could not ask many questions regarding the usage of it. Instead, I challenged the interviewees` imagination and asked what kind of features it should contain in order to fulfill their needs in such an app.

- **Acceptance and rejection**: either is the device or technology being accepted or rejected. It is being predicted by actual use and ease of learning and use, the latter is influencing acceptance more than the actual usage.
  The interviewees were asked here if they would have accepted to be tested with an AppSens sensor or if they would have sticked to the ordinary ECG if they were at risk for AF. Further, what AppSens must avoid in order for people not to use their product, and if this is a product they will recommend to others.

2.1.3 Technology adoption lifecycle

In 1963, E.M. Rogers developed the Diffusion of Innovation (DOI) Theory, also known as the Adoption Curve (LaMorte, 2018) (Maeli, 2016). It is one of the oldest theories in social science. It was developed in order to better explain how, often over time, a product or an idea spreads and achieves momentum through a social system or in a specific population. In the end, the result of the diffusion will be that people adopt the new product, behavior or new idea. Like mentioned before, the key is that the person must find the idea, product or behavior innovative and new (LaMorte, 2018). Initially, the model was applied to home economics and agriculture, but later also applied to new technologies and ideas. The model describes how new ideas and innovation are adopted and accepted by cultures and groups (Maeli, 2016). DOI is divided into five adopter categories also referred to as the *ideal types*: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. These are conceptualizations of real observations and designed so it is possible to make comparisons. The thoughts behind having ideal types is to guide research efforts and to function as a framework for the synthesis of findings in research. Furthermore, ideal types are not the average of all observations in the specific category. Hence, exceptions must be found, if there is not, ideal types would not be necessary (Rogers, 1983). The adoption curve is displayed in figure 5, thereafter the characteristics of the ideal types will be described (LaMorte, 2018):

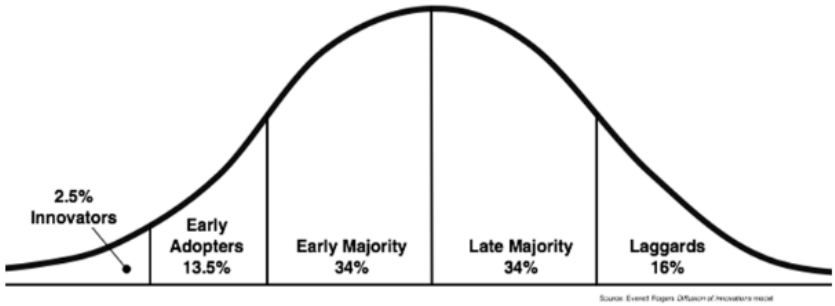


Figure 5: The adoption curve by Rogers (LaMorte, 2018).

- *Innovators*: are venturesome and eager to try out new things, even though the new idea or technology they adopt may be unsuccessful.
- *Early Adopters*: are opinion leaders. They are aware that a change is needed and therefore comfortable to adopt it, and they do not need to be convinced in order for a change to happen.
- *Early Majority*: adopt new ideas before an average person, but they are seldom leaders. Before they are willing to adopt it, they most often, have a need to see evidence that the innovation is working.
- *Late Majority*: are skeptic to change, and will not adopt before the majority have tried it first.
- *Laggards*: bound by tradition and therefore very skeptical of change and very conservative (LaMorte, 2018).

2.2 User experience (UX)

Whenever a human is interacting with technology, the user experience (UX) is present. In the healthcare industry, the usage of electronic medical records is increasing, which has led to set UX in focus. Furthermore, this focus has played an important role in the integration of user-centered design principles in the healthcare workflows, products and processes. In all technology, which is also associated with modern delivery of healthcare, there are opportunities and user experience issues. Due to the increasing array of devices, patients,

providers and systems interaction in order to treat, set diagnoses and manage diseases, the user experience is now a growing important topic within healthcare (HIMSS, 2019). Don Norman, inventor of the term *User Experience*, defines it as: "*User experience encompasses all aspects of the end-user´s interaction with the company, its services and its products"* (Norman & Nielsen, n.d.). The focus is to gain a deep understanding of the user; what their values, abilities, needs and limitations are. The core of UX is to be able to ensure the users that they will find value in what you are offering them (usability.gov, n.d.). The product design, regulatory compliance and hardware technology choices are, among others, factors that are affecting usability in healthcare. Also, since there has been a shift from a fee-for-service to a more value-based healthcare, there is a change in the customer relationship in every level of the healthcare supply chain. For clinicians, it is also important to improve the user experience for their patients because it has a big impact on their patients but also their own care and satisfaction (HIMSS, 2019).

Peter Morville (2004) claims that for the user experience to be valuable and meaningful for the user, there are some factors that have to be taken into consideration when giving information (Morville, 2004). To simplify it, he has taken these facets and made a model called *The User Experience Honeycomb.* The model is visualized in figure 6, and the facets will be presented below (Wesolko, 2016):

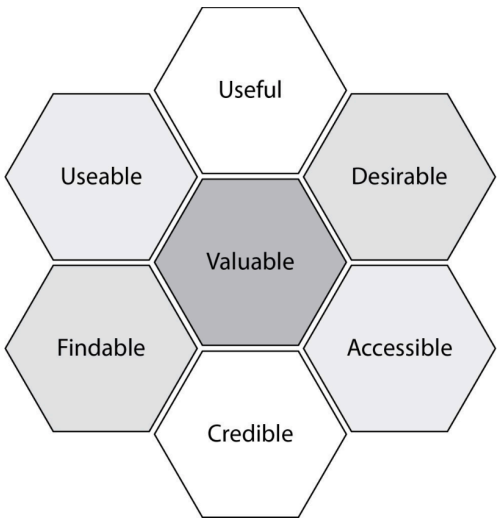


Figure 6: The user experience honeycomb (Wesolko, 2016).

- **Useful**: the service or product should fulfill a need and be useful.
- **Usable**: the system where the service or product is delivered have to be easy to use and simple. The users` learning curve should be as painless and short as possible.
- **Findable**: information should be easy to navigate and find. The user should be able to find a solution quickly if there is a problem.
- **Desirable**: the visual esthetic of the system, product or service have to be appealing and simple to translate. The design should be to the point and minimal.
- **Accessible**: the service or product should be designed so that it can be used by everyone, also so that users with a disability will experience the same UX as others.
- **Credible**: the company and its services and products have to be trustworthy.

2.2.1 Human computer interaction

Human-Computer Interaction (hereafter HCI) is what can be called a multidisciplinary study field that focuses on the interaction between computers and humans, and also the design of the technology. Initially HCI only concerned computers, but now it covers design in almost all kinds of information technology. Further, it also tries to grasp the understanding of how it is to be a computer user and creating services and products that works seamlessly. For a company, this is a major important skill to master in order to obtain the needed knowledge and perspective to develop more efficient products which will also increase the sales (The Interaction Design Foundation , n.d.).

Most technology are designed with the younger user in mind. The reason for this is that many designers are young themselves, and that younger people tend to quicker understand and interact with new technology. Elderly people on the other hand, are often associated with having problems with technology and the adaption of new ones. Therefore, knowing the user is a hallmark of good design, and to be able to develop user-friendly devices, systems or interfaces for the end user. Also, before the design gets to specific, the basic

human processing requirements must be accounted for, to be able to optimize the performance and satisfaction (Charness & Jastrzembski, 2007).

One model that has been widely used within designing technology is *The Model Human Processor.* It was developed in 1983 by Card, Moran and Newell in order to understand how people remember, store and perceive information, to be able to better understand the humans and design technology thereafter (Foundations of Human-Computer Interaction, n.d.). The human mind is what can be called an information-processing system, and this model can be applied in order to predict user-behavior instead of explaining what is actually going on inside the minds. When trying to predict the gross human behavior such a model is useful, see figure 7. The model is divided into three interacting systems: 1. The perceptual system, 2. The motor system and 3. The cognitive system. The perceptual system consists of sensor and buffer memories, and here are the memories being symbolic coded while visualized in an image store. The symbolic codes are being sent into the cognitive interaction system, where they are stored in the working memory, the long-term memory. Further, humans use this information when responding and making decisions. In the motor system is the respond carried out. Below in figure 7 follows a visualization of the model (Card, Moran, & Newell, 1983).

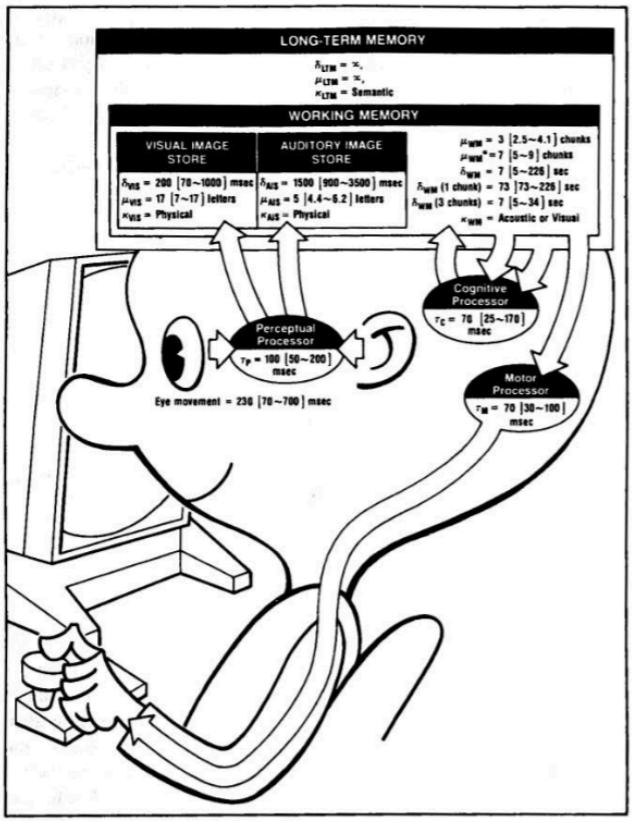


Figure 7: The Model Human Processor (Card, Moran, & Newell, 1983, p. 27)

This and other cognitive models are being applied in design in order to simulate the users` performance, so that designers in a better way can predict which specifications that will be the best choice and most effective. This is cost-efficient and also helps the designers to aviod user studies that are time-intensive and not least that it may help prevent products that are poorly designed (Charness & Jastrzembski, 2007)

2.2.2 Elderlies and technology

Seniors most often have less experience with technology than younger people. Cognitive aging and biological aging affects how they experience and interact with technology. Often, a difference in use of technology occurs, also referred to as the *digital divide*. This is a result of fear of technologies, general skepticism of adopting new technologies and a lack of

confidence in use (Spreicer, 2011). According to a study on technology and elderly people in the US, by the School of Gerontology in Southern California, it shows that adoption to new technology is directly correlated to higher education and income levels. Furthermore, 87% of the elderly with a college degree find technology comfortable to use. For those who have not attended college, the previous figure falls to 70%, whereas those with less than a high school degree adopt technology with only a 40% rate (The University of Southern California, n.d.).

Ballegaard, Hansen & Kyng (2008) states through one of their perspectives, *The Citizen Perspective,* that elderlies have increased authority and power to decide for themselves whether or not to integrate new devices into their lives, preferably as non-invasive as possible. They further argue that citizens are the experts of their own lives and experts in managing their own health through their routines. By saying this, they claim that when designing a healthcare technology, it is important to do this through a citizen view and that the new technology's disruptive nature should be minimized. Essentially, to be able to develop a successful healthcare technology it requires coherence between the design of the technology and the citizens' life and routines (Ballegaard, Hansen, & Kyng, 2008). Another aspect to consider when talking about the elderly and technology is that many seniors suffer from one or more chronic diseases. This will impact their use of technology and often are these technologies designed and developed for younger people with a mindset that their product, service or device should contribute to boosting fitness and health. Another barrier towards technology and elderly is the ease of use, particularly when they are learning how to navigate the device (The University of Southern California, n.d.).

2.3 Protection of health-related data

Protection is of major importance when working with health-related data, especially when the data now is becoming more and more digital. Literature regarding cloud computing, protection and regulation in Europe, which also includes the regulations in Norway, has been reviewed in the section below.

2.3.1 General Data Protection Regulation

Health-related data is defined as "*Epidemiology information related to health conditions, reproductive outcomes, causes of death and quality of life*" (For McGraw-Hill Concise Dictionary of Modern Medicine, n.d.).

For a long time, all over the world, EU´s laws regarding data protection have been considered as a gold standard. Technology has changed and transformed our lives for the past 25 years in ways nobody predicted or could have been able to imagine, therefore a review of the rules was necessary. In 1995 *The European Data Protection Directive* (Directive 95/46/EC*)* was adopted. The purpose of this law was to protect individuals when processing personal data and the free movement of this. In April 2016, the *General Data Protection Regulation* (EU 2016/679) was adopted. This lead to a repealing of the Directive 95/46/EC and replaced it on the 25th of May 2018. This new law consists of many existing rights, but also new ones have been added. E.g. an individual can request that their personal data shall be deleted from an organization if the person withdrew his or her consent, or if it no longer is necessary for the organization to possess the collected data (European Data Protection Supervisor, n.d.). This regulation applies to all companies that are operating in the EU regardless of where they are based in the world (European Commision , n.d.).

In EU, nearly all organizations will be affected by the GDPR law, but the ones that will be most affected is the healthcare organizations. The reason for this is because healthcare possesses sensitive information about people, more specific information regarding health and treatment, and this has to be handled in line with strict compliance rules. It is getting increasingly more difficult for this sector to maintain the data in a secure way and at the same time share data with others and keeping the individuals fully informed. Also, since healthcare organizations are changing their procedures and policies on how they use, store and collect data, particular issues will arise. Due to the increased cyberattacks which also have hit the healthcare sector hard, GDPR are placing additional requirements to security. This involves, among other things to maintain appropriate levels of security, built in

organizational and technical data protection and data hygiene. These requirements will demand the organizations to follow the given policies in order to maintain effective cybersecurity. This applies to everyone within the healthcare sector and also the providers of services using connected apps and devices (Sturman, 2018).

2.3.2 Cloud computing and health-related data

There are some speculations regarding when and where the term *cloud computing* has its origin. Network-based computing is a notion that dates back to the 1960s, but cloud computing is said to have occurred in 2006. It was former Google CEO, Eric Schmidt, who first introduced it at an industry conference. He said "*I don't think people have really understood how big this opportunity really is. It starts with the premise that the data services and architecture should be on servers. We call it cloud computing – they should be in a "cloud" somewhere*" (Regalado, 2011, para 9).

Cloud computing is an umbrella term for everything from data storage and processing to software on servers that is available from remote server parks connected to the internet. It is common to divide cloud services into service models. The three most common are software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS). In the first model, the service is delivered over a network and the customer uses the supplier's applications on a cloud-based infrastructure. Here, the customer has no control over the servers, operating systems, applications, storage options or networks. In the PaaS model, the customer introduces applications either developed or purchased by the customer themselves through the use of programming tools and languages supported by the supplier in the supplier's cloud-based infrastructure. The customer has control over their own applications, but they do not have control over operating systems, servers, storage or networks. The IaaS model concerns the provision of data infrastructure as a service over a network. Compared to the others who has no or little control, the customer has here control over storage, operating systems, relevant applications and servers. Also, in some cases, they have some control over certain elements of the network (e.g. on the firewall page).

Furthermore, cloud services can also be divided into delivery models such as public cloud, private cloud or a hybrid cloud. When a cloud is public, the vendor has made the cloud services available for all customers. A private cloud on the other hand is only available to those businesses the cloud is meant to apply. The environment where the cloud service is delivered from, will typically be dedicated to each individual customer or a defined group of customers. The private cloud allows in a greater degree for more specific customization compared to the public cloud. A hybrid cloud is a mix between the two delivery models above (Datatilsynet, 2018).

Cloud storage is one of the terms under the cloud computing umbrella. It is "*a network of remote servers that allow for centralized storage and online access to these resources*" (McHale, 2018, para 2). In other words, instead of the files being stored on a person`s own computer hard drive, the files are stored on a server that is conncected to the internet. This method brings along many benefits, among other things it is cost-effective, convenient and it also automatically takes a back up of the files. Further, the user do not have to worry about files taking up the space on the computer and it is not necessary to upgrade or delete files in order to make room for new ones (McHale, 2018). Many sectors are now taking cloud computing into use, among others we find education, insurance, finance and also healthcare (Sommer, 2014). Given the digital transformation in the medical services, massive amounts of data are created which includes among others treatment, diagnostics, patient files, blood-test results, CT-scans and so on. Cloud computing promises that by moving the healthcare data online this will be more efficient and be cost saving. Further, new evolving services such as mobile health and e-health are basically based on cloud services. Due to the principle of medical confidentiality and sensitivity of health-related data, the law is regulating the combination of health data and cloud computing strictly (Kraul, 2017).

3.0 METHODOLOGY

There are no wireless systems for long-term atrial fibrillation detection and diagnostic offerings in the market today. The most common ones are wired systems, like the Holter Monitoring system and the doctors 30 seconds wired ECG, together with several event recorders for maximum 1 minute recording randomly taken by a user of the device. The problems with today's methods is that they are not simple, long-term, cost-effective or accurate enough. The unnecessary deaths and strokes must therefore be avoided with a new and innovative technology and method. The AppSens solution to this is a wireless continuous long-term self-service heart-monitoring device, purchased without prescription. The product consists of four main elements: an electronic part, an electrode patch, a heart test and a cardiology review. The sensor is designed for continuous ECG monitoring which work up to 7 days, and the user can continue doing daily life activities. Inside the electronic part, there is a processor with a heart fibrillation algorithm (known technology) which detects heart fibrillation and transmits ECG and information via a low-energy Bluetooth (BLE) app on Android or iOS mobile phone that further stores the data in a cloud. The user will thus, in the case of simple self-testing, diagnose the atrial fibrillation. In case of detecting an atrial fibrillation, the treatment should then be consulted with either a GP or a cardiologist specialist. AppSens aims to be a leading provider of innovative wireless medical sensors and medical application for the mobile patient. What is innovative with this product, at least in Norway which is the country in focus, is that people are not able to go and purchase an ECG and do a long-term monitoring screening of themselves (AppSens, 2018).

The research for this master thesis was conducted on people who participated in a clinical trial performed by AppSens at the hospital Sørlandet Sykehus in Arendal, Norway. The people involved in the clinical trial have been invited and voluntary joined. The individuals

that have been chosen to participate in this research have been chosen randomly and they voluntary participated.

3.1 The structure of the methodology

The choices in the methodology for this thesis will in the below section be described using "the research onion" by Saunders et al. (2009) as a framework for the methodology.

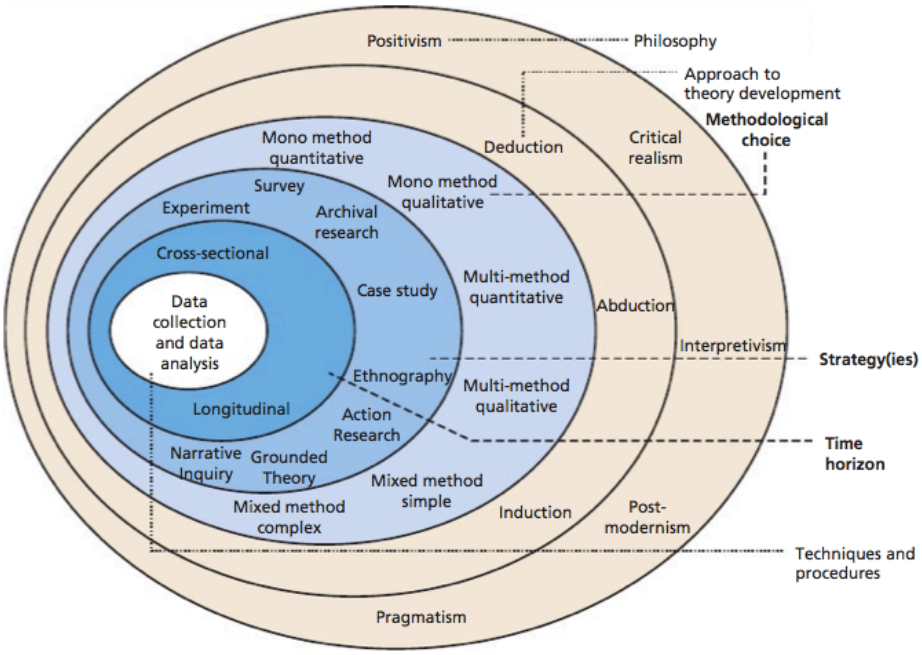


Figure 8: The research onion (Saunders, Lewis and Thornhill, 2016, p. 124)

3.1.1 The research philosophy

Among philosophers, there are no particular outstanding way for understanding the world, because assumptions and understanding the world is the base in all studies. In order to understand the research question, it is necessary to be clear on the philosophy that has been applied in the project (Dudovskiy, n.d.). Research philosophy is based on ontology, epistemology or axiology. This master thesis is built upon an epistemology philosophy. The reason for this chioce is because this philosophy allows me to find and investigate knowledge that is acceptable and adresses facts that will match this. It is therefore

necessary that I define what the knowledge in this particular research is (AllAssignmentHelpUK, 2017). Another reason for this choice is that this research is an exploratory study which means that it is of value for me to investigate what is going on in order to pursue new insight. To be able to do so, I must ask questions so it is possible to see the phenomena in a new light. Further, this type of study is flexible in the way that it allows for change. This does not mean for the direction to be absent at anytime, but that the focus can be broader in the beginning, and that it will progressivly narrow throughout the process (Saunders et al., 2016).

The research philosophy is the first layer of the onion, and the first thing that has to be established within the research process. This is because the beliefs and assumptions I have towards the subject in the research, is the background for the choice of philosophy. Researchers normally do have assumptions towards the subject they are investigating, either they want to or not, and this will most likely influence what methods and strategies that will be employed (Saunders et al., 2016). So, after finding the philosophy, I must find the philosophical stances which is associated with the chosen philosophy. Here, interpretivism has been applied, because it first of all relates to the epistemology philosophy, but also since this allows me to gain an understanding of how people experience both their own and others actions (AllAssignmentHelpUK, 2017).

Interpretivism originates from two intellectual traditions: *symbolic interactionism* and *phenomenology*. In symbolic interactionism, humans are interpreting the social world around them which is a continual process. The interpreting of actions happens between the people that are interacting with each other, and this will lead to an adjustment of their actions and meanings. Phenomenology on the other hand, refers to how humans tries to make sense of the world around them. In an interpretivism approach, it is necessary that the researcher understands that humans have different social roles in their everyday lives. Therefore, social actors is an important term within this approach (Saunders et al., 2016). An interpretivism approach allows me to collect data in small samples and to use a qualitative

method (Saunders et al., 2016). This has been done within this thesis, and this is because I wanted to grasp each indivudual`s assumption and understanding of the world from their point of view regarding the situation at hand, the sensor. Further, it was also of interest to see whether or not their meanings and actions would be adjusted after the clinical trial. More about the process has been described and presented in the section below in *3.2 Data collection.*

3.1.2 The research approach

The next layer in the research onion is the research approach. Either the approach is abductive, inductive or deductive. An abductive approach has been chosen here. In an inductive approach, you move from data to theory, in a deductive approach you move from theory to data and in an abductive approach you combine this by going back and forth (Saunders et al., 2016). The three approaches and their charactheristics in short are presented in table 1.

The three different approaches		
Inductive	Specific observation →	General conclusion (may be true)
Deductive	General rule →	Specific conclusion (always true)
Abductive	Incomplete observations →	Best prediction (may be true)

Table 1: The three different approaches (Dudovskiy, n.d).

An abductive approach allows for collecting data that is rich and detailed which again allows me to explore the situation at hand and identify patterns and themes regarding the

phenomenon. Later, I will try to integrate these identified findings into a conceptual framework and from there build a theory based on the findings. Testing of this will happen by using new and already existing data, and if it is necessary it can be revised (Saunders et al., 2016). Normally in an abductive research process, it starts out with “puzzles” or “surprising facts”, and they need an explanation and it is not possible to explain them with already existing theories. As presented in table 1 under the abductive approach, I tend to choose the best predicition or explanation to explain the “puzzles” or “surprising facts” that was initially identified. Further, it allows me to explain the identified findings either by cognitive or numerical reasoning, or to combine the two (Dudovskiy, n.d.). Unlike the other two approaches, it also allows for establishment of new knowledge and insight (Kolko, 2010).

Whereas this thesis is based on qualitative data and theory, there are still some unsolved “puzzles” to be explained. Therefore, an abductive approach seems to be the best fit for me being able to go back and forth between theory and the collected data. Also, since the AppSens sensor system is unique and completely new, there are no excisting theory that matches the research exactly. But since there are already a lot of theory that can be related, and data has been collected, this approach is the most reasonable because it allows to combine the deductive and the inductive approach in order to find an explanation to the research questions.

3.1.3 The research strategy

In the third layer, the choice of the research strategy is defined. A strategy is a plan of action on how I will achieve the goal. In order to be able to answer the research question, it is necessary that a strategy as a plan is defined. This is the methodological connection between the choice of method to conduct and analyze data and the choice of philosophy applied in the research. Traditionally, some strategies are linked to particular approaches or if the research is qualitative, quantitative or a mixed method. But, often there are open

boundaries between research approach, philosophy and strategy. Thus, a particular strategy is not necessarly superior og inferior compared to any other.

According to Saunders et al. (2016), to be able to achieve a reasonable coherence throughout the research process, the key is to choose the strategy that will make it possible to answer the research question(s), which will guide the choice of strategy. This coherence will again be linked to among other things, the chosen approach, the philosophy, the amount of time the researcher has, existing knowledge and sources of data. But, these strategies should not be considered as mutually exclusive (Saunders et al., 2016).

Grounded Theory has been used as the research strategy in this thesis. It is in a wide range of contexts used to develop theoretical explanations in social interactions and processes, this also includes management and business because this concerns people's behavior, e.g. employees or consumers (Saunders et al., 2016). In this research, it is the `potential consumers` behavior that is in focus and important for me to investigate on. Grounded Theory was developed as a process in order to explain, interpret and analyze the meanings which social actors have regarding their everyday lives and how they construct them to make sense of it, in specific situations. Further, it is well suited in combination with a qualitative research, and it provides a systematic approach on how to conduct and analyze data of this nature. Earlier was it clear that this strategy leans towards an inductive approach, but now it is more common to refer to an abductive approach. The reason for this is that you in an abductive approach move between data and theory and theory and data, since you in Grounded Theory simultaneously collect and analyze the data by coding it and categorize the data (Saunders et al., 2016).

3.1.4 The research choices

The fourth layer of the research onion, Saunders et al. (2016) describes different research method choices, which are describing how the data has been collected, e.g. through

observation, interviews or surveys. The data used in this thesis consist of primary and secondary data. The primary data is collected throughout interviews with participants in the clinical trial. Whereas the secondary data is previous publications such as reports, articles and other literature (Bryman, 2012). This layer is important, because it is here you define your methods in the research design, either you are seeking a quantitative or qualitative method, or a mix of them. In a qualitative method, the researcher is allowed to explore opinions, personal accounts and descriptions. Whereas with a quantitative method, the researcher will consider the measurements and the quantity. What distinguish a qualitative method from a quantitative method is according to Saunders et al. (2016, p. 165) that a qualitative method is: "*often used as a synonym for any data collection technique (such as an interview) or data analysis procedure (such as categorizing data) that generates or uses non-numerical data*". Whereas the quantitative method "*is often used as a synonym for any data collection technique (such as a questionnaire) or data analysis procedure (such as graphs or statistics) that generates or uses numerical data*" (Saunders et al., 2016, p. 165). Further, there are three methods that can be used; a mono-method, a multi-method or a mixed-method. In a mono-method you only focus on either a quantitative or a qualitative method, in a multi-method you can use information from both of them, but the focus will stay on only one of the sources. A mixed-method on the other hand allows for the study purpose to use both methods (AllAssignmentHelpUK, 2017).

In this research, a mono-method has been used with a qualitative method. This is the only method that has been used in order to collect data. Briefly spoken, for me it was most natural to choose a mono-method because this research holds an interpretivism research philosophy with an abductive approach. This method allowed me to understand and investigate the individuals' thoughts regarding the situation at hand, by communicating with the participants directly.

3.1.5 Time horizons

The fifth layer is regarding time horizon methods, and there are two types to distinguish between; *longitudinal* or *cross-sectional*. When designing the study, question regarding what time horizon the study should have is important to ask. A longitudinal horizon is when the research is like a diary that consist of snapshots or events over a longer period of time, whereas a cross-sectional horizon is more used in short time studies, that captures snapshots from a particular time. What time horizon you will apply, will depend on the research question(s) (Saunders et al., 2016) (AllAssignmentHelpUK, 2017).

A cross-sectional time horizon has been chosen within this study based on the time limit given this research. Due to the limited time, the interviews were conducted over a short period of time, this also regards the evaluation methods used. According to Saunders et al. (2016), this method is mostly used within studies that want to research a phenomenon at time in an academic setting precisely, because they are often time constrained. But, academic studies can also be a longitudinal study, the researcher just has to start the research process early (Saunders et al., 2016). Due to delays in the clinical trial, I had to choose a cross-sectional time horizon in order to be able to handle the data that was collected in the interviews. Also, it was not possible for me to start to collect data before AppSens was ready to carry out the clinical trial.

3.2 Data collection

The center of the research onion and the sixth layer is data collection (Saunders et al., 2016). This section will elaborate on how the primary data was conducted, what methods that have been applied, the interview situation and how they were handled.

3.2.1 Primary data

According to Saunders et. Al (2009), primary data is data that has been collected especially for a research. In this thesis, the primary data was collected from participants in the AppSens clinical trial.

3.2.2 Qualitative interviews

The varieties of human experience are investigated through qualitative interviews. This method is used by social scientists to understand the interviewees' subjective view of the world. It allows for the interviewee to speak freely about their own life situation with their own word, which will give voice to the common people (Kvale, 2006). According to Kvale & Brinkmann (2009), knowledge is produced in qualitative research interviews through social interaction between the interviewee and the interviewer. The production of the data depends of the interviewer's ability and skills in asking questions, and follow-up questions. Further, the situated personal judgements and the knowledge of the topic the interviewer has, plays a major part whether or not the interview will be of quality and useful (Kvale & Brinkmann, 2009).

I have conducted 20 qualitative interviews. The first ten interviews were conducted on the same day only short time after the participants got the sensor on. After they had been wearing the sensor for 5 to 7 days, the last round of interviews found place with the same participants. Only participants from the clinical trial was included in this research, since my focus is the potential consumer. Since nine out of the ten participants were Norwegian and one Swedish, the interviews were held in Norwegian. The interviews lasted between 8 and 34 minutes. Furthermore, the interviews were audio-recorded then transcribed into Norwegian and then translated into English.

Below in table 2, is a presentation of the participants in the clinical trial, they are coded as participant 1 to 10, and then follows gender and age. The order in the table is similar as in

the appendix which can be found in appendices 3 to 12. Initially there was supposed to be 100 people participating in this clinical trial. Due to technical challenges and that AppSens were only able to have 30 instead of 100 sensors ready for the clinical trial, there were only 30 participants. They will later on perform new rounds of testing. Because I thought there were 100 people participating, it was decided beforehand that 10% of the participants should be interviewed in order to get the most correct picture from the clinical trial. I still wanted to interview 10 people which equals 33% of the participants. The reason for this was to ensure enough participants, but also that the selection would be full worthy in order to get a certain idea what the ´potential consumer´ thinks about the heart rhythm monitoring device.

There are the same numbers of females and males, five of each, and the age ranges from 29 to 67 years. They all have attended college. The purpose of this study is to investigate how the potential consumers perceive the AppSens sensor and further their expectations, experiences and what trust they have towards the device.

Participant number	Gender	Age
Participant 1	Female	61
Participant 2	Female	63
Participant 3	Male	60
Participant 4	Male	34
Participant 5	Female	29
Participant 6	Male	45
Participant 7	Male	41
Participant 8	Female	52
Participant 9	Female	45
Participant 10	Male	67

Table 2: Overview of the interviewees

3.2.3 The interview design

A semi-structured interview guide has been used. In this kind of guide, I have a number of questions for the interview, but the order may vary from interview to interview. Also, I have the opportunity to ask follow-up questions. Normally are the questions more general than in a structured interview. The benefit by using this method is that I have the opportunity to control the interview, but at the same time, the interviewee can answer the questions as they want. This type of guide is often used in interviews where there are more than one person doing the interviews, or if the researchers is only able to interview one person a time (Schjødt, 2018). The latter is the reason for the choice how the interview guide was structured. This method is most commonly used in modern interview research (Brinkmann & Tanggaard, 2010). In an exploratory study, can in-depth and semi-structured interviews be helpful in relation to what you are trying to research and gain new insight (Saunders et al., 2009). The interview guide is structured and based on the Senior Technology Acceptance & Adoption Model (STAM).

The interview guide was used in order to ensure an extensive data collection, but also to have a structure during the interviews. There were made two different guides, one for the interviews before the clinical trial and one for the interviews after they had tested the device, they can be found in appendix 13. The reason for having two rounds of interviews was to later on compare if their relationship towards AppSens had changed during the testing period. Both of them are structured so that they are divided into categories which again has main topics. Also, some questions have been repeated in round two, on purpose, to better compare. Further, the questions were prepared based on the RQs and the STAM model, also follow-up questions were added in order for me to catch the interviewees' meanings and that they were accurately understood during the interviews. With a semi structured interview, there are room for improvisation which was much used especially in interview round two, depending on what was said. According to Kvale (2007), an interview situation is a moral enterprise. Ethical and moral issues is a major part of interview research, due to that the human interaction in an interview situation will affect what the interviewee are saying, and it will therefore affect the way we understand the human condition. Further,

ethical aspects must be considered in an interview situation, from the beginning until the end (Kvale, 2007).

Prior to the interviews, an application for permission to both perform the clinical trial and interviews was sent by AppSens to the regional committee for medical and health research ethics in Norway (Regionale komiteer for medisinsk og helsefaglig forskningsetikk, REK). I have also been added as a member of the AppSens research team. Further in the process, I wrote a declaration of consent and information letter to the participants, which can be found in appendix 14. I have followed REKs guidelines, and it is therefore safe to say that the data have been handled and processed with care.

3.2.4 The interview situation

The interviews were conducted at Sørlandet Hospital Arendal. Before the first round of interviews, the participants were handed an information and consent form which they read and sign before agreeing to being interviewed. It informed the participants who I am, what the information would be used for, some information regarding the thesis, and further about their right to withdraw from it at any given time and their anonymity. I also introduced myself and repeated in summarize the main components in the information letter. I was provided a room so the interviews could be done undisturbed. The second round of interviews were also held at Sørlandet Hospital in Arendal, except two of them which was carried out by phone, due to that they were unable to be present in person.

3.2.5 Recording of the interviews

The interviews were audio recorded. Due to new regulations and guidelines from REK, recording by phone is no longer legal, so therefore an audio recorder was used, it is depicted in appendix 15. Saunders et al. (2009) states that there are pros and cons by using audio recording for interviews. For example, the benefits are that it allows for the interviewer to only ask questions and listening, instead of taking notes at the same time, you are able to

use direct quotes and that you can listen to the recordings several times. The downside by using an audio recorder is that there could occur a technical problem, it can inhibit some of the answers from the interviewee and therefore reduce the reliability, and it require a lot of time to transcribe the audio recordings (Saunders et al., 2009). The transcribing of the recordings has especially been present in this process, due to that there was many interviews to transcribe, but also that the clinical trial was delayed from mid-February to the end of March.

Furthermore, Saunders et al. (2016) states that in addition to be aware of the advantages and disadvantages, you as a researcher should also record contextual data that are among others; the setting of the interview (could you be overheard, was it noisy or quiet), the time and date so that you do not mix up the interviews, and the location of where the interviews were held (Saunders et al., 2009). I made sure that the audio recorder was working by taking tests before the interviews started, also the recorder dated the interview and what time each interview found place. I was provided an office for the interviews at the hospital, and the interviews was conducted without anyone interrupting. Further, I wrote down the names of the participants on one sheet, on another it was written down when they were interviewed by coding them by numbers and what gender they were, to make sure that the interviews did not got mixed up. After the first interview, the interviewee and I agreed on when and where the next interview should find place, this was noted on another sheet. Phone numbers was also exchanged in order for both parties to reach contact in case something changed.

3.3 Limitation

This research focuses on what perception users of an off-the-shelf heart rhythm monitoring device have. The focus will mainly be on the Norwegian population, due to that this is where the clinical trial finds place and this will be the first market they will launch the sensor. The data will be based on 10 out of 30 participants, I will argue that this is not enough to generalize the entire population.

4.0 ANALYSIS

In this chapter is the method for the analysis presented. As an introduction to this chapter there is first a presentation of the nature of qualitative data. Thereafter will a presentation of the choice and reasoning of method follow, with an elaborated explanation of the analysis process of the raw material from the conducted interviews.

4.1 The nature of qualitative data

In order to be able to analyze qualitative data must the researcher understand the nature of it. Often are qualitative research associated with a philosophy which are interpretivist, the reason for this is that the researcher has to find a way to make sense of the socially and subjective expressed meanings from those who are included in the research. It is indicated by social constructionism that partially shared realities and meanings depends on peoples own interpretation of events that happens around them. Meanings in this kind of research depends on social interaction, and therefore is qualitative data more likely to be complex, varied and elastic compared to quantitative data. Understanding and analysis of the data therefore have to be sensitive in order for the characteristics to be meaningful. Normally are the qualitative data characterized by its fullness and richness, because the researcher has an opportunity to investigate a subject that are as real as possible.

Meanings that are retrieved from a qualitative research are usually from images and words, not numbers as in a quantitative research. Due to that images and words can have meanings that are multiple, is it necessary that the researcher clarify and explore them with great care. Hence, the quality depends on the interaction between data analysis and data collection so that meanings are allowed to be clarified and explored. Since qualitative data are non-standardized they are normally complex in nature and large in volume. The researcher is likely

to be met with a huge amount of data that needs to be analyzed, transformed, explored and synthesized in order to both address and answer the given research question(s) (Saunders et al., 2009). There are especially three features with qualitative research that distinguish from a quantitative research. The first one is that an inductive view within qualitative research shows the relationship between research and theory, where the theory is generated from the research. In this research has an inductive approach been applied. From this, grounds the researcher an understanding which is theoretical based on the people and context in the meanings, perspectives and language which forms their view on the world.

A crucial step here is that, after understood and described the world from the participants point of view, the researcher based on this must account for a social scientific explanation of the social world. Here, it is important that the social scientific account does not differ from the world seen by the interviewees. The second feature is that by employing an epistemological philosophy with an interpretivist approach, like done in this research, means that the researcher tries to grasp and understand the meanings the participants have of the social world. The last and third is that an ontological philosophy could also be applied within a qualitative research because it implies that when individuals interact will social properties be the outcome of this, instead of the phenomena at hand will be the cause of it (Bryman, 2012).

4.2 Data analysis

A content analysis has been used for this research in order to make sense of the mass of qualitative data and to better provide an answer for the research question and sub questions. This method is an analytical technique which is used on qualitative data to analyze them quantitatively by creating codes and categories. This analytical method is suitable to use in order to answer descriptive questions that starts with “who”, “when”, “what”, “how” and/or “where”. The reason for this is that it can help to analyze and find out what is included in the content, who the content includes, help find out how much something changed, where and

when an issue in the content is evident, how many or how much in the content a variable occurs or what patterns or trends are evident when comparing sources of data.

A specific definition of the content analysis method that has been widely used is the one by Berelson (1952): "*Content analysis is a research technique for the objective, systematic and quantitative description of the manifest content of communication*" (Berelson, 1952: Saunders et al., 2016, p. 608). This definition is important due to that it highlights the key concepts *objective, systematic, quantitative description* and *manifest content*. The usage of objective and systematic relates to specific rules of how to code and categorize the data, which usually are predetermined by the researcher prior the data collection. In some cases of content analysis, the categories can emerge during the analysis, but then it is important that the researcher explains how this was done so that this facilitates for later subsequent attempts in replicate the same results. The use of objective extends to that the researcher does not fully rely on the subjective judgement, but also identifies objects in the data that are factual. A content analysis should in order for others to replicate it, be conducted in a transparent, replicable and consistent way. For systematic development of analytical categories in content analysis there are five general principles for how the categories should be (Holsti, 1969: Saunders et al., 2016):

- They should obviously link to the purpose and scope of the topic of research, and evidently show the relationship of these categories to the objectives and research question(s).
- The analytical category should be comprehensive so every unit of the relevant data can be placed into a category.
- The category should be mutually exclusive to the relevant data, so the data only can be placed into one of the categories and not fit more than one.
- The category should also be independent in the manner that data can be related, but do not have the same characteristics, and therefore can not be in the same category.

- In order for avoiding conceptual confusion, the categories must be developed only from a single classification.

Quantitative description relates to the purpose of content analysis, the purpose to describe and quantify the aspects of visual or textual data after they have been coded and categorized. The data are collected by a qualitative method, or they can be derived from already existing qualitative sources. Manifest content in a content analysis is related to analyzing the data which is apparent. In the definition by Berelson, manifest content and objective are linked in the way the objective tries to also find factual objects within the data and do not only trust the subjective judgement. Doing this in a manifest content manner is to use phrases or words which are present in the data and then use them as the basis for a system for categories and then analyze the content. By analyzing manifest content should this improve reliability, but also increase the chance that the analysis is conducted in a replicable, consistent and transparent way.

A semi-structured interview guide was developed prior to both the rounds of interviews, and the STAM model was used as framework. But, some changes were made for the second round of interviews after the first round was performed. Questions were made and put into the different categories as I will call them from now on. After the interviews, they were transcribed and put into the software NVivo 12. I first started to look for words and phrases that could be the basis for a systematic development for codes, like in a manifest content manner. This led to 20 categorizes and I found it difficult to get a proper overview of the data. Further, I used again the STAM model and coded the data after those categories which was made beforehand. I found this quite useful because I felt the categories where mutually exclusive in the way that the relevant data could only be coded in one category, even though they could relate to others. The interview transcriptions were coded and analyzed separately. I then made bar charts for each question in the respective categories, to better visualize the answers. By doing it this way, I ended up with an overview over each question. I did not find all the categories from STAM so important for the matter of answering the research questions, therefore I have excluded them and much of the collected data. Also, I felt that the scope was

too broad in order to answer the given research, the scope of the findings therefore had to be narrower. I then decided to break it further down into three main categories that relates to the aim of the research and they are: *expectations, experiences* and *trust*. Transcriptions from both rounds of interviews were added in the same NVivo file and coded all together, they did not get separated as when I used the STAM model. The reason for this choice is to get an even more narrowed scope of the analysis, but also in relation to better sort out the most important findings from the transcriptions. Also, they are merged so I can even better compare the answers. Three categories are developed from the research questions in combination with findings from the relevant data, content analysis allows for codes to emerge from data. An explanation of what I have empathized in the three following categories are displayed in table 3, in order for the analysis to be transparent, replicable and consistent (Saunders et al., 2016). An overview of the coding in each category are displayed in table 4. The transcriptions from the qualitative interview were coded and analyzed, and then transformed into quantitative data by putting the findings into bar charts which makes it easier to measure the findings.

Expectations	Experience	Trust
Relates to the expectations the interviewees had made up for themselves before the clinical trial of the heart monitoring device, in this research, the AppSens wireless heart monitoring device	Relates to the experience the participants have after they have tested the device. It relates to their experience explicit to the AppSens heart monitor device.	Relates to what trust they have in this explicit device, but also if they trust that their data is being handled with care after the regulations.

Table 3: An explanation of the key topics in the analysis

Expectations	Experience	Trust
• Expectations before the test • Have used technology to track own health before • Wear the device for 24-hours a day • Prevent the everyday life • Provided good enough information before the test	• How the test went • If the device lived up to the expectations • User-friendliness • If it prevented the everyday life • Easy to take the test by themselves	• Trust that the device can give correct answers of the heart rhythm • Trust that the sensor is capable of detecting AF. • The trust in an AppSens heart monitoring device vs an ordinary ECG • Trust that the data is being handled after regulations

Table 4: Overview of the coding in each category

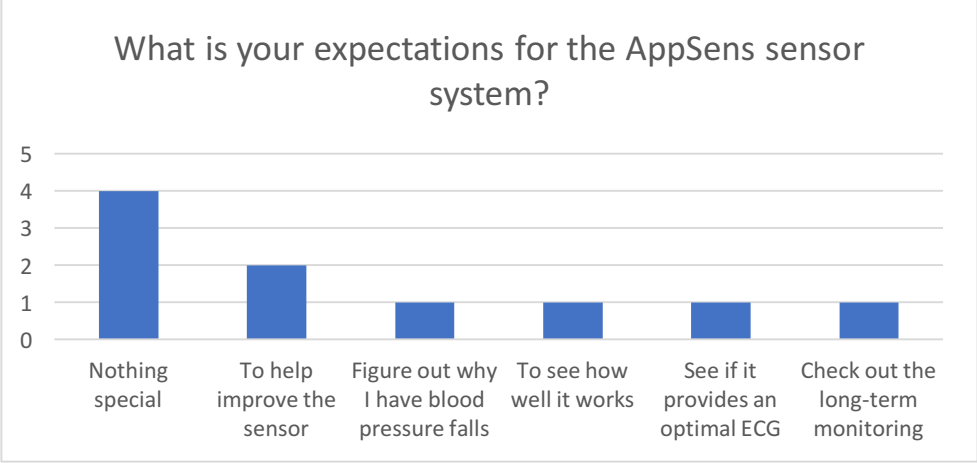
5.0 FINDINGS

In the following section a presentation of the findings from the three key categories will be presented. An explanation of the categories will also follow. The findings have been displayed in bar charts for the purpose of visualizing the results so the reader can get a better overview.

5.1 Expectations

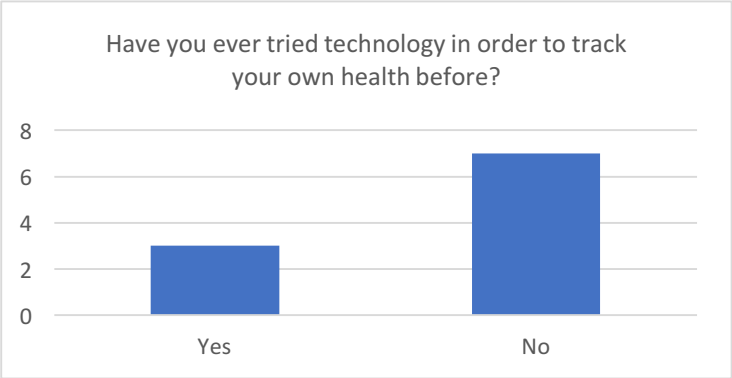
In this category questions were related to the interviewees expectations prior the clinical trial for testing out the heart rhythm monitoring device, the AppSens sensor.

Four of the interviewees did not have any special expectations for the clinical trial. Two of them hoped that they could help improve the sensor for further development. Participant 2 hoped to find out why she had blood pressure falls (Appendix 4). One said that the expectations for the sensor was to give an optimal ECG, whereas one was excited to see how well it worked. And one was eager to check out the long-term monitoring device. Several of them said that they knew they were not sick, so they did not have any expectations for the sensor to find anything wrong with their heart.



Bar chart 1: Expectations for the AppSens sensor system

For the question "*Have you ever tried technology in order to track your own health before?",* seven out of ten replied they had never tried to track their own health with technology before this clinical trial. Two of them had tried out Apple Watch and Lifesum (event recorders). While participant 5 had tried the fixed apps on her smartphone (Appendix 7).



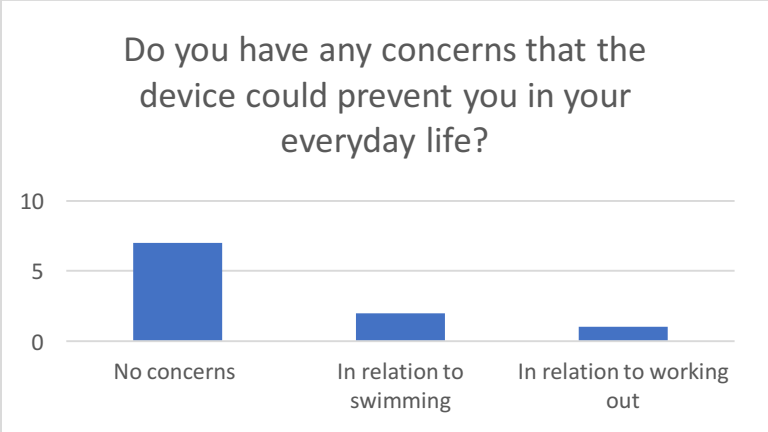
Bar chart 2: Used technology to track own health before

They were asked if they had any problems relating to wearing the device 24 hours a day for several days. All ten of the interviewees said that did not have any problems with it, and had no further elaboration to this question.

Bar chart 3: Wear the device for 24 hours a day

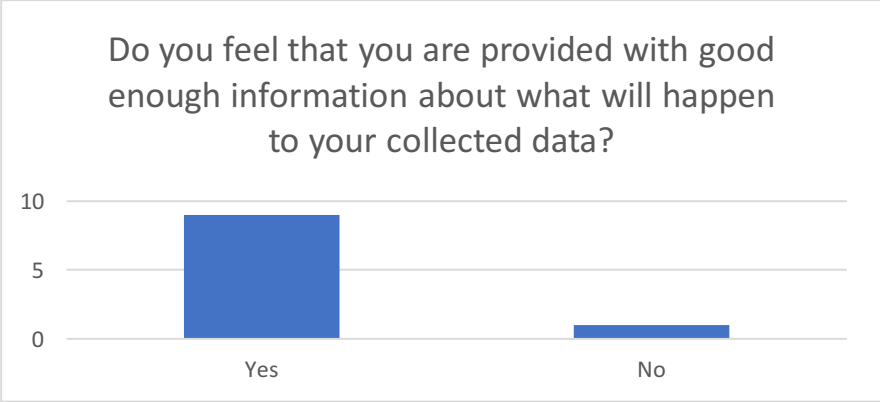
In the following question, they were asked if they thought the device could prevent them in their everyday life. Seven of them did not thought it would, whereas two of them regularly go

swimming once a week and since they could not swim with the sensor, it would prevent them in that way. Participant 5 had concerns related to working out with the device (Appendix 7).



Bar chart 4: Could the device prevent in any way

The interviewees were asked if they felt they had been provided good enough information before the clinical trial, about what kind of information the sensor would collect and what would happen to the data. Nine of the participants said that they did felt that they were provided good enough information before the clinical trial. Some of them said that they did not read through the information letter, but that they still felt satisfied. Participant 6 said: "*Yes, if I was extremely concerned about it I would have read through it all, but I have not of course*" (Appendix 8). Another who had the same mindset was participant 4, he said following: "*Ehm, I guess it's like all other for example online newspapers that want your declaration of consent, and it is not that often that I bother to read, I just approve*" (Appendix 6). Participant 8 felt that she was not good enough informed, her reason was: "*I got the electrode on… so I just signed*" (Appendix 10).

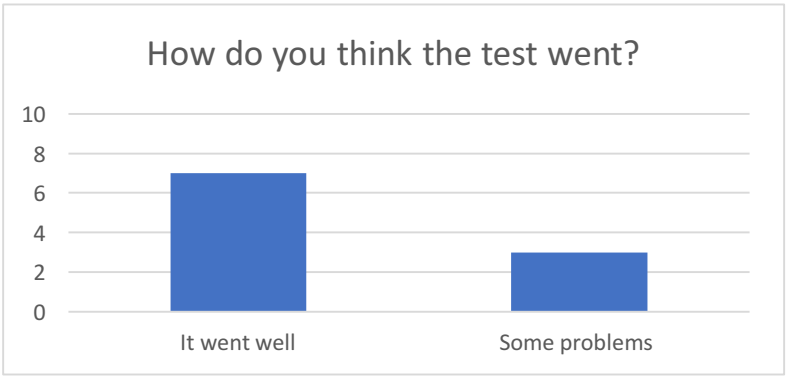


Bar chart 5: Provided good enough information

5.2 Experience

This category entails findings regarding the interviewee's experience with the AppSens sensor after they tried it out in the clinical trial.

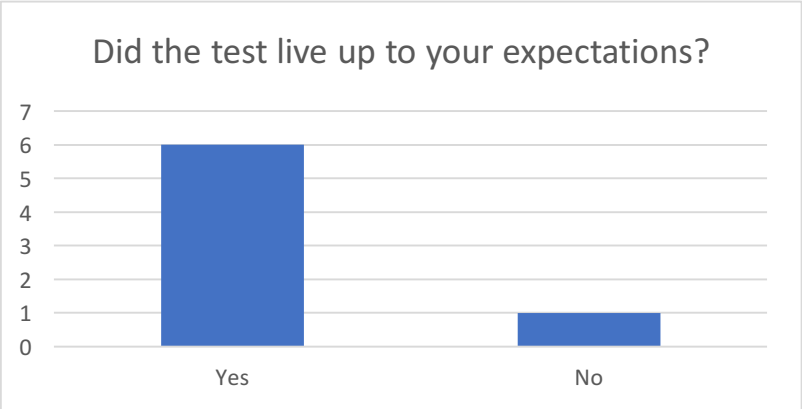
In respect of the question "*How do you think the test went?"*, the answers were a bit divided. For some it went without any issues or problems, but some had technological issues like the device lost touch with the app, another said that the device loosened from the chest.



Bar chart 6: How the test went

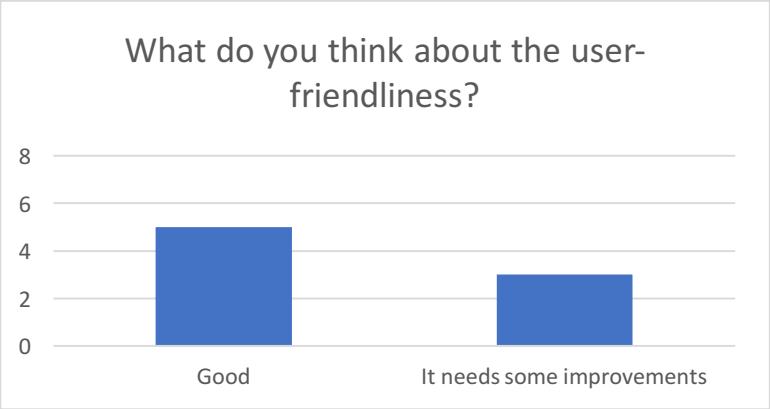
The next component within this category is if the test had lived up to their expectations. Most of the participants claimed that it did. Participant 9 on the other hand said that it did not; when she was working out the electrodes on the patch loosened. She said: "*I've found out*

that it's not intended for people with breasts… it gets so narrow, and then it gets too sweaty here (points between the breasts) compared to men who are completely flat" (Appendix 11). Participant 2 said that it had started to itch a little bit, whereas participant 5 also said that it did not seem to be constructed for women with breasts since it loosened when wearing a sports bra (Appendix 3 and 6). I did not ask participant 2 and 5 if it lived up to their expectations on background of their previous sayings. Participant 8 was either not asked, therefore are there only seven respondents in bar chart 7.



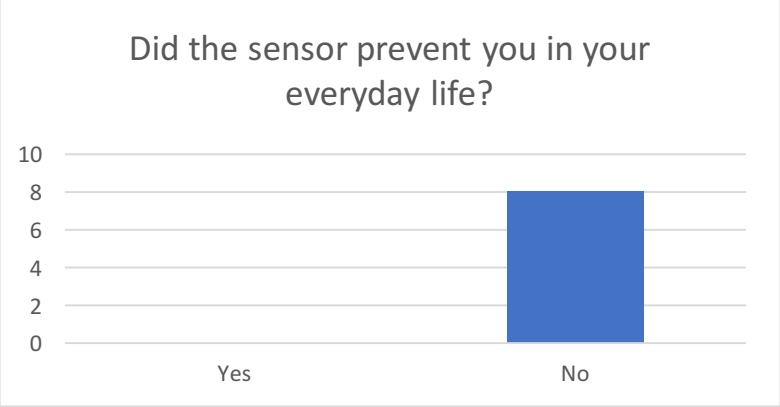
Bar chart 7: If the device lived up to the expectations

They were asked about their thoughts about the user-friendliness of the AppSens sensor. Participant 3 and 9 was not asked about this particular question, due to that this is a semi structured interview and I asked the questions that seemed natural during the interview. Five of the interviewees said that it was easy and simple to use. Participant 4 said that: "*It wasn't a problem there, it's not something I think could be improved or changed in relation to the ease of use*" (Appendix 6). Whereas three of them said that there was room for improvements. Participant 5 said: "*That's probably something that needs to be improved, I certainly think so. It has an improvement potential, but that's why we try it out then. See what is good and what needs to be done about it*" (Appendix 7). She did not specify what could be improved.



Bar chart 8: The user-friendliness of the system

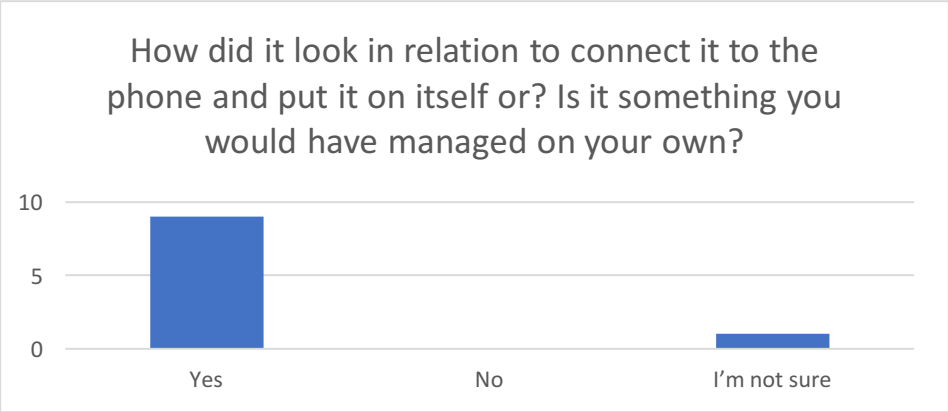
They were asked if it prevented them in their everyday lives. Participant 7 and participant 8 were not asked about this because as mentioned this is a semi structured interview. Eight out of eight interviewees who were asked about it said that it did not prevent them in their everyday life, but had no further elaboration to the question.



Bar chart 9: Did the device prevent the everyday life

The last question of the category, *experience,* is if they think they would have managed to perform the test by themselves. The day the clinical trial started, they were assisted to get the sensor on and connected to the app on their phone. Nine of the participants said that it looked easy and something they would have managed by themselves. Participant 1 said that she did not dare to say yes or no, because she did not do it by herself (Appendix 3). Participant 7 said that he thinks he would have managed to connect the phone and the sensor by himself, but

regarding putting on the sensor, he said: "*The sensor on the other hand, it should have been put on by someone, if there is no good instruction manual*" (Appendix 9).

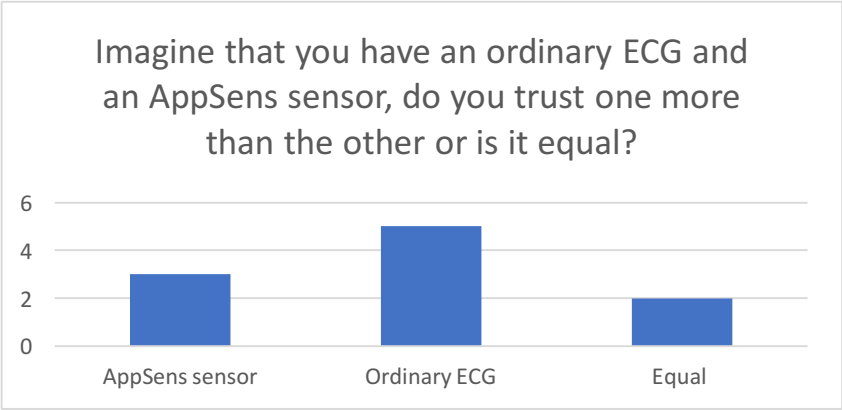


Bar chart 10: Doing the test by themselves

5.3 Trust

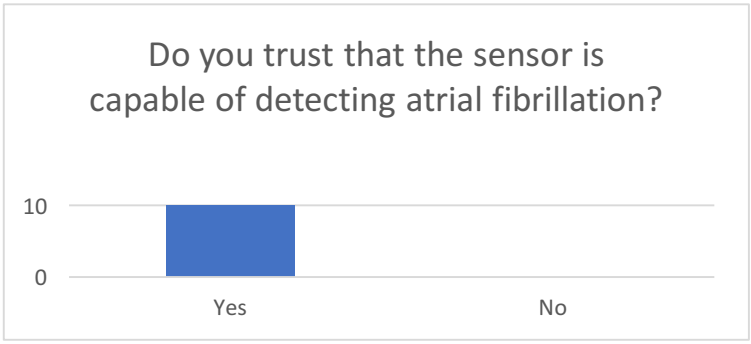
This third and last category entails findings from the interviews if they had trust in the heart rhythm monitoring device, the AppSens sensor. Also, if they trusted that their data which the sensor collected, would be handled after given policies and not be misused.

In the first round of interviews, they were asked if they trusted the AppSens sensor more, less or equally to an ordinary ECG. Five of them said that they for now trusted the ordinary ECG more than AppSens, but participant 5 stated that "*For now, I don't have any relation to this (pointing at AppSens senor) so it is a bit difficult to compare, but ECG in general is very much to be trusted, except that it depends on who reads it. So, ECG is a little user-dependent, or who is good at reading the ECG, that's the thing I'm thinking about*" (Appendix 7). In other words, she is more concerned with the person reading it and not the ECG itself. Further, three of the interviewees said that they trusted the sensor more, and two of them said that they trusted them equally. Participant 3 said that he would have preferred an AppSens solution due to that he then would have the long-term monitoring and then get a broader picture of the challenges (Appendix 5).



Bar chart 11: The trust in the AppSens sensor vs ordinary ECG

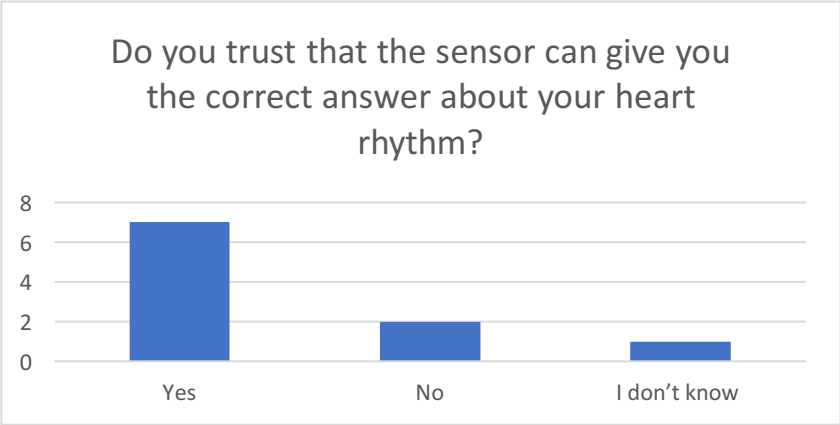
Before the test in the first round of interviews the interviewees were asked if they thought the sensor could be capable of detecting atrial fibrillation. All ten of the interviewees said they trusted that the sensor would be capable of detecting AF. Participant 8 said: "*Yes, I can't know for a fact yet since I haven't seen any results from this one yet, but you do trust what has been used for the longest time*" (appendix 10).



Bar chart 12: Trust the sensor to detect AF

After the test, in the second round of the interviews they were asked the same question. Now, seven of them said that they still trusted that the device would be capable of detecting AF. Two of them said no, due to that their sensor had been showing strange signals and therefore they could not trust it for now. Participant 10 said that he did not had any relation to it, so therefore he could not make a statement (Appendix 12). In other words, he was not sure what

to reply to this question. Participant 5 was more concerned with the importance of having enough experience when reading the ECG. She said that the ECG can be good, but what really matters is the experience the cardiologist has with reading the analysis (Appendix 7)

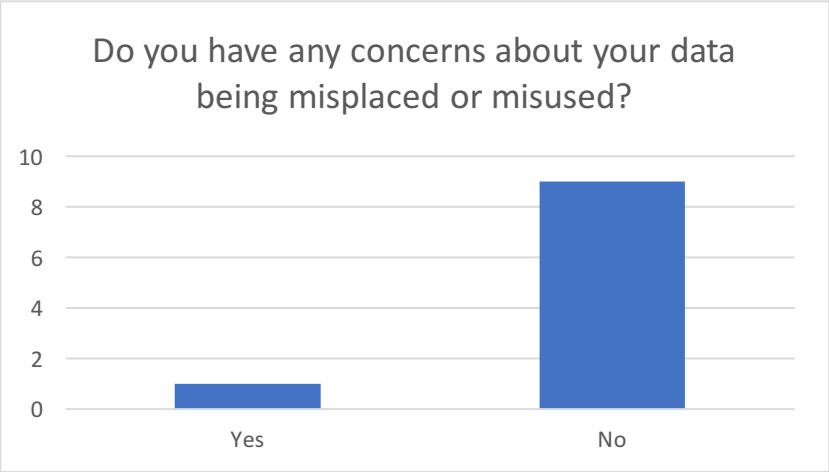


Bar chart 13: Trust the sensor will give correct information

They were asked if they had any concerns related to that their data would be stored in a cloud. None of the participants had any problems with their data being stored in a cloud. Participant 1 claimed that: "*That's how it is these days, so I think it's alright*" (Appendix 3).

Bar chart 14: Concerns to cloud storage

In the last question of this category, the participants were asked if they had any concerns if the collected data could be misplaced or misused. Nine of the interviewees said that they were not concerned about the data being misplaced or misused, several said that in relation to an ECG they did not mind the data being stored in a cloud. Participant 3 was afraid of this and he said: "*You should always be a little skeptical with your personal data. Definitely*." (Appendix 5).



Bar chart 15: Concerns that data can be misplaced or misused

6.0 DISCUSSION

The three key categories; *expectation, experience* and *trust* will in the following chapter be discussed in combination with findings from the interviews and theory. The aim of the research was to answer the following research question: "*What perceptions do users of an off-the-shelf heart rhythm monitor device have before and after using the device?"*. To answer the question, it has been split into three sub questions:

1. *What expectations do users of an off-the-shelf heart rhythm monitoring device have before using it?*

2. *What experiences do users of an off-the-shelf heart rhythm monitoring device have after using the device?*

3. *What trust do users of a device for heart rhythm monitoring have in the device?*

For the purpose of structure, the three key categories have been used as framework for the discussion.

6.1 What expectations do users of an off-the-shelf heart rhythm monitoring device have before using it?

Self-tracking is an emerging trend where individuals are adopting one or more tools to collect personal data about themselves. This gaining of self-knowledge may lead to a change in living and how they behave (Li, Dey, & Forlizzi, 2010). Before the clinical trial started and the investigation of what perceptions users have of an off-the-shelf heart rhythm monitor device, it was important to find out what expectations the users had. *Expectations* are here understood as what thoughts the interviewees had towards off-the-self heart rhythm monitoring devices before trying it, and in this case the AppSens smart sensor and what they

thought the sensor could do for them. An interesting finding from the interviews was that they did not seem to have much expectations for trying out the device. Only participant 2 said that she had expectations for the sensor for her own benefit, she was hoping that the sensor could be helpful in findings out why she from time to time had blood pressure falls and passed out (Appendix 4).

Most of the participants answered that they did not have any special expectations for the test or towards the device. Another interesting phenomenon that was present in most of the interviews was that many of the interviewees did not think that they were sick, therefore they did not have any expectations that the sensor would find anything wrong with their heart. This is an interesting observation due to that symptoms are not always present when it comes to silent atrial fibrillation (Indremedisineren, 2018). But on the other side, the occurrence of AF is more frequent from the age of 65, and the interviewees are from the age of 29 to 67 (AppSens, 2018). So, it is natural that especially the younger interviewees are not worried about having AF.

According to a research done by Accenture, consumers are more willing to use wearable technology rather than websites. But, websites are the most commonly used technology, and the usage has since 2016 remained stable. However, research shows that the usage in self-service digital health tools among consumers are increasing, and this goes beyond the "regular" websites. Wearable technology is among other things; usage of mobile phones, social media, electronic health records (EHRs) and smart scales. These tools are often referred to as Internet of Health Things (Safavi, Webb, & Kalis, 2018).

None of the participants claimed that they had any problems with wearing the device for 24 hours a day, even though only three of the participants had actually tried wearable technology before. When the interviewees were asked if they thought the device could prevent their everyday life in any way, three participants said yes. Two of them said it would prevent them

because they regularly went swimming. Participant 5 said that she was a bit worried that the device could prevent her in her workout sessions (Appendix 7). In other words, one could argue that they had more thoughts about the device before trying it out, than they actually said directly in the interviews. They were not necessarily positive, but they had thought how it could prevent them instead of doing something for them, e.g. detecting something abnormal with the heart.

EU´s law of data protection has been considered as the golden standard for protecting individuals' personal data. Since technology for the past 25 years has been such a big influence in our lives, it has been necessary to have rules and also review them over time in order to match the development of technologies. In April 2016, the General Data Protection Regulation (EU 2016/679) was adopted, and replaced the Directive 95/46/EC from 1995, in May 2018. This new law also protected the individuals, but in a more comprehensive manner, e.g. an individual could request that their personal data could be deleted from an organization (European Commision , n.d.).

The interviewees were all asked if they felt that they were provided good enough information before the clinical trial. Information regarding what kind of personal data the sensor would collect, and what would happen to them afterwards. Nine of the participants said that they felt they were provided good enough information before the clinical trial. Some of them said they did not read through the information letter, but that they still felt satisfied. Participant 6 said: "*Yes, if I was extremely concerned about it I would have read through it all, but I have not of course*" (Appendix 8). They also had to sign a consent form, and participant 4 stated that: "*Ehm, I guess it's like all other for example online newspapers that want your declaration of consent, and it is not that often I bother to read, I just approve*" (Appendix 6).

Especially the health care sector has experienced an increase in cyber-attacks due to the sensitive information they hold. The health care sector is getting more digital, so it also is

getting more difficult to maintain a secure way of storing the personal information (Sturman, 2018). Participant 8 said she did not feel that she was provided good enough information, but she just signed the consent form anyway (Appendix 10). Based on these sayings one could argue that people not necessarily are concerned what will happen to their data. Why people are not more concerned could be linked to many factors. It could be due to strictly regulations and therefore have not many experienced a personal cyber-attack for instance, or maybe it could be that since internet is not something you can actually see, you just think it will be safe, or that people are naive when it comes to accepting terms. The reasons could be many.

6.2 What experiences do users of an off-the-shelf heart rhythm monitoring device have after using the device?

Adoption and acceptance are two words that are often used interchangeably when it comes to technology, these two words are important to distinguish between because they do have two different meanings. Adoption is a process where the user becomes aware of the technology, and at the end of the process the user will embrace it and make full use of it. Whereas acceptance in this context is understood as an attitude towards technology where the user is influenced by several factors. If the user does not accept the technology, there are little chance that the adoption will find place (Renaud & Biljon, 2008). In the second sub question "*What experiences do users of an off-the-shelf heart rhythm monitoring device have after using the device?* ", the intention was to investigate the experience the participants had with the device after the clinical trial. They were asked how they thought the test went, this is one factor that later will lead to acceptance or rejection. If they did not have a good experience, this would most probably lead to a bad experience and they will not adopt the device.

Seven of them said that they thought it went fine without too much problems, but three of them said that they were not satisfied. According to what Renaud & Biljon (2008) claims, the three of them would probably not accept the device and therefore not adopt it. Godoe &

Johansen (2012) states that when adopting a new technology, there are two important factors that plays a role; the system specific dimensions and personality dimensions. Adoption of technology could be understood as doing something completely new than done before, e.g. purchase a new product or perform and acquire a new behavior. To accomplish this, the key is that the person must perceive the behavior, idea or product as innovative (LaMorte, 2018). Since the participants were invited to participate in the clinical trial, is it difficult to either confirm or deny if they find the device so innovative that they would adopt it by themselves. This would have been easier if they bought the device by themselves and performed the test from their own free will. However, one can argue that they do find this technology innovative since they are willing to participate, but if they are accepting and adopting the device is another question.

There are different factors amongst the interviewees that influence whether they accept or reject the technology, among other things, a great difference in age is present. Younger persons often have more experience with technology than older persons, and a digital divide may occur. The results of this is that older persons tend to have a general skepticism of adopting new technologies, lack of confidence in use and fear of technologies (Spreicer, 2011). Further, most technology is designed for younger people, and the designers are often young themselves. In the development of the technology it is crucial that the designers know their users, in order to create a device that is user-friendly and easy to use, in order to create a good experience (Charness & Jastrzembski, 2007).

Atrial fibrillation occurs more frequent from the age of 65, so the intended end user of the AppSens sensor is from this age (AppSens, 2018). However, in the clinical trial one of the goals was to find out their perceived experience when using the device. Therefore, it was not so much of importance that all the participants were close to 65 years old. Also, cognitive models such as *The Model Human Processor* can be taken into use when designing a product to simulate the preferred end users' performance. Further, Charness & Jastrzembski (2007) argue that this model can better predict which specifications that will be most effective and

the best choice, and this is cost efficient compared to just having several clinical trials (Foundations of Human-Computer Interaction, n.d.) (Charness & Jastrzembski, 2007).

After they had tried it out, they again were asked about expectations, more specific if the device had lived up to their expectations. Six of them said that it did live up to their expectations, but four out of them did not have any special expectations so they did not have much to compare with. But, only seven of the interviewees were asked if the device lived up to their expectations. Participant 9 said that the device did not live up to her expectations and she said that this device could not be designed for women, because between the breast it gets narrow and it is not that functional especially during workouts (Appendix 11). Participant 5 also said that when she was wearing sports bra during workouts, it loosened a little bit (Appendix 7). On one hand this is a good observation for the designers, so they can adjust it. On the other hand, these two participants are 45 and 29 years old. This means that they are quite younger than the ideal end user and may be more active than a "normal" 65-year-old. One should not generalize, a 65-year-old could be just as active as the participants are. But, none of the female participants that were older mentioned anything about this problem.

Whenever a human being is interacting with technology the user experience (UX) are present. UX is a growing important topic within healthcare due to the increasing array of devices, systems, patients and providers. For clinicians, it is important that they improve the user experience for their patients, because it has a major impact on the patients, but it will also affect how they provide care and satisfaction (HIMSS, 2019). The participants were asked if they find the device and usage of it user-friendly. The results would probably have been different if the app was fully developed. During the clinical trial, the participants only saw and used a demo app which showed only the heart rate (ECG signal). Five of the participants said that the device and app was easy to use, and did not need any further changes. Participant 4 said "*It was not a problem there, it's not something I think could be improved or changed in relation to the ease of use*" (Appendix 6).

Even though the app was not fully developed, three of them clearly said it was room for improvements. One of them who meant this was participant 5, she said following "*That's probably something that needs to be improved, I certainly think so. It has an improvement potential, but that's why we try it out then. See what is good and what needs to be done about it*" (Appendix 7). Again, this participant is the youngest of all of them, and she might demand more of the technology compared to the oldest participant who are 67.

It is not easy to satisfy all consumers, but to gain a better understanding of the potential consumer and their needs, *The User Experience Honeycomb* can be applied. The seven facets consider factors that is of importance when trying to create a product or service that is valuable and meaningful for the user (Morville, 2004). But, by doing this, designers have to generalize the potential end users unless they ask them, but this is both time consuming and cost driven. Probably they will match the needs many consumers have, but not all of them, because it is difficult to satisfy all the needs every individual consumer has. The participants were assisted in putting the sensor on their chest and connecting the device to the app on the phone. They were asked if they thought they would have managed this on their own. All of them, unless one, confirmed that it looked easy, and they were sure that they would manage this themselves. Participant 1 did not dare to say whether she would manage this or not by herself, because she got help with this at the clinical trial (Appendix 3). Participant 7 said that he would managed it by himself, but he was a bit unsure of the sensor itself, since there was no instruction manual, he said that it should be put on by someone (Appendix 9). In the clinical trial, the participants were not handed a user manual, but this will follow in the package that will be sold.

Ballegaard, Hansen & Kyng (2008) argue that citizens are experts in their own lives. Through one of their perspectives, *The Citizen Perspective,* devices should be integrated by the users themselves and preferably as non-invasive as possible. The disruptive nature of new devices or technology should be minimized. A successful healthcare technology require coherence between the design of the technology and the citizens' life and routines (Ballegaard, Hansen,

& Kyng, 2008). None of the participants said that the device prevented them in anyway, not even the two who regularly went swimming. This might have prevented them more if they had to wear the device for a longer period. If you compare wearing a heart monitoring device for maximum 7 days to get your heart checked out and to not be able to swim during this period, most people would probably accept it. This is also confirmed by the two participants since they did not feel that the device prevented them.

6.3 What trust do users of a device for heart rhythm monitoring have in the device?

Rogers developed in 1963 the Diffusion of Innovation (DOI) model, also known as the Adoption Curve (LaMorte, 2018). The model describes how innovation and new ideas are accepted and adopted by cultures and groups. Further, the model divides these groups and cultures into five adopter categories, or ideal types (Maeli, 2016). Ideal types are not the average of all observations, exceptions must be found and if not, there would not be necessary with ideal types (Rogers, 1983). It was interesting that there was such a big difference in age, due to that younger people tend to have more experience with technology than seniors, and one could therefore think they would be more demanding in features and such (Spreicer, 2011). Also, since the younger generation is used to technology, they might trust it more than the elderly generation.

In both rounds the interviewees were asked if they trusted the AppSens sensor. In the first round of interviews all of them answered that they did believe that it was capable of detecting atrial fibrillation. None of them asked questions regarding the technology or had any doubts. After trying the device this impression was changed. Seven of them still thought the device could provide them with correct answers regarding their heart health. Two of them were now more skeptic, and one of them, participant 9, said that she would not trust the device as it works now (Appendix 11). Further, participant 8 said "*Yes, I can't know for a fact yet since I haven't seen any results from this one yet, but you do trust what has been used for the longest time*" (Appendix 10). Still, seven out of ten interviews who trust the device are good numbers. There will always be those who does not fully trust the technology. On the other hand, the

technology should be reliable and if a person's experience is unreliable, it would impact the trust.

Another interesting phenomenon that became clear during the interviews was that both the younger and the older persons expressed that they were skeptic to new technology. They were asked if they trusted the AppSens sensor more, less or equal to an ordinary ECG tester. Five of the participants said after trying the device, that they trust an ordinary ECG more than the AppSens sensor. This is an interesting finding, due to that seven of them claimed that they believed the AppSens sensor would be capable of detecting AF, also after trying the device. If they did believe in this, they would probably have answered that they trusted the different devices equal or that they had more trust in the AppSens sensor. So, in other words, they contradict themselves with these sayings. But, people are creatures of habits and like participant 8 said, people tend to trust what have been used for the longest time (Appendix 10). Three of the participants said that they had more trust in the AppSens sensor after trying it, participant 3 said: "*I think I might would have used such an AppSens solution… because it is a more long-lasting and then you get a bigger picture of the challenges*" (Appendix 5). Participant 5 on the other hand, stressed that the ECG, no matter if it is the AppSens sensor or an ordinary ECG, it all depends on who reads the ECG, because this is where the real challenge is. She was more concerned with this rather than the technology and what type of ECG it is (Appendix 7).

Cloud computing is an umbrella term for everything from data processing and storage to software on servers which is available from remote server parks that is connected to the internet (Datatilsynet, 2018). Given the digital transformation in healthcare, huge amounts of data are created. Cloud computing promise that it is both efficient and cost-saving to move the healthcare data online (Kraul, 2017). The interviewees were asked if they had any concerns about their data being stored in a cloud, which none of them had. Participant 1 said the following to this question: "*That's how it is these days, so I think it's alright*" (Appendix 3). What she says is in line with what Kraul (2017) states, that e-health and mobile health are

basically based on cloud services. Therefore, we have been used, or at least becoming more used to that our personal information is being stored in an online cloud.

With health-related data comes a principle of handling them with confidentiality and sensitivity. The combination of health data and cloud computing are regulated strictly (Kraul, 2017). With the increasing cyber-attacks of health-related data, the GDPR law are placing additional requirements to cyber security (Sturman, 2018). The participants were asked if they were concerned that their data could be misused or misplaced. Out of ten, only one of them had concerns. He said the following about it: "*You should always be a little skeptical with your personal data. Definitely*." (Appendix 5). This is interesting, because health-related data is among the most sensitive data there is. That people are not more concerned is both positive and negative. The positive is that people are willing to share their data by using technological devices and cloud computing solutions, such as the AppSens sensor where they use cloud computing. What is negative with this attitude towards sharing personal data online, it that people may be less concerned with what they are sharing. Also, there is a risk that their personal information can be misused or misplaced. Even with implementation of the GDPR law, there is always a risk of getting hacked. So, it is like participant 3 say, you should always be a little skeptical.

7.0 CONCLUSION

The purpose of the research was to investigate on "*What perceptions do users of an off-the-shelf heart rhythm monitor device have before and after using the device?"*. In order to identify what perceptions the users' have, the three key topics; *expectations*, *experience* and *trust* needed to be explored. An overall conclusion on the level of expectations the users had of the heart rhythm monitoring device, the AppSens sensor, is that they had only limited expectations towards the device. The reason for this could be that some of the participants are quite young and therefore will probably not have atrial fibrillation. On another side the majority of people are experienced users of technology. Self-tracking is an emerging trend, and will probably continue to evolve and be a bigger part of the everyday life (Li, Dey, & Forlizzi, 2010). According to a research by Accenture, the health consumer is increasing the usage of wearable technology, whereas the usage of regular websites has been stable since 2016 (Safavi, Webb, & Kalis, 2018). Findings from the interviews shows that only three of the interviewees had tried or used wearable technology on a regular basis. In other words, the level of experience and knowledge could explain why they did not have bigger expectations about these technologies beforehand.

The second key topic explored was what *experience* the users had with the heart rhythm monitoring device after they had used it. In summarization, their experiences were both positive and negative. Most of the interviewees expressed that they found the device nice to wear, easy to use and user-friendly, they had good experience with the AppSens sensor. Whereas a lesser part of the participants was not satisfied with the device, since the device had loosened during their workout sessions. The overall conclusion is that most of the participants who lived a "normal" life without too tough and intensive work out found the device user-friendly. But, as participant 9 said, the designers should bear in mind that the sensor should be suitable for both men and women (Appendix 11).

The third key topic is *trust.* Expectations and experience leads to a good trust. If they have expectations they have interest in the specific product. Without expectations, they would probably never have bought it. This case was a bit different due to that they were invited to participate in the clinical trial, and therefore difficult to measure the expectations they would have if they bought it from own free will. Only one of them answered that their expectations was to see how well the sensor works, this is in other words about trust. I would say that experience with the device is the primary factor if they trust the device or not. This is because if they do not have a good experience, they would never trust it. On the other hand, if they do have a good experience, this would probably lead to trying it out several times, which means that they have trust in the device. The overall conclusion is that the participants have more trust in an ordinary ECG as the situation is today, but seven out of the ten interviewees trust the AppSens sensor to be capable of giving the correct ECG analysis of the heart. Also, since the product is not launched on the market yet, and is completely new, this could be an impact on their trust towards it. As we are creatures of habits, the majority of people will probably have most trust in what have been used for the longest time, as participant 8 said (Appendix 10).

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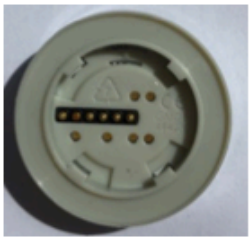
Appendices

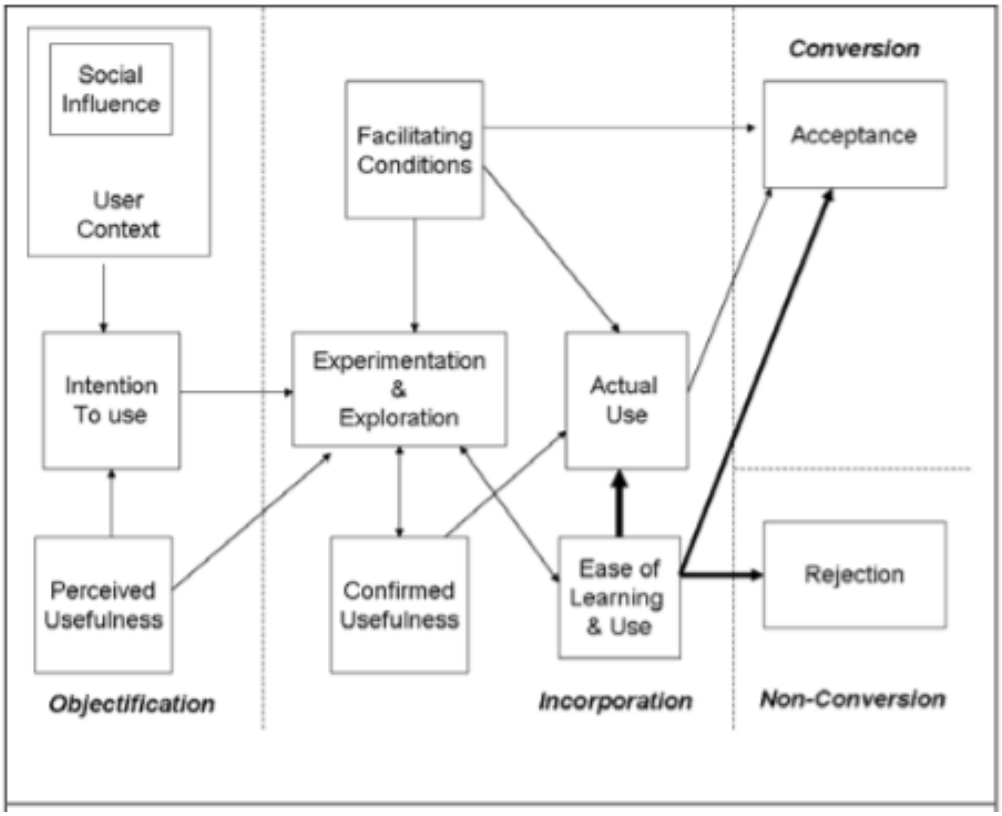
Appendix 1: The AppSens Smart Heart Sensor

1. The electronic part



2. The electrode patch and the product put together

Appendix 2: The original STAM model



(Renaud & Biljon, 2008, p. 8)

Appendix 3: Participant 1

Female, 61 years old

Date of the interview: 25th of March and 1st of April 2019

First interview

I: First I want to start by asking how old you are?

P1: I'm 61 years old.

I: 61 years. And what is your profession?

P1: I'm a healthcare worker.

I: You're a healthcare worker. Are you in a full-time job or?

P1: In a full-time job.

I: In a full-time job. Are you often in contact with the healthcare service?

P1: Yes, I am.

I: On a personal level, not work related.

P1: Oh, not work related, no I am not.

I: No.

P1: No, I'm not, I'm relatively doing well.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P1: No, I don't have any chronic diseases.

I: Have you ever tested any apps or other technology to track your health?

P1: No, I have not.

I: No. So, this is the first time?

P1: Yes.

I: Have you ever, before today, done an ordinary ECG test?

P1: Probably.

I: Yes?

P1: A couple of years ago.

I: Do you remember why you did this?

P1: It was because I had some heartbeat, some disturbances or something. It was something about a syncope-like state.

I: Okay, did you do this at your GP or?

P1: Yes.

I: Yes, at your GP. Did you find this any discomforting or?

P1: No, it was alright.

I: What do you think could have triggered you take such an AppSens test?

P1: It must have been in relation to training. Then I could have followed the pulse and the rhythm and yes, a little during some training. But I haven't done it yes, but I've been thinking about that.

I: No, right. But what is youre expectations for the test?

P1: No, im participating in this test because it's a project I was asked if I could be a test person, and I think it is interesting.

I: Mhm.

P1: And sometimes, I have felt my heart jumping a little bit, but whether its normal or abnormal, I don't know.

I: No, right. But then you can hopefully find it out now.

P1: Yes. Or I've been at the cardiologist a year ago, I had forgotten that. Just because of that. Because of these rhythm disturbances, or what to call it. The heart that jumps a little or it skips a beat, I'm a little uncertain about that.

I: Yes.

P1: Yes. They didn't find anything abnormal. It wasn't something wrong with the heart.

I: Was it a regular ECG or?

P1: I had such a 24-hour monitor.

I: What is your thoughts about wearing a device 24 hours a day?

P1: I think it will be fine.

I: Yes?

P1: Its fine, I don't have any thoughts about it being uncomfortable. I've done it once before in a previous test situation, and then it was the patch that gave me a bit of itching from the glue I think. But I have nothing, it can withstand water and I don't have to take any account of it so we'll see if it lasts.

I: Yes, right.

P1: He-he.

I: Do you think it can prevent you in any way?

P1: No, I don't believe so.

I: No.

P1: No, no.

I: That's good. Do you have any concerns related to the device not working or something else?

P1: No, no worries.

I: No worries?

P1: No.

I: That's good. So, when you tell me that you have the feeling of jumping heart, what expectations do you have that the sensor can do for you? Do you hope it can figure out something?

P1: At best, so maybe it detects a period where the heart may jump slightly, but it may take a long time between each time so it is not guaranteed it will happen during the test period.

I: No, right. But let's say the sensor will find something, what do you think you want to do with your results?

P1: Then I would have conferred with a cardiologist, about what he was thinking and done what he was saying.

I: That's good. But do you trust that the sensor is capable of finding atrial fibrillation or other heart failures?

P1: Yes, I guess it might find something and that's probably what they are testing now. And if it finds something then it is great and it can help someone in the future and map the disease picture in a better way, then it is great.

I: Mhm.

P1: And if it doesn't, then they have to work further and find better solutions.

I: Yes. But do you trust more or less or just as much on this wireless sensor versus an ordinary ECG tester?

P1: I have not though about this, but I think that this is tried and studied enough so I believe so.

I: Mhm.

P1: Yes.

I: Alright. Are you familiar with the new privacy law, GDPR, that came last year?

P1: Ehhm. No.

I: No. But do you feel that you have been given enough information regarding what will happen with your data that are being collected?

P1: Yes, I guess they are being used sensibly after what I have read.

I: Mhm.

P1: Yes.

I: What is your thoughts on that the collected data will be saved in an online cloud?

P1: Yes, that how it is these days, so I think it's alright.

I: Yes. But do you have any concerns that your data can end up misplaced and be misused?

P1: No, I don't. I can't quite understand that there is so much to misuse, he-he-he.

Second interview – over the phone

I: How do you think the test has gone?

P1: It has gone really well.

I: Yes?

P1: No problems, I don't have a stroke.

I: Nothing?

P1: No.

I: But have you got a rash or something?

P1: No.

I: No. No problems with the signal?

P1: Yes, it disappeared on the first day.

I: The first day?

P1: Or second day. The second day it disappeared around 1 o'clock I heard, then it came back around 22 o'clock in the evening

I: Okay.

P1: I'm not sure what happened.

I: No. But do you think that the test has lived up to your expectations?

P1: Yes, my expectations were not so great in relation to the fact that I was just going to be a test person, and at least it worked in relation to the test having gone smoothly.

I: Mhm, yes that's good.

P1: Yes.

I: Last Monday, you got help to put it on and set it up on the phone.

P1: Yes.

I: But do you think, if you were to do this yourself, that it looked difficult?

P1: It didn't look hard. Now it was those who did, it was not that I tried it myself. They did this for me and if it had been something, now it didn't go on the phone I have a, a…

I: an iPhone?

P1: An iPhone. So, I borrowed a phone.

I: Yes.

P1: And if it's possible to get it on an iPhone eventually, I don't know, but if the phone is a challenge then phones have to be lent to the actual check and test execution.

I: Yes, no, they'll get it on Apple eventually, this is just a demo app.

P1: Yes.

I: Mhm.

P1: But so far it has worked fine. But now it was not I who put it in, and if it is difficult, I dare not say because I have not tried it.

I: No.

P1: But it looked okay when they first got me in.

I: Mhm.

P1: It has been working.

I: Yes.

P1: Mhm.

I: That's good. But do you trust that is can give you correct rhythm of your heart?

P1: Sure, I see it does so. Or I not sure if its correct, but I can see, I can feel when I have extra beats and then I can see that they are registered.

I: Yes.

P1: Mhm. I have done some small tests on it and it has been transferred.

I: That's good. Now it is like that, when it is fully developed, that if the sensor finds something, then you get the answer on the app and not in person by a doctor. What do you think about that?

P1: Yes, then I will get a message on the app that it is an answer?

I: Yes, that it has found something and that you should check this out further.

P1: Yes. Yes, but I think that's okay.

I: Mhm. Do you think that this sensor can help to make the consumer pathway easier and then lead to that more people would check for atrial fibrillation?

P1: I think that, if some people can feel a disturbance in their hearth rhythm which you can easily feel, then this could be a very good way to find out.

I: Mhm.

P1: Yes.

I: Yes. What do you think about the user friendliness?

P1: It has been okay, there have been no problems with having it on, that it has been too big or too small or itched or loosened. I can see that it has loosened a bit at the bottom of the patch a few times.

I: Yes.

P1: I've used it when I've showered, and it's not been a problem.

I: No, that's good. Do you feel that it has prevented you in your everyday life?

P1: No, nothing.

I: Nothing, that's great.

P1: Mhm.

I: Have you felt safe?

P1: Yes.

I: You haven't been afraid of showering with it?

P1: No, I have thought that it just has to go as it goes and it absolutely has he-he. Not taken any consideration. And if there is a test then it is test, then you just have to find out if it works, and it has.

I: That's good.

P1: Mhm.

I: Are you aware of the cardiology service they will offer in the app?

P1: Yes, a bit, I think it's great if a heart doctor takes contact.

I: Yes?

P1: And that you get a consultation with the doctor there, rather than going to your GP who will then refer to a cardiologist.

I: Yes, that you could get…

P1: Direct contact with the specialist health service.

I: Yes, mhm.

P1: But there is nothing wrong by doing both, that is can be sent to the GP. I think that it would have been a plus if they could have done both.

I: Yes. Then you have the option.

P1: Yes, but that you have as the first choice that the cardiologist makes contact and that you can get consultation there.

I: Yes.

P1: At the same time the GP has got it.

I: Right.

P1: Mhm. It would have been my wish.

I: Mhm. Now I would like to ask a bit about the app, it is really simple now, there are not so many features on it. But what features do you think it must contain in order to be functional for you?

P1: I don't really know if I have enough insight into and expectations of. It must provide a summary of continuous monitoring of heart rhythm. That's what the app should lead to, I don't know if there are other features, blood pressure measurement if there are such things you think. What do you mean by other features?

I: No, for example that you can see the pulse, add data, get a 24-hour history and that type of things.

P1: Yes, you do have a 24-hour history with the app that is on 24-hour with a sensor.

I: Mhm.

P1: And it could have measured, in fact the pulse is the hearth rhythm, but blood pressure, I'm not quite sure.

I: No?

P1: Not sure what to expect.

I: Yes.

P1: After all, it is the heart rhythm that it should give knowledge about.

I: Right.

P1: Yes.

I: Yes, and how much it should contain then.

P1: Yes, then it has to, it is other features in relation to blood pressure measurement, 24-hours measurement and so on, so if it is able to do all that in the same app, yes that would probably have been great he-he.

I: Yes, right.

P1: But it can be challenging to get more features on the same app, I don't know.

I: Yes he-he.

P1: But nothing is impossible.

I: Probably not. They manage to do so much these days.

P1: Yes, they do.

I: But what do you think about downloading the result on a PDF file?

P1: Yes, if it can go to the GP. I have no great need to have it, because I can't do anything about it, but it should be with both a cardiologist and with the GP.

I: Mhm.

P1: And if I can print it out, it has no purpose I think.

I: No.

P1: That I should sit with a long print of my heartbeat. The most important thing is that it is where I might need in the future.

I: Mhm. But let's say you had been at risk for atrial fibrillation.

P1: Yes.

I: And AppSens had been on the market, do you think you had chosen it or had you chosen an ordinary ECG?

P1: I'd probably chosen this if it was on the market yes, and if it was approved for this use.

I: Mhm?

P1: Mhm. So, I think it must be able to give, there must be some history in it, whether it is in 24 hours or if it turns in when the heart makes a rhythm change and you then get a history a little back in time and something in time to catch it.

I: Yes.

P1: Because it is too late to, once the rhythm has been there, it is over quite fast, so having to use a measuring instrument you pick up from the bag and then measuring something, then it’s too late.

I: Yes.

P1: So, it has to be something that can capture a history.

I: Yes, right.

P1: Back in time.

I: Mhm. That’s true, it can come and go, and it passes quickly like you say.

P1: Yes, it does.

I: Mhm. What do you think AppSens has to avoid so that people will use their product? It there something you think that they must not do?

P1: No, it is not. It must be user-friendly in that it is easy to use the app and as the app is developed today it is not too big for anyone to go with it a few days or at a time.

I: Mhm.

P1: I think it looks, so far it has been very good.

I: Yes, that's good.

P1: If it can be transferred to a watch or something, everything can certainly happen. It worked, it worked well.

I: Yes, that's good. Do you think that you will recommend this product to others?

P1: Yes, if I think, I think the GPs are a group that will really be able to make use of it and for their patients if they are wondering if they have a rhythm disturbance that is hard to find.

I: Mhm.

P1: I think so.

I: Yes.

P1: After all, it's really an advance to catch up on rhythm disorders early.

I: Yes, right. That is really important.

P1: Mhm.

I: But now it is so that this test can be used several times, but only by the same person. What do you think about it?

P1: I did not quite understand that, it is that this app I go with now can, it can be used again after what I was told. But only by the same person?

I: Only by the same person, because it will be connected to your social security number, then it would be put in your cloud. All the collected data.

P1: Yes.

I: You have to change the battery and the patch.

P1: Right. And is this put in one, with my name on for another time in the future? Is that what you think?

I: Yes, not the one you are wearing now though. It is a test, so it has a test code.

P1: Yes, do it will go on…

I: No, the one that will come on the market will have a unique number/code.

P1: Yes.

I: Mhm.

P1: Yes, I think that's okay.

I: Yes?

P1: That it is connected to my heart and me as a person he-he.

I: It might be a bit of a difficult question, but if the product was packaged in an environmentally friendly and user-friendly way, how do you think the packaging should have been?

P1: Yes, good question.

I: It is probably not something you have thought of, so I understand. It would have been fun to hear if you had any tips.

P1: No, user-friendly. Environmentally friendly, it must be how the material, safety and material use.

I: Mhm.

P1: Yes, I can do too little about that.

I: Yes. In the end, the sensor consists of two parts, one electronic part and one patch. The electronic part can be used several times, but the patch must be replaced between each test. So, I wonder how the most sensible selling is, do you think it is best to be sold with a patch and an electronic part with the option of buying multiple patches separately, or three patches and an electronic part with the option of buying multiple patches separately or another solution?

P1: Now I do not know if it is difficult to properly put the patch on that sensor, but if there is no problem, to connect the sensor and patch, then it is no problem that it is sold separately.

I: Yes?

P1: For example, there are three patches for a sensor.

I: Mhm. Yes, it might be good to have someone in the back-up if something happens.

P1: Yes. Or if the patch is connected to the sensor for first use.

I: Yes.

P1: Also, there are two spare patches if needed.

I: Mhm.

Appendix 4: Participant 2

Female, 63 years old

Date of the interview: 25th of March and 28th of March 2019

First interview

I: First I want to start by asking how old you are?

P2: 63.

I: 63.

P2: Yes.

I: And what is your profession?

P2: I'm an ASP (after school program) leader

I: ASP leader. How long education do you have?

P2: Prior?

I: Yes?

P2: Ehh, you could say eh, three years plus a little bit I have taken after.

I: Yes, do you work full-time, part-time or?

P2: I work 70%, that is part-time.

I: 70% alright. Are you often in contact with the healthcare service?

P2: No.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P2: No.

I: Have you ever tested any apps or other technology…

P2: No.

I: No, nothing?

P2: No, nothing like that.

I: No apps on your phone where you can check…

P2: Things with the body?

I: Yes?

P2: No.

I: Have you ever, before today, done an ordinary ECG test?

P2: Yes.

I: Yes. How was this experience? Was it alright or?

P2: Yes, yes, yes.

I: Did you do it at your GP or in a hospital?

P2: Then I was in a hospital.

I: You were in a hospital.

P2: Yes.

I: Had you been referred by your GP or?

P2: No, I had a blood pressure drop so I ended up in a hospital.

I: Oh alright. Mhm. But what do you think could have triggered you to take an ECG test, such as AppSens. That you will go and buy a test you can take from home?

P2: No, I don't think I would have ever done that.

I: No?

P2: No.

I: But what is your expectations for this test?

P2: No, I'm a little excited because since I get this blood pressure drops occasionally I tend to pass out.

I: Right.

P2: Yes. At one of the researchers on this project knew this, because s/he is a good friend of mine.

I: Mhm.

P2: Yes, so therefore was it a bit exciting to be a part of this project, if they can find something in relation to the heart rhythm and everything.

I: Yes, sure. Exciting. But what do you think about wearing the device 24 hours a day? Do you think it might prevent you in something?

P2: No, I think I will just forget about it in the end.

I: Yes. But do you have any concerns related to that it might not work, or if it falls off or something like that?

P2: No, now I heard, because im going on a trip this weekend and the reception is probably not so good in the mountain, this is what worried me, but it didn't matter.

I: Now you told me a little bit what kind of expectations you have in relation to what the sensor might do for you, and that is to see if…

P2: Yes, to see if there are any findings.

I: Mhm. Let's say that the sensor will find something, what do you think that you will do with the results?

P2: I think I will have to check it out further.

I: Mhm.

P2: Go to my GP.

I: Then you will give your GP permission to download…

P2: Information from the test? Yes.

I: Yes. Do you trust that the sensor can discover atrial fibrillation or other heart failures?

P2: Yes, I do trust that it can help me if it is something to further examination.

I: Mhm. If you imagine that you have the AppSens sensor versus an ordinary ECG tester, do you trust one of them more or less?

P2: He-he, I guess I currently trust more a regular ECG tester, because this is very new.

I: Are you familiar with the new privacy law, GDPR, that in May last year?

P2: No.

I: It's a bit about how they are now going to process your data and…

P2: Yes.

I: Do you feel that you have received good enough information about what will happen to your data when they are collected?

P2: Yes, yes. Mhm, mhm.

I: That's good. But what do you think about them being stored in a cloud?

P2: No, I don't have any opinion about it, no.

I: No. But do you have any concerns that this data might end up misplaced and misused?

P2: No, no. I really don't. It is the heart rhythm. It would probably depend on what you were examined for, but I haven't really thought about it even. I feel safe.

Second interview

I: How do you think the test has gone?

P2: I think it's fine. I haven't thought so much about it, but now it starts to itch.

I: Now does it start to itch?

P2: Yes, it itches. It's the patch.

I: Yes, are you allergic or sensitive?

P2: A little.

I: Is there anything else you think has been bad with the test?

P2: P2: No, the only thing is that there is some stress with the phone that one must have nearby. But now I have just done that (showing a fanny pack)

I: That is smart!

P2: Yes.

I: Now you got help putting on the sensor and connecting it to the phone, but what do you think about the difficulty? Does it look easy?

P2: Yes, it looks simple.

I: But how did it look in relation to connect it to the phone and put it on itself or? Is it something you would have managed on your own?

P2: Yes, I guess I would have managed it by myself.

I: Mhm. But do you have any concerns related to this?

P2: No, but you now you are worried they might find something.

I: Mhm.

P2: You never know if you have something.

I: No, that's just that. But do you trust that the test can give you the right heart rate?

P2: I trust, yes, I do.

I: Mhm.

P2: I do. I trust the test, but I don't know if I had something.

I: Mhm. But if it had found something, what do you think about getting the answer on the app rather than a doctor?

P2: Well, I suppose I think I'd rather be with a doctor.

I: Yes?

P2: Yes. So, I could have asked a little and yes

I: Yes. Do you think there had been an unsafe situation if it had popped up a message that the sensor has found something, check this further?

P2: No, but I would have been pretty quick to go to a doctor and have this checked.

I: Yes.

P2: Yes, that would I have done.

I: Mhm. Do you think the sensor can simplify the consumer pathway that might lead to that more people would have checked themselves?

P2: Yes, I think so.

In: Why?

P2: I think there are more steps to ordering an ECG.

I: Mhm. Do you think that many would know that they had felt a bit to bother in a way if they had gone through the doctor? If they hadn't felt so much but ..

P2: Yes, I think so.

I: That it would be easier to take this one?

P2: Yeah, maybe I think sometimes, even if you can feel something, I think it would have been easier to put on such a thing to get it checked.

I: Mhm

P2: Instead of going through everything else.

I: Yes. What do you think about the usability so far? Now it is in the test phase, but do you think…

P2: I think it works perfectly okay

In: Yes, that's good. But have you felt safe?

P2: Yes, absolutely safe.

In: Yes. Have you felt that it has prevented you from doing anything in your everyday life?

P2: No, it hasn't, as long as you can shower. I was with my GP on Tuesday, I had asked if I was allowed to show it and I was. He noted that I was participating in this test and he said he thought this was the future

I: Yes?

P2: More wireless and yes.

I: Yes. Let's say that they had a finding on atrial fibrillation or that it had found something else, do you think you would have gone through your GP or would you, now AppSens should offer a cardiologist service

P2: Okay, after?

I: Yes, but then you have to pay a small sum, I'm not sure how much. But then you should be able to get answers quite quickly and that a cardiologist reads the ECG. Do you think you would have done it or gone through the GP?

P2: Then I would have done that.

I: You would have chosen the service?

P2: Yes, mhm. Yes.

I: The app is now not so complicated yet.

P2: No.

I: But did you find it easy to understand?

P2: Yes, because mostly it's just numbers moving.

I: Mhm. But have you been afraid of pressing something worng?

P2: No, because I just enter the app and checking that it is working.

I: Yes. But what do you think that it has to contain in order to be useful for you?

P2: No, I hadn't needed much more than just seeing yes.

I: That is was a signal?

P2: Yes, mhm.

I: Okay. But what do you think about that you can download the results on a PDF file?

P2: Yes, no, it's okay.

I: If you had been in the risk group, would you go through your GP or would you have taken such an AppSens?

P2: Then I would have taken such an AppSens test I think.

I: Mhm. Why?

P2: It's a little safer, I don't know.

I: Yeah, mhm. What do you think they need to think about and avoid so that people don't want to use the product?

P2: No, it is this with the phone, that is what is stress with it. And if they could have found something else here (pointing to the patch) if people itch from it.

I: Mhm.

P2: But otherwise is it very okay I think.

I: Yes?

P2: I'm not thinking about it. Hadn't that itching started, I wouldn't have thought about it.

I: No. Is this a product you would recommend to others?

P2: Yes, I will. If this works, then it is fantastic.

I: Mhm. Now it is that if you had bought it then it will be connected to you and your social security number, so it can only be used by one person.

P2: Yes.

I: What do you think about that?

P2: I almost think it must, so you have control over it. That it is just connected to one person.

I: Yes, mhm. That you can't switch between spouses and?

P2: Yes, it has to be connected to one person.

I: It may be a bit difficult to imagine, but if it should have been packaged in terms of being user-friendly and environmentally friendly. Do you have any ideas?

P2: No, I don't.

I: No?

P2: No, I haven't thought about that.

I: No, it's very understandable. In the end, I have question for you that is quite long; The sensor consists of two parts, an electronic part that can be reused several times is also the disposable patch.

P2: Yes.

I: The electronic part also contains a replaceable battery.

P2: Okay.

I: Now you get three answer options, how do you think this most sensibly sold: a. With one piece of patch and the possibility that you can separately buy more when needed, b. A complete package with three patches and an electronic part or c another solution?

P2: B

I: B?

P2: Yes.

I: Tre patches and one electronic part?

P2: Mhm.

Appendix 5: Participant 3

Male, 60 years old

Date of the interview: 25th of March and 29th of March 2019

First interview

I: First I want to start by asking how old you are?

P3: I am 60 years old.

I: 60?

P3: Yes.

I: Mhm. And what is your profession?

P3: I'm a kindergarten teacher.

I: Kindergarten teacher.

P3: Mhm.

I: So, how many years of education do you have?

P3: 3 years at the university

I: Do you work full-time or part-time?

P3: Full-time.

I: Mhm. Are you often in contact with the healthcare service?

P3: Eh, I have regular checks once a year or something like that.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P3: No, or I had a heart attack a few years ago.

I: Okay?

P3: Two-three years ago.

I: So, you are being checked out because of this?

P3: Yes, mhm.

I: Have you before this, tested apps or other technology to track your own health?

P3: No, I haven't. No apps.

I: No, not any medical devices either?

P3: No, or I have tried a blood pressure monitor.

I: Okay, but it's nothing that you have been wearing?

P3: No. Or I have might worn it over some time.

I: Okay?

P3: A couple of days, yes, I guess so.

I: Alright, and how was this experience?

P3: It was alright.

I: You have probably done an ordinary ECG test before you came here today?

P3: Yes, I have.

I: And what do you think about that?

P3: It was alright.

I: Yes. What do you think could have triggered you to buy such an AppSens ECG test?

P3: If I felt that I was at risk, then I would probably have done it.

I: What is your expectations for this test?

P3: Ehm, expectations.. That you get a result that you can use for something that makes it better for others later.

I: Yes. What do you think about wearing the device over several days 24 hours?

P3: He-he. I don't know yet, because I have just put it on, but I think it will be fine.

I: Do you have any concerns that it will prevent you somehow?

P3: No.

I: That's good. But do you have any concerns at all?

P3: No, I'm not worried he-he.

I: He-he, that's good. Men let's say that the sensor will detect something, what do you think you will do with the results?

P3: No, I had to deal with it then and there I think. How serious they are or if I have to change my way of living or yeah.

I: Yes. But do you trust that the sensor is capable of detecting atrial fibrillation or other heart failures?

P3: Yes, I don't have any reasons not to.

I: No. But if you think about an ordinary ECG machine versus AppSens, do you trust one of them more or less?

P3: I think that maybe since the sensor will do it over time, in more situations, that might, if you are stressing the heart in a way, it will detect something.

I; So, you trust the sensor the most?

P3: Yes, I would do that.

I: Yes, exciting. Are you familiar with the new privacy law, GDPR, that came in May last year?

P3: I have heard a little bit about it, but I haven't deepened myself in it.

I: It has tightened the rules in relation to your personal data, that the data is yours.

P3: Yes, that you now are able to get your data out and…

I: Yes. Do you feel that you are provided good enough information about what will happen to your data that will be collected?

P3: Now?

I: Yes?

P3: Yes, according to the information letter we got, it looks alright. If they are following that he-he.

I: He-he. But what are your thoughts on that the data that are being collected will be stored in a cloud? Do you think it's alright or?

P3: Eh yes, I'm not sure how secure the cloud is against hacking in any way or something like that but.

I: Mhm. No, it is really heavy regulated in Norway when processing patient data, but everything that is digital is of course at risk.

P3: Yes, exactly.

I: But do you have any concerns about your data being misplaced or misused?

P3: You could have, you should always be a little skeptical with your personal data. Definitely.

Second interview

I: How do you think the test has gone?

P3: It's been okay.

I: Mhm?

P3: Yeah, I really haven't noticed I've had it on.

I: No?

P3: No.

I: Is there anything you think has been good or bad?

P3: Now I have had that phone with me all the time, because it must hang on.

I: Yes, because you got to borrow an Android phone?

P3: Yes.

I: Yeah, mhm.

P3: So that's what has been the challenge, that it should be nearby all the time.

I: Yes. But have you experienced itching or it has fallen off or something like that?

P3: No, but I took it off yesterday because there was something wrong with the signal or something I was told.

I: Yes, I see.

P3: Mhm, so we took it off yesterday.

I: Yes. But do you feel that the test has lived up to your expectations? In terms of what you wanted to get out of it?

P3: Yes, yes.

I: Yes, that’s good. On Monday, you both got help putting it on and connecting it to the phone, what do you think about the difficulty of this? Is this something you think had been easy to do on yourself or?

P3: I think so.

I: Yes?

P3: Yes, mhm.

I: Do you have any concerns about it? Either putting it on or connecting it to the phone or something like that?

P3: No.

I: No. Do you trust that you can get the correct answer regarding your heart rate from the test?

P3: At least it looks like it.

I: yes?

P3: Yes.

I: That’s good. If the sensor finds something, then you should get an answer on the app and not personally by a doctor. What do you think about it?

P3: If there are any margin of error there, it can be worrying.

I: Yes?

P3: If you get such a "warning, warning" then you have to be able to contact your doctor quite quickly then if you have any concern, I think.

I: Yes. Have you felt safe during the test period?

P3: Yes.

I: Yes?

P3: Absolutely safe.

I: You haven't thought it can be scary to shower for example because it's electronics?

P3: No.

I: No, that’s good. Has it prevented you from doing anything?

P3: No.

I: No?

P3: Nothing.

I: They will also offer, in the app, a cardiologist service. Are you aware of that?

P3: Yes, a little bit. Or you can please explain a little bit by the way.

I: After completing the test, if it has found something, then you can get the offer of cardiology service.

P3: Yes, right.

I: Then you have to pay a sum. Do you think you had used it if it had found something, or had you gone through your GP?

P3: If I had been worried I might have chosen it.

I: Mhm?

P3: But clearly, the GP is normally the first one to go to. But if you are a typical cardiac patient then you might want to have a little more expertise.

I: Yes?

P3: Mhm.

I: Right. Now that app wasn't that complicated, because it's just a demo. But do you think it was easy to handle or were you afraid to press something wrong?

P3: No, it was simple.

I: Yes. Also, downloading the results as a PDF file, what do you think about that?

P3: I think maybe I don't need it, but the doctor needs it.

I: Mhm. So, you think it's okay to bring it along and show it?

P3: Yes, possibly.

I: Yes. If you had been at risk, would you use AppSens or would you prefer a regular ECG?

P3: I think I might have used such an AppSens solution.

I: Mhm?

P3: Because it is a bit more long-lasting and then you get a bigger picture of the challenges.

I: Mhm. But what do you think, or do you have any idea of what to avoid for people not to use the product?

P3: What to Avoid?

I: If it is something you have thought of when you have been wearing it yourself?

P3: No, I haven't thought about it. But they must avoid being too complicated, but it does not seem complicated.

I: No. Do you think this is a product you are going to recommend to others?

P3: Yes, I think so.

I: Mhm?

P3: If they are at risk.

I: Yes?

P3: To provide security.

I: Now it is so that the sensor is connected to your social security number and thus only to a person, which means that it can only be used by one person. What do you think about it? Do you think it should be possible to be used, for example, between spouses?

P3: Yes, you have a choice yourself. It may be wise.

I: Now it's a little difficult question, I understand if you have no thoughts about it. But if it should have been packaged in a user friendly and environmentally friendly way, you have some idea of how it should be…

P3: Yes, you are thinking if it should have been sold in stores?

I: Mhm.

P3: No, that is, if it is environmentally friendly packaging. It might be a good idea to think about it.

I: Mhm. Now it's a bit long question, but you get three answer options.

P3: Okay.

I: The sensor consists of two parts. The patch and an electronic part. The electronic part can be used several times, but the patch must be replaced between each test.

P3: Mhm.

I: How do you think this most sensibly sold, a. Where you get a patch and an electronic part and then you can buy more patches if needed, b. That you get with three patches and an electronics part or c another solution?

P3: Okay. Maybe solution 2, where you get more patches.

I: So that you have some in back-up if you need that?

P3: Yes, mhm. If it were to come loose or something.

I: Yes.

Appendix 6: Participant 4

Male, 34 years old

Date of the interview: 25th of March and 29th of March 2019

First interview

I: First, I want to ask you how old you are?

P4: I am 34.

I: 34. And what is your profession?

P4: I'm a consultant and case worker.

I: What kind of education do you have?

P4: I have three years from university after high school.

I: Do you work full-time, part-time?

P4: Full-time.

I: Full-time. Are you often in contact with the healthcare service, for private reasons?

P4: For private reasons im in contact with the healthcare service two til three times a year with a cold, influenza, pneumonia, yes.

I: Yes. If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P4: No.

I: Have you ever tested any apps or other technology to track your own health?

P4: No, never

I: No. But have you done an ECG test before?

P4: I did it when I was hospitalized for a pneumonia, to check all kind of things.

I: You did it at a hospital?

P4: Yes, it was at a hospital.

I: What do you think could have triggered you to buy an AppSens test?

P4: What could have triggered me?

I: Mhm?

P4: No, it has to be more focus on my own health. And if you are aware that there are some heart problems within the family I guess.

I: Mhm. What is your expectations for this test?

P4: I don't have that big expectations to be honest.

I: What do you think about wearing the device..

P4: I have only been wearing it for 20 minutes and it seems alright, I can't feel that it's there.

I: No.

P4: No, so it is really small and neat and nice.

I: That's good. So, you don't think there will be any problems wearing it 24 hours a day?

P4: That's not going to be a problem. What is going to be the problem is that I can't swim with it, because I swim a lot.

I: Ah alright.

P4: I spend much of my time in the swimming pool, mhm.

I: Yes. But do you have any other concerns about it?

P4: “shakes the head and signals no”

I: No, so only that with the swimming pool?

P4: Mhm.

I: Do you have any expectations for what the sensor can do for you?

P4: No, I have a lot of heart problems within my family, so maybe it can detect something already now.

I: Mhm. But if it should detect something.

P4: Yes.

I: What do you think you would do with your results?

P4: No, then I have to get some further examination I guess. And follow it up a little closer.

I: Do you trust that it is capable of detecting something?

P4: Of course, I trust that, I like that technology development we have today, he-he. So I fully trust that.

I: He-he, that’s good! But if you think that you have the choice between doing an ordinary ECG or an AppSens test, which one would you trust the most?

P4: There is none of them I trust more or less. I think they are quite equal, and I think that the technology is coming so far that the device should be able to detect as a full-scale ECG would.

I: Yes.

P4: Mhm.

I: Are you familiar with the new privacy security law, GDPR, that came last year?

P4: I have heard about it several times.

I: Yes, it’s about that your data is yours and there is more focus on security on the data that is being collected, especially healthcare data. Do you feel that you have been provided good enough information about what will happen do your data that is being collected?

P4: Ehm, I guess it’s like all other for example online newspapers that want your declaration of consent, and it is not that often that I bother to read, I just approved.

I: He-he. Do you feel that in the information letter you got, that it is well described?

P4: It says very well described.

I: Yes.

P4: To be completely honest, I didn’t read it that carefully.

I: No. But what do you think about that the data that is being collected will be stored in a cloud?

P4: It is really good if you can use it to some sort of research, I guess. Really good.

I: Do you have any concerns that the data can be misused?

P4: No, no, no, no, not at all.

I: No, is there something else you are thinking about?

P4: No, I think most of it are alright. I don’t mind being used.

Second interview

I: How do you think the test has gone?

P4: I think it has gone really well. I didn't notice the sensor, it really hasn't been a problem. I didn't think about it being there.

I: No?

P4: I thought about it a little on the first day, because then it itched a lot.

I: You thought about then, yes?

P4: Yes, towards the evening. But after that I have not noticed anything. I've been a little bit aware of it, because I usually swim a lot.

I: Mhm, that’s right, I remember that.

P4: But showering has gone well, I have just watched that I do not stand very much with the stomach in the water.

I: Mhm.

P4: But otherwise, very fine.

I: That’s good. But is there anything you think has been bad or good or?

P4: I don’t think there has been any negative with it. I think everything has been very nice and tidy in the process of testing, and during the period I have had it on myself has been very straightforward. So, I think it's a pity that I haven't been able to complete, that it was destroyed or.

I: Yes, did it stop giving signal or?

P4: No, it started giving lots of weird signals.

I: Oh, okay. Could you see this on the app?

P4: Mhm. It was completely wild. One would think that I had a crazy workout.

I: He-he, but then it wasn't?

P4: No.

I: But aside from that, has the test lived up to your expectations?

P4: Absolutely, absolutely. It has been very fine.

I: Yes.

P4: Mhm.

I: Do you think it's been fun to sit and watch ...

P4: Yes. I've been through constantly, he-he-he.

I: Yes, but that's good. Now you got help putting it on and connecting to the phone. By the way, did you borrow a phone?

P4: Yes, I borrowed a phone.

I: Yes. But what do you think about the difficulty, does it looks alright?

P4: It looked very easy. I would have done it myself.

I: Mhm?

P4: Absolutely.

I: It's not something you think might have been difficult? Either put it on properly or connect it or?

P4: No, as long as it should be in the middle of the sternum I do not think it should be so very difficult.

I: No.

P4: No.

I: That’s good. Do you trust that it can give you the correct answer about your heart rhythm?

P4: Yes.

I: Mhm?

P4: I think so. I just noticed that if you scratch a little beside it then it shows some weird things when I followed the app simultaneously.

I: Yes.

P4: So, I don't know if you should have some kind of logging when it happens, it's because I scratched or I lay like that or something.

I: Mhm.

P4: It might have been wise.

I: Yes. Further forward in time, now your app has an algorithm

P4: Mhm.

I: If it finds something, then you get a message on the phone, on the app. What do you think about it versus getting a doctor's message?

P4: I don't think that mattered

I: No?

P4: I don't think so. If it had found something, as long as you were told, then it is the best.

I: Mhm.

P4: That's what you need.

I: You hadn't been stressed about getting such a message?

P4: No, I wouldn’t. But others may have, but they would also have been scared and horrified no matter if the phone had come from someone.

I: Yes.

P4: If you had received a phone or seen it yourself.

I: Mhm.

P4: I think.

I: Yes. Are you thinking that this sensor can simplify the consumer pathway that can lead to that more people will check themselves?

P4: Yes.

I: Yes? Why?

P4: Because it is easier to access instead of going to your GP and perhaps from there to be referred to something, you can also just check yourself if you have a feeling that something is wrong.

I: Mhm.

P4: Something that can be there and then at a pharmacy or anywhere really.

I: Mhm. Do you think people might ..

P4: But it is necessary that the app be developed so that it can work on Apple.

I: Yes, yes.

P4: It is absolutely necessary.

In: It's coming

P4: He-he.

I: He-he, I totally agree. But do you think people don't go to the GP now and take the ECG because they don't feel sick enough or they think the process is too cumbersome?

P4: Yes, mhm. I think so.

I: Mhm. But what do you think about usability then?

P4: Very nice.

I: Mhm?

P4: It wasn't a problem there, it's not something I think could be improved or changed in relation to the ease of use.

I: No?

P4: It's just an app and put it on

I: Mhm.

P4: It worked right away

I: That’s good. But have you felt safe during the test period? In relation to showering?

P4: Yes, yes. As long as I knew that I couldn’t swim with it. I expect that would have been destroyed or that it wasn't so waterproof that you could swim with it. But otherwise very fine.

I: Since you have not been able to swim with it, it has prevented you from your everyday life. But is there anything else?

P4: Nothing else.

I: No?

P4: I don't really know for those who sleep on their stomachs, maybe it actually prevents them. Because as long as it is very much affected only when you scratch next to it, I think it will at least be affected if you sleep on your stomach.

I: Mhm. They will in the app offer a cardiologist service, have you been informed about it?

P4: I haven't been informed, but I've read about it in the questionnaire we've received.

I: Yes. Do you think you would use this service?

P4: If they had found something then I would, absolutely.

I: Yes?

P4: I'd rather have a cardiologist specialist who takes that assessment than that I have to go to the doctor myself and be referred further from there.

I: Yeah, mhm. Now that app wasn't so complicated

P4: He-he

I: It has only one function

P4: Mhm

I: But if you think it should have been optimal for you, what features do you think it should contain?

P4: I think it should also have contained information about pulse.

I: Mhm? Then you could ...

P4: Then I could have checked my pulse often.

I: Mhm. Also, you said that you could write some notes, here I did this and that and so on

P4: Mhm, mhm.

I: If they had checked over it afterwards then they could have looked at the notes

P4: Yes, yes.

I: Mhm.

P4: It would have been very wise.

I: Yes. But do you think you wanted to look at the history or is it not so important?

P4: No, it is not so important to me as long as it does not appear that something is wrong. But you have to be good at writing those notes then, log what you have done during the period.

I: Mhm.

P4: So, if it later on comes a phone or something like that, then you may have taken a note that shows that there was really nothing wrong.

I: No, right. It is not so easy to remember what you have done.

P4: No, if you are going to log in for a week then it is not so easy to remember every day.

I: Yes. What do you think about the possibility of downloading the result on a PDF file? Is there anything you think is useful or?

P4: It's not significant, no.

I: No. Supposing you were in the risk group, would you have taken such an AppSens or would you prefer an ordinary ECG?

P4: It's much easier with the one you can arrange yourself

I: Mhm?

P4: Mhm. If it had been on the market, then I would definitely have chosen it.

I: Yes. Is it something you think that they must avoid in order for people not to use the product?

P4: No, but after I took it off I became very red and irritated in that area.

I: Oh yes, are you usually sensitive to patches or?

P4: No, nothing like that.

I: Hm.

P4: That's what is so strange. But I do not know if there is a special substance in it or in the glue or.

I: No, I'm a little unsure about it myself. It's not very comfortable.

P4: Look here (shows me the rash)

I: Oh, look at that. Have you shown it to the researchers?

P4: No, should I?

I: It might be nice for them to see it and be aware that you've got a reaction.

P4: Yes.

I: Mhm. But do you think this is a product that you would recommend to others?

P4: Yes.

I: Mhm?

P4: I think so.

I: Yes.

P4: It's really fine for those who have heart problems in the family

I: Mhm?

P4: Which then thinks yes, it has happened to everyone in the family when they are 40-50 years. So then at least I will wait 10 years before I check myself.

I: Mhm.

P4: Then it is so much easier available that you can start here.

I: Mhm. That you take a screening for example once a year?

P4: Yes, mhm.

I: The test can be used several times, but only by the same person. What do you think about it? It will be "locked" to your social security number.

P4: Mhm. No, I think it has to be like that. I have no idea. It would have been better if it could have been used by several, but then of course the device would have to be more expensive if you were to use it several times in several individuals

I: Mhm.

P4: So, it's the cost utility features rating.

I: Yes. Perhaps a little difficult question, but if it should have been packaged in an environmentally friendly and user-friendly way, do you have any ideas?

P4: I'm a huge environmental conscious ha-ha-ha.

I: He-he. It's important you know.

P4: Yes, by all means. But you shouldn't have it in plastic then.

I: No?

P4: Preferably. But I have no idea in what way.

I: No. But it was only if you had any immediate thoughts.

P4: Tips and tricks he-he.

I: He-he, yes. But some of the products you can buy, they are wrapped in plastic that is almost impossible to open. Do you think it should be easy to open or?

P4: Easy to open, yes, that is certainly an advantage.

I: Mhm. Now comes a little long question, and then you get three answer options.

P4: Mhm.

I: The sensor consists of two parts, an electronic part and a patch. The electronic part can be used several times, but the patch must be replaced between each test.

P4: Mhm.

I: Do you think it would have been most sensible to sell it with a patch and an electronic part also, you can buy more patches if needed, or that you get three extra patches and an electronic part or another solution?

P4: I would think it was best to sell it with one of each part and then you can rather buy refills of those patches.

I: Mhm. So, alternative a then, the first one?

P4: Yes.

Appendix 7: Participant 5

Female, 29 years old

Date of the interview: 25th of March and 28th of March 2019

First interview

I: First I want to start by asking how old you are?

P5: I'm 29

I: 29. And what is your profession?

P5: Yes. I'm a healthcare worker with cardiovascular technologist education.

I: Alright, what kind of education do you have then? Did you first become a healthcare worker?

P5: Yes, and then I took a further education in ultrasound of the heart.

I: Your work status, are you working full-time, part-time?

P5: Yes, 100% full-time.

I: You are working within the healthcare service, but are you often in contact with the healthcare service for personal reasons?

P5: No.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P5: No.

I: Have you ever tested any apps or other technology to track your own health?

P5: No, none besides the fixed one on the phones.

I: Yes.

P5: Like the ones on iPhone and yes.

I: Yes. Do you enjoy tracking your own health?

P5: Yes, Im really, I find it really fun to pay attention on my body and yes, health and lifestyle things he-he.

I: Yes, right.

P5: So, it is really fun to try out this app as well.

I: Yes. Have you ever done an ordinary ECG test?

P5: Ehm, I have only tried ECG yes, but I have never been wearing a Holter register or something like that before. I have attended a bike test with ECG, where you bike and test your heart rhythm at the same time.

I: Yes. But did you do these tests at your GP or?

P5: No, it has been in connection with research at a hospital, where they have needed test persons.

I: Okay, so it's not because you felt in a bad shape and therefore took it?

P5: No.

I: What do you think could have triggered you to take an ECG test?

P5: Why I should have done it?

I: Mhm?

P5: No, it would have been if I experienced palpitations or felt in bad shape or.

I: Yes.

P5: If that is what you were thinking about?

I: Mhm.

P5: Yes, if I felt that something was irregular.

I: Yes, because you wouldn't take it just to take it? You would have felt that something was wrong?

P5: No, I don't think I would have just screened just to screen. I think I would have got a referral if I felt that something was uncomfortable.

I: Mhm. What is your expectations for this test?

P5: I think it will be very exciting. Since I have some experience with ECG, I know that there are some challenges with the patches, I have a lot of experience with Holter.

I: Yes.

P5: They are a bit problematic because you have to replace the patches and some might get allergic, so it will be exciting to see if this is better. I relation to exercise, showering, you don't have to change the battery. So, I do have some expectations for it.

I: Yes.

P5: That it should be a little bit better.

I: What do you think about wearing it 24 hours a day?

P5: No, that will be exciting to see. I think it will be fine, it's just one, the benefit is that there are no wires and it seems like that's better.

I: Mhm.

P5: And that, the only thing is that it is a round button in the middle that might be a bit uncomfortable when you are working out and that it can be a bit in the way, but otherwise it seems better.

I: That's good. But do you have any concerns that it can prevent you in your everyday life?

P5: No. The only thing is that I'm exercising a lot, so that might prevent me a little bit in training, more specific strength traning.

I: Yes.

P5: But we'll have to figure that out he-he.

I: Yes, it will be exciting to see.

P5: At least you avoid all the wires and it will be exciting to see when you sweat a lot.

I: Yes.

P5: If it will fall off.

I: Do you have any concerns about it? That it won't work or something like that?

P5: Eh, no. It is an app, that will be recording all the time, so it will be exciting to see if that registration will manage to record smoothly all the time or whether there will be a lot of disturbances when you are in much activity.

I: Yes, right.

P5: You could see it on a regular ECG, where the patient must lie completely at rest, if you only move an arm the ECG will detect that things are moving.

I: Yes right.

P5: So, then you will not get a record that is just as good.

I: No.

P5: So it will be exciting to see if it's the same on this one.

I: Yes. But if it would have found something, what do you think you would do with your results? Is this something you would talk to your GP about or?

P5: Yes, it might be a good way to find them with irregular heart rhythm. There are a lot of people having it, but they don't know about it. So, I would have conferred with the GP if something where detected, mhm. So, yes.

I: Do you trust that the sensor is capable of detecting atrial fibrillation or other heart failures?

P5: Yes. I think it is capable of that. I have looked at the app that it currently has good records. So, I believe that.

I: That's good. But if you imagine that you have an ordinary ECG and an AppSens sensor, do you trust one more than the other or is it equal?

P5: For now, I don't have any relation to this (pointing at AppSens senor) so it is a bit difficult to compare, but ECG in general is very much to be trusted, except that it depends on who reads it. So, ECG is a little user-dependent, or who is good at reading the ECG, that's the thing I'm thinking about.

I: Yes.

P5: The equipment is good, but it depends on the person reading it.

I: Okay.

P5: You have to be good to read ECG in order to discover the rhythms.

I: Yes.

P5: But not always, when you do an ordinay ECG test it will always follow with an information about the rhythm, but I don't always feel that, you have to be good at reading ECG and not fully trust what the paper says.

I: No

P5: I believe that it sometimes reads it wrong.

I: Mhm, yes. So then you have to read and look at the curves from the ECG?

P5: Yes, and have enough experience in order to be able to read it.

I: Yes, I guess that's not that simple.

P5: No, there are many different heart rhythms so to be capable of separating them is not always easy.

I: No.

P5: So, you should have enough experience in order to read them. So, yes.

I: Right.

P5: Mhm.

I: Are you familiar with the new privacy security law that came in May last year, GDPR?

P5: Hm, I'm not quite sure.

I: Briefly, your data is your data and you are the one in charge over them, and the security are tightened. Do you feel that you are provided enough information about what will happen to your data that will be collected?

P5: Yes, I got to read the information letter in advance.

I: What are your thoughts on that the data will be stored in a cloud?

P5: Mhm

I: Is that something you…

P5: No, its alright with a heart rhythm he-he.

I: Yes. But do you have any concerns that your data might end up misplaced and misused?

P5: It is always a risk when you send it up in a cloud, you never know, but there are so stright regulation now and you are careful with patient safety.

I: Mhm.

P5: So, I don't think there will be a problem.

Second interview

I: How do you think the test has gone so far?

P5: It has gone very well, but there has been some trouble with the contact to the app.

I: Oh?

P5: At night. It has gone to sleep, I think.

I: That's strange.

P5: So, there have been some technical challenges indeed.

I: Okay.

P5: But wearing it has been no problem.

I: No?

P5: The only thing is that it is probably a little more made for men than ladies, considering when you go with the sports bra it loosens a little.

I: It does?

P5: But otherwise it has gone fine.

I: Mhm. Is there anything you think has been good or bad?

P5: The advantage is that there are no wires, but the disadvantage is that with the mobile then. That it loses coverage a bit, that it jumps a little in and out. Then you have to know what to do to get it back on.

I: Mhm.

P5: And reconnect it, but otherwise it has gone really well.

I: That's good. Now you got help putting on the sensor and connecting it to the phone, but what do you think about the difficulty? Does it look okay?

P5: Yes, that's something I think everyone can do.

I: Mhm?

P5: As long as they have some knowledge of how to work a phone.

I: Yes

P5: There are not many buttons to push or many things to do.

I: No. But if you should have done this yourself, do you have any concerns about connecting it or putting it on your own or?

P5: No, but you have to have some knowledge, you have to be safe on a phone and apps and all of that. So, it may be a little challenging for the older generation.

I: Mhm.

P5: But overall, I don't think it will be a problem.

I: No. Do you trust that it can give you the correct answer? About your heart rhythm.

P5: Yes, now is it very new, so I have little experience with it. And if that connections falls out all the time then you do not know if it detects or not, if you are not on guard yourself. Then you have to check the app and see that it registers.

I: Yeah, mhm.

P5: But assuming, when I see that it records, I think that, I trust it.

I: Yes. What do you think you're going to get an answer to the app and not that someone will call you, such as a doctor?

P5: I think it might be a bit like that, a little scary maybe. That an app will explain to you what kind of rhythm you have and not that there are some people telling you that and who has looked over it. And that you are absolutely confident that it is right the answer you get.

I: Yes. If you had received a message that something was discovered and that you should check this further, do you think it might have put people out a little?

P5: No, if it had been something, it would have been better than not knowing anything. So, then I would rather have gone and checked this with the doctor afterwards if I had received an alarm or a message or something like that.

I: Mhm.

P5: I'd rather have known than not knowing, if I walked around with something that could make you flicker or have palpitations or, yes.

I: Mhm.

P5: So, if it could have been discovered then that's just fine.

I: Mhm. Do you think that the sensor can simplify the consumer pathway, so that more people will get a check?

P5: Yes certainly, because you know that if you go with an unknown atrial fibrillation then it can cause a stroke, and nobody wants that, it is serious. So, if you can discover it earlier, then I think it's something people want to wear.

I: Do you think the barrier is less to get checked if you can go and buy a test like this versus going through the GP even if you do not feel sick, but that you want to check that everything is fine?

P5: I think the easier it gets, the easier it becomes for people to check. If there is a lot of stress, a lot of referrals and that the process is long, I think there will be more cumbersome for people.

I: Yes.

P5: If things are simple and straightforward and it follows the technology then I think people will check.

I: Yes?

P5: At least more than they do now.

I: Mhm. What do you think about the ease of use then? Now you have had some technical problems then.

P5: He-he, yes. That's probably something that needs to be improved, I certainly think so. It has an improvement potential, but that's why we try it out then. See what is good and what needs to be done about it.

I: Mhm. But have you felt safe?

P5: Yes, yes.

I: You haven't been afraid to shower with it?

P5: No, I've done just as usual. Exercised and showered and yes. It has gone really well, there has been no obstacle.

I: No…

P5: It's also comfortable to wear. There is a lump here, but it is lovely that there are no wires. You can feel that it's sitting on, so it's not been a problem.

I: It hasn't prevented you in anything?

P5: No

I: No, that's good. How has it been to workout with? I remember you told me you loved exercising.

P5: It has gone very well. Sometimes there has been some noise, but for the most part it has shown a nice registration.

I: Mhm?

P5: That's very positive then. Compared to the other ECGs available, it is almost impossible to read what kind of rhythm it is. It makes a much better ECG signal, or so it looks like. So, it is an advantage that it becomes better readable.

I: Yeah, mhm. Let's say you had a heart rate that showed atrial fibrillation or something else

P5: Mhm

I: AppSens will offer a cardiologist service, where you pay a sum that I am unsure of, and then you can get answers relatively quickly. Would you have used it or would you have gone through your GP?

P5: Then I would have availed myself of those who have experience with it, not gone to the GP.

I: Mhm?

P5: But gone to those who had knowledge of it.

I: Yes. Now the app, it's not finished now and not that complicated. But do you think it was okay? Hehe.

P5: He-he. Yes, yes there are not many

I: There are not so many features on it, he-he.

P5: He-he, no so it's very easy to deal with

I: But what do you think it must contain if it should have been optimal for you? What are you missing?

P5: It is a bit difficult, because I can see that it is not fully developed. But it must have been that it was a straightforward overview that you can always see that the ECG signal goes. That it is a straightforward and log-in. There are not so many features you need in that app. I think the fewer functions, the easier it is.

I: Mhm, that's true.

P5: So, I don't think you need so many features really.

I: No. What do you think about downloading your results as a PDF file?

P5: No, I have nothing against it. It had just been nice, considering curiosity he-he and that I have some experience with it.

I: Mhm.

P5: Then I could see a little and had some overview myself.

I: Mhm. Let's say you were in the risk group and AppSens was on the market, would you have used it or would you have taken the ECG at the GP or got a referral?

P5: Hmm ..

I: It can be a little difficult to imagine.

P5: Yes, it is a bit difficult for now I have tried this one and I know a little more what it is all about, but I had probably done what I had received as a recommendation.

I: Mhm.

P5: I would choose the one that got the best results, so it's a little difficult to know what I would have done really.

I: Yes, it's understandable.

P5: But it sounds really good to be able to go home with an app and follow along, and drop all the wires, not least. Especially when you are active and exercising, it is very advantageous.

I: Mhm.

P5: Wouldn't have ignored the fact that I had chosen an app with a connection. It sounds very simple at least.

I: Yes. But do you think they have to think about avoiding people not wanting to use the AppSens sensor?

P5: For people not to use it?

I: Mhm?

P5: That it should be easily accessible to everyone and that it should be easy to use.

I: Mhm.

P5: It must be a focus. And that people gets a quick answer afterwards

I: Yeah, mhm. That it can't go too long?

P5: No. That is a problem now, that people goes with a registration then it is submitted, then we must also look at it, also it must be sent to the GP, therefore it takes a long time before people get notified.

I: Okay, how long does this take?

P5: Three weeks.

I: Three weeks yes. Can I ask how long they go with it ..

P5: They wear with it for three days

I: Three days yes.

P5: It must also be read by someone with experience.

I: Mhm

P5: And if there is no hurry and serious, you will of course look at it right away.

I: Mhm.

P5: But if it's just that it can be something, then it goes through the GP and then it takes three weeks.

I: Okay.

P5: And it's something people think is very stupid that they can't get an answer right away. So, there is a potential then, you want quick treatment and quick response, preferably that everything should go fast.

I: He-he, yeah that's how we have become. Things should preferably happen quickly.

P5: He-he, yes. So, it maybe the app can contribute on that.

I: But is this a product you think you would recommend to others?

P5: Yes, with some adjustments I think it will be very good.

I: Mhm. That test is connected to a person and their social security number, so it can only be used by this person. What do you think about it?

P5: No, that's good, so you are sure that the person who has that disorder of the heart or not.

I: Mhm.

P5: So, I think it's good then.

I: Yes. It may be a little difficult to imagine, but for it to be packaged in an environmentally friendly and user-friendly way, do you have any thoughts on what it might have looked like or material or something?

P5: Oh, it's hard he-he-he.

I: He-he. It's a difficult question, it's just exciting to hear if you have any ideas or ideas about it?

P5: Yes, he-he. No, I haven't thought anything about it.

I: No?

P5: No, I don't know.

I: No. Now you will get a bit long question, and then you get three answer options.

P5: Okay

I: The sensor consists of two parts, the electronic part and the patch.

P5: Mhm.

I: It also contains a replaceable battery. Do you think it is most sensible sold as a. With a patch and with the possibility that you can separately buy more patches when needed for repeated tests

P5: Sell?

I: Sell the electronic part with a patch

P5: Yes

I: And if you wanted to take the test again, could you just buy the patches or buy a complete package of three patches and an electronics part or another solution?

P5: I don't know. It depends on what there is difference in price, how much it will separate.

I: I don't know.

P5: No, as I see it now, it doesn't look like you need very many patches.

I: No?

P5: So, and what was “a” again? It was?

I: Then you buy a set, with a patch and….

P5: Also, you can buy...

I: Yes, you can buy more if you need it.

P5: Yes, then I think I would have done it.

I: Mhm. Do you think then, if you only get one patch that people can think that I don't want to spend more money and then they have to buy it in addition?

P5: In addition?

I: Yes?

P5: No, it is not certain that you would need more patches.

I: No, right.

P5: Now I have been wearing this for 4 days and it still hasn't loosened so.

I: No.

P5: It probably depends a little. Some people like to have some backup, but others take it a bit as it comes.

I: He-he.

P5: It probably depends on what you prefer. Some like to have an extra in spare, so it's probably a bit user-dependent.

I: Yes.

Appendix 8: Participant 6

Male, 45 years old

Date of the interview: 25th of March and 29th of March 2019

First interview

I: First I want to start by asking how old you are?

P6: I'm born in 74, which means I'm soon 45.

I: 45. And what is your profession?

P6: I work as a sales representative for a pharmaceutical company.

I: Mhm. What kind of education do you have and how many years?

P6: I'm a physical therapist.

I: You're a physical therapist. And your work status, are you working full-time, part-time?

P6: Full-time.

I: Full-time. Are you often in contact with the healthcare service, for personal reasons?

P6: No.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P6: No.

I: No. Have you ever tested any apps or other technology to track your health?

P6: Lifesum and AppleWatch he-he.

I: Right, mhm. Do you find it interesting to pay attention or is it…?

P6: Yes, it's fun to pay attention

I: Yes. But that's why you do it, in order to have an overview?

P6: It is in relation to for example exercise, like what is this, how many calories and how high is the pulse and so on. Yes.

I: Mhm, right. Have you done an ordinary ECG test before?

P6: No.

I: No. But what do you think could have triggered you to go to your GP or bought an AppSens to examine your heart? Could it be because you felt something with your body or would you have done it when you reached a certain age or?

P6: Ehm. I would… done it from a certain age in order to exclude atrial fibrillation. And maybe I would have done it already if I didn't ended up doing this.

I: Yes, mhm.

P6: We got these Apple Watches (point at his watch) because we are working with atrial fibrillation and, and they should be able to detecting by ECG, so that's why we got this at work as a little gadget.

I: Yes, yes.

P6: Mhm.

I: What is your expectations to this clinical trial then?

P6: That it should show, that it should be able to be validated and give a good ECG that can be used of most people, at GPs offices and at hospitals that will make it easier for both patients and not at least doctors and healthcare workers to detect atrial fibrillation in the population.

I: Mhm. What do you think about wearing a device 24 hours a day?

P6: It's fine.

I: Fine? Right. Do you think it can prevent you in living your everyday life?

P6: No.

I: No. Are you worried that it might stop working or do you have any other concerns around it..?

P6: No, no.

I: No. If, if the sensor find something either if it is atrial fibrillation or something else, what do you think you will do with your results? Will you share them with your GP?

P6: They will be shared with a cardiologist.

I: Right.

P6: He-he-he.

I: A cardiologist?

P6: Yes, he-he.

I: He-he. But do you trust that it is capable of finding something?

P6: Yes.

I: Mhm.

P6: I do.

I: Yes. But if you have an ordinary ECG machine versus AppSens, do you trust of them more or less?

P6: Today would I of course trust an ECG more.

I: Mhm.

P6: But, in 14 days could we probably say that this works just as good.

I: Yes.

P6: Right, and it is a little bit exciting to be a part of the testing.

I: Yes, right. That's good. Are you familiar with the new privacy security law, GDPR, that came in May last year?

P6: Mhm.

I: Do you feel that you are provided good enough information about what will happen to your data? That are being collected.

P6: Yes, if I was extremely concerned about it I would have read through it all, but I have not of course.

I: No, he-he.

P6: I have signed for it, he-he.

I: He-he. But what do you think about that you data being collected and stored in a cloud?

P6: Ehm, no I haven't made up any big thoughts about it actually.

I: No.

P6: The things that will appear there is not so sensitive, because I am healthy. If I was sick and needed some kind of insurance or something, then I would have been much more skeptical towards things being stored around in a cloud.

I: Yes, right.

P6: But in the end when this is done, the data are mine which I own and they will be on my phone.

I: Mhm. Do you have any concerns that your data might be misplaced or misued or something like that?

P6: No, not in this situation.

I: No.

P6: No. This is so little controversial.

Second interview

I: How has the test gone?

P6: Very good.

I: Are you still wearing it?

P6: Yes, yes.

I: Yes, that's good. Is there anything you think has been good or bad?

P6: The first night I noticed that I was wearing it, but after that I didn't think about it.

I: No. Have you experienced itching or something like that?

P6: No.

I: No. Did it live up to your expectations?

P6: Yes absolutely. It was just as expected, really, no stress. You forget, because it's not my phone, so I forget the phone. I forget to charge it and stuff like that.

I: Yes.

P6: But I expect it had been different if it was connected to my phone.

I: Yeah, right. So, it has been a bit cumbersome?

P6: A bit cumbersome to have to carry around an extra phone. And after I got my Apple Watch I usually never bring my own phone either.

I: Oh yes, you just use the watch?

P6: Yes.

I: Yeah, so don't you think about bringing your own either?

P6: No.

I: No, then I understand the problem when you have to carry an additional phone as well.

P6: Yes, when you have to carry one that is so big he-he.

I: He-he. I understand that. But now you got help both putting it on and connecting it to the phone. What do you think of the difficulty? Do you think that you could have done this on your own or?

P6: Yes.

I: Yes. But it's not something you think might have been difficult about it?

P6: No, I don't think so. If it's just a QR code or something for those who aren't used to it, that could have been something. But it has been completely unproblematic and very good.

I: Yes. Do you trust that it gives you accurate heart rate information?

P6: After a while it probably does.

I: Mhm?

P6: Now it shows a lot of strange things.

I: Yes?

P6: This is how it looks now (shows the ECG signals)

I: Oh, look yes.

P6: But that's why this is a test.

I: Yes.

P6: So, it may have started to loosen a bit, that is why you get such weird.

I: Yes.

P6: It has been worn at riding tours and summit tours and everything possible, so it is properly used.

I: Yes, that’s good. What do you think that if it had found something then you would get an answer on the app and not a personal doctor?

P6: No, I think it's okay. If you, if it comes up a message like, a clear message. A notice to take this here and send it to your doctor or something, possible findings and talk to the doctor. I think that is absolutely great.

I: Now they will offer a cardiology service in the app.

P6: Mhm.

I: Where do you pay a sum, how much am I unsure, do you think you used it rather than go through your GP?

P6: Yes.

I: Yes. Do you think it will simplify the consumer pathway that will make more people test themselves?

P6: Perhaps not the cardiologist app, that it will mean so much then I think it's much more important to get this out to people so they realize that strokes are a disaster and now you can easily check this out. I got updated the watch and the phone yesterday, so now the ECG works on it.

I: I read it. Have you tested it?

P6: Yes.

I: Yes? And it works?

P6: It works very well (shows how this works and takes an ECG).

I: But since you now have Apple Watch.

P6: Mhm?

I: Do you think that you don’t need AppSens?

P6: No.

I: No?

P6: I just see it as a fun tool if you have symptoms.

I: Yes?

P6: This will be, AppSens will be much more pro.

I: Mhm?

P6: And proper. Who will run all the time you wear it.

I: Mhm.

P6: So typically, people you love such as mom and dad, they will of course get this from me for Christmas and then I will ask them to wear it.

I: Mhm

P6: A week's time or something like that

I: Yes, in order to get that long-term overview?

P6: Yes. At least that's how I see it. But now I work in the health care field and I’m interested in this.

I: Yeah, right.

P6: So, I probably have a different relationship to it, than maybe your fellow students

I: Yes. When you are within the field it may be easier to know about it or seek it out.

P6: Yes. Probably. So, this will probably go along with big public education campaigns and that kind of thing, I would have thought it would have been perfect.

I: Yes. But what do you think about the usability?

P6: Absolutely top.

I: Yes. Have you felt safe during the period?

P6: Yes.

I: In relation to water and showering?

P6: Never thought about it.

I: Never thought about it.

P6: No. I showered with it and exercised with it, worked with it, sweated with it yes.

I: Mhm. That’s good. Have you ever felt that it has prevented you from doing anything in your everyday life?

P6: No.

I: No? You've done everything you usually do?

P6: I have done everything as usual.

I: Yes.

P6: The only thing is that you have to drag along the phone.

I: Yes, that's true.

P6: But in the long run it might go straight into a smart watch.

I: Yes, it can be.

P6: It should be easy to get so that it disconnects from the phone and onto the smart watch when it doesn't find it for example.

I: Mhm. It's not a bad idea. There are more and more people who use such smart watches.

P6: Yes.

I: But now, that app, it's terribly simple now, but what do you think it should have contained if you were to see it as optimal for you?

P6: It had to be something ala FitBit or Apple's health help.

I: Mhm?

P6: That you had pulse and heart rhythm, maybe run such a sleep record and something like that

I: Yes?

P6: That you had, when you connect it, got the whole thing.

I: Mhm. Yes.

P6: Especially that, if it could have detected sleep apnea.

I: Yes?

P6: Because you go with this, the probability is quite large that you will be able to see that you have an algorithm that shows it when you sleep.

I: Right.

P6: There is also a huge potential, there are many who goes around with it and they do not know it.

I: No.

P6: Then they are tired and exhausted and get heart failure and everything that follows.

I: Exciting.

P6: Yes. I would think you could have used it for that as well.

I: Yes, you can do a lot of different things now with all these plug-ins.

P6: Yes.

I: Cool. But what do you think about downloading the results on a PDF file? Do you think it is useful or?

P6: It should be useful for you to bring it to your GP, if you do not use the cardiologist thing or something, then yes.

I: Yes. But, seeing that you were at risk, do you think, or now it is still evolving, but would you prefer AppSens or would you have taken a regular ECG?

P6: Now I know that maybe it is difficult and, many are asymptomatic and they come and go and so on, so I would say this is a much, much better solution really for everyone because you get records over a long time. You are lucky if you get something registered on the ECG just when you are inside and taking it.

I: Mhm, yes.

P6: So, there is a much better solution here.

I: Because you also have the Holter devices, they are a bit more circumstantial.

P6: But that's true, then you're suddenly sick right away.

I: Yes, and then you have to go through the GP and get a referral.

P6: Right. This can really everyone do whether you are interested in health, if you are exercising a lot, concerned about this and so on, then everyone can put it on.

I: Mhm. It is true. And maybe there is something about you and, or at least I'm a little like that myself, that if I feel something is wrong then I would like to have an answer quickly. Not have to wait for a long time.

P6: Yes, and then you should book an appointment with the GP and then maybe 14 days three weeks just there in waiting time if you are a little unlucky. So, if you have tools that are good and validated that you can trust. Then you can just as well stick this here and take it at home.

I: That's true. But do you think it is something that AppSens must think of to avoid so people don't want to use the product?

P6: I think it had been, it might have been smart to have two. Two variants.

I: Okay?

P6: Off the equipment.

I: Mhm?

P6: You have one that could be such a petrol station, pharmacy variant. AppSens Basic or Personal or something like that. Which is a simple matter, you plug in, download it, and it will be a cheaper option because you don't have to be able to replace the battery and other things. And maybe you can buy it for 300 kr, just to say a price.

I: Yes.

P6: Then you have it, a low threshold offer.

I: Mhm

P6: So, you are at the store and you don't feel well, you have had palpitations, stress and everything like that. Then you can buy it here, stick it on and then go with it for a week and get this checked. Since it doesn't cost that much, you can tear it off and throw it afterwards, finished. Then you have AppSens Prof.

I: Mhm?

P6: This could be offered at the doctor's offices and to emergency centers and departments and such, which is a better product that can cost more, but which can simplify everyday life for example at a stroke department. The patient comes in with a stroke and wires and things, they can take it here which is sterile packed and on with it. Then they can connect it to the department's monitor or iPad, something like that, so you get it in right away and it is reusable. Then you replace the battery and so on.

I: Mhm. But how do you think that pro, how would you connect it to each person? Because now it is so that when you connect it to your phone, it will be connected to you.

P6: Yes

I: That there should have been another solution or?

P6: No, you could have had the same solution. You could have had an iPad, a phone or something that is in a department, and have them marked 1, 2, 3, 4, you also have three pieces that are in the reception when a patient gets in. It might be a lot to do and its not always time to put on a ordinary ECG with wires and so on, so you could have put this on instead and then it goes to the departments….

I: iPad or?

P6: iPad or phone or something like that.

I: Yeah, smart. But do you think this is a product you will recommend to others?

P6: Yes.

I: Yes. You may not have thought very much about it, but if it or the packaging, for it to have been user friendly and environmentally friendly, do you have any ideas about it?

P6: No, maybe. Of course, I want to have it simple.

I: Mhm?

P6: You could have had a box ala the ones the razors come in.

I: Yes?

P6: In a bit like hard plastic, on one side you pull off the back and then it is just out with it, off with the patch and then on.

I: Yeah, mhm.

P6: So, there won't be so much fuzz.

I: No

P6: Then there are old people who might have to manage it. It must be simple.

I: Yes, so it's easy and open and?

P6: Yes.

I: Mhm. Now you said a little about it, but for now it can only be used by one person. But do you think that the cheaper variant can only be used by one person then?

P6: Yeah, I thought so.

I: Yes?

P6: I buy it for dad and then he gets it in Christmas gift or birthday gift or something like that, so he can wear with. And then it costs little money and then I can throw it afterwards, finished with it. So, you don't have to think about it anymore, and then he can get another one next year. Something like that. But then you must have the price that is so high

I: Low, so people bother to spend money on it?

P6: That you bother to buy it. But like, people buy Alco meter the day after and they cost up to 300kr, so they can check that they can continue to drive, but it has something to do with it so that you can buy it on impulse.

I: Yes.

P6: If it costs 800kr then the impulse factor is decreased.

I: Yes, yes. Then you should be interested I think.

P6: Yes, then you should be interested or have a reason for it. It is desirable for many to check this out and possibly find flicker.

I: Mhm. It is very true. But do you think that the one-time, the cheap variant will only be sold with an electronic part and a patch? Or more patches?

P6: No, I would have had it, it costs little to have an extra in the box if it should be loosened or something like that, so you had a spare patch lying in the box if it had to be loosened or something like that, but the battery have to last for at least one week.

I: Mhm.

Appendix 9: Participant 7

Male, 41 years old

Date of the interview: 25th of March and 29th of March 2019

First interview

I: First I want to start by asking how old you are?

P7: I am 41.

I: 41. And what is your profession?

P7: I work for a pharmaceutical company.

I: Alright.

P7: Former healthcare worker.

I: Okay, so your education is as a healthcare worker?

P7: Yes.

I: And you working status, do you work full-time or?

P7: Full-time.

I: Are you often in contact with the healthcare service? For personal reasons.

P7: On a personal basis?

I: Yes?

P7: No.

I: No.

P7: Very rarely.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P7: Asthma

I: Asthma? Mhm. Have you ever tried any apps or other technology in order to track your own health?

P7: Hmm, no nothing else besides Apple watch.

I: Right.

P7: Mhm.

I: What do you think about it? Does it give you enough information?

P7: It gives me favorable things, for example it reminds me on being in activity during the day and so on.

I: Right, mhm.

P7: That I think is beneficial.

I: Mhm. Have you in the past done an ECG, an ordinary ECG test?

P7: I have, after a car accident many years ago, 5-6 years ago.

I: Okay?

P7: They did take an ECG, but I think it was a routine or something just to check.

I: Right. What do you think could have triggered you to take an ECG? To you think it could be because of your age or that you felt something with your body or something within the family or?

P7: What could have triggered me?

I: Mhm.

P7: If you got double heart beats or something like that could have triggered me to do it. Ehm, that's the only thing I guess.

I: Yes.

P7: Yes.

I: Mhm. But what is your expectations for this test? The clinical trial.

P7: It's that you get a more long-term overview if you might have something abnormal or something like that.

I: Mhm.

P7: Other than that, I don't have any expectations.

I: No?

P7: No.

I: What do you think about wearing a device on your body?

P7: I can't feel it.

I: You can't feel it?

P7: No.

I: Do you have any concerns that it can prevent you from your everyday life or?

P7: No, I don't think so. It is fine to wear it when working out and so on, so I will check now on Sunday because I have football practice so that will be exciting to see if it's in the way or not.

I: Mhm.

P7: But I can't feel that I'm wearing it.

I: No. That's good. But do you have any other concerns? That it might stops working or something like that?

P7: No, then I will feel more sorry for you guys he-he.

I: He-he, yes.

P7: He-he-he.

I: He-he. But what do you think you would do with your results if the sensor detects something?

P7: Yeah, then you have to trust that the doctors knows what to do and give guidance if there are any abnormal findings.

I: Mhm.

P7: Which can possibly be corrected, other than that I don't think…

I: But if you got informered that the sensor detected something, and you will be informed trough the app, would you then have seen your GP?

P7: Then I would have become a little nervous I think.

I: Mhm?

P7: Or it depends on what it finds though, I have some knowledge so it depends on what kind of feedback I would get.

I: Mhm.

P7: But if there were any feedback coming from the app where it says something im not familiar with, then I would get a high pulse and get nervous I think.

I: Mhm.

P7: In that sense, I think it would be better if I was contacted by phone.

I: Yes.

P7: That someone would have called me instead of me getting a message and then would have to start calling.

I: Mhm.

P7: Because, I feel that if I get a message about an abnormal finding because it will be sent in

I: Mhm?

P7: And you get a message where it says that you should contact your GP or something. Then you call, and everyone knows that it's not always an easy task to get through on the phone at the GPs office and so on.

I: Mhm.

P7: But if there was a finding and I would have received a meeting, a follow-up meeting or a phone call, I think I would be alright with that. Because what you don't know won't hurt you. That is my opinion.

I: Mhm. But do you trust that the sensor is capable of detecting atrial fibrillation or other heart failures?

P7: Yes.

I: Mhm.

P7: I do trust that. Espesically in relation to the fact that I have participated in some ECGs and so on earlier and ECG is able to find most things, and when even Apple watch manage to detect a little bit then I count on that this one will as well. I saw that this one has 3 contact surfaces and Apple watch only has 2, so I trust that this one will find it, I do trust that.

I: Mhm. If you think about this app or this sensor versus an ordinary ECG tester, do you trust one of them more or less or is it equal?

P7: To be totally honest, I would have trusted this one more (points at the sensor) because the other ones are too old-fashioned.

I: Mhm.

P7: After all, they have been used for all years. So they don't feel as modern, espesically if you compare with phones and everything, so you will see the development of the old house phone where you had to stand and spun it with wires to cellphones, so for my sake, but I like technology so I trust further development.

I: Mhm. Exciting. Are you familiar with the new privacy security law GDPR which was introduced last year?

P7: A little bit, but not the whole.

I: No.

P7: It is regarding the privacy.

I: Yes.

P7: I can't think about anything in particular.

I: But do you feel that you are provided good enough information about what will happen to your collected data?

P7: No, not really.

I: No.

P7: I actually don't know.

I: Did you read through the information letter, this one? (I'm showing it to the participant)

P7: Yes.

I: Right.

P7: Yes, yes, I did read through that one. It says in there, you see I thought you were talking about the privacy security law that came last year

I: Ah, alright no. Im sorry, I meant the data which the sensor collects.

P7: Yes, I did read that one, that it will be deleted and so on.

I: Yes.

P7: I expect it to work automatically, so no worries.

I: Yes, but what do you think about your data that is being collected will be stored in a cloud?

P7: I don't mind.

I: No.

P7: It's not a cloud then, it's a hard drive that stand somewhere, so that's fine. He-he.

I: He-he.

P7: It doesn't mind me, first of all I have a candidate number and then they have to couple the candidate up. So, the value to someone, besides research, what should that have been?

I: Mhm. Do you have any concerns that your data can end up misused or misplaced?

P7: If they were to misuse my ECG, then I would like to see how.

I: He-he.

P7: Im not sure how it can be misused, maybe if you go on a date or something and the other part has the sensor, then it can be misused, but other than that there no value in it. It's not.

I: No.

P7: It's not like it's you bank account or something like that so.

I: No, that's true.

P7: No.

Second interview – over the phone

I: How has the test gone?

P7: It's been fine. I think it logs out of the mobile from time to time when it jumps between network and mobile data and so on.

I: Okay?

P7: So there is one thing I think is a bit like that, I noticed for example yesterday, I don't know if you have the overview?

I: No, I don't have access to it.

P7: No, and now I see how, I look at the log here now that it starts to struggle with the contact and so on, I worked out yesterday.

I: Ah, okay.

P7: I ran and showered, and so on, so it can't record properly. It looks like I have something very wrong, he-he.

I: He-he, I've heard someone else who also said it.

P7: Yes.

I: But do you think it's been okay to wear?

P7: Yes, yes, it's been okay to wear. It has not been a problem.

I: It hasn't prevented you in your everyday life?

P7: No, it hasn’t. It hasn’t actually done that.

I: No. But has it lived up to your expectations?

P7: It has lived up to the expectations so far, from now on, it was probably a week since I got it on, wasn't it?

I: Yes, on Monday.

P7: Yes, Monday is a week ago. It is unable to read a normal ECG now.

I: No.

P7: It doesn't. Only when I bend forward or something like that when you sit and read, it struggles.

I: Yes.

P7: What I notice, you know the sensor that sits above the patch itself?

I: Yes?

P7: It is the one who has started to loosen from the sticky patch that you put on the chest.

I: Okay, okay.

P7: It's the one who has started to loosen, that's why it doesn't

I: Ah.

P7: It's the one who loosens.

I: Yes. But did you turn red or itch?

P7: I am red.

I: You're red?

P7: I see it now, I've taken it off. Where the big one is, I'm a little red.

I: Okay.

P7: But it looks okay.

I: Does it hurt?

P7: Now?

I: Yes?

P7: No, but it has itched a bit along the way when you have been active and so on, then it has itched a little.

I: Yes.

P7: But it is natural then in a way, since the sweat is left on.

I: That's true.

P7: Yes.

I: Now you got help putting it on and connecting it to the phone.

P7: Mhm.

I: Are you thinking that it looked difficult or could you manage this well yourself?

P7: I probably would have been fine doing it myself, but now I'm quite technical then.

I: Yes. But do you think it would be easy to put on the sensor yourself?

P7: The sensor on the other hand, it should have been put on by someone, if there is no good instruction manual.

I: Okay.

P7: It's okay to put it on your sternum.

I: Mhm?

P7: That is pretty good, but you have to shave and such so it doesn't hurt when you take it off.

I: Yeah, right.

P7: Yes. So, a regular doctor or nurse can put it on.

I: Mhm. But do you trust that the test can give you the correct answer about your heart rhythm?

P7: Yes.

I: Yes?

P7: I trust that.

I: Mhm. I asked you about this last time too, but now you have been wearing it. It will be so that you will get answers in the app and not personally by the doctor, has it changed anything? Or do you still think it's not okay?

P7: Well, if I had just received a message that, contact the doctor so it had been okay for then you had just contacted the GP.

I: Mhm.

P7: It had been okay. But what I also think about, it would have been a little easy to see some more information in the actual detail window when looking at the heart rhythm.

I: Yes?

P7: For example, beats per minute, the pulse would have been nice to see.

I: Yes. Is there anything else you could think of in the app?

P7: Yes, details of ECG and so on, information. Beats per minute, maybe show some simple ECG values for example. But it is because I am a little more interested then, therefore I thought it would be nice to see.

I: Mhm.

P7: But the pulse is minimum at least, I think.

I: Yes.

P7: And that you can go back in history and see.

I: Yes, so you could get an overview?

P7: Yes.

I: Yes.

P7: That you could have got a day report for example.

I: Yes. But do you think this sensor can help simplify the consumer pathway so that more people will test themselves?

P7: Yes, I think so.

I: Mhm?

P7: In fact, I think that if you have access to it yourself then I think that, if you can buy it at the pharmacy or something like that, then I think you will do it yourself.

I: Yes.

P7: In fact, the ones working at the pharmacy could have helped you put it on if on if they had the opportunity and time.

I: Yes, that you could have bought and put it on there?

P7: Mhm.

I: Mhm. But have you felt safe during this period, in terms of shower and such?

P7: Yes, it has gone very smoothly.

I: Yes. But what do you think about the usability?

P7: In other words, it is user-friendly in itself, and the app it is a bit, you have a sensor there and when you enter it says that AppSens is logging.

I: Mhm?

P7: And when I press it, I get two options "forget this sensor" or "details".

I: Yes?

P7: If I had only been able to press it and then came straight in, it would have been much easier than to have to press it in for a while and then go into details instead of only pressing it.

I: Yes.

P7: And then had a command where you drag left if you want to take it away. If you replace it or something like that, but I can imagine if you have this sensor and maybe use it several times, I don't know.

I: Mhm.

P7: Or maybe it doesn't?

I: Yes, it can be used several times, you just have to change the patch between each test.

P7: Yes, yes.

I: But what do you think about downloading the results on a PDF file? Do you think it's useful or isn't it a point?

P7: A report yes, yes, the 14-day period.

I: Mhm?

P7: I think the ECG will also be able to see when people sleep when they are active and so on.

I: Yes.

P7: How to get an overview, for example, that you have slept during this period.

I: Mhm.

P7: For so many hours, you have been physically active for so many hours.

I: Mhm.

P7: So maybe someone gets a little like this aha experience. It may be that you have been at rest, you have had a resting pulse or your resting pulse has been like that and for so long.

I: Yes.

P7: That would be nice. Furthermore, it could also have been a bit specific in relation to physical activity, I think in relation to which zone you are on the physical activity might have been a bit fun to know.

I: Yes.

P7: But you one in a fat burning or a condition-building phase.

I: But do you think this should have been on the app or on the result after the test ended?

P7: You can get the result at the end of the test, if you have a normal ECG and get an interpretation of the ECG, then that report becomes quite small.

I: Mhm.

P7: You have a normal ECG, thank you for the sample, and then there is nothing more.

I: No.

P7: And that's okay, maybe there are many who think it's okay, like okay I had no problem.

I: Mhm.

P7: But besides that, it could have been okay to get information about the other, and if you want to know more about various things then there is more information, because then you get an increased usefulness of it.

I: Yeah, right.

P7: Then it is also more likely that you get young people to use it.

I: Yeah, right.

P7: Not just the 40+, maybe they want to use it for exercise or whatever it is.

I: Mhm. But let's say you had been at risk then.

P7: Yes.

I: And AppSens had been on the market, do you think you then…

P7: And AppSens had been?

I: On the market, it worked just fine.

P7: Yes.

I: Do you think you would have tested yourself with an AppSens or would you go to your GP and get an ordinary ECG?

P7: So, if you are in the risk group and if I as a person had thought that I was at risk.

I: Mhm?

P7: Or my GP has said that I am at risk

I: Yes?

P7: Then the option, as I see it, the doctor would probably come up with a recommendation.

I: Yeah, mhm.

P7: And the recommendation he had come up with, it is then if I should go with ECG or AppSens.

I: Mhm.

P7: But if you consider it here and you are not with the doctor, but think about it yourself.

I: Yes?

P7: Then it would have been easy and simple to go to the pharmacy and just bought it yourself.

I: Yes.

P7: But if you are a relative of someone, then you can do it.

I: Yes.

P7: Yes, even parents can use it on their children if they want to.

I: Yes.

P7: Yes. If they are wondering about something or they will follow along a little bit.

I: Yes.

P7: But if I am with the doctor and I had the choice between this and the usual ECG, AppSens had been much easier.

I: Yes?

P7: It had been less impractical.

I: Yeah, mhm. But is it something you think that AppSens must avoid in order for people not to use the product?

P7: So, it's an ECG measurement.

I: Yes.

P7: That's the thing, as long as it says it's an ECG meter.

I: Mhm.

P7: Compared to more complex ECG meters then.

I: Yes?

P7: You think, it is a matter of feeling insecure so you can take your own measurement yourself.

I: Yes.

P7: And there are plenty of such people who like to do that.

I: He-he.

P7: But there's nothing specific I think they should avoid. They cannot say that they are as precise as, for example, an ordinary ECG. If they say that this does not work as well as an ECG, then I will not choose it.

I: No, that's true.

P7: So, it doesn't work.

I: Mhm. Do you think this is a product you are going to recommend to others?

P7: Based on the situation we have today, where you have no overview or report or what it refers to. I have no useful value of it now.

I: No, it's clear.

P7: Right and when I do not have a useful value of it.

I: Mhm?

P7: Then there is nothing you recommend. It must have given me some kind of utility in order for me to be able to recommend it.

In: Yes, it is clear.

P7: And got the AppSens report or that I can look at my pulse, or get an overview in the app how the week has been and so on, that brings a useful value and this is something I could have recommended. But as of today, with no useful value, I see no idea that others will use it if you understand what I mean.

I: No, it's clear.

P7: So, because it is so early in the phase of the product then it’s not possible to recommend. But by increasing utility, the recommendations also increase.

I: Mhm. Now the test can only be used by one person, but it can be used several times. What do you think about that?

P7: What? That the test can only be used by one person?

I: Yes?

P7: Yes, so if I had bought such a product and it could only be used by me, then I have to buy a new one for a cohabitant or child or relative or whatever.

I: Mhm.

P7: But why shouldn't it be used by others?

I: Because it connects to your social security number.

P7: Yes, that's okay. And then the sensor is yes, yes I see it.

I: Mhm.

P7: But if I go to buy it at the pharmacy then it is not connected to any person, or is it the app that does it?

I: Yes, because it has a unique serial number and then connects it to you. So it is not connected to you before you buy it, but when you connect it will be.

P7: Yeah, okay.

I: Mhm.

P7: For hygienic principles, it is fine.

I: Yes.

P7: But it can only be used on me.

I: Mhm?

P7: The problem is then, if I have two pieces at home.

I: Mhm?

P7: And not it is marked or I have not had the opportunity to mark it.

I: No?

P7: If you see what I mean?

I: Yes.

P7: And I put on the wrong one, then I get a little annoyed because then I have to take it off again and then waste a patch and so on.

I: Yes.

P7: It must be marked.

I: Mhm.

P7: Somehow so I can recognize which one is mine. Of course, I can write with a marker or something like that, but it disappears.

I: Yes, yes.

P7: A sticky note or a symbol that you can put in the middle.

I: Mhm.

P7: It would have been okay, so if it can be blue or red or something like that, just another color.

I: Mhm. But if you think it should, or the package it comes in.

P7: Yes.

I: It should be both environmentally friendly and user friendly, how do you think it should be?

P7: A cardboard box.

I: A cardboard box?

P7: Yes.

I: Mhm?

P7: I don't think plastic; a cardboard box had been fine.

I: Yes.

P7: White cardboard box, because it is sterile and it is associated with health.

I: Yes. Now the sensor consists of two parts: the electronic and the patch.

P7: Yes.

I: In terms of how it will be sold, do you think it was best and sold a patch and an electronic part or a package of three patches and an electronic part or another solution?

P7: No, it's pretty easy to figure out for yourself. I doubt you do it yourself, but if you go to McDonalds one day.

I: Mhm?

P7: And then you have to go in one registry to buy the hamburger

I: Yes

P7: Then you have to go in the next registry to buy a soda

I: Yes

P7: Then you need another registry to buy a pommes frites.

I: Mhm?

P7: And when you buy a starter pack, it seems to be ready for use.

I: Mhm.

P7: Without several different considerations. First of all, you see how it is interconnected and, it can be very easy for you guys to just place one in the box, if you think, some things that you buy that have battery in them have such a plastic piece that you just pull out then it is activated. That there is plastic between the electric and yes, or a piece of paper or something and then you just pull it out then it will connect, so the battery is not discharged. But it's also one on and off button, so if you just turn it on and off.

I: Mhm.

P7: Or there is no on and off button on this one?

I: There is a button in the middle to enable Bluetooth.

P7: Why can't there be one on and off button as well then?

I: Maybe, I'm a little unsure.

P7: Had it been an on and off button, and then you could hold it in to activate Bluetooth.

I: Yes.

P7: Slightly longer to sync the first time up to your phone and the app and serial number as well. No when I press it then it can turn off, no it was nothing.

I: Okay.

P7: I realized.

I: Just to make it clear, would you have sold one patch and an electronic part fully connected?

P7: The first package should have been completed.

I: Yes.

P7: Ready to just put on and turn it on. So, the patch and battery and everything are in it.

I: Yes.

P7: It would have been nice.

I: Yes.

P7: Because then you see how it looks. Because since I have now taken it apart I am a little unsure how the battery should sit and so on and so on.

I: Yes.

P7: But when I put on the big box on the outside. I do not know, have you ever photographed?

I: No.

P7: No, okay. Because if there had been a mark on the small piece of plastic below, where I should put the mark above so that I match it to get it in place.

I: Yes.

P7: A small marking, a small color marking for example.

I: Mhm.

P7: That allows you to line up the marking. So, it's easy to put on. Just a tint or something, it would have made it much easier I think. Because now, I sit and struggle to get it back on, and its plastic and so on. The likelihood that I am destroying something is high, so if you want to sell more then maybe it should be easier to switch.

I: Yes, yes. So, you're sure you have it right?

P7: Yeah, so you are sure you got it right.

I: Mhm.

P7: Because it would have been great when I put it back on, that I don’t have to start struggling on my chest and so on, I would like to do it before I put it on.

I: Yes. It's clear.

P7: Mhm. And so, if the app would let me know, there is another thing, that the app would have given me a tease when it is not online for example.

I: Yes. That you had been told?

P7: I'm not told.

I: No.

P7: And it annoys me.

I: Mhm, that's understandable.

P7: Yes. And if it starts to get bad contact, it also depends on the algorithms to figure out that it is getting bad contact, then maybe I should be told to switch so I do not wear it for a full day or two days maybe, so the records I have done in the two days have not been good enough because it is unable to read the ECG properly.

I: Yes. This was many good suggestions.

P7: Yes. Now it was not what you asked for, but okay.

I: No, but it's exciting anyway he-he.

P7: He-he.

I: That's what I wanted to ask you if you didn't have any more?

P7: Is it possible to get it in a different color?

I: Another color? What kind of color did you think?

P7: Yes. Maybe gray

I: Yes?

P7: Had I been a boy then I would either have had blue or a black, if I were a girl I would have had a red one. I don't know, now it's probably a bit general though.

I: Yes, but I understand what you mean.

P7: Yes. Because it had been a little more fun.

I: Mhm. I'm a little uncertain about medical equipment, whether it has to be white, but certainly.

P7: Yes. It is good that there is no flashing light on it at least, which lights when it is active.

I: He-he, yes.

P7: It would have looked a bit dumb.

I: Yes, I agree.

P7: If I had to clean it after using it once, how do I do it?

I: That's a good question, I'm not sure

P7: Is it just to remove the battery and put it in the dishwasher? If it's a product to be reused, if I'm not just going to throw it, then I'll have the option to clean it.

I: Yes, I'm a little unsure about that. But I do believe that it will tolerate some mild soap on a cloth. Because you can't swim with it….

P7: Yes, just wipe it with a cloth. Yes, it may make sense.

I: Yes.

P7: And then, what was more. The four holes on the underside, why are they there?

I: The four?

P7: The holes on the underside, why are they there?

I: Good question.

P7: I think of course you have the patch all over, but I thought about this with sweat and stuff, if it comes inside then there will be an emulsion because of the salt.

I: Mhm.

P7: I see that when you put it on you have such a piece of plastic.

I: Yes, unfortunately I do not have so many good answers to give you how it is built. But I can take it further.

P7: Yes. Will it be affected when I talk on the phone? No, it doesn't.

I: I don't know.

P7: No, just forget it. I've tried it.

I: Yeah, okay.

P7: When I buy it there the package in the box, it would have been okay, because I can count on if I had done this myself at home.

I: Mhm?

P7: Then it's easy that it gets wrong the first time, so I have the opportunity to switch so a back-up would have been nice if it had been included. Or such a patch.

I: Yes.

P7: So, it would have been okay.

I: Yes, so you sold a regular package, but plus an extra patch?

P7: Mhm.

In: Yes.

P7: Then I can go and buy a five pack or a simple package over time.

I: Yes.

P7: And if it had come in what to say, an environmentally friendly package then it would have been fine.

I: Yes, certainly.

P7: In cardboard or paper or whatever.

I: Yes.

Appendix 10: Participant 8

Female, 52 years old

Date of the interview: 25th of March and 28th of March 2019

First interview

I: First I want to start by asking how old you are?

P8: 52

I: And what is your profession?

P8: I'm a healthcare worker

I: Mhm. So then you have a degree within healthcare?

P8: I or Im not quite sure actually, I have a further education within intensive care, but I took that before it became a master degree. I'm not quite sure.

I: Yes. But do you work full-time or part-time or?

P8: Full-time

I: Full-time.

P8: Mhm.

I: Are you often in contact with the healthcare service for personal reasons?

P8: No, I'm not.

I: No. If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P8: Yes, I have one kind of asthma. But it doesn't bother me that much, but if I catch a cold will it last for a long time, that's that.

I: Mhm. Have you ever tried apps or other technology to track your own health?

P8: No.

I: No. Have you done a regular ECG test before?

P8: Yes.

I: Mhm. Did you do it at your GPs office or at a hospital?

P8: It was at a hospital I think, at work.

I: Oh, so it was at work?

P8: Mhm.

I: How was this experience? Was it alright or?

P8: Yes, yes. Nothing to be afraid of.

I: No.

P8: No.

I: What is your thoughts, if you didn't had done an ECG test before or if you were to take a new one, what do you think would have triggered you to for example see your GP or bought such an AppSens test?

P8: No, that would have been if they found something I needed to pay attention to. If I had some kind of rhythm disturbances or.

I: Mhm?

P8: That I could feel something sometimes, then I would have been triggered to buy one. If I were to feel something myself, even though they didn't find anything wrong, then I would have had a registration at home.

I: Mhm. What is your expectations to this clinical trial?

P8: This came a bit abruptly, so I didn't have the he-he, I just hope that they will be able to develop a good electrode and test so it will be convenient for people to be registered. To help with that is actually my expectation. I don't expect or I don't think that they will find something with me.

I: No.

P8: No.

I: What do you think about wearing the device on your body 24 hours a day the next days?

P8: No, I think it will be fine.

I: Right. Do you have any concerns that it might prevent you in your everyday life?

P8: No because I think, you can shower with it right?

I: Yes, but you can't swim with it.

P8: No, no. But I think it will be just fine.

I: Yes. But do you worry that it might just stop working or is there something else that comes to mind?

P8: No.

I: No.

P8: Then I just think that, since Im here I can just ask right, if there is something I have questions about.

I: Yes, right.

P8: Mhm.

I: If the sensor were to find something, what do you think you would do with your results?

P8: No, then I had to go further with it, if there is something I have to do. Unless it's just some extra heartbeats that almost every one of us have.

I: But do you trust that the sensor can find either atrial fibrillation or other heart failures?

P8: Yes, I do think so. At least in the future, it is still under development. But that rhythm I first saw, it looked very nice.

I: Yes.

P8: It is clear that if it finds something and suspects something, then you could go further just to be sure.

I: Mhm. But if you imagine that you have the AppSens sensor versus an ordinary ECG tester, do you trust of them more or less or is it quite equal?

P8: Yes, I can't know for a fact yet since I haven't seen any results from this one yet, but you do trust what has been used for the longest time.

I: Mhm?

P8: You do. That is how I would have thought, something that is well tested and

I: Right.

P8: Then you have different types, at my workplace we have two types

I: Mhm?

P8: One of them is better than the other one, but it is also much more circumstantial to use.

I: Okay?

P8: It depends on what problem statement you have. If it is something you have all the time or if it is something that comes rarely.

I: Yes, yes that's true.

P8: Mhm.

I: Are you familiar with the new privacy security law that came last year in May?

P8: No.

I: No. It stands for general data protection regulation, it should protect your personal data even better. So, your data is your data. It is only you who have control and choose what you want to do with them.

P8: Mhm.

I: Do you feel that you are provided with good enough information about what will happen to your collected data?

P8: No, but I think that, no because I got he-he, just got grabbed in the hallway, then I got the electrode on and then it was a bit difficult to get it to work on my phone, so I just signed.

I: You didn't read through?

P8: No, I haven't really done that.

I: No.

P8: But I think that you guys have been doing this for a long time, and besides for my sake, if anyone should have seen what kind of heart rhythm I have, I'm not worried about it.

I: No.

P8: Besides, it also depends on what kind of information it is.

I: Right.

P8: Yes.

I: But that data that are being collected will be stored in a cloud.

P8: Mhm.

I: What is your thoughts on that?

P8: No, for my sake its fine.

I: Mhm?

P8: After all, I don't understand what they can misuse, it had to be of course, personal data, my social security number and so on, things like that.

I: Mhm. But are you worried that the data can be misplaced or misused?

P8: No.

I: No?

P8: No, I'm really not.

I: No.

P8: But I have never been exposed for something either, so therefore he-he, maybe that's why.

I: Yes.

P8: If you have been exposed for something, then it is probably really bad.

I: Mhm.

P8: At least if you get your identity stolen.

I: Mhm.

P8: But I don't think about it. No.

Second interview

I: How do you think the test has gone so far?

P8: It has gone really well, I can't even notice that I have it on me, it's not in the way.

I: That's good.

P8: The only thing is when you wash yourself that you notice that there is something there. But it has completely disappeared from my memory.

I: He-he.

P8: It is, it is very good to wear.

I: Yes. But is there anything you have so far noticed that you have been good or bad?

P8: No, it is that the one (pointing to the electronic part) is a little big, but I do not see under the clothes at least. So no, there's nothing bad about it. I don't know I'm wearing it.

I: No.

P8: So, it's kind of gone.

I: That's good.

P8: Also, that I can just jump in the shower and, but I saw that the amplitude became a little smaller afterwards, but then it dried up again and then it became normal again.

I: Okay.

P8: I think it can handle it well, I have showered every morning and it's fine.

I: That's good.

P8: Mhm.

I: But now you got help putting it on and pairing it up to your phone, but do you find the difficulty level, this seems difficult or is this something you think it ...

P8: No, it went pretty fast. Now they didn't get it connected up to my phone because I have a Motorola phone like that

I: Yes?

P8: But it must have been typed something wrong or something, I do not know, but they got it up but then it just and it would not be activated.

I: No.

P8: So, when they did it on this (showing the phone) it went very fast. So, I don't think it's difficult.

I: No?

P8: I don't think so. It is very easy to record your rhythm and look at it. But it depends, most people out there do not understand what that rhythm means.

I: No.

P8: But since I work with this I have a little knowledge, it is a bit more fun to look at it.

I: He-he

P8: He-he.

I: Yes, that's just that. I don't know if I had gotten that much out of it, he-he.

P8: He-he. There is something about it, you have to know what you see.

I: But in relation to putting it on, do you think it had gone well?

P8: Yes, I think so. Absolutely.

I: Yes?

P8: Yes. You had to press a little hard the first time when they started it, but I think it will go just fine.

I: Yes.

P8: Mhm.

I: But if you should have done it on your own, do you have any concerns about it? Either putting it on or connecting to the mobile phone or something else?

P8: No, but now I didn't get to do the startup then.

I: No.

P8: If you know what the app is called and download it, then it usually goes well. But to connect it to it (pointing to the sensor), I don't know if they inserted a code or, I didn't notice. They may have entered something.

I: Yes, they entered a test user.

P8: Yes, right.

I: Now you are a little familiar with the ECG, do you trust that it can give you the right heart rate?

P8: Yes, it was very nice, when I am at rest, is it a very nice ECG.

I: Mhm?

P8: But as soon as I move, it gets a lot of noise.

I: Yes.

P8: So, it doesn't endure so much noise yet. I can just go up a staircase or stand a little like that (moving on the upper body) then I have ventricular tachycardia right away according to it.

I: Okay.

P8: Mhm. So, I am a little excited about it, but if I sit completely still or lie and sleep safely then it is very nice. You can't see the history of it and I can't see the pulse on it either.

I: No…

P8: It's just the simple rhythm I see, but it's nice when I sit still.

I: Yes.

P8: But I would have wished for a little more, I would like to have gone in and look at the history during the day and the pulse and…

I: Yeah, right.

P8: Mhm. But it certainly comes when it's finished, I believe.

I: Yes. But let's say it had caught something

P8: Mhm?

I: What do you think, now it's just a demo app, but what do you think about getting an answer on the app and not getting a phone from your doctor?

P8: It's a bit fictitious and ask me who works with this because I might have seen what it was and went on with it myself.

I: Yes, that’s true.

P8: But then, it should, then it should at least be the registered so that I can go to health personnel and have it checked. If those episodes had been so good that you could have presented it to your doctor so that he could have referred you further.

I: Yes.

P8: Because you do not have the opportunity to judge this if you are not familiar with it.

I: No, right. That's just that. But do you think it would have been more frightening if it had popped up a message "you have something" and you have to go check it out? Or did you think it was okay?

P8: No, it would have been okay. It would have depended on what I had checked, now I'm checking the heart. No, I didn't think if there had been anything else I think, you just have to talk to the doctor.

I: Yes.

P8: It's okay to register it, many things you can't get registered otherwise.

I: No, that's true. But do you think that AppSens can simplify the consumer pathway so that more people will check themselves?

P8: Yes, in relation to atrial fibrillation

I: Mhm?

P8: There are many who can have. Yes, I want to believe that it is a good device to catch it, because here you can go for a long time without it bothering you.

I: Mhm.

P8: Also, one might get it registered on their own phone and then take it further when one has had a seizure and get checked what it is. For it probably has an algorithm that makes it decide what to record and store.

I: Mhm. Because you think that, or do you think it could have been, that if the accessibility gets better, then people think they should test for it, instead of going through the GP and following the regular pathway?

P8: Yes, I think so. But I think most people who do not know about it before would rather have gone to the doctor's office and got connected the same

I: Yes?

P8: I don't know, but I think so. That is the safest.

I: Yeah, right.

P8: There they know everything and take it further if needed. But such user-friendly for having in a hospital, it must be very straightforward in relation to the others if you get a good rhythm.

I: Mhm.

P8: Mhm. But you do not get sold so many if you just have them at health centers

I: No, that's just that.

P8: Mhm.

I: Mhm. But what do you think about the user-friendliness? Do you think it's okay to handle?

P8: Yes, yes, yes, it's simple and, but now it's pretty small on that app, but I want to think that it gets bigger so you yes, see all the events and the pulse throughout the day. That one can get all the graphs in the world and I might think that it will be like that, that app. Like many of them are, like when you wear heart rate watch.

I: Yeah, right.

P8: That it gets a little like that. And they are easy to use many of them. It is very easy to wear and less in the way than a pulse watch can be.

I: Yes.

P8: Now I don't know how long the battery works on it?

I: Now it's probably a week

P8: Yes.

I: Mhm.

P8: It doesn't have to be charged probably.

I: No.

P8: It's also very good

I: He-he

P8: But then it may be that I have to change it myself, or is it a battery inside that can be replaced?

I: Mhm.

P8: Yeah, it is?

I: Mhm.

P8: I don't know how easy it is to switch

I: I think it's simple, it's such a watch battery.

P8: A big flat one yes?

I: Mhm, that's it. But have you felt unsafe during the test period? In relation to showering or something like that?

P8: No, I haven't thought about it at all.

I: No?

P8: No, I haven’t. But it is clear that I might have thought more about different things if I had something I would have checked

I: Yes

P8: Then I would have been more afraid that it might have stopped working for example

I: Yeah, then you had been a little more aware of protecting it or?

P8: Yes, now I just have to test it and I don't think there is anything wrong with my heart, I also go in to see that it is there occasionally.

I: Mhm

P8: It's kind of like that. I have no worries and if it stops working then yes, and should they find something then it is okay to know.

I: Yes. Let's say you now had a finding on atrial fibrillation, would you have gone through your GP or would you have used AppSens, they should offer a cardiologist service.

P8: Oh, they are?

I: Yes, eventually. Do you think you would have used it and got a quicker answer? And by a cardiologist or would you have gone through your GP? Now, that service will cost something, I'm unsure of the price.

P8: Mhm. No, I might have used it. I think so maybe. It is very okay with things that are done over nights and fast and, and if it is safe then you do not have to leave your work and go to the doctor.

I: Right.

P8: Then I would have included the information another time I was going to a regular check.

I: Mhm.

P8: So, I think so.

I: Yes.

P8: Everything one can get arranged quickly and easily, that's good.

I: Mhm.

P8: When it is safe then.

I: Yes. Now that app is not fully developed yet, it's just a demo, but do you think it has been easy to understand and navigate on?

P8: Yes, there is nothing to navigate on. It's just a tap so you get the rhythm. So, really I think it was terribly boring.

I: Mhm?

P8: One can really only check that it is rhythm and that it is connected.

I: Yes. If there should have been a optimal app for you, what do you think, now you mentioned it with your pulse and history, but is there anything else you think should be included?

P8: No, it is, history and what they think are rhythm disorders.

I: Mhm

P8: And of course, pulse variation throughout the day.

I: Mhm.

P8: That's exciting. And the history of the day, so that you can get an overview, if you go with it for 14 days

I: Mhm. So, you can go back and see?

P8: Yes, so you can go back and see, you might also get a graph of how it has been. And maybe also that you can make a note, as you can on the others, such as I was biking for one hour on Tuesday and so on.

I: Mhm.

P8: That you can write some log notes even over what you have done.

I: Yes, so you can enter notes where you know that you have exposed the heart a little extra?

P8: Yes, that is how it works now. People who go with the device can register. When we look through the results, if you have between 8-9 have 150 in pulse then this is normal if you are at the gym, but it is not normal if you sit at home and watch TV.

I: No.

P8: So, it is because you can see what you do when it changes.

I: Yes, yes.

P8: Mhm, so it would have been a bit nice to be able to enter notes during the day. And also for those who get something in certain situations.

I: Mhm, yes.

P8: It's probably not that difficult to make it in an app.

I: No, it is also nice for the doctor to get the extra information. It's smart.

P8: Especially if you go to the gym, because then it is normal to be high in pulse rate.

I: Yes. It should be possible to download the result on a PDF file, what do you think about it?

P8: Yes, it must be fine.

I: Yes?

P8: Mhm, but then they might be transferred or sent to the mail and download it or?

I: I'm actually not sure how it will be, but I think you should get it on your mail and then you can download.

P8: Mhm.

I: If you had been in the risk group for atrial fibrillation, would you have bought an AppSens or would you have taken a regular ECG at your GP?

P8: I would have done it at work he-he.

I: Yeah, he-he.

P8: I would have just stopped by probably

I: Mhm.

P8: But then it depends on whether one has such a thing that comes and goes or, the most important thing is to get some blood thinners if it persists.

I: Mhm.

P8: But I think if I hadn't worked with it, I'd have gone to my doctor and asked what I should have done.

I: Yes.

P8: Mhm. Then they had to have taken an ECG.

I: Mhm. If your doctor had offered you an AppSens, do you think you would have done that or would you stick to an ordinary ECG?

P8: I could have worn that, if they had found it, to see how much it was, for example, whether it had been all the time or sometimes.

I: Mhm.

P8: Mhm. Then I could have worn it, because it was very easy to wear. There are no wires or anything that falls off, it is not in the way. So, it is very simple compared to the old ones.

I: Yes?

P8: Mhm. It is user-friendly, you can’t feel that you are wearing it. It is more that other people can see that you are wearing it he-he.

I: He-he.

P8: That they are wondering what I have taken on, if I have become ill.

I: He-he. But what do you think AppSens must think about for people not to use their product? What do they have to avoid?

P8: For them not to use it ...

I: Is there anything that comes to mind?

P8: No, I can’t really think of anything.

I: No?

P8: I don't.

I: No, but it's fine.

P8: It is more suited for the younger generation, I don’t know, if a 75-year-old lady who don’t know much how to operate a phone, in some way it is for the future generation.

I: Mhm.

P8: That's for all the computer users.

I: Right.

P8: Much of the equipment is. But like this, when it's as simple as this. But if you are 75 and have not worked with the heart then you may not be very interested in going in to check how it is, then you will only get it registered, and then the doctor will take care of the rest.

I: Yes.

P8: So, it's for those users too, there are just some others who have to deal with the processing of data.

I: Yes, it is clear.

P8: But now it's so that people shouldn't have an iPhone I realized, though.

I: No, right now it only works on Android. But it will also become available on iOS for Apple.

P8: Yes, exactly. Because it will be a little silly to exclude it, because there are quite a few iPhone users.

I: Yes, yes. It's just now in the test period

P8: Mhm.

I: But do you think this is a product you would have recommended to others?

P8: Yes, I could have recommended that to many who wondered if they had anything.

I: Mhm?

P8: If they had palpitations for example.

I: Mhm.

P8: Just to find out what it is

I: Mhm. The test can be reused several times.

P8: Oh yes?

I: Only replace the battery and the patch.

P8: Oh yes, so it can.

I: Yes, but then it will, because there is a special number or code on the sensor that will be connected to you, so it can only be used by the same person. What do you think about that? Do you think it would have been better if it could have been used by several, for example between spouses?

P8: It can be used by more than one I want to believe. If you just loan each others phone he-he.

I: It will be connected to your health record.

P8: Yes.

I: So, there is a little problem there ...

P8: I'd rather suggest and have two types that were almost the same. It must have been okay to have one inside such as in the health service and

I: Mhm?

P8: That could be connected to several. And one out there among people, one they can buy and have as their own, if it goes straight into my health record.

I: Mhm.

P8: Mhm. Yes, some were not only connected to one person, but to an instrument, but then you have to process the data yourself.

I: Yes, that's just that. If this should have been packaged in a user-friendly and environmentally friendly way, do you have an idea of how the packaging should be? Maybe it's a little difficult question he-he.

P8: Mhm. No, it should be, the packaging should be appealing in a way. Nice to look at. It should perhaps have been in a degradable material at least.

I: Not so much plastic?

P8: Not so much plastic yes. Paper and bamboo or I don't really know what to use to make things, they can almost make everything possible.

I: You can.

P8: Yes, or reusable.

I: So, to the last question, the sensor consists of two parts: an electronic part that can be used several times also it is the disposable patch. It also contains a battery.

P8: mhm.

I: Now you get three answer options, how do you think this is most sensibly sold, a. With one piece of patch and that you can buy several of the patches as needed separately, b. Complete package with three patches and one electronics part, c. Another solution?

P8: It depends, I would have had another solution. I would have liked to have several patches if I had first bought it. I wouldn't have thought that it was the patches that were cheap and the other one that was expensive, I don't know he-he. Yes, maybe 10 patches then.

I: 10 patches?

P8: Then you have a little, yes. In a package.

I: Yes.

P8: It is like that if you buy some equipment and it is cumbersome to obtain more, then it is okay that you have a little back-up yes.

I: Yeah, so you have stacked up?

P8: Yeah, right. If there is something wrong with the rhythm then maybe you have to take some medication, then you have to see how it works. Yes, more patches.

I: Mhm.

P8: Then you can use it a little longer. The battery is easier to obtain.

I: Yeah, right.

P8: Mhm.

I: Yes.

Appendix 11: Participant 9

Female, 45 years old

Date of the interview: 25th of March and 28th of March 2019

First interview

I: First I want to start by asking how old you are?

P9: Eh, 40 he-he, I'm 45 and a half.

I: And what is your profession?

P9: I'm a healthcare worker.

I: You're a healthcare worker.

P9: Mhm.

I: So, then you have a degree in healthcare?

P9: Yes, a degree.

I: Yes.

P9: Plus, some administration

I: Yes, mhm. What is your working status? Are you full-time, part-time or?

P9: Yes, full-time.

I: Full-time.

P9: Yes.

I: Yes. Are you often in contact with the healthcare service for personal reasons?

P9: No, not often. It is usually just the routine controls.

I: Yes

P9: Mostly.

I: Yes. If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P9: No.

I: No. Have you ever tested any apps or other technology to track your own health?

P9: No.

I: No?

P9: I have only tested the ones at the hospital once, but it's not like trying out any equipment.

I: No, it not like you have any apps in order to track?

P9: No.

I: Have you ever done an ECG test?

P9: Yes, I have done that.

I: Did you do this at your GP or?

P9: No it was at my workplace, but just for fun. We took ECG at work he-he. By the way, I did take one when I was pregnant, because I had such a high pule. So, then I had to take it because of that. Mhm.

I: Did you do that at your GP or?

P9: No, it was at work, then I got a doctor to look at it.

I: Okay. What do you think about it? How was the experience?

P9: To take an ECG?

I: Yes?

P9: Yes, that's not a problem.

I: Mhm. But what do you think, if you didn't have done it before or if you wanted to take a new ECG, what do you think could have triggered you to do so? Could it be because of age or sickness or that you felt something with your body?

P9: I probably wouldn't have thought about taking it if I felt something.

I: Mhm.

P9: And I do know that if I had chest pain during exertion, then it wouldn't help to take just a regular ECG, I had to do it properly. But, and not really with arrhythmia, so then I know that I had to take something that would monitor long-term.

I: Mhm.

P9: I have had something from time to time, then I have thought what could that be. But it is rare I have done anything about it.

I: Yes. What is your expectations for this test?

P9: My biggest expectations are that x (one of the researchers) should be happy he-he-he.

I: He-he-he.

P9: No, I mean, I haven't sat that many expectations to it. I have thought that it is alright to wear and test if it is working. We also have ECG at work, Those Holter and R-testers, especially the Holter is a bit tricky because it has so many wires.

I: Yes.

P9: Then I have, I think that this could be an exciting experience.

I: Yes.

P9: For those who are wearing it. The R-tester and this one doesn't isn't that different, but at least there is nothing hanging loose.

I: No.

P9: So, I think that at least that is better.

I: But what do you think about wearing it 24 hours a day for several days?

P9: No, what I'm excited about is whether the skin can withstand it, I don't have a particular fragile skin, but that it will be alright. That it won't be a rash or itching or something like that. Also, I'm a little excited about showering, that it will be fine. Other than that, it won't be a problem.

I: No. Are you worried that it might prevent you in your everyday life?

P9: No, I'm going to work out tonight. I was told that it was alright. I'm also playing a handball match on Thursday so I hope it will be okay, he-he-he.

I: He-he, yes it will be exciting to see when you sweat.

P9: Yes, and that is nice actually, because that is a bit of the point to test it out.

I: Yes, yes.

P9: The handball matches could get a bit rough, physically speaking, but I just have to put if back on if it falls off.

I: Yes, he-he.

P9: He-he-he. At least you will know

I: He-he. But do you have any concerns that it won't work or if it will stop working?

P9: No, I can't worry about that.

I: No?

P9: As long as I'm not sick. In other words, since I don't have any symptoms.

I: No, that's true.

P9: If I thought that there was something, if I had symptoms which would be important to detect, then I would have been more concerned about it working and detecting everything that it should.

I: Yes.

P9: Yes, but I don't have any worries about it now.

I: No. But let's say that the sensor will detect something.

P9: Yes.

I: What do you think you will do with your results?

P9: No, that depends on what it will detect.

I: Mhm.

P9: If I need to get a pacemaker, then I just have to get it he-he.

I: He-he.

P9: No, if it finds arrhythmia of some kind, then I just have to check with the doctor to see if there is anything I need to do anything about.

I: Mhm.

P9: Mhm.

I: Do you trust that the sensor is capable of detecting atrial fibrillation or other heart failures?

P9: I trust the people behind it, so I expect they have control. And if it is first set on it, then it will find it. It is a computer in a way, it can't choose not to.

I: No, right.

P9: So it will detect the things it is set on to find. I think it's a bit disappointing that I cant see the pulse and those kind of things for myself, at the app he-he.

I: Yes.

P9: You can see the heart beating, but not how fast and so on he-he.

I: No, you would have liked to see that?

P9: Yes, that would be a little fun. But I expect that the software will be so good that it detects the things it should. If not, it will not enter the market.

I: No, that's true.

P9: He-he.

I: But if you can picture that you have an ordinary ECG tester and the AppSens sensor, do you trust one of them more than the other?

P9: Compared to a regular ECG, you will get more angels from the heart. So, I would, I think that it is maybe more useful in a normal diagnosis with a regular ECG. But I would have trusted this one more when it comes to detecting rhythms.

I: Yes.

P9: Because when you take a simple ECG, it only counts those 10 seconds.

I: Mhm.

P9: Then you don't know anything more. After all, you can get plenty of extra systoles when you are done.

I: Yes, true.

P9: So, in that way, I trust that this will detect it rather than a regular ECG.

I: Yes, because of the long-term monitoring?

P9: Yes, because it is over time.

I: Mhm. Are you familiar with the new privacy security law GDPR that came last year?

P9: We learned something about it.

I: It stands for general data protection regulation

P9: Yes. Because we got some introduction to it at a meeting, but I cant remember in detail what it is about.

I: No. No, it's just more about securing of data and that the data is yours.

P9: Yes, and that you have access and all that.

I: Yes. But do you feel that you are provided with good enough information about what will happen do you collected data?

P9: This one?

I: Mhm?

P9: Yes, yes. I have read, but I think that this is not my personal secrets he-he.

I: No.

P9: So, it doesn't matter.

I: But what do you think about that your data will be stored in a cloud?

P9: It, it. It's not, it is such a number

I: Mhm?

P9: After all, it is not linked to my name, so there can be as much heartbeats as possible for my sake.

I: Yes. You are not worried that the data could get misplaced and misused?

P9: No, if it had been my previous illness, now I don't have anything, but if it would be some sort of personal things then I would have been a little bit more skeptical, men not I'm not in relation to this.

Second interview

I: How has the test been so far?

P9: Ehm, shared.

I: Shared?

P9: Yeah, I took it off yesterday.

I: Mhm?

P9: It loosened, it is quite nice to wear in the first place.

I: Mhm?

P9: I was working out on Monday and then it already loosened down at the end, that electrode in the end.

I: Yes.

P9: But, the signals were still there so it doesn't matter that much. I've found out that it's not intended for people with breasts.

I: No?

P9: It gets so narrow, and then it gets too sweaty here (points between the breasts) compared to men who are completely flat.

I: Mhm.

P9: So that's probably why it loosened, the bottom one. Also, the plastic thing around, it was angled towards the side so it was a little uncomfortable. On day three, it started to itch around because it irritated.

I: Okay, yes.

P9: Yes. I also played a match yesterday and when I got home it had moved, the patch.

I: Ah okay.

P9: Then it completely loosened.

I: Yes.

P9: So, I took it off then, after the match.

I: Mhm.

P9: On Monday when I was exercising I didn't have coverage, so I thought I'd test it on the match as well. Just to see how the signals were.

I: Yes?

P9: But I have tested it with a little jump and bounce, and then they become very strange.

I: Yes?

P9: But as long as it was hanging right, I hadn't worked out, I think it would have worked pretty well.

I: Mhm.

P9: But there will be a lot of interference here (pointing to the chest). Whether it's the skin that moves more or whatever, I don't know.

I: No.

P9: Mhm.

I: So, then it hasn't lived up to your expectations then you would say?

P9: Uh, no. So, the thing here (the electrode) was unproblematic.

I: It was the patch?

P9: But the patch, that is, the patch hung well, but the electrode that was attached to the patch, they were the ones that loosened.

I: Oh, yes.

P9: So, the patch itself hung.

I: Okay.

P9: But they detached from the patch.

I: I see. You said you itched a little?

P9: Yes.

I: Yes. Have you been struggling with this all the time?

P9: It came on day 3 I think.

I: Yes.

P9: Mhm.

I: That's not so good.

P9: No he-he.

I: But it's good to get it tested out then.

P9: It's not that good. Hehe.

I: But now on Monday you got both help to put it on and connect it to the phone.

P9: Yes

I: What are you thinking about it? Does it look okay? Do you think you would have managed on your own?

P9: Yes, yes. It was just a sticker.

I: Yes?

P9: Yeah, it would have been alright.

I: Do you trust that it can give you accurate information about your heart rhythm?

P9: No.

I: No?

P9: Not now.

I: No.

P9: I can't show it now, but during exercising, if I had gotten flicker during exercising it wouldn't have been visible. I examined this with an ambulance driver who watched it at the same time, and it was just a mess.

I: Yeah, mhm.

P9: So, as it is now, I don't think you had seen if I had gotten flicker during activity, but if I had got it when I was at rest then yes.

I: Yes, then it is different?

P9: Yes.

I: But what do you think, because it is meant that if it detects something then you should get an answer in the app and not personally by a doctor. What do you think about it?

P9: That I would have the answer myself?

I: Mhm?

P9: I think it's okay if I'm a healthcare professional, but I don't know if I think it would have been so good if it tells me “you have flicker”.

I: Yes.

P9: Then it depends on how much information the patient has received in advance. After all, it is flicker it is trying to detect.

I: Mhm.

P9: It might not be so bad if the app says you have flicker, consult a doctor. I think this should be done in collaboration with a doctor anyway. So that the doctor can request that you wear one and then you get it on prescription or go and buy it at the pharmacy. Then I think the doctor should contact you again, if there was anything or not.

I: Mhm.

P9: For me, I would have seen that it was flicker, so I would have thought that I just have to talk to those who can do something about it.

I: Yes.

P9: So, if only the information is good enough in advance. But if it's not an atrial fibrillation, but a ventricular fibrillation and it comes up specifically, and people then go in and google it then it's not that fun.

I: No, that's true.

P9: So, I think that if, it should just come up a message that it is arrhythmia and that you have to talk with your doctor about it.

I: Mhm. That you don't get specific ...

P9: No, I think so. If my husband had it and seen that he had ventricular fibrillation then he had gone and checked it online, I don't think it would have been any fun.

I: No, that's true.

P9: In ventricular fibrillation, there is not much you can do.

I: No. But do you think that if it had been fully developed and on the market, it could would have led to that more people checked themselves?

P9: If it would be like now you can check if you have atrial fibrillation?

I: Mhm?

P9: Yes, I think if there had been a lot of focus on it, and it is sometimes in the media. Then I think many had thought it would be wise to do so.

I: Yeah, mhm.

P9: I think it is important that the information that comes out is factual.

I: Mhm.

P9: It is not always that factual in the large newspapers like VG and Dagbladet. But I guess it would be that people would think that I want one to check if I have flicker because I have some irregularity and that is not good to say what it is.

I: No, that's true. That is my opinion, but it is not always you go to the GP because you do not feel sick enough or something else, but despite this you want to take a check.

P9: Again, then it is really important what information the app will give you.

I: Mhm.

P9: Next time then.

I: Yeah, mhm.

P9: Because if it is ventricular in circulation, then it is fine, then you have discovered it, then you have to go to the doctor. But we know what people do, they google things first.

I: Yes

P9: Then someone gets a little sweaty. The flicker, we must treat the atrial fibrillation.

I: Mhm. Apart from that, you have felt safe during the testing period with showering and…

P9: Well, that has gone well.

I: Mhm. Do you feel it has prevented you from doing anything? Has it been in the way?

P9: No, it haven't.

I: No.

P9: Just that it has been itching.

I: Yes.

P9: But it hasn't been in the way.

I: No. Now they are going to offer a cardiology service in the app.

P9: Mhm.

I: So, you pay a sum and then you can get a cardiologist to look at the result.

P9: Mhm.

I: Do you think you would have done that or would you have gone through your GP?

P9: I think most people would have thought that then they had to talk to the heart specialist.

I: Mhm?

P9: I think most would have chosen that.

I: Yes. Now the app is very simple, but what do you think it must contain?

P9: Now I just see the rhythm.

I: Mhm.

P9: So, for a patient's sake, one wouldn't have needed to even see the rhythm because they don’t know anything about it.

I: No.

P9: Most of them. For me it would have been fun to be able to rewind to see if there was anything when I was exercising for example.

I: Mhm.

P9: But I'm not sure how much the patient will do with it.

I: No?

P9: For me it might have been fun to go in to see if I have atrial fibrillation or if there are other things.

I: Mhm.

P9: Right. But I can know a little about it.

I: Yeah, right.

P9: And the patients don’t.

I: No.

P9: I don't know what. So, what they need to know is perhaps such a message that there is some arrhythmia.

I: Mhm?

P9: And that you should talk to a cardiologist or the GP.

I: Yes. But do you think there should be some features on it, whether you can see the pulse or add notes or?

P9: Yeah, on some of them so you can mark a button that you felt something, and you wonder what is. That should have been in the app.

I: Mhm.

P9: That you can mark at some point in the app that I felt something uncomfortable.

I: Mhm.

P9: Then you can go back and see what it was there, for example.

I: Yes.

P9: It might have been wise.

I: Mhm.

P9: Because when you see that it was something completely harmless and then it is okay.

I: Mhm.

P9: So maybe that. And maybe that you could have written in or marked that I felt it there and then, so that the cardiologist can see if there is something you have symptoms of or if it just pass by in silence.

I: Yes.

P9: It might could have been wise.

I: What do you think about downloading your results on a PDF file? Do you think it is useful or?

P9: You can't look at all the heartbeats if you take it over a week.

I: No?

P9: It doesn't work. Then it must have been for you to download the recordings it has made where it has detected something.

I: Mhm.

P9: But again, I think, how much should the ordinary man in the street look at his heart rhythm?

I: Mhm.

P9: Maybe it's okay. I'm a little unsure about that.

I: Yes.

P9: If it should be that way, it is your own heart and of course you have the right to see your own heart beats.

I: He-he.

P9: But there is something about the knowledge that they do not have.

I: Yes.

P9: And if they get it down. But the most important thing is that they are told if there is anything and that there is something they should talk to the GP about, or cardiologist. And then they are terrified until they talk to the cardiologist or the GP, because now the app has said that something is wrong with my heart.

I: Mhm. But, seeing that you were at risk, do you think, or now it is still evolving, but would you prefer AppSens or would you have taken a regular ECG?

P9: As of today, as how it works now, I had to have chosen what already exists. But if it works just fine, then I think I'd rather have it than the Holter that exists, with all those wires.

I: Yes?

P9: Yes. For the practical part, it is much easier.

I: Yes.

P9: The R test is not so bad either.

I: No?

P9: There is not very much difference between those in relation to having it on. It has a cord, but you can't shower with it, you have to take it off and on and you may have to change the patches.

I: Oh yes, okay.

P9: So that is how it is perhaps more practical in everyday life. What I am a little skeptical about which I have not received, because now I have not made it wet or anything at all really, around it.

I: No?

P9: When the patch gets wet several times and yes, does it dry properly? Is it disgusting and ugly? Yes, like that in relation to the skin for a long time, I don't know.

I: No.

P9: Im not sure if it would have become worse or better or what.

I: No. What do you think AppSens must think about and avoid for people not to use it? If you have any immediate thoughts about it?

P9: First thing is that it of course must work, but they do not send this on the market before it works.

I: No.

P9: That's the first thing. And then it does not become woman-discriminatory, but it works on everyone, that it is just as comfortable and functional for everyone.

I: Mhm.

P9: And then it must not be too expensive.

I: No.

P9: Because then people will avoid it, I think.

I: Mhm.

P9: Someone pays anything for anything.

I: That's true.

P9: But for those who do not have that good economy will not be able to get it, but they may then choose other things. I don't know if this is going to go under the free card scheme, so maybe that should be considered.

I: Mhm.

P9: This is how it works with the Holter device. But it is not certain that this will do so. It is probably the same with the consultation with the GP, it will probably not be covered under it either?

I: No, you only buy the test.

P9: Yeah, right. But if you are going to buy the consultation with the cardiologist who is going to evaluate it then there will also be an expense. So, it will soon be many kroners, so they have to think about that so they don’t sell themselves out of the market because of the price.

I: Yes, that's true. Do you think this is a product you are going to recommend to others? Not as it is now then he-he.

P9: No, if it is up and running and someone is in doubt about what it is, then I might as well, there are alternatives in the hospital or you can try an AppSens.

I: Yes.

P9: Yes, so I wouldn't have had any problems with it if I knew it worked properly.

I: Yes.

P9: Mhm.

I: The test can be used several times, but only by the same person. What do you think about it? That it cannot, for example, be switched between spouses.

P9: The thing is that it hangs so firmly by the patch, so you have to take it off and then put it back on.

I: The electronic part with the battery part

P9: Yes

I: It can be used several times, but the patch must be replaced between each test.

P9: Yes.

I: Mhm.

P9: So, you could have used it on several people? Or in practice you can do it.

I: You can do it, but it does come up in your cloud that is connected to your social security number.

P9: Yes. So, you can actually do it, you also know that it was the other one that was wearing it.

I: Yes.

P9: So, if there is something there so okay it is your heartbeat, so actually it could have worked.

I: Mhm.

P9: But then it may not be easy the next time when you talk to a cardiologist. Then they must then see what time it is used.

I: Mhm.

P9: It shouldn't be that difficult then. You can cheat this, because if you have used it for a week yourself then you see the result in the app that no here is nothing. For it must be able to be used several times, so if, for example, your husband had taken it afterwards, then it will be in my cloud, his heartbeat. But if anything was found then I would have said that he should go to the GP or the cardiologist.

I: Mhm.

P9: So really then, then it is not foolproof in relation to the fact that others can use it.

I: No, but it can be problematic, that is if you can get it down to PDF, but if you do not, it will lie in the spouse's cloud and it is a bit tricky with privacy and patient safety.

P9: Yes. But it's the spouse's decision, if they think it doesn't matter.

I: Yeah, mhm. It may be a bit difficult to imagine, but if it was packaged or the packaging was environmentally friendly and user-friendly, how do you think it should look like? And what material?

P9: Plastic is really up in time. The thing with plastic is that it is not so dangerous, only that is has to be treated properly after use. I think, I'm a little tired of such huge big boxes when it's not needed.

I: Mhm.

P9: So, as small as possible and also it should be pretty.

I: Mhm.

P9: A little proper. And then of course it should be an instruction manual, but I think that you can find it online. So, it doesn't have to be a thick case to come with it.

I: Yes, just a simple step-by-step?

P9: Yes, it can also say that you can find more information online. But it might not be very under-friendly for older people.

I: No?

P9: When you need it on your phone, check there, you may need to find data and information. But the older ones are getting better and better.

I: They do.

P9: So, it may not be a problem. But that's why I think it should be as small as possible and in a recycled material of course. That it gets packed in it.

I: Yes.

P9: And that there is not a bunch of instructions. They can rather find it online. You must be told how to download the app and it may be in the app an instruction on how to use it.

I: Mhm. So, there is one in the box and one in the app?

P9: Yeah, I think it doesn't have to be a full instruction in the box, only the first step. You may as well show how it should hang, because it can be better with pictures, but you should be able to do it on the website as well if it exists or in the app.

I: Mhm.

P9: So, the most important thing is maybe how to download the app and then get instructions on how to use it.

I: Yes.

P9: Maybe.

I: As I said it consists of two parts, the electronic part that can be used several times, you just have to replace the battery and the patch.

P9: Mhm.

I: Do you think it would have been best to sell a package of one patch and one electronic part, or a package of three patches and one electronic part or another solution?

P9: I think that if you go and buy those patches afterwards then there will be even more packaging because they must also be packed in something.

I: Mhm.

P9: So, I think you might well, you can say that if they are not used then they are just thrown, but I think ... The only thing is that I'm not sure how many times you need it yourself.

I: No...

P9: Because if you use it for a week or 14 days, which will depend on how long the patch and all that will work, then you will think that is has detected what it needs to detect.

I: Mhm. The only thing is that it is said that from the age of 65 the risk increases.

P9: Yes. But how long can it lay at home? How long is the patch durable? If it is durable for three years then it might be okay. But you do not have to do this once a month.

I: No, no. Once a year or every half year.

P9: But if you maybe do it after a year again, if the patch is durable, then that's fine. Now I really forgot your question because I started talking about something else.

I: It was if you would have sold it with ...

P9: So, I think three pieces fine.

I: Mhm?

P9: So, then you have for three years.

I: Mhm.

P9: Or if it suddenly occurs sometime after three months then you have the opportunity to do it again.

I: Mhm.

P9: And then you can buy more patches later.

I: Mhm.

Appendix 12: Participant 10

Male, 67 years old

Date of the interview: 25th of March and 29th of March 2019

First interview

I: First I want to start by asking how old you are?

P10: I'm 67, I was 67 in 2018.

I: Alright, so you turn 68 this year?

P10: Yes, 68.

I: What is your profession?

P10: I'm retired now.

I: Yes, but what kind of education do you have?

P10: I'm a real estate agent, I used to run my own agency.

I: Alright, so you are retired now like you said. Are you often in contact with the healthcare service?

P10: Yes, because I have had a lot or I have among other things had prostate cancer and was operated in 2018. So, I have routine controls because of that. First, I had a three months control, then I'm having a six months control because of that.

I: If I am allowed to ask, answering is completely optional, but do you have any chronic diseases?

P10: Yes, I have something called Polymyalgia Rheumatica. I have to take 5mg of Prednisolon each morning because it is an arthritis. Also, I have had Borrelia that I have struggled with, but I think it is under control now. But when it comes to medicines, I use Prednisolon.

I: Mhm. Have you ever tested any apps or other technology to track your own health?

P10: No.

I: No, so this is new for you?

P10: Yes.

I: Have you done an ordinary ECG before?

P10: Probably. I was hospitalized with a sepsis in November.

I: Uff.

P10: I was hospitalized almost a whole week, quite sick. Because I had, they took a, they took a tissue sample of the prostate gland.

I: Oh, then it developed to a…?

P10: It is usual that you can get an infection there, because it goes through the rectum.

I: Yes.

P10: And then a got a heavy sepsis and was hospitalized a Saturday night, with a very high fever. It was also the number before I was admitted to the intensive care unit and then after a week, Saturday, no excuse me, the Friday after I was discharged.

I: Right, so then they had it under control?

P10: It turned out to be prostate cancer. But I haven't had any radiation therapy or something like that, so the operation was successful.

I: That's good. What do you think could have triggered you to take an ECG test besides if you were rushed to the emergency room or something like that?

P10: No, that must have been if I felt that the heart, if I had any heart problems.

I: What is your…

P10: I do feel that..

I: I'm sorry, please continue.

P10: I can sometimes feel that it can be a little like, I'm not sure if it is atrial fibrillation or that is beats a bit fast.

I: That it tends to flick a bit in a way?

P10: Yes, yes.

I: Yes, then it will be exciting to see if the test manage to detect something.

P10: Yes. Mhm. Yes.

I: What is your expectations for the test?

P10: Nothing special.

I: What do you think about wearing the device on your body 24 hours a day then?

P10: No, it's just the way it is. I could take it off on Friday they told me.

I: Yes.

P10: Then I will do that.

I: Then you do that.

P10: I can't swim with it. I have problems with my leg, the one leg after the operation. They removed some nerves in the stomach and I think it affected some nerves in the leg, so I have to work out carefully. I was thinking of swimming this weekend, but I'll see.

I: Yes.

P10: Then I will remove it on Friday.

I: Yes, it is wise to do. But do you have any concerns that the device could prevent you in your everyday life?

P10: No.

I: No. Are you worried about it not working or?

P10: No, the only thing that I'm worried about is that phone, that I should put it somewhere where I am not present or that it should be discharged or if I press a button I'm not supposed to.

I: Yes, right.

P10: Because this is a phone I borrow.

I: Oh, alright.

P10: Because I have an iPhone myself.

I: Yes, so you got to borrow an Android phone?

P10: Yes.

I: Mhm. Let's say that the sensor would find something, what do you think that you will do with the results? Would you go through your GP or?

P10: No, I expect that, if they find something, they can read it, then I expect that they will let me know.

I: Mhm.

P10: And I expect that I will talk to, that I will get the advices I need and not that I'm left with this to myself.

I: No, right. But do you trust that the sensor is capable of detecting something?

P10: Yes, I might expect that.

I: Mhm. But if you imagine that you have the AppSens sensor versus an ordinary ECG tester, do you trust one of them more or less?

P10: No, isn't this a test thing? So, I guess I trust a ECG thing more than something that is under development, of course.

I: Yes. Are you familiar with the new privacy security law, GDPR, that was introduced last year in May?

P10: Hm, not that much.

I: Briefly, it is about that your data is yours and that the security regarding personal data are stricter. But do you feel that you are provided enough information…

P10: Yes, there are no problems with that.

I: What is your thoughts about that the data that is being stored, or collected will be stored in a cloud?

P10: I don’t have any problems with that.

I: No. You are not worried that the data can be misused or misplaced?

P10: No.

I: No. You don’t have any thoughts around that?

P10: No, I don’t have any problems with that.

Second interview

I: How do you think the test has gone?

P10: No, it's been fine.

I: Is there anything that has been good or bad?

P10: No, no. It's been okay. It has been a little silly to have to go with the big phone in your pocket.

I: He-he, yes, it's understandable.

P10: But otherwise it's no problem. I've been a little scared to get close to the button and that, but I was happy to be done with it now. But there has been no discomfort.

I: No, it hasn't itched or something like that?

P10: No, I have been wearing it, I have showered with it and such and it has been completely unproblematic.

I: That’s good.

P10: So, the only thing is if I went abroad and bathed and sunbathed and those kind of things, it would have been a little weird.

I: He-he. But do you think the test has lived up to your expectations?

P10: Yes, I didn't have any particular expectations.

I: No?

P10: After all, it is the result that counts, it's not my expectations. I don't know what kind of expectations I had. But of course, I assume that there will be some results from this here.

I: Mhm.

P10: Then it is interesting to know what it will be.

I: Yes, of course.

P10: To get some information about it.

I: Yes, yes.

P10: Yes.

I: Now you got help putting on the sensor and connecting it to the phone.

P10: Yes

I: Did it look difficult?

P10: No, it wasn't my phone.

I: No.

P10: As long as I got help, it was okay.

I: But do you think that it would have been fine to do on your own phone?

P10: Yes, I might think so, if it was such an app that was easy to use.

I: Yes?

P10: But I have no relation to that, because I don't know how it works. I just went with it, so it wasn't a problem.

I: No.

P10: I slept while wearing it and, it hasn't been a burden to me.

I: That's good. But do you think, if you were to put the sensor yourself, that it would have gone well?

P10: Yes, I think so, but now I don't know if it's difficult to install that app.

I: No, you can, when it is fully developed, download from the AppStore.

P10: Yes.

I: Mhm.

P10: That should be fine.

I: Yes.

P10: Now I don't know how to connect it, so if I can do it or not, I don't know because I haven't got any introduction on how to do it. But I suppose that if it were like another regular app, then it should have gone smoothly.

I: Mhm.

P10: Mhm.

I: But do you trust that it can give you the correct answer regarding your heart rhythm?

P10: I have no relation to that.

I: No?

P10: I can't take a stand related to that.

I: No.

P10: Because I do not know how well it is developed.

I: No, that’s true.

P10: So, I simply don't know.

I: No. But when it is up and running, now this is just a test.

P10: Yes.

I: If it had found something then you should have been notified on the app.

P10: Should I?

I: Yes. What do you think of that rather than personally by a doctor?

P10: That's fine enough.

I: Yes?

P10: If I had understood it then. Now I haven't checked that app.

I: No, this is just a demo so now that function doesn't work.

P10: No. No then, but it would probably have been very fine.

I: Yes. But do you think this sensor can simplify the current consumer pathway so that more people will check themselves?

P10: So, now I have no problems with the heart.

I: No, but do you think more people would have tested themselves?

P10: Yes, it would probably have been great, instead of going to the hospital and that.

I: Mhm.

P10: Then it is very simple.

I: Yes.

P10: So, then you don't have to spend time with the doctor or other personnel. Just put it on, it is clear that it will simplify.

I: Right. But what do you think about, now you have said that it has been great to wear, how is the user-friendliness overall? Do you think it's been okay?

P10: Yes, based on the small prerequisites I have, it is.

I: Mhm?

P10: Very simple and easy.

I: You felt safe during the test period?

P10: Yes, and I am confident on my health. I know I will be taken care of. But it is clear that it is great if you don't have to go to the GPs office.

I: Yes.

P10: Because of things like this.

I: Mhm. But you have not been afraid to shower with it compared to…

P10: No.

I: No, that's good. Have you ever felt that it has prevented you from doing anything in your everyday life?

P10: No, the only thing is that I have to remember to bring the phone.

I: Yes.

P10: Yes.

I: Mhm. When the app is finished they will offer a cardiology service

P10: What is that?

I: It's a heart doctor.

P10: Mhm.

I: Where you can then pay a sum, I'm unsure of the price, but then a heart doctor can look at your results and give you faster feedback.

P10: Yes.

I: Do you think you would have done it or do you think you would have gone through your GP?

P10: No, when you start approaching 70 and above, if they can measure heart attacks, for example, it is an advantage.

I: Mhm. So then would you have used that service?

P10: Yeah, I wouldn't mind.

I: Yes.

P10: But it doesn't help right away if you have a stroke.

I: No. But the thought behind it is to detect atrial fibrillation that can lead to strokes.

P10: Mhm.

I: Now the app is very simple, is it something you think it should have contained?

P10: I can't, because I have no prerequisites to be able to comment on it.

I: No?

P10: Because I don't know the app.

I: No, it's clear. What do you think about downloading the results on a PDF file? Is there anything you think you needed?

P10: Yes, it could have been okay to know.

I: Mhm. If you were at risk, would you use AppSens or would you use a regular ECG?

P10: If I would have used this one?

I: Mhm?

P10: No, then maybe I wanted to, now that it is under development and if I had been at risk, then I might would have trusted an ECG.

I: Yes. But if it was on the market then?

P10: If it was just as good, then I could have trusted this one.

I: Mhm. Now the case is that the test can only be used by one person, because it connects to your social security number. What do you think about that? That one cannot, for example, switch between spouses?

P10: I don't know, I haven't thought about it.

I: No?

P10: Well, you have your own phone so you can just as easily have each one.

I: Yes.

P10: Yes, but that's how it is. I have no control over the apps for my wife, and I have my apps on mine.

I: No he-he.

P10: So, then we might as well have each one.

I: Yeah, right. Now you may not have thought anything about it, I know it is a somewhat difficult question, but if it should have been packaged in terms of being user friendly and environmentally friendly. Do you have any…

P10: This one?

I: Yes. How it could have looked or what kind of material?

P10: No, it might could have been even smaller.

I: Mhm?

P10: If it would have been possible.

I: Mhm. But the packaging the device should come in?

P10: I didn't see any packaging it came in. They just put it right on my chest.

I: Yeah he-he. It is true. It consists of two parts: the electronic part that contains a battery and a patch.

P10: Mhm.

I: The electronic part can be used again only if you change the battery, but the patch must be replaced every time. Do you think it was best to sell it as a package where you had a patch and an electronic part or a package of three patches and an electronic part or another solution?

P10: I haven't thought about that.

I: No?

P10: I don’t have any relation to it.

I: No.

P10: I might think that it would have been okay to have, to be able to change the patch.

I: Mhm. That you have an extra?

P10: Yes, because you have to take it on and off.

I: Mhm.

P10: That it's okay to have more patches, several of them.

I: Mhm.

Appendix 13: The interview guide

Semi-structured interview guide for both rounds of interviews

For the first round of interviews

Mitt navn er Selma og jeg er på mitt siste og avsluttende år på masterprogrammet ”Business Administration and Innovation in Health Care” ved Handelshøyskolen i København. Dette semesteret skriver jeg min masteroppgave i samarbeid med AppSens. Formålet med intervjuene er å samle informasjon om hva intervju objektene tenker om bruken av AppSens sin sensor, deres forventninger og deres erfaringer etter endt klinisk utprøving. Intervjuene er konfidensielle og anonyme. Intervjuene vil bli spilt inn, deretter transkribert og så analysert. Innspillingene vil bli slettet. Analysen vil skje på et aggregert, ikke et personlig nivå, og ingen identifiserende informasjon vil kunne linke tilbake til deg som blir intervjuet. Du kan trekke deg fra intervjuet når som helst.

PERSONAL INFORMATION	• Hvor gammel er du? • Mann/kvinne • Hva er yrket ditt? • Utdannelsesnivå: hva mange års utdanning har du? • Hva er din arbeidsstatus? (heltid/deltid/pensjonist/student/ufør/annet) • Er du ofte i kontakt med helsevesenet? • Hvis jeg får lov til å spørre, har du noen kroniske sykdommer?
INTENTION TO USE	• Har du tidligere testet ut apper eller annen teknologi for å tracke din egen helse? - Hvis ja, hva slags? Opplevde du dette positivt/negativt? • Har du fått utført en ordinær EKG test før? - Hvorfor? Og hvor (sykehus, fastlege)? - Hva synes du om dette? Hva er dine erfaringer? • Hva mener du trigger deg til å ta en slik test? Eventuelt, hva trigget deg den gangen du gjennomførte en slik ordinær EKG test?
PERCEIVED USEFULNESS	• Hva er dine forventninger til denne kliniske testen? - Hva synes du om å gå med et apparat på kroppen i flere døgn? - Tror du at ved å ha apparatet på kroppen konstant under testperioden vil hindre deg i hverdagslivet ditt? - Er du bekymret for at du ikke skal få den til å fungere? Eller har du noen andre bekymringer? - Hva er dine forventninger til hva sensoren skal gjøre for deg? • Hva tror du at du velger å gjøre med resultatene dersom sensoren skulle finne noe?
TRUST	• Stoler du på at sensoren kan oppdage atrieflimmer eller eventuelle andre hjertefeil? • Stoler du like mye på en slik trådløs sensor teknologi i forhold til en ordinær ledningsbasert EKG måling?

FACILITATING CONDITIONS	• Er du kjent med den nye personvernloven GDPR som ble innført i EU i mai i fjor? (General Data Protection Regulation) • Føler du at du har fått god nok informasjon om hva som skjer med dine data som sensoren samler inn? • Hva synes du om at dataen blir samlet, overført og lagret i en nettbasert sky? • Har du bekymringer for at dataene dine kan havne feil og bli misbrukt?

Be intervjuobjektet om et mobilnummer og avtal neste intervju!!!

For the second round of interviews

EXPERIMENTATION & EXPLORATION	• Hvordan synes du testen gikk?
	• Hva synes du var bra? Hva synes du var dårlig?
	• Synes du testen var enkel å forstå og utføre?
	• Levde testen opp til dine forventninger?
	  - Hvorfor, hvorfor ikke?
	• Nå fikk du hjelp til å sette på sensoren og koble den opp til mobiltelefonen din, hvordan opplevde du vanskelighetsgraden av dette?
	• Dersom du skulle gjort testen helt på egenhånd, har du noen bekymringer til dette?
	  - sette på produktet på deg selv,
	  - koble sensoren og mobilen
	  - noe annet relatert til bruken?

CONFIRMED USEFULNESS	• Stoler du på at testen kan gi deg korrekte svar om din hjerterytme? - Hvorfor, hvorfor ikke? • Hva er dine tanker om å få svar via en app fremfor personlig av en lege? • Tror du at denne sensoren kan bidra til at forbruker forløpet blir forenklet og flere sjekker seg for atrieflimmer? - Hvorfor/hvorfor ikke?
ACTUAL USE	• Hva synes du om brukervennligheten? • Følte du deg trygg i undersøkelsesperioden? • Følte du på noe tidspunkt at sensoren hindret deg i ditt hverdagsliv? - Hvis ja, hvordan? • Hvis du fikk utslag på atrieflimmer, ville du da benyttet deg av kardiolog tjenesten AppSens tilbyr, eller ville du gått via fastlegen din? - Forklar denne tjenesten dersom ikke vedkommende er klar over det. • Nå som du har gjennomført testen, hva tenker du at du vil gjøre med resultatene dine? • Hva tenker du om negative resultater? Stoler du på at dette er korrekt?
EASE OF LEARNING & USE	• Synes du det var enkelt å navigere seg frem og forstå appen? - Var det noe som var uklart å forstå? - Var det noe du synes manglet? • Hva synes du om å få lastet ned resultatet fra undersøkelsen som en PDF-fil?
ACCEPTANCE & REJECTION	• Sett at du var i risikogruppen; ville du da testet deg via AppSens eller ville du ha gått via fastlegen din og utført en ordinær EKG måling? • Hva tror du AppSens må tenke på for å unngå at folk ikke vil bruke produktet? • Er dette er produkt du vil anbefale til andre? - Hvorfor, hvorfor ikke?

ENVIRONMENTAL THOUGHTS	• Hva gjorde du med sensoren etter du var ferdig med testen? - Fikk du beskjed om hvordan du skulle resirkulere den? - Synes du dette virket greit eller vanskelig? • Hva tenker du om at testen kan brukes flere ganger, men kun av samme person? • Hvordan vil du anbefale at dette blir emballert for at det skal være både brukervennlig og miljøvennlig? • Sensoren består av 2 deler, en elektronisk del som kan gjenbrukes mange ganger, og et engangs plaster patch som også inneholder et batteri. Hvordan tror du dette mest fornuftig selges - A. Med 1 stk plaster patch og muligheter for at du separat kan kjøpe flere patcher ved behov for gjentatte tester. - B. Komplett pakke med 3 plaster patcher og 1 elektronikk del. - C. Annet.

Appendix 14: Information letter to the interviewees

Forespørsel til test-personer for AppSens Smart Sensor om å delta i intervju om brukeropplevelse ved bruk av sensoren

Formål

Formålet med prosjektet er å undersøke brukervennligheten og brukeropplevelsen for AppSens hjertesensor. Opplysningene som blir innhentet skal benyttes i en masteroppgave ved Copenhagen Business School.

Problemstillingen i oppgaven er som følgende; *"Hvordan kan Appsens forenkle forbruker forløpet i dektektering av uoppdaget atrieflimmer fra fylte 65 år?"*

I tillegg er det også utarbeidet tre forskningsspørsmål knyttet til problemstillingen:

- Kan AppSens bidra til å oppdage flere uoppdagede atrieflimmer i den norske befolkningen?
- Kan forbruker forløpet bli forenklet ved bruk av AppSens?
- Kan AppSens sikre at forbrukeren stoler på devicen og dermed vil kjøpe denne på apoteket/nettet istedenfor å følge det ordinære forløpet via fastlegen?

Hvem er ansvarlig for forskningsprosjektet?

Det er Dr. Jarle Jortveit som er ansvarlig for forskningsprosjektet som gjelder utprøvingen av sensoren, og dette gjennomføres i samarbeid med Sørlandet Sykehus.

Student Selma Sandberg skal i en egen studentoppgave undersøke brukervennligheten ved sensoren.

Hvorfor får du spørsmål om å delta?

Du får spørsmål om å delta i intervjuer fordi du har sagt deg villig til å delta i den kliniske utprøvingen av sensoren.

Hva innebærer det for deg å delta?

- Dersom du velger å delta i prosjektet, innebærer dette at du blir intervjuet to ganger. Hvert intervju vil ta omkring 20-30 minutter. Det første intervjuet inneholder spørsmål om din erfaring med EKG fra før (dette er selvsagt ikke nødvendig at man har), hvilke forventninger du har til AppSens sin enhet, videre litt om å være tilkoblet et apparat som vil måle hjerterytmen ditt over lengre tid.
- Det andre intervjuet inneholder spørsmål vedrørende din opplevelse av den kliniske testen, litt om å ta apparatet i bruk, hvordan det var å være tilkoblet apparatet, brukeropplevelsen og brukervennligheten.
- Intervjuene vil bli tatt opp på lydopptak.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Dersom du ønsker å trekke deg fra intervjuene vil ikke dette påvirke din deltakelse i den kliniske testen.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- De som vil ha tilgang til intervjuene er prosjektmedarbeider Selma Sandberg og forskningsmedarbeidere i AppSens AS. Veiledere ved Copenhagen Business School vil ha tilgang til innsamlet materiale, men kun etter at intervjuene er ferdig behandlet. Dette innebærer at intervjuene er gjort om fra lyd til tekst og anonymisert.
- Ingen uvedkommende får tilgang til intervjuopptakene. Navn skal ikke oppgis i intervjuene, og når de er ferdig transkribert vil intervjuene får hver sin kode som lagres på en egen liste adskilt fra øvrige data.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Prosjektet skal etter planen avsluttes 15 mai 2019. Lydopptakene vil bli slettet. Intervjuene vil som sagt bli behandlet slik at de vil bli anonymisert og kan ikke spores tilbake til deg.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

Regional komité for medisinsk og helsefaglig forskningsetikk har vurdert prosjektet, og har

gitt godkjenning (REK (2018/1854-3).

Etter ny personopplysningslov har behandlingsansvarlig/prosjektleder Dr. Jarle Jortveit et

selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag.

Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel 6a og artikkel 9 nr.

2 og ditt samtykke.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Dersom du har spørsmål til prosjektet kan du ta kontakt med prosjektleder Dr. Jarle Jortveit, tlf. 99450714, jarle@appsens.no

- Prosjektmedarbeider Selma Sandberg, tlf. 41 76 38 36, mail: sesa17ac@student.cbs.dk

Med vennlig hilsen

Jarle Jortveit
Prosjektansvarlig
(Forsker)

Selma Sandberg
Student/prosjektmedarbeider

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet: Undersøke brukervennligheten og brukeropplevelsen for AppSens hjertesensor, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i intervju
- ☐ at intervjuene blir tatt opp på lydopptak

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 15 mai 2019

(Signert av prosjektdeltaker, dato)

Appendix 14: Audio recorder

The audio recorder used in the interviews are depicted below.

Model: Olympus VN-541PC