

# User interface for registering and sharing health data for patients with chronic diseases

**Niklas Andersson**

DEPARTMENT OF DESIGN SCIENCES | FACULTY OF ENGINEERING LTH |  
LUND UNIVERSITY | 2019

MASTER'S THESIS



**ENGAGING  
CARE**



# User interface for registering and sharing health data for patients with chronic diseases

**Niklas Andersson**



**LUND**  
UNIVERSITY



# User interface for registering and sharing health data for patients with chronic diseases

Copyright ©2019 Niklas Andersson

*Published by*

Department of Design Sciences  
Faculty of Engineering LTH, Lund University  
P.O. Box 118, SE-221 00 Lund, Sweden

Subject:	Interaction Design (MAMM01)
Division:	Division of Ergonomics and Aerosol technology
Supervisor:	Johanna Persson
Examiner:	Günter Alce

## **Abstract**

The cost of healthcare in Sweden has risen steadily since the beginning of the 21st century and one of the major contributors to the increase are chronic diseases. Chronic diseases are complex and long-lasting disorders which cause disability and death worldwide. To counter the increasing trend, studies show that advancements in digitizing parts of the healthcare could make the treatment of patients more effective while at the same time providing better patient centered care. Sweden has set a goal of being the best in the world at using the opportunities offered by digitization by the year 2025 which requires innovative solutions in eHealth.

Engaging Care is a company that wants to change the way communication is done in healthcare by offering a cloud based platform for secure asynchronous messaging between patient and caregiver. This platform could be further developed by incorporating a feature of registering and sharing health measurements performed between revisits at the hospital, which is a common occurrence for patients with chronic diseases. This thesis describes how a prototype of this feature was developed using a human centered design process. The development of the project started with an interview series with chronically ill patients and the development used common methods found in human centered design. The prototype was tested using seven test participants which resulted in a SUS score of 86.7.

**Keywords:** Human centered design, Digital healthcare, eHealth, User interface



# Acknowledgements

---

In this section I would like to extend my gratitude to a number of people who have helped me during this project.

Firstly I would like to thank all of the people working at Engaging Care for their support, help and motivation during the entire process. You have really made me feel like a part of the team and I am forever grateful for the experiences I have received along the way.

I would also like to thank my supervisor Johanna Persson for the valuable guidance, advice and encouragement during the entire process.

My gratitude goes out to all of the patients and healthcare professionals who volunteered to be interviewed for this thesis, as well as all of the people who participated in the user tests. The report would have been nothing without your input.

Lastly, I would like to thank my family, friends and everyone else who have encouraged and supported me along the way.



# Contents

---

<b>1 Introduction</b>	<b>11</b>
1.1 Digitizing the healthcare in Sweden	11
1.2 Engaging Care	12
1.3 Project description and goals	13
1.4 Limitations	13
1.5 Related work	14
1.6 Report structure	14
<b>2 Background</b>	<b>15</b>
2.1 Chronic diseases	15
2.1.1 Chronic respiratory diseases	15
2.2 Self-management	16
2.2.1 Self-management for patients with chronic respiratory diseases	17
2.3 Engaging Care mobile app	17
2.4 Design theory	18
2.4.1 Interaction design	18
2.4.2 User experience	19
2.4.3 User centered design	20
2.4.4 Human centered design	20
2.4.5 Design principles	21
2.5 The human centered design process	22
2.5.1 The four activities of the design process	22
2.6 Methods	23
2.6.1 Interviews	23
2.6.2 Personas	24
2.6.3 Prototyping	25
2.6.4 Testing	26
<b>3 Observation</b>	<b>29</b>
3.1 Interviews	30

3.1.1 Preparations	30
3.1.2 Sample selection	30
3.1.3 Interview design	31
3.2 Analyzing the interviews	32
3.2.1 Method	32
3.2.2 Findings	32
3.3 Developing personas	35
3.3.1 Identifying behavioural variables	35
3.3.2 Mapping interview subjects to behavioral variables	36
3.3.3 Identify significant behavior patterns	38
3.3.4 Synthesize characteristics and relevant goals	38
3.3.5 Completing the remaining steps	38
3.4 Specifying requirements	42
<b>4 Ideation</b>	<b>43</b>
4.1 Concept generation	44
4.2 Wireframing	45
4.2.1 Concept 1 - Extended chat	46
4.2.2 Concept 2 - Health data screen	47
4.2.3 Concept 3 - Notebook	48
4.3 Evaluation of the three concepts	49
4.4 Digital mockup	50
4.4.1 Feedback on the mockup	51
4.4.2 Displaying health data	51
<b>5 Prototyping</b>	<b>53</b>
5.1 Creation of the prototype	54
5.2 Hi-fi prototype	54
5.2.1 Home screen	54
5.2.2 Health data main screen	55
5.2.3 Health data detailed view	56
5.2.4 Adding new measurement	59
5.2.5 Sharing health data	60
5.2.6 Managing measurements	61
<b>6 Testing</b>	<b>63</b>
6.1 Usability testing	64
6.2 Testing scenarios	64
6.2.1 Wireflow of the prototype sections	65
6.3 Results of usability testing	68
6.3.1 Think-aloud protocol and other comments	68
6.3.2 SUS-score	69
6.4 Proposed improvements	70

---

<b>7 Discussion</b>	<b>71</b>
7.1 The design process	71
7.1.1 Observation	71
7.1.2 Ideation	72
7.1.3 Prototyping	73
7.1.4 Testing	73
7.2 The use of digital tools in healthcare	74
7.3 Ethical considerations	74
7.4 Future work	75
<b>8 Conclusions</b>	<b>77</b>
<b>Appendix A Study information</b>	<b>85</b>
<b>Appendix B Informed Consent</b>	<b>89</b>
<b>Appendix C System usability scale</b>	<b>93</b>





# Abbreviations and acronyms

---

app - Application

COPD - Chronic Obstructive Pulmonary Disease

EC - Engaging Care

FEV1 - Forced Expiratory Volume

FVC - Forced Vital Capacity

HCD - Human Centered Design

hi-fi - High Fidelity

lo-fi - Low Fidelity

MVP - Minimum Viable Product

SUS - System Usability Scale

UCD - User Centered Design

UI - User Interface

UX - User Experience



# Chapter 1

## Introduction

---

*The introductory chapter will first describe the relevance of this thesis followed by a short presentation of the company Engaging Care. Afterwards a description of the project, it's goals and limitations will be presented and finally the structure of the report is presented to the reader.*

### 1.1 Digitizing the healthcare in Sweden

*"In 2025, Sweden will be best in the world at using the opportunities offered by digitisation and eHealth to make it easier for people to achieve good and equal health and welfare, and to develop and strengthen their own resources for increased independence and participation in the life of society."* This is the goal set by the Swedish association of local authorities and regions [1]. It is a huge challenge that requires big investments of all players in healthcare but in the same time opens up opportunities for companies, through innovation to streamline the healthcare thereby saving money and preventing suffering.

The cost of Swedish healthcare has risen since 2000 by an average of 4.2 % yearly and requires new solutions to keep an effective and patient safe care [2]. The increase is dependent partly of the increase in population but also of higher unit costs. To keep up with this trend, technical innovations are proposed as a solution where new innovative technology could be the key to combat increased costs and reduced time spent with healthcare professionals. The report 'Värdet av digital teknik i den svenska vården' from McKinsey & Company writes that a fully developed digital strategy where the possibilities have been fully utilised would save 180 BSEK during the period of 2016-2025 [2]. The strategy could also make it possible to provide bespoke healthcare fitted to each individual patient which would improve the quality of the care and increase the confidence in healthcare.

The report from McKinsey & Company has identified seven areas where digital technology has a potential to increase the effectiveness of the healthcare and save money [2]:

1. Distance monitoring with sensor technology
2. Self diagnosis and counseling
3. Distance consultations
4. Internet booking
5. Digital self-care
6. Monitoring of medication
7. Preventive healthcare

As the population increases in age the burden of chronic diseases is increasing world-wide. In 2001 chronic diseases contributed to 60% of deaths but are projected to rise to almost 75% of all deaths in 2020 [3]. Because of the increase in prevalence, the costs of treating these types of patients will also increase, emphasizing the need for effectivization of the healthcare for patients who have the need for continuous contact with doctors or nurses.

## 1.2 Engaging Care

Engaging Care (EC) is a company that develops a cloud based platform for communication between healthcare professionals and patients. With the platform EC want to facilitate the communication between the caregiver and the patient while also encouraging self-monitoring. Today the service consists of:

1. A communication tool for asynchronous text based communication between the caregiver and the patient.
2. A curated list of articles and information specific for the patients' diseases.

The service provides the patient with information that would otherwise be hard to obtain and a way of asking their closest caregiver questions and sharing information about their disease. The caregiver could in the same way send information to the patient and remind them about important details of the care process. The patients can reach the service as a downloadable app on their smartphone while the caregivers use computers to access the service.

EC conducted a pilot study in 2018 where a minimum viable product (MVP) of the platform was tested with 16 organ receivers and their care team [4]. The result from the pilot study showed that all of the patients felt more included in their own care and wanted continued access to the application. The caregivers also felt more prepared before visits when they had the possibility to communicate with the patient in between. This resulted in more efficient meetings.

However, the study also showed a need to be able to digitally note health data and to share it with the caregivers. This finding is the basis of this project.

## 1.3 Project description and goals

From the findings of the pilot study performed by EC there is a need for a better way for patients to log their health data and to share it with their healthcare professionals. Today this is done by providing the patient with a notebook in which the patient is then asked to write down the results of the measurements they are asked to do. This notebook is then brought to the hospital at the revisits where the patient is further examined. A more in depth description of how the measurements are done today will be provided later in the thesis.

Since the core feature of the EC service is to provide a secure and efficient communication channel between the patients and the healthcare professionals, EC wants to investigate if a digital tool for sharing health measurements with the caregivers can be incorporated in the app. During an early meeting with the development team the following questions were asked.

- Can a digital tool be used to provide a better user experience for patients and healthcare professionals in the process of registering and sharing health data?
- How can this digital tool be designed to best fit the needs and wants of the end users?
- How can this potential feature in the best way be incorporated in the EC platform?

By applying a design process with well established techniques methods a prototype of an application (app) will be created thereby answering the questions asked above.

The work procedure will be mostly based on the design process described by Don Norman [5] but some techniques and methods will be brought in from other sources as well.

## 1.4 Limitations

The limitations of this report is partly governed by the sample size that was interviewed. EC has previously made a pilot study that investigated the first release of the app to patients who have undergone organ transplants with their respective caregivers [4]. Since this was the primary contact the company had with the healthcare this population was chosen to be interviewed. Even though the app is meant for anyone with a prolonged disease all of the patients interviewed were patients who had gone through with a lung transplant.

The focus of the thesis will be on the patient interface and the healthcare professionals will not be prioritized in the development of the prototype. This is mostly due to time restraints but should be a priority going forward and implementing the function in the EC platform.

Since the feature developed in this thesis is based on an already existing app the user interface (UI) will have to be designed in such a way as it could be implemented into the existing app. Because of this there are some limitations in how free the design choices can be. How well the concept fits the overall design of the app will be a factor determining the consistency and therefore the result. However, the UI will not be the main focus of this thesis.

## 1.5 Related work

Digitizing healthcare is not something new and has sparked the rise of areas such as telemedicine and eHealth [6]. Digitizing the communication has been tested thoroughly and shows that both demand and support is strong with both patients and healthcare professionals [7]. Many clinics has some sort of digital communication tool and the Swedish municipalities has a shared service called "1177 Vårdguiden" which has some healthcare consulting services.

The explosion of digital healthcare providers such as Kry, Doktor24 and Min Doktor is another example of how the digital tools are being incorporated in the health care industry today. Their main focus is on primary care with chat and video calls for quick consultations and prescriptions [8].

The use of wearables made from non-health companies such as Fitbit, Jawbone, Apple and Nike have emerged as potential tools for the healthcare industry as they can function as indications of the persons health status [9]. However, the implementation of these products have not been only positive and the use of wearables come with some downsides including reliability and the forced use of proprietary software. How often these types of products are used today in a professional setting is somewhat unclear.

## 1.6 Report structure

The report will begin with a brief chapter on the background and theory needed to understand the process, followed by how the design methods were used.

Methods used in the development of the prototype followed the Human Centered Design (HCD) process as described by Don Norman [5]. This process consists of four different activities:

1. Observation
2. Ideation
3. Prototyping
4. Testing

Even though all of the methods used in this thesis can be categorized under one of these activities and are enumerated, the design process is non-linear and iterative. Therefore the thesis will be written in a semi-chronological order where each step will be followed by the next method to make it easier for the reader to understand the logical progression to the next part.

Lastly the report will feature a discussion on some chosen aspects of the thesis followed by the concluding statements of the project as a whole.

# Chapter 2

## Background

---

*This chapter will first cover the necessary background related to chronic diseases and self-management which is central to understanding the patients' situation. After this a brief description of design theory and relevant terms will be covered followed by the methods used throughout the thesis.*

### 2.1 Chronic diseases

There is no consensus on the definition of chronic diseases and the definition changes depending on country, organizations and professional communities [10]. Because of disagreement there is somewhat of a debate on what the definition should be of a "chronic disease" and what diseases should be included in this umbrella term. According to the Swedish national strategy for prevention and treatment of chronic diseases a chronic disease is a "disease that a person has during their lifetime or for a very long time" [11]. This is the definition that will be used in this thesis when referencing chronic diseases. These types of conditions are common and almost half of the Swedish population have at least one chronic disease. Furthermore it is thought that 80-85% of the healthcare costs can be linked to these groups of patients [12]. The most common diseases included are: cardiovascular diseases, diabetes, cancer, lung diseases, mental illness, neurological diseases and prolonged pain [11]. These are all complex and require repeated communication with the healthcare.

#### 2.1.1 Chronic respiratory diseases

One of the major types of chronic diseases are the ones affecting the lungs and airways. It is estimated that more than 1 billion people worldwide suffer from chronic respiratory conditions and in Sweden 1.9 million people live with some sort of respiratory disease [13, 14]. Respiratory diseases make up four of the ten most common causes of death some of



them are entirely preventable [15]. While some have strong genetic dependencies, some are triggered entirely by the environment like tobacco smoking and air pollution which make them to some extent preventable.

Some common chronic respiratory diseases include:

- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Lung cancer
- Cystic fibrosis
- Tuberculosis
- Lung fibrosis

As with many other chronic diseases, chronic respiratory diseases can result in a lowered quality of life and forces the patient to drastic lifestyle changes. This often means the patient needs to regularly monitor their health status. Based on the severity of the disease the diagnosis often mean a life long commitment of performing tests at home and reoccurring visits to the hospital to prevent the disease from developing further [11]. If the condition of the patient is severely worsened the patient ultimately needs a lung transplant. This means that parts of, or the whole lung is transplanted from another human to the patient. While this increases the quality of life for the patient they still require repeated monitoring to prevent a rejection which is a condition where the patient's immune system recognizes the transplant as a foreign object and starts destroying it. To prevent this patients who have undergone lung transplant operations needs to take immunosuppressive drugs for the rest of their lives.

## 2.2 Self-management

As the healthcare has transitioned and the patients have become more empowered the term self-management has been popularized. Self-management is the day to day management, responsibility of patients' well being and the implementation of health promoting activities [16, 17]. Self-management is aimed to provide the patients with knowledge, skills and promote self-efficacy [18]. This has shown to improve the patients health status and reduce the need for visiting the emergency ward [18]. It is also the aim of the Swedish government wherein a patient centered care is being promoted as one of the main strategies combating chronic diseases. In the same report it is proposed that patients with chronic diseases should be able to self manage parts of follow-up and treatment based on their needs and abilities [11]. In a comparison between ten other countries Sweden performed worse in communicating goals, treatment alternatives and providing written plans how the patients should manage their diseases than the average [19]. The possibility of digitizing self-management and self-monitoring of the patients' health could provide the means of increasing the empowerment and responsibility of their own treatment. A study performed by PwC concluded that 79% of healthcare professionals could imagine recommending the use of an app for the control of a chronic disease in the future [8]. This indicates that there

is both a need and the will to use digital technologies for self-management and monitoring of health data.

## 2.2.1 Self-management for patients with chronic respiratory diseases

As with many other chronic diseases chronic lung patients are often asked to self-monitor their health data and communicating it with the healthcare professionals. This is often done before the diagnosis is final to monitor the progression of the health status informing the healthcare professionals how to proceed with the treatment. Patients are given necessary instruments to perform the measurements and an empty notebook where the results are written down. The patient is then asked to bring the notebook to the hospital at the regular revisits where the healthcare professional goes through the measurements, analyzing the health status of the patient and adding it to their journal if necessary. Examples of how a spirometer for home measurements and a filled out notebook can look can be seen in Figure 2.1. Since the revisits can infrequent with long periods of no contact it can be hard for the healthcare professional to get instant updates and is relying on the adherence of the patient to get updates on their well being. The hospital can often times be located far away from the home of the patient. This is for many patients both an inconvenience and pose a risk since chronically ill patients are immunosuppressed because of the diseases or medication and are therefore more susceptible to diseases.

Patients with chronic respiratory diseases are given a portable spirometer and asked to measure necessary values. A spirometer measures airflow and by calculating the volume and speed of the air that is inhaled and exhaled the spirometer gives an estimate of the lung capacity. Portable spirometers have been used for decades to monitor the health status of patients and detecting lung transplant rejection [20].

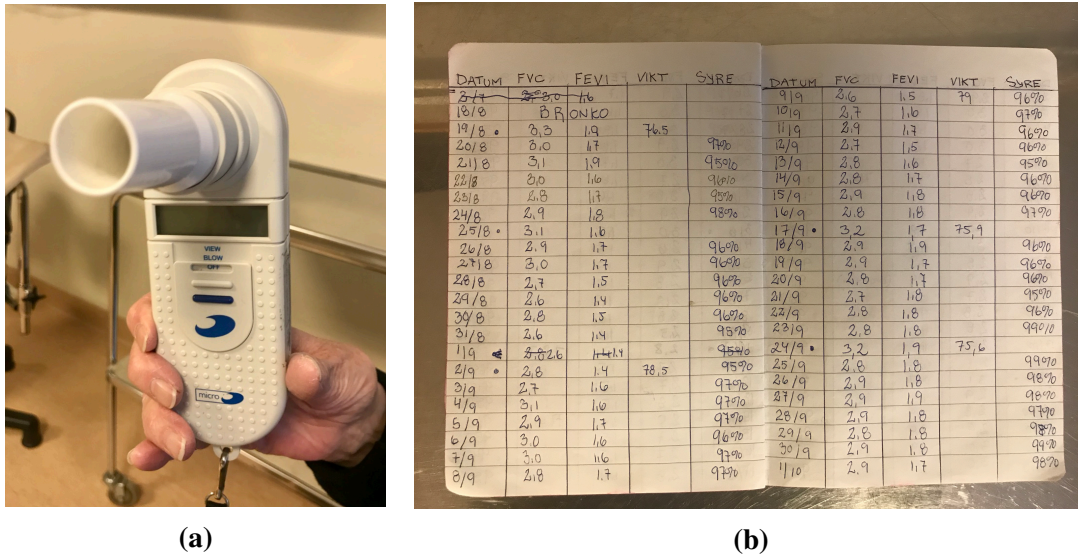
A spirometer has the possibility of performing multiple measurements relating to lung capacity. The most commonly used measurements for monitoring a lung transplant patient are listed below:

**FVC** = Forced vital capacity - measures the total amount of air a person can forcefully exhale into the spirometer after a full inhalation

**FEV1** = Forced expiratory volume in 1 second - measures the amount of air that is exhaled during the first second after a full inhalation

## 2.3 Engaging Care mobile app

As previously described in the introduction EC has developed a computer based interface for healthcare professionals and a mobile app for the patients. From their own smartphone the patients can write messages, send photos and access a library of curated articles written specifically for their disease and recovery process. The chat function works as an asynchronous messaging service which lets the patient reach the clinic at any time of the day. The caregiver can then answer the patient when it fits their schedule. The platform's main user base consists of clinics who deals with patients who have reoccurring contact with



**Figure 2.1:** (a) A Micro Plus spirometer used by one of the interviewees. (b) Notebook with measurements of lung capacity, weight and level of oxygenation performed daily from one of the patients

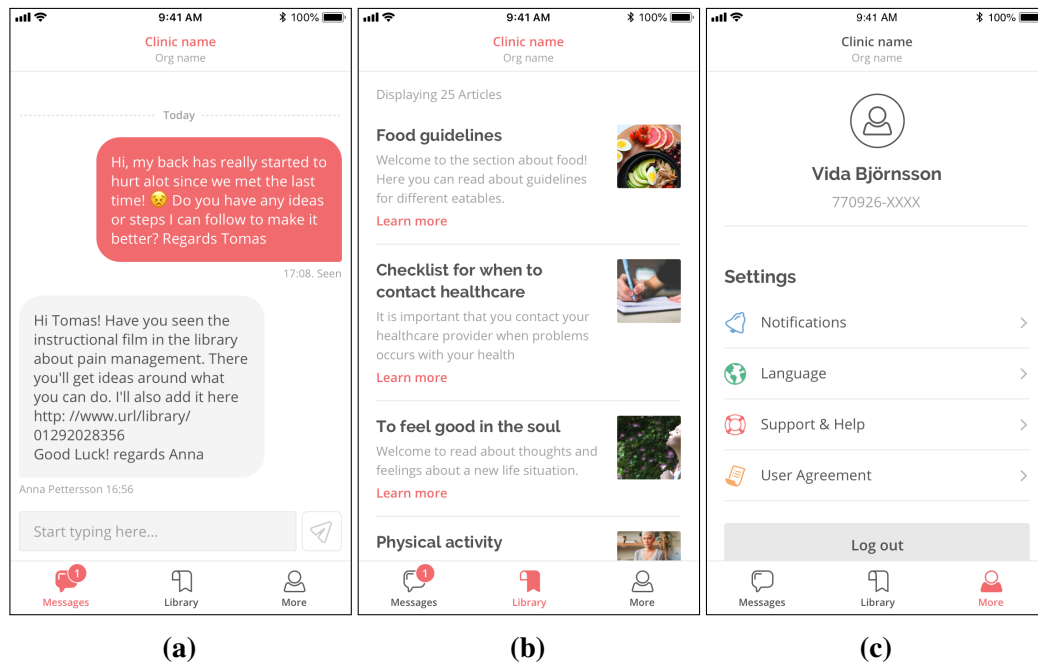
the healthcare as the need for continuing the contact is high. One main advantage is to avoid unnecessary trips for patients between the home and the hospital. This is especially important for patients with respiratory diseases and transplant patients as their immune system is suppressed. The possibility of having direct contact with the healthcare also increases support and facilitates patient centered care. By having curated information in a library the patient can easily find relevant information which is made just for his or her disease. This increases the patient's knowledge and empowers him or her to participate in the recovery, making informed decisions. A cornerstone in the patient centered care [11]. Examples of how the interface can look like from the patient's point of view can be seen in figure 2.2.

## 2.4 Design theory

As this thesis is based on a design process, some background into the subject is therefore needed. Design theory is a vast topic so only a brief description of the most central aspects of the theory will be covered.

### 2.4.1 Interaction design

Most products are designed to interact with the user in some way. This means that the human interacts and cooperates with, through or using the product. [21]. The design of the interplay between the user and product is called interaction design. Preece et al. [22, p. 23] define interaction design as: "Designing interactive products to support the way people communicate and interact in their everyday and working lives."



**Figure 2.2:** The interface of the current version of the EC app. **(a)** Shows the interface for the chat function. **(b)** Shows the main window of the library function. **(c)** Shows the "More" screen.

Interaction design is a field of design where the human interaction with a product is at focus. The goal is to produce a product which makes it clear what it is capable of and allows the users to achieve their intended goal as effective as possible. A product designed with this in mind will result in a better user experience and will yield a more effective use of the product. Interaction design is a multidisciplinary field which involves a lot of different disciplines including design, cognition, information techniques and data sciences to name a few [22].

## 2.4.2 User experience

As mentioned above, the user experience (UX) is fundamental in the interaction design field and describes the users' experiences when using the product. Every product that is used by someone has a user experience and will elicit some sort of feeling when using it [23]. Be it good or bad. The impression of the product and how it works will ultimately dictate how the product is used and what it is capable of. The UX of a product deals with the emotional connection to the product a user gains when using it. A product with good UX will *feel* better and more intuitive whereas a product with bad UX will generate frustration and irritation.

### Usability

Usability refers to the design of a product to optimize it to be easy to learn, effective to use and enjoyable [22]. Usability is part of the UX and has to be viewed in the context of

when and how the user interacts with the product [24]. The official definition is governed by ISO 9241-11 which describes usability as [25]:

*“the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.”*

By ensuring that the product has high effectiveness, efficiency and satisfaction it concludes that the product also has high usability [24]. These terms will be shortly described below.

**effectiveness** - the ability of users to complete tasks using the system, and the quality of the output of those tasks

**efficiency** - the level of resource consumed in performing tasks

**satisfaction** - users' subjective reactions to using the system

How a product is evaluated based on usability is further described in the section on testing.

### 2.4.3 User centered design

User centered design (UCD) is the process of where the end user is the focus during the entire design process and have a big influence over the design choices of a product or service. The concept was first described by Don Norman in the 80's in the book "User-Centered System Design: New Perspectives on Human-Computer Interaction" [26]. In 1985 Gould and Lewis proposed three principles of design that will lead to useful and easy to use interactive products [27].

**Early focus on users and tasks** - The designer must understand who the user is. This is done by research and study of the users, preferably in the environment that the product will ultimately be used.

**Empirical measurements** - Observations and analysis of the users interaction with the product should be made early and continuously in the development process.

**Iterative design** - Any problem that show up during user testing should be fixed and tested again. This will result in a iterative design where the product is made better for each loop.

### 2.4.4 Human centered design

The term Human Centered design (HCD) is closely related to UCD and can be seen as an expansion of the UCD ideas. However the concept has grown and is now an ISO standard, ISO 9241-210 where the specifications and guidelines for designing using UCD are regulated [28]. HCD does not focus on a specific set of users as UCD does but instead addresses the needs of every human, and argues that everyone should be able to use and understand the product regardless of ability, education or background [29]. By applying a HCD process the needs and capabilities of the people who are the intended users are matched by the design [5].

In this thesis a Human centered design process has been applied to answer the questions and reach the goals presented in the project description.

## 2.4.5 Design principles

Creating a good user experience by using a HCD process can be a challenging task as each person perceives a product differently. Using a product is a subjective experience and it can be seen as impossible to adhere to all the differences in the human population. Don Norman presents some design principles in 'The design of everyday things' [5] to help the designer ensure that the experience is overall positive. These have since been expanded upon and there are others that can be used. The principles that are described by Don Norman and Preece et al. will in this thesis be used to explain the design choices made and will therefore be briefly described below [5][22].

### Visibility

Visibility is describing how well a function is seen and found by the user. The more visible any function is, the more likely it is for the user to discover the function, know about it and use it. On the other hand, if a function is hidden or have low visibility it is harder for the user to find it and know about it.

### Feedback

Feedback provides information to the user that an action has been taken. The feedback can be done in many different mediums including visual, aural, tactile or just as text. The information provided should clearly convey what action has been taken so as the user never has to guess what action was taken and what the consequences of doing so will be. This will help the user faster understating how the app works and preventing the user doing the same error many times.

### Constraints

In the same way you can increase the visibility of an action you want the user to take, you can constrain the action the user can restrict the actions a user can take at a given moment to not let the user make incorrect actions. These actions will make the user not make mistakes or take the wrong action.

### Consistency

Consistent design will be easier to understand for the user since the design follows unspoken (or outright given) rules where the same type of action garners the same response. Since the response will be the same for each action that follows a set rule it will take shorter time for the user to learn the UI and will make the user intuitively understand what the next action should be.

### Affordance

Affordance of an object is how well the design of the object conveys what the object does. An object with high affordance it will be very clear how to use it and what it will do.



## 2.5 The human centered design process

Going from a problem which needs to be solved to a completed solution is not a straight linear process but an exploratory process which can take multiple side steps to ensure that the correct solution is being developed. There are many different approaches to how this can be done based on the different aspects and perspective of interaction design. This thesis will be based on the HCD process governed by the ISO standard [28]. Don Norman describes in the book 'The design of everyday things' how the HCD process can be achieved by following a set of general activities connected to each other [5]. These activities are listed below:

1. Observation
2. Ideation
3. Prototyping
4. Testing

These activities should inform each other of the next step in the process and are iterated, over and over until a desired solution is found. As the iterative nature of HCD is incorporated in the design process the solution will continuously be refined and improved upon [5, 21, 22]. This does not only mean that the four activities are repeated but the methods in each activity is iterated until enough information is gathered to continue to the next activity. The insights gained in one activity will influence the way to conduct the following activity based on what the results or data says.

Even though this thesis is mostly based on the HCD described in 'The Design of Everyday Things' some aspects of the book 'Interaction design: Beyond human computer interaction' and 'Interaktionsdesign och UX' will be incorporated as well [5, 21, 22]. The basic layout of the process from nothing to a finished product is quite similar and incorporates mostly the same activities. A visualization of how the activities connect to each other can be seen in figure 2.3.

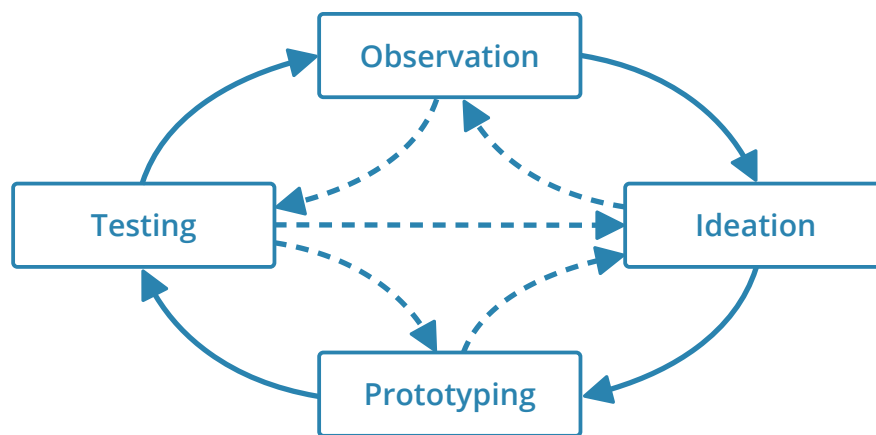
### 2.5.1 The four activities of the design process

#### Observation

The first activity of the design process is to observe the intended user and their activities to understand their interests, motives and needs [5]. By investigating the users the designer can then formulate the problem and the requirements that the final product should have. There are many different methods that can be applied in the observation activity but the main goal is the same - to gain a deeper understanding of the users and how they will perceive and be affected by a new solution or product.

#### Ideation

The activity of generating concepts and ideas of solutions is called ideation and follows the observation activity. In this phase of the process the goal is to create multiple conceptual



**Figure 2.3:** The human centered design process as presented by Don Norman [5]. Additional lines has been added to emphasize the iterative aspects of the design process based on the method used by Preece et al.[22]

models of how the problem can be solved. The concepts can then be further detailed with specific design choices as the concepts are developed.

## Prototyping

The interactive aspect of the design can not be truly evaluated before interactive prototypes of the ideas are created. Prototypes are tangible interfaces of the concepts developed in the ideation activity. The prototypes lets the user interact with it as if it is a real product without having to create a fully functional version each time.

## Testing

By testing the design choices it can be quantified how well the product performs in terms of usability and user experience. This will highlight the design choices that can be improved upon and actually see what the users think of the product. Since the product is going to be used by the intended users once released, it is advantageous to use the end users to perform the testing as well.

## 2.6 Methods

### 2.6.1 Interviews

Interviews are a way of gaining direct input from the user and is a guided conversation where the interviewer asks the interviewee questions about a specific topic. There are multiple varieties of interview techniques ranging from how much control the interviewer has over the discussion [22]. These will be shortly described below.



**Unstructured interview** - Exploratory conversation with open ended questions which gives the interviewee the possibility of answering as long or as short as they want. No script is used but instead a brief list of topics that can be discussed during the interview. This gives the interviewee the possibility to go in depth in the answer and the data to be complex and rich.

**Structured interview** - Structured interviews have a set script with questions that have been written before the session. The questions are often short, closed and have a set form of answers that the interviewee could answer e.g yes or no.

**Semi-structured interview** - A mix of both unstructured and structured interviews with both open ended questions and closed questions. There is a script prepared before the session, however the interviewer can at any moment probe further to gain more information about a topic if needed.

These different interviewing techniques can be used in different stages of the designing process and makes the interviewing method a powerful tool to be used in any part of the product life cycle. The amount of structure the interviewer poses on the questions will affect the ratio of qualitative and quantitative data received. A more structured interview will yield more quantitative data which will be easier to analyze but will not be as in depth as the qualitative data that a more unstructured interview will yield.

### 2.6.2 Personas

As mentioned in the design theory, understanding the users' needs and motivations for their behaviours is key to designing a successful user centered product. Since the product cannot be aimed at each specific person it can be useful to use models to represent different user groups. The models are used to describe the behaviours, motivations and thought of each individual by aggregating them into more comprehensive descriptions. The models used to represent a group of users is called personas [22, 30]. Cooper et al. [30] call personas "composite archetypes" and is grounded in the data gathered from the actual users in the observation phase. By grouping similar behavioural patterns into archetypes, an understanding of how the users are behaving can be found and personas can be developed. The models can then be used to emphasize the commonly occurring behaviours and characteristics of the users. It should be said that not all the users can be accurately portrayed in one persona and that multiple personas should be used for a project. Cooper also writes that one of the main strengths of using personas in the design process are that they can determine what the product should and can do. In the early ideation phases personas can be used to empathize with the users, helping create concepts and function. Later in the process personas can be used to evaluate the developed concepts [30].

One of the most important properties of the personas should be the goals of the fictional characters. Goals correspond well with the cognitive processes of all humans and is an easy way of constructing life like personas. However peoples' goals are hard to articulate and not be asked in the interviews but instead be reconstructed by the observations, interview answers and behaviours done in the data gathering. Cooper et al. [30] presents three basic goals a human have:

**Experience goals** - How the user wants to feel while they are using the product

**End goals** - The motivations of why the users are using the product. What are the thought of outcomes for using the product?

**Life goals** - Hopes the user have outside of using the product. These are long term desires and motivations and are important for the connection with the product.

Since personas should always be grounded in real people the creation should always start with data gathering of some sort [31,32]. After thorough data gathering the following steps are proposed by Cooper et al. [32] to create the personas:

1. Identify behavioral variables.
2. Map interview subjects to behavioral variables.
3. Identify significant behavior patterns.
4. Synthesize characteristics and relevant goals.
5. Check for redundancy and completeness.
6. Expand description of attributes and behaviors.
7. Designate persona types.

Arvola presents a similar way of developing personas where behavioural variables are found and mapped on scales ranging from one extreme to another [21].

### 2.6.3 Prototyping

A prototype is a model of the final user interface used to test the design ideas created in the ideation phase of the design process. Prototyping is the process of materializing the ideas that are generated in the ideation phase to a tangible artefact. A prototype can be seen as an early draft of how the final product will look like and work [21]. Ideas communicated as a description or by word can be hard to interpret and evaluate. Instead a prototype can be used to show rather than tell the user what the end product will be. Prototypes have the advantage of not requiring the same amount of development time as a finished system but can still give the same feelings as a finished interface. As the final products often are interactive, it would be impossible to recreate the sensation for the user if the user could not interact with the idea. Often a prototype is limited to some areas of the fully developed product where the functions that are of interested are emphasized and expanded and other aspects are de-emphasized [22]. Prototypes can take many forms, from simple sketches and mock-ups to fully fledged interactive prototypes where the users input will garner some sort of response from the system.

#### Low fidelity prototyping

A low fidelity prototype (lo-fi) will, as the name implies be a low tech rendition of the final product and can be made in many different ways. Lo-fi prototypes are often made using pen and paper and only shows the most basic of information in the interface [5]. In

some cases the user can still interact with the prototype, with the help of the designer who controls how the 'system' works. The main advantage of using lo-fi prototypes is that they require very little time to produce while still being able to test the basic functions of the system.

### High fidelity prototyping

High fidelity (hi-fi) prototypes more closely resembles the finished product and will have more integrated functionality than lo-fi prototypes. However the hi-fi prototype is not a complete system but a set of chosen functions which are more or less developed. In this stage of the process design choices has been made for the UI and the interactive aspects of the prototype is fully developed [22]. Hi-fi prototypes are often developed using specific prototyping software which makes it possible to add interaction and responses to the designed system.

### 2.6.4 Testing

Testing a design is an important step in the process since this is the step that finally tells the designer if the idea and the implementation of it is done in a satisfactory way. Tests are techniques that the users interacting with a product, usually with the goal of assessing the usability of that product [21, 22]. A product could potentially fulfill all of its requirements from a technical aspect but still fail if the usability of the system inhibits the user from reaching its intended goal. Therefore it is vital for the designer to test how the user interacts with the product in order to test if it performs in the way it was designed. The main methods for evaluating and testing the design in the various stages of this thesis are presented below.

#### Cognitive walkthrough

Evaluation of a concept or a product can be done without user tests and still be a reliable way of testing the functionality and usability of it. Cognitive walkthroughs are a way of simulating a user's problem-solving process at each task to complete a set goal [22]. By using a task centered approach walkthroughs are used to evaluate how well integrated the functions are and how easy it is to understand the functionality of the system. The general goal of the walkthrough is to test if the end users would find the concepts easy to use without any prior knowledge of the system.

For each step towards an end goal set up by the designer the following questions needs to be asked [22]:

- Will the user know what to do to achieve the task?
- Will the user notice that the correct action is available?
- Will the user associate and interpret the response from the action correctly?

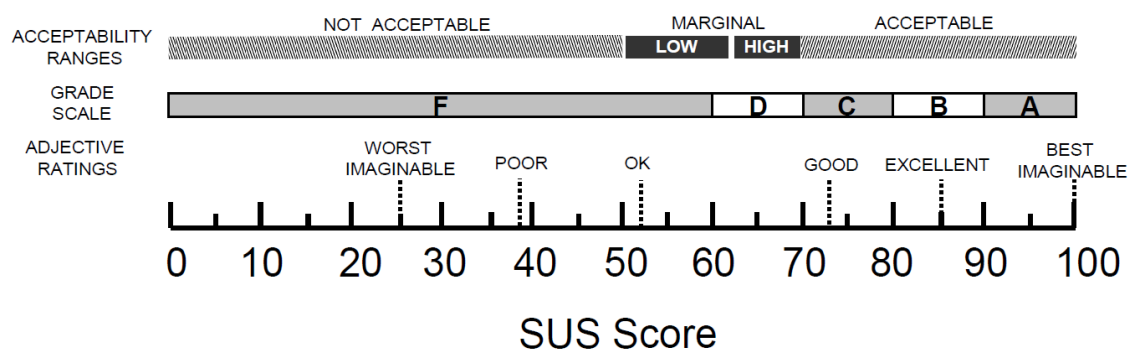
By answering these questions from the point of view of a typical user the designers can then gain insights of strengths and weaknesses of the system. The pro of using cognitive walkthroughs is that no user tests are required. However deep knowledge about the end users is necessary for being able to conduct a reliable evaluation.

## System Usability Scale

The system usability scale (SUS) is a test made for a wide variety of interfaces [24]. It has been shown that SUS is highly reliable, even when comparing with other similar tests and with varying sample sizes [33]. The test comprises of ten statements, five positive and five negative. The user is asked to rank the statements on a 5 point scale going from “strongly disagree” to “strongly agree” [24]. These are converted to a numerical score ranging from 1-5. The questions the user is asked to answer are listed below:

1. I think that I would like to use this product frequently.
2. I found the product unnecessarily complex.
3. I thought the product was easy to use.
4. I think that I would need the support of a technical person to be able to use this product.
5. I found the various functions in the product were well integrated.
6. I thought there was too much inconsistency in this product.
7. I imagine that most people would learn to use this product very quickly.
8. I found the product very awkward to use.
9. I felt very confident using the product.
10. I needed to learn a lot of things before I could get going with this product.

Every other question is a positive and negative statement and the scoring of them are calculated differently. For odd statements (positive) a new score is calculated by:  $Score - 1 = Score_{new}$ . For even statements (negative) the score is calculated by:  $5 - Score = Score_{new}$ . The new scores are then added together and multiplied by 2.5 to yield the overall score of the product. On top of yielding a numeral score from 0-100 Bangor et al. added an additional adjective rating scale to translate the score into a qualitative assessment of the usability [33]. The scale with the added adjectives can be seen below in figure 2.4.



**Figure 2.4:** The system usability scale with added adjectives describing the scores [33]

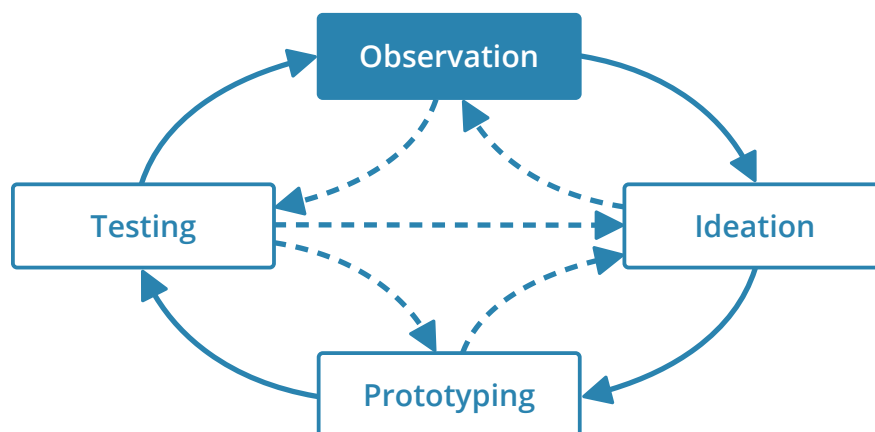


# Chapter 3

## Observation

---

*The initial step of the human centered design process is observation. The purpose of the observation activity is to conduct the initial research to fully understand the users' needs, capabilities, and behaviors. How the observation activity was performed will be described in this chapter.*



## 3.1 Interviews

In the beginning of the observation activity one interview was held with a nurse at the transplantation clinic where the following interviews were going to be held. This interview was more exploratory in its design and followed an unstructured interview design. The findings of this interview laid the foundation of the background information of chronic diseases previously described. The analysis of this interview will not be presented here as it would be a repetition of the information already presented to the reader. Instead the patient interviews will be described below.

### 3.1.1 Preparations

The objective of the patient interviews was twofold.

1. Interviewing patients would give more in depth knowledge about the potential users of EC's product.
2. Knowledge about how the users would perceive a health data measurement tool could be investigated and direct questions about its form could be asked.

To be able to create a script for the interviews the main topics of discussion was discussed with the colleagues at EC to ensure that the correct information would be received after the interviews. A basic script was written with the intent of gaining the sought information based on the feedback from EC.

### 3.1.2 Sample selection

A total of five interviews with patients were performed. All of the patient interviews were conducted at the hospital in connection to a revisit at their main health clinic. The interviews took 30-50 minutes depending on how much time the patients had and how detailed the answers were.

All of the interviewed patients had at some point in their lives performed a lung transplant but had different diseases leading up to the transplantation. The diseases were chronic obstructive pulmonary disease (COPD), Cystic Fibrosis and alpha-1 antitrypsin deficiency.

A close dialogue was held with the healthcare professionals at the transplantation clinic on the selection of the patients. A lot of energy went into trying to find as diverse set of interviewees as possible regarding gender, age, background, etc. A summary of the patient demographics can be seen in Table [3.1](#). Prior to the interviews each patient received a short summary about the project which can be seen in Appendix [A](#).

The choice of using this patient group was based on multiple reasons. The clinic at which the patients were treated had previously been part of the pilot study and a good relationship with the company. The patients who have gone through with a lung transplant will have continuous contact with the healthcare for the rest of their lives. Lung transplant patients also perform more follow up on health data than many other patients. The patients that have performed a lung transplant also fit the segment and markets (customer profile) that EC are focusing on at this time.

**Table 3.1:** Sample demographic.

Interview	Gender	Age
1	Man	43 years old
2	Woman	20 years old
3	Man	50 years old
4	Woman	62 years old
5	Man	58 years old

### 3.1.3 Interview design

The interviews followed a semi-structured script where some main topics were discussed. Since most patients have very different stories and their experiences differ some questions were not applicable. The semi-structured interviews were also used not to break the natural flow of the conversations and to let the interviewee answer the questions in their own words with as much time as they wanted. This also made it possible to probe deeper into specifics of the users' experiences. The outline of the script followed the following topics:

- Basic demographic information.
- In your own words, would you like to describe the history of your disease?
- Have you on your own looked after information about your disease and in what ways have you done it?
- When you were discharged from the hospital, were you asked to perform any measurements of your health data?
  - if so, how was that data communicated to the healthcare professionals?
- Did you perform any measurements of health data that you were not asked to perform?
- How often and in what ways did you have contact with your healthcare professional?
- Assuming that there would be a way for you to digitally communicate health data measurements with your healthcare professional, how would you like that feature to look?
- How do you experience the revisits at the hospital?

The interviews were all recorded with a microphone and were transcribed to be able to analyze the interviews multiple times. Prior to the interviews the patients were again read the information about the study and were asked to sign the informed consent seen in appendix [B](#).



## 3.2 Analyzing the interviews

### 3.2.1 Method

Analyzing the interviews was performed by listening to the interview and transcribing the interviews to text. To be able to categorize the information gained from the interviews a qualitative content analysis of the transcriptions was performed [31, 34]. The analysis was performed in a low level of detail where themes and patterns were analysed and anything more specific than that were discarded [22]. Interesting passages in the interviews that showed typical characteristics for that person were highlighted. Since the focus of this project was how they would perceive a new digital tool for measuring health data the focus of the content analysis were on how they would perceive such a tool. Groupings of the annotations and key findings were put on post-its and grouped together based on overlapping themes [22]. The groupings featured demographic information, different aspects of the disease, how they communicated with the healthcare today, how they would perceive a new digital tool for measuring health data. If a patient's view on a subject was missing the transcribed interview were looked through again to find confirming or refuting evidence of the persons opinion on the subject. Although in some patient interviews it was hard to find any indication of one view or another on a subject and their opinion were therefore opted out of the group. This was so that there were no guessing of any individuals' opinion and that all opinions were well motivated from the interviews. From the groupings it was clear that there were a wide spectrum of opinions on most subjects.

### 3.2.2 Findings

The interviews were helpful in understanding the users and provided information about the daily lives of patients who had performed a lung transplant. A summary of the major take home messages from the interviews will be presented and afterwards a chapter of how the data was processed.

#### Overall perception of the healthcare

All of the patients interviewed were overall very happy with their care and attributed that to the team based healthcare that the staff provides. This gives the people a personal connection to the healthcare as they often meet the same care giver which follows the progression through multiple years. For one patient up to 20 years. As this was probed further it was found that this was also a good way to motivate the user, making them more prone to adhering to the health regimen. Most patients interviewed were born with their diagnosis and had been dealing with the ramifications of the disease for their entire life. One patient told that during the first year after the transplant they visited the healthcare team "25-50 times" and developed a strong personal connection to the team and their specific nurse. Automated responses were not considered as motivating as the personal feedback a healthcare provider could give.

## **Remote communication with healthcare professionals**

Communicating with the healthcare remotely was some of the most common complaints of the interviews. Half of the interviewed patients had some complaints regarding how well the communication worked. For some patients it felt hard to reach the nurses or doctors over the telephone since they often were put on hold. The nurses does not have specific roles where one is in charge over answering the phone but are left to answer it or return calls when they have some time over from helping other patients in the clinic. Since it was common for patients to not be answered immediately, some patients had changed their routine of contacting them, going from calling on the telephone to emailing, saying "they are so hard to reach here in Lund". This underlined the need for a secure asynchronous messaging service where non acute queries could be answered remote.

## **Perceived intercommunication between healthcare professionals**

The problems with communication were not only felt between the patient and the healthcare professionals. The patients who were coming from other municipalities and therefore had other hospitals as their main hospital, had been experiencing miscommunication between the two hospitals. A lot of responsibilities were put on the patients. One patient recalled "...sometimes when you are admitted to the hospital you are not allowed to be in charge of the medication yourself, but that a nurse have to do it and it is not always that it's right". These patients were also afraid of forgetting important information about their disease and medications since it was not necessarily communicated between the home hospital and the transplant clinic. This was further highlighted by the fact that they seldom gained a written report about how well they performed on the yearly reviews.

## **Contact with multiple units within the healthcare**

Chronic patients have contact with multiple departments within the healthcare that does not necessarily communicate with each other. These departments have different interests with the patient and are therefore interested in different aspects of their health. Since chronic patients often have multiple diagnoses this means that the risk of receiving contradictory information is high. Some patients told that the way of monitoring the different aspects of their health status differs between clinics and that a centralized way of doing it would be positive.

## **Health measurements**

How often the patients performed health measurements were very different and both depended on their health status and how involved they were in their recovery. Some patients were newly transplanted and were therefore asked to perform measurements on lung capacity, temperature and weight more often than patients who had gone years since their transplant. Many of the patients felt a responsibility to do everything in their power to be as healthy as they could since they knew what had been required for them to continue living.

"The responsibility came automatically with the transplant since it was a gift from someone who had deceased". However there were still some variability of the desire to be active and proactive in how they dealt with the recovery. Some patients only did as they were told by the healthcare professionals and some went above and beyond, measuring other parameters than the ones asked for and staying on up to date of the newest findings from academic research. These patients are sometimes called e-patients and are more participatory in their treatment, trying to be proactive [35]. The reasoning for making additional measurements were primarily to increase the self sufficiency and take control of their own disease and recovery.

## Process of measuring health data

There were some differences in how the data from the health measurements were noted. Some patients were preferring the pen and paper solution where each day the value was written down and given to the nurse at the revisits. Some patients liked to note the measurements digitally on their smartphone as it was always with them and gave the possibility of drawing graphs based on the data. The question of reminders were brought up and the ones that finds the feedback form a digital app motivating were more inclined to think that such a system would increase the adherence to the measurements. One interviewee said during the interview that she felt old fashioned but wanted each device to be separate. This so that "if the battery on my phone dies i can still make measurements of my blood sugar". Some interviewees were also worried that this would be just "another device" that they were forced to use. This was also highlighted by the fact that few of the interviewees were positive of the notification feature. If such a feature would be implemented it would have to be optional.

## Adherence

The adherence to the measurements were not primarily that the measurements were hard to do or annoying but more that for some patients felt unnecessary. Since most people had been sick since birth they had developed such a good feel for their own body and are confident in that they would feel sick or worse than usual if something was wrong. Measurements were in many cases only done to confirm their suspicion if e.g they felt like they had a fever or something similar. However, during one of the interviews the patient showed the notebook where all the measurements from when she began recording them were. This showed that some people took the responsibility seriously of performing measurements on a daily basis. Figure 2.1b shown in the background depicts one the patient's notebook with routinely filled out measurements.

## 3.3 Developing personas

Even though the data from the interviews showed some definitive overlapping it was hard to quantify the data into something tangible. With the limited access to patients and the amount of qualitative data it was decided to create personas from the interviews. This would help quantifying the findings described in the earlier chapter and be a useful tool to evaluate the proposed solutions in the future. On top of the use in this thesis the development of personas would also serve as an intermediate goal as they can be reused in future EC design projects that need to be user centered.

The development of the personas mainly followed the method by Cooper et al. [30] and briefly described in the Methods part of the thesis.

### 3.3.1 Identifying behavioural variables

To develop relevant behavioural variables the findings from the interviews were analyzed. As relevant information was read the corresponding opinion, view or thought was searched for in the other users' interviews and notes. Following the recommendation of Cooper et al. the focus was laid on the interviewees' activities, attitudes, aptitudes, motivations and skills [30]. Because of the semi-structural script used in the interviews and the post interview analysis of the transcription this was fairly easy to find. If the transcription analysis had missed an important aspect of the user's interview, the transcription was re-analyzed.

Some of the most telling quotes were noted as they could serve as further inspiration of the persona biography. Examples of quotes like *'I'm very active in my own disease and have always been. I'm not a person who keeps it [the sickness] a secret but put it out there first'* would confirm that the patient is very active in the recovery and is generally open with the disease. Once all of the interviews had been analyzed a total of 14 potential behavioural variables were found where 8 of them could be completed with views from all of the patients.

The following behavioural variables were found and analyzed

- Opinion on new digital tool
- Frequency of measurements
- Frequency of contact with healthcare outside of appointments
- Motivation to do measurements
- Preference of raw numbers or graphs
- Openness with the disease
- Desire to be active in the recovery
- Prerequisites to be active in the recovery

These variables were identified as key to understanding the users and how they would perceive a new digital tool to use as a communication device with the healthcare.



Patient 1: Male. 43 years old



Patient 2: Female. 20 years old.



Patient 3: Male. 50 years old.



Patient 4: Female. 62 years old.



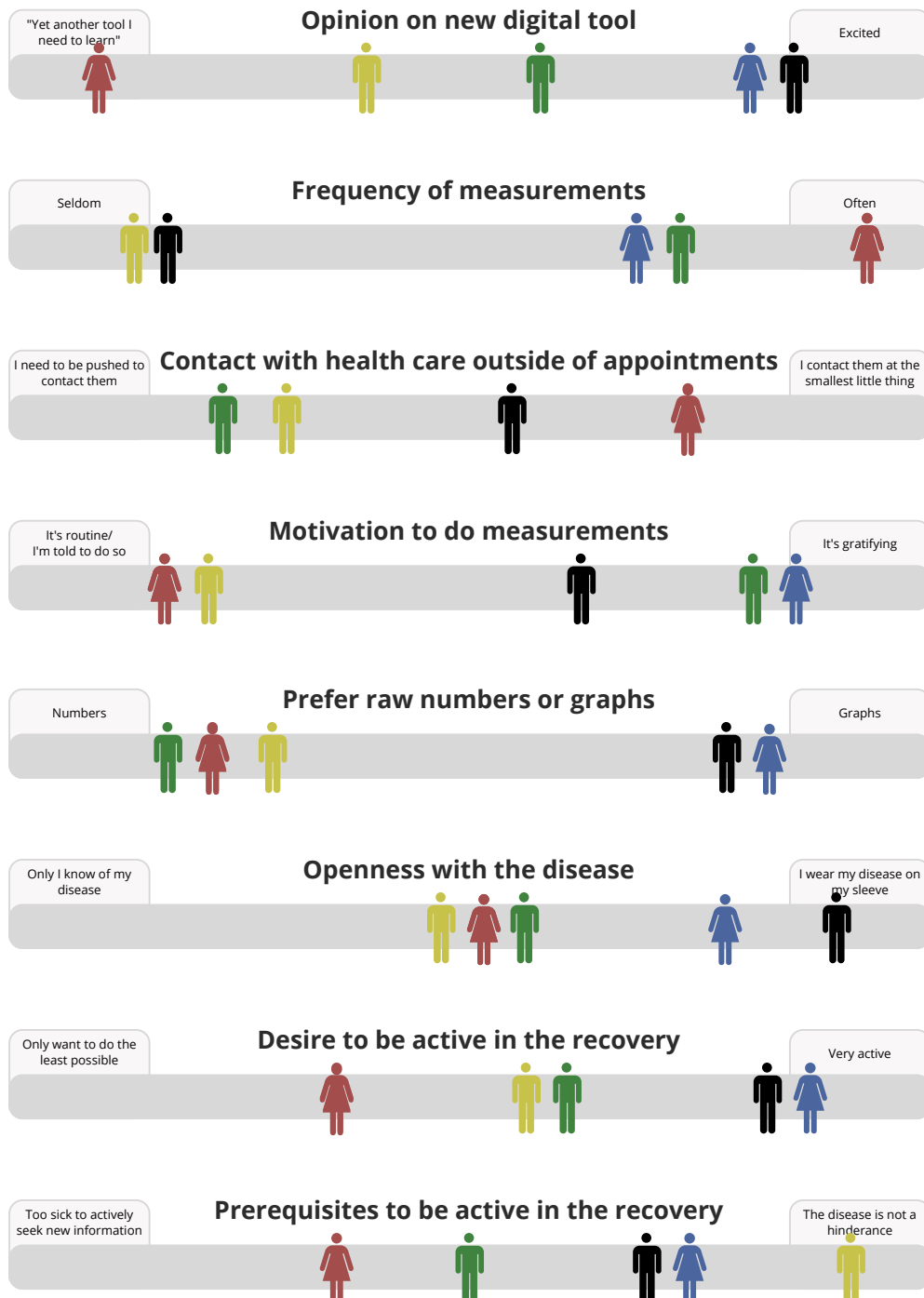
Patient 5: Male. 58 years old.

**Figure 3.1:** The icons used to describe all of the patients interviewed in the spectrum of behavioural variables

### 3.3.2 Mapping interview subjects to behavioral variables

The variables identified in the previous step were put on a scale reaching from one extreme to the other where each person was then mapped based on the data given in the interviews. The extremes in each case was chosen arbitrarily while fitting a spectra of people. As the population of interviewees were somewhat small the spectra was widened to fit in potential other patients on the scale. The scale with the mapped patient can be seen in Figure 3.2. In figure 3.1 a map over the icons used for keeping track of each individual is shown.

## Behavioural variables



**Figure 3.2:** Mapping of the subjects

### 3.3.3 Identify significant behavior patterns

Based on the mapping two distinct behavioural patterns emerged. These can be seen in figure 3.3. One being the "Extrovert e-patient" and another being the "Independent patient". These names are used mainly to distinguish them from each other and had only a loose connection to the mapping of the data. The first persona emerged from the often clustering of the blue and black interviewees where as the second one was based on the often grouped green, red and yellow interviewees. How the two behavioural patterns emerged can be seen in Figure 3.3

### 3.3.4 Synthesize characteristics and relevant goals

Based on the behavior patterns gained from the mapping the personas could take form. Starting by writing motivations of why the behaviour patterns emerged the personas consisted by brief bullets and notes. Searching for observed quotes in the interviews that would explain the motivations of the personas were prioritized.

#### Goals and frustrations

Since none of the interviewees had tried the EC app before the interviews it was hard to ask the specific questions about end goals or life goals. Therefore it had to be interpreted from the overall answers to the questions asked. However, because of the questions spanning multiple topics it was fairly easy to find information that could be synthesized to relevant goals.

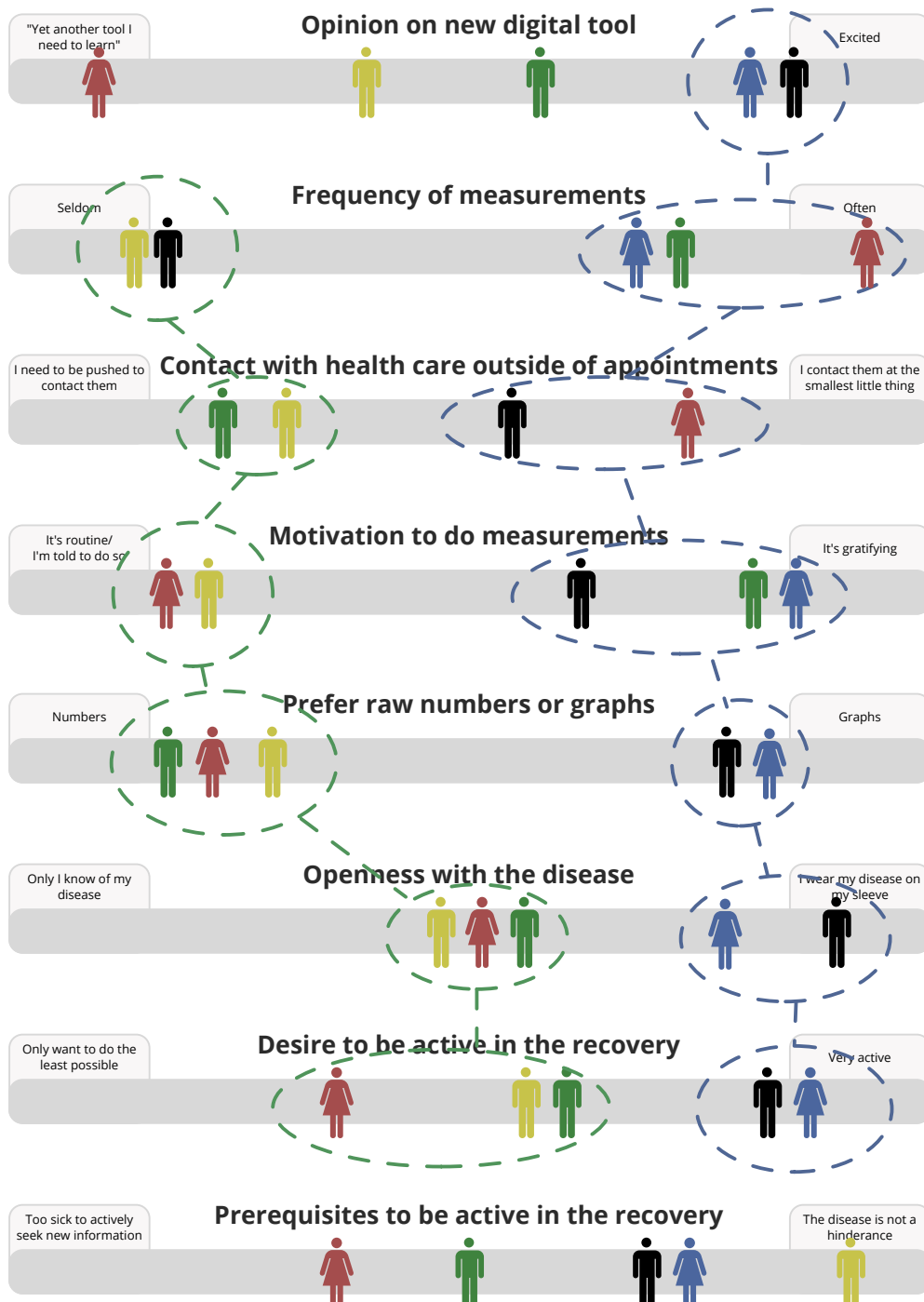
### 3.3.5 Completing the remaining steps

At this stage the personas were almost finished and the remaining actions were therefore completed in one step.

As there were a lot of information about the interviewees that were not able to fit in the biography a section of quantifiable sliders were added. These would convey information that were more related to the use of a digital app and would be an easier way of comparing the two personas, turning qualitative data into more comparable parameters. The biographies were expanded with more information and a section explaining the personas' diseases were added. This would convey the history of each persona's disease and how it affected them from an early age. As a finishing step of writing the biography a descriptive quote for each persona was added.

The last step presented by Cooper et al. is to assign a persona type, prioritizing them but since both persona types were equally important and based on the end user group they were both assigned a primary priority. The finished personas can be seen in figure 3.4 and 3.5

## Behavioural variables



**Figure 3.3:** Mapping of the subjects with identified behaviour patterns.





**Emma Lind**  
 26 years old  
 On sick leave  
 Lives in Malmö  
 Lives at home with mom and dad

*"I usually ask people in the transplant group on facebook if they got the same information as me whenever I learn something new"*

**About Annas disease**

Anna has been diagnosed with Cystic Fibrosis since birth. 4 years ago she got a lung transplant which got rejected 1 year ago. She therefore had to go through another lung transplant.

**Biography**

Each day Anna measures her lung capacity and weight. Afterwards she puts the numbers in a note taking app with a note which she shows her nurse at each visit which is every week. She never uses the provided notebook since she forgets to take it with her.

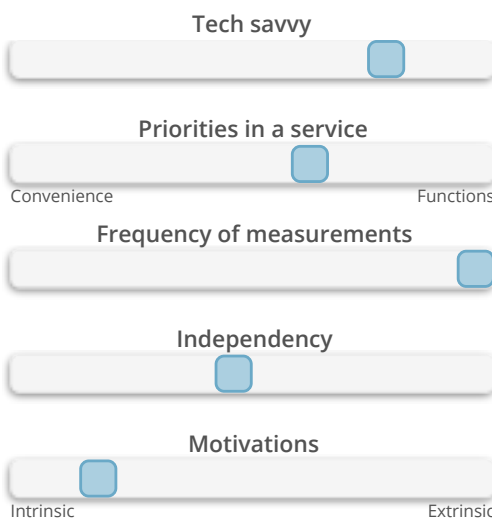
Anna also measures her daily activity with a Fitbit which she puts in her note taking app as well. The fitbit is used as a reminder to exercise more since she wants to become more healthy

Anna is very active on social media and turns to the facebook groups she is part of to gain new information about her disease, what she should be allowed to and can't do. She often googles her disease and stay ontop of any new findings on Cystic Fibrosis which she shares with her friends in the social media groups.

Anna is worried that she could face another rejection and is therefore determined to not let that happen again.

**Influenced by**

- Patients in the social media groups
- Health care professionals
- Her parents



**Goals:**

- Be able to go to school and study
- To learn what improves her health
- To provide her experience to her groups on social media, helping others

**Frustrations:**

- That she does not get the same information from the home hospital as at the transplantation clinic
- That she can't share her data with her physician before she comes for a visit

**Figure 3.4:** Persona 1. Emma Lind



**Göran Isaksson**

58 years old  
Working part time  
Lives in Emmaboda  
Lives with his wife and two kids

*"When I go to the hospital to take the tests everything is taken care of and I can just sit back and let the doctors do what they need to do"*

### About Görans disease

Göran was diagnosed with Alpha 1-antitrypsin deficiency at 22 years old after years of problems with his lungs. He was transplanted 13 years ago and has had few side effects following the treatment.

### Biography

Göran mainly performs health measurements since he is told to do so by his physician. In the beginning he was more interested but since he feels he is stable he doesn't do it as often as his physician would like.

Early in the disease Göran was much better at measuring his lung capacity but has been doing it less and less since he doesn't get reminded to do so by his physician as often. Sometimes his wife has to remind him to do his measurements since she wants to see the progression as well.

Göran visits the hospital once every month to do tests but rarely performs any tests in between the appointments. He measures his lung capacity only when he feels ill or unusually short-winded and calls to the hospital to see if he needs to change anything.

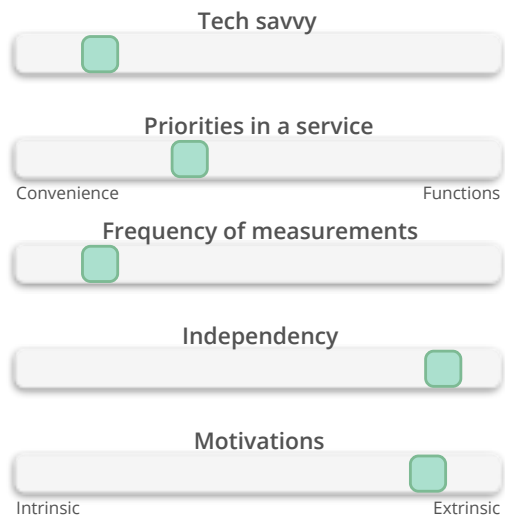
Göran wants the health care professionals to send written information to him before each visit so he knows what will be done and so that he is prepared.

#### Goals:

- To remain independent and decide for himself how he should treat his disease
- Want to become so healthy so he can help his wife in the garden with yard work

### Influenced by

Health care professionals  
His wife and extended family



#### Frustrations:

- When the doctor tells him to change his way of living
- That there is no way for him to see trends in the measurements
- Sometimes forgets to prepare before a visit at the clinic

**Figure 3.5:** Persona 2. Göran Isaksson.

## 3.4 Specifying requirements

At this point in time the most basic requirements of the health data feature was determined with the help of the product team at EC. These are listed below:

1. The patient can register various types of health data in the app
2. The patient can view their registered health data in the app
3. The patient can share their health data to a connected healthcare professional
4. The healthcare professional can view the health data

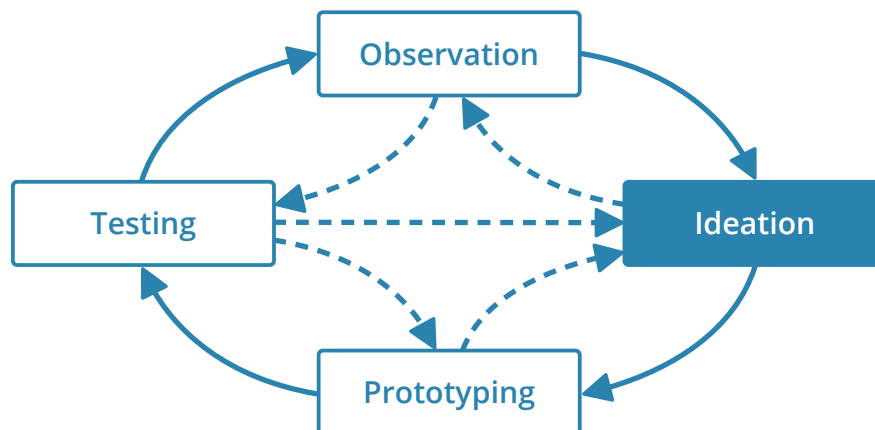
Additional requirements based on the personas could have been set at this point in time but was deliberately not done as to not limit the creative process of the ideation activity which will be described next.

# Chapter 4

## Ideation

---

*The second step of the human centered design process is ideation. In this activity potential solutions are created based on the data gathered and the requirements laid out on the observation activity.*



## 4.1 Concept generation

Coming from the observation activity going into the ideation activity the aim was to create as many viable solutions as possible. Even though the requirements set in the previous step were explicit the method was to not get stuck on one idea, possibly forgetting about alternatives that could be better. To not become too focused on one or a few ideas early in the ideation phase the method of creating the concepts were based on the two recommendations of Norman [5]:

- Generate numerous ideas.
- Be creative without regard for constraints.

With this in mind the concept generation could begin. In the earliest stages of the concept generation few constraints were applied to the UI or the functionality. The only constraints that were applied to the concept generation was the basic navigational elements that have already been established by the existing app.

The requirements laid out in the previous chapters worked as a starting point where the elements were first sketched out to evaluate them individually. Thereafter the individual elements were combined into wireframes. A figure of the process of sketching individual elements to simple wireframes can be seen in figure 4.1. This is however a small sample of all the sketches drawn up at this stage. At this point of the process a sitemap could have been developed to further establish the user journey from starting the app to performing a certain task [21]. A sitemap is a description of the hierarchical structures of the system and can function as a way of mapping out how the functions and screens are related to each other. This was intentionally left out of the process as it was thought of as a hindrance for the design process and could have excluded some solutions. Instead the focus was laid on sketching out functional components that would then organically grow into combinations and again into wireframes. An example of how an early wireframe was illustrated can be seen in figure 4.1b.

### Choosing viable concepts

Assessments of the individual elements and the wireframes were done continuously as they were being developed. The method of assessing them was inspired by the process described by Preece et al. for developing a conceptual model [22].

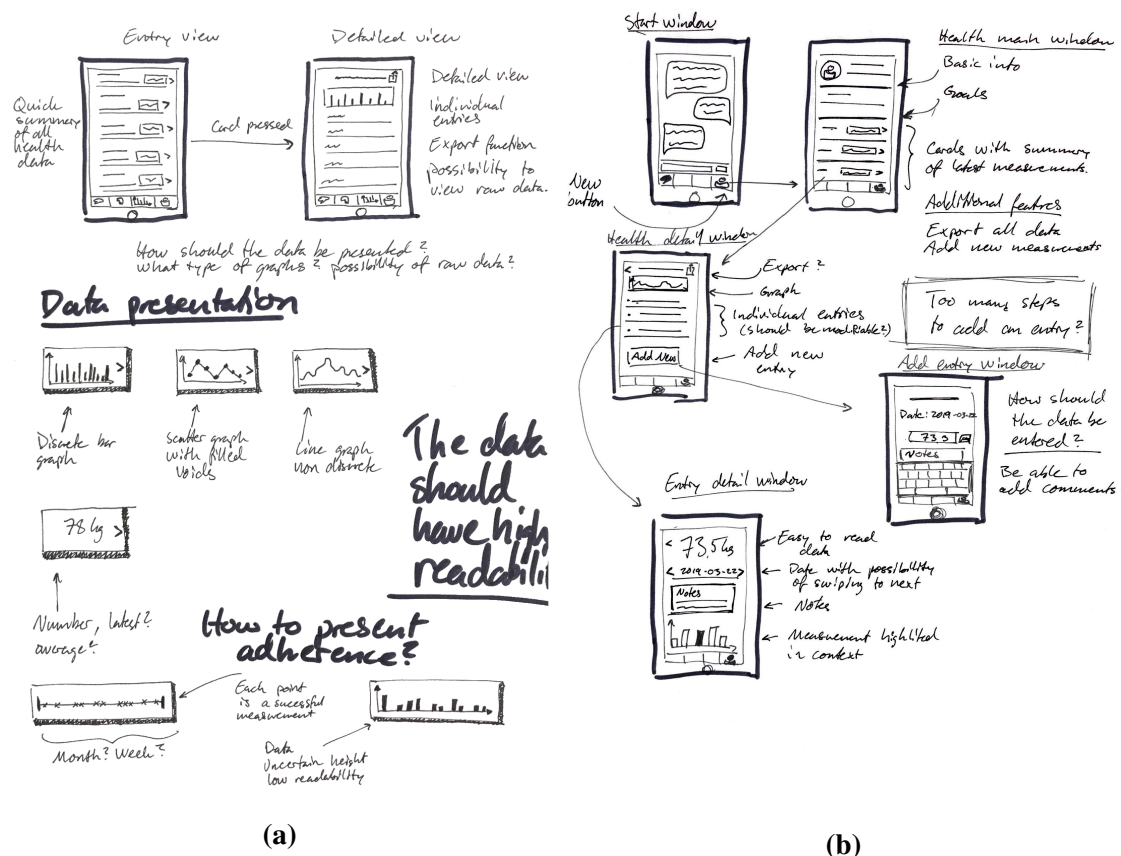
- Which interface metaphors are most suitable and will help the users understand the product and its functions?
- Which interaction types best support the users' activities?
- Do alternative interface types support other design insights or options?

However, since two personas had been created in the previous step the users in the questions could be substituted with Göran and Emma. By acknowledging them in the process each element or interaction process could be weighed against each other. The thought process went: "How would Emma or Göran use this function?", "Would this interfere with Göran's perceived image of how this element would work?", "Which alternative interface

metaphors would help Göran understand the functionality?", "What functions would make the app work during an ordinary day in Emmas life?"

Additionally the elements and were subjectively tested against the design principles visibility, feedback, constraints, consistency and affordance previously described. However, no user tests of the concepts were performed at this time.

As this process continued a few general concepts were conceived. These will be shortly described below.



**Figure 4.1:** Sketches made during the concept generation for making and displaying the overall concept and individual UI components. (a) shows early design of UI elements. (b) shows an early wireframe where the elements have been combined.

## 4.2 Wireframing

To fully articulate how the functionality of the prototype would be and establish overall hierarchy of the system the concepts were developed into wireframes. By adding arrows the interactions between each screen could also be simulated. This was done to get an overview of how the user would be required to move from one screen to another without using a sitemap. Sometimes these types of models are called wireflows and can be seen as a combination of wireframes and flowcharts [36]. However the word wireframe will be used in this thesis to describe the method.

The wireframes are not fully fledged prototypes but are an intermediary where the elements have been combined to screens. The UI is just a proposal at this stage and can be changed at any time.

A total of three separate concepts were developed at this time which will be described below.

### 4.2.1 Concept 1 - Extended chat

The first concept developed was to make use of the already developed and established chat window of the EC app. The concept grew from the thought of having as simple user flow as possible. By using already made functions the users would not have to learn any new functions or getting used to a new UI.

The wireframe of concept 1 can be seen in figure 4.2. The message screen looks like the present EC app as no design changes has been made to the UI. However the functionality of the chat would be improved in this concept where the chat now works as an input field to register measurements in. The wireframe shows a scenario in which the user has set a notification for when he usually registers his measurements. The chat shows two new messages with prompts of adding a new measurement. The user then enters the value in the text field and sends it as a message. As a response for providing a measurement the service would then use automated responses to show a graph of the previous week's values.

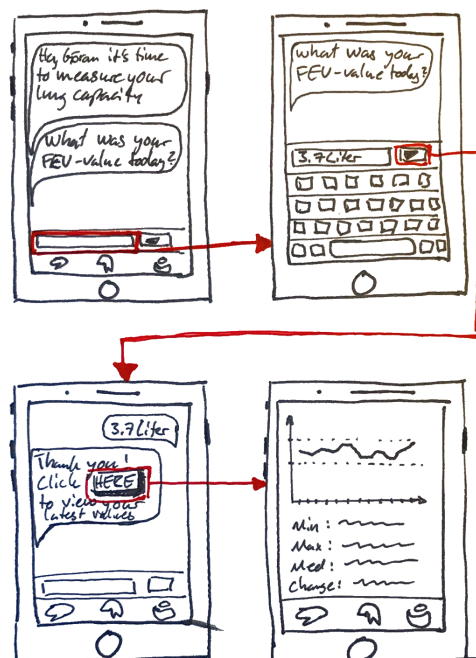


Figure 4.2: Wireframe of concept 1.

## 4.2.2 Concept 2 - Health data screen

This concept would extend the bottom navigation bar with a dedicated health data page. Here the health data would be gathered and summarized in a main page which the user curates her own health data. As with the other main functions in the app - the messages screen and the library, the health data screen was seen as a separate tool which could be used without the need for the other functions. A wireframe of how the concept was thought of can be seen in figure 4.3. The navigation bar has been extended and now holds a button for accessing a health data page. If the user clicks on the button they access a main page which shows the latest metrics the user has put in. This view would be a summary and not feature any statistics or advanced functions. Because of the obvious separation between the measurements and the visually pleasing look a card-based UI was designed. By pressing the cards a separate detailed view of each metrics could be reached. Here more tools are available as well as more detailed statistics of the recent measurements. From this screen the user can then choose to add a new measurement from the plus icon which is always present since it floats above the underlying elements.

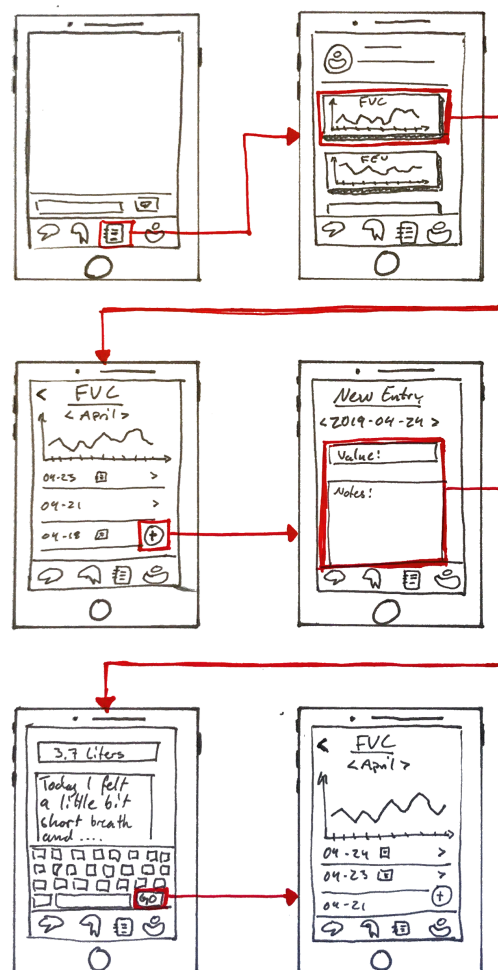


Figure 4.3: Wireframe of concept 2.



### 4.2.3 Concept 3 - Notebook

The third concept developed from the idea that the notebook used today for self-monitoring is a good metaphor that should be as closely resembled as possible. Because of the very well known activity of measuring ones health data today this would be replicated closely in the digital app. In this concept the "more" button in the bottom navigation bar would be switched to a "about me" button. By pressing this button the user would be presented with a new screen where personal information could be gathered. The personal information would not be limited to only health data but other important information as well such as prescriptions, meetings, general notes etc. From the about me page the health data could be reached by. Here the user would be presented with a calendar based interface which would emulate the process of analogously noting the health data. However once the user access the page for a specific metric the user can reach more advanced functions such as viewing trends as a diagram of the data and possibly statistics.

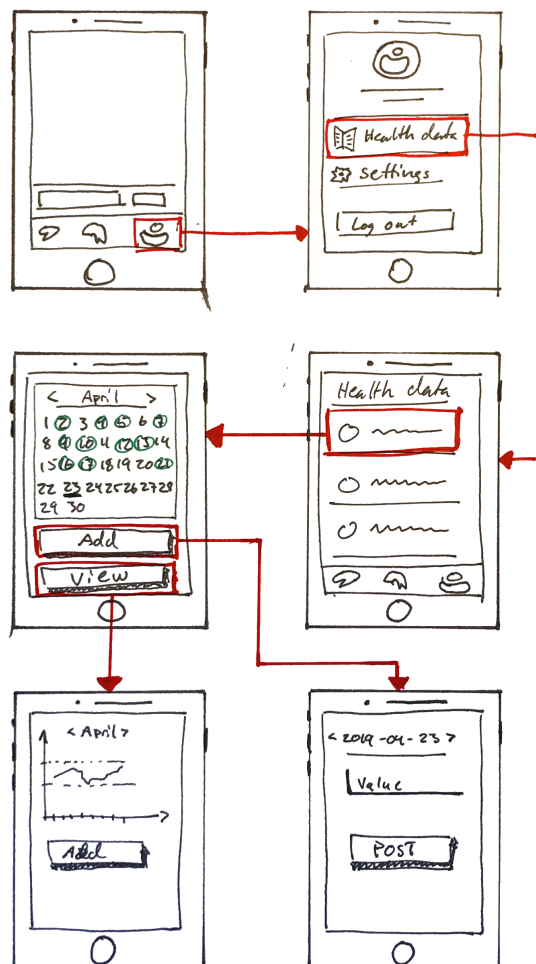


Figure 4.4: Wireframe of concept 3.

## 4.3 Evaluation of the three concepts

To evaluate which concepts to continue with the personas developed in the observation phase was used again. By using the personas and performing a cognitive walkthrough the usability of the concepts could be evaluated [22, 31, 37].

To make the evaluation equal for all concepts two sample tasks were created. The tasks was chosen to be simple and would cover the most basic and common tasks a potential user would do while interacting with the product. The tasks for testing the concepts were:

1. View the most recent values and be able to interpret the data.
2. Add a new measurement.

Since the concepts are developed differently it would require the user to perform different amounts of step to complete the tasks. To evaluate the usability of the concept the questions proposed by Preece et al. were asked at each step of the task [22]:

- Will the user know what to do to achieve the task?
- Will the user notice that the correct action is available?
- Will the user associate and interpret the response from the action correctly?

The two tasks were performed as if the personas Göran and Emma had performed them. The results are listed below in table 4.1. The results are listed as a "yes" or "no" to the questions presented above. The concept with the most amount of "yes" answers would be the most promising concept. Based on the result of the walkthrough the best concept to continue with was concept 2.

### Comments on the results

As shown in the results the task of viewing data was completely unable to be done by any of the personas in concept 1 since that function was based on the user providing a response to the prompt, thereafter gaining access to the data. This was something that was not thought of before the walkthrough but was evident after the evaluation.

The answers to task 2 in concept 2 were for Göran quite uncertain as it required many steps to add a measurement and the feedback that it was unclear if Göran would interpret the response correctly. Since the higher levels of design would give a more clear answer to these questions they were put to "maybe" in the evaluation and a deeper analysis would have been made if it was a tie between the concepts. Retrospectively, having test with real people would probably have gained a better result in this stage but because of the time restraints this was not done.

**Table 4.1:** The results of performing a cognitive walkthrough using the personas

<b>Concept 1.</b>	Göran	Emma
<b>Task 1. - View data</b>		
Action evident?	No	No
Action available?	No	No
Interpret response?	No	No
<b>Task 2. - Add measurement</b>		
Action evident?	Yes	Yes
Action available?	Yes	Yes
Interpret response?	Yes	Yes
<b>Concept 2.</b>	Göran	Emma
<b>Task 1. - View data</b>		
Action evident?	Yes	Yes
Action available?	Yes	Yes
Interpret response?	Yes	Yes
<b>Task 2. - Add measurement</b>		
Action evident?	Maybe - too many steps	Yes
Action available?	Yes	Yes
Interpret response?	Maybe - needs feedback	Yes
<b>Concept 3.</b>	Göran	Emma
<b>Task 1. - View data</b>		
Action evident?	Yes	Yes
Action available?	No	Yes
Interpret response?	Yes	Yes
<b>Task 2. - Add measurement</b>		
Action evident?	No	Yes
Action available?	No	Yes
Interpret response?	Yes	yes

## 4.4 Digital mockup

After it was decided to continue with the second concept a digital mockup was made. This was the first step of creating a digital representation of what the end product would look like. By turning the wireframe into a digital rendition it was possible to incorporate the general design styles, colors and fonts established in the EC brand style guide. Prior to this none of these assets had been used so to test whether the concept would work with these in place. With the EC general styles incorporated, the relationships between the individual elements could be further developed. The visual hierarchy, grouping and overall aesthetics could now be evaluated in a more life like way.

The mockup was created using the software Sketch and can be seen in figure [4.5](#). Sketch is a desktop program for creating designs and prototypes. In Sketch the designer

can make screens, or artboards that are designed specifically for smartphone screens and was later used to create the end prototype. The design was kept as close to concept 2 as possible. It should be noted that at this stage no prototyping was done and that the added flowchart was added afterwards to better communicate to the reader how the user would interact with the UI - similarly to the wireframes in the concept generation.

### 4.4.1 Feedback on the mockup

The mockup was not evaluated using any formal methods but instead feedback was given by the design team at EC. The mockup was presented as shown in figure [4.5](#). During the presentation the user flow from one screen to the next was shown. Each screen as well as the usability and user flow was critiqued. A summary of the feedback is listed below:

- "Make the home screen more fun to look at, the elements should give a reason for interacting with it."
- "It takes too long for the user to come to the input page. Streamline the user flow."
- "Make more clear icons for every action."
- "Make the chart element bigger with increased visibility of numbers and data."

This feedback was brought along during the development of the prototype.

### 4.4.2 Displaying health data

During the development of the UI of the feature the way of displaying the measurements was widely discussed. Health data can be presented in various ways ranging from the raw data to complex graphs and diagrams. Based on the findings of the interviews and the behavioural variables it was clear that people perceive the information given to them differently and reacts to information in different ways. Therefore it was concluded the app should be able to show multiple renditions or be customizable to show the data in the way the user wants it to be.

The personas was once again utilized by asking: "What information is Göran and Emma in seeing when being presented by data?" Even though Emma would like more advanced functions and show additional data the common features required by both personas were the following:

- highest recorded value in any chosen interval
- lowest recorded value in any chosen interval
- average/median recorded value any chosen interval

To create an interface that is as usable and as understandable as possible some research went into finding the best visualization of the registered data. Line graphs were chosen over bar graphs based on the increased visibility when viewing trends [\[38\]](#). If the user on the other hand would be interested in seeing the raw data the possibility would be given to them by adding additional functionality.

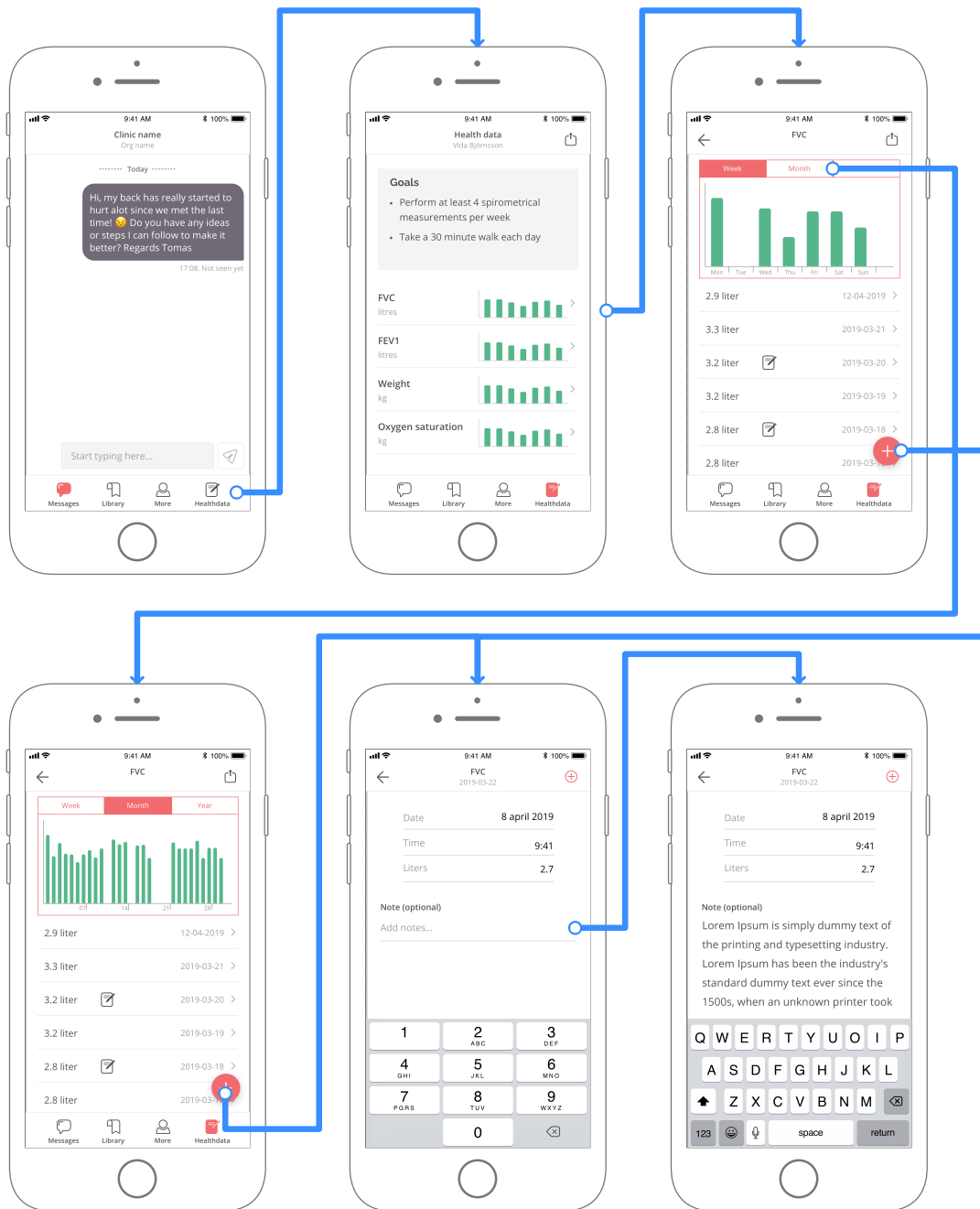


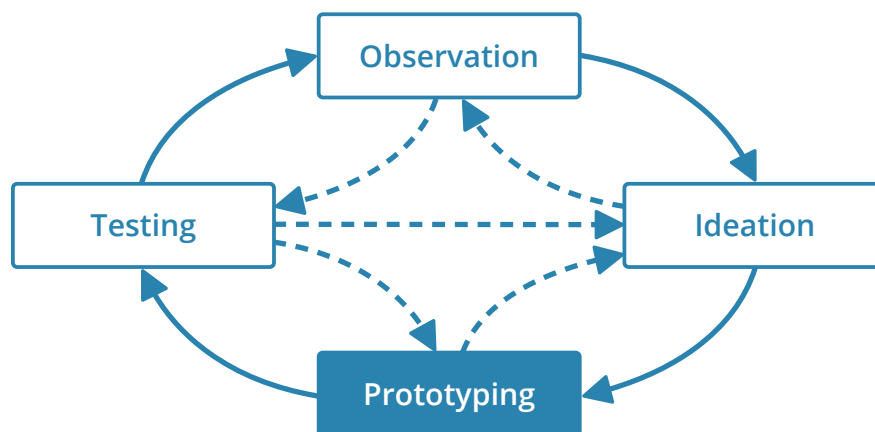
Figure 4.5: Mockup of concept 2.

# Chapter 5

## Prototyping

---

*The third step of the human centered design process is prototyping. This action features process of realizing the concepts generated in the ideation action to a refined, interactive product which can then be tested.*



## 5.1 Creation of the prototype

To fully be able to test if the ideas generated in the previous phase a functional prototype had to be developed. Even though the mockup could easily be turned into a prototype it was decided to only bring inspiration from the mockup and to acknowledge the feedback given during the evaluation but to redo the UI from the ground up.

### The absence of a lo-fi prototype

Lo-fi prototypes can make an exceptional intermediate step between rough sketches and a digital hi-fi prototype since the major modes of interaction can be tried out without having to produce a fully interactive hi-fi prototype. However, since a mockup had already been produced and the overall navigation of the system had been set by EC the choice of not producing a lo-fi prototype was made.

### Hi-fi prototype

For the hi-fi prototype in this thesis the designed artboards were first created using Sketch and then uploaded to the website inVision. This was done mainly because inVision can be run in any browser and the tester could therefore use their own smartphone to access the prototype, creating a more natural testing environment and not needing the phone to be connected to a computer.

Creating a hi-fi prototype means that some limitations has to be set in terms of functionality. Since Sketch can only create static artboards all of the data and text had to be constant or additional artboards has to be created which could simulate the change between the two states. Because of this all of the data and graphs were predesigned and mostly based on the findings from the shown notebook seen in figure [2.1b](#). As these limitations also prohibits the prototype to change language the choice was made to design it using Swedish. As the aim was to test the prototype on the end user it would be more realistic if the native tongue was used. Also, the risk of not being able to translate all medical terms was deemed quite high which might have impacted the test negatively.

## 5.2 Hi-fi prototype

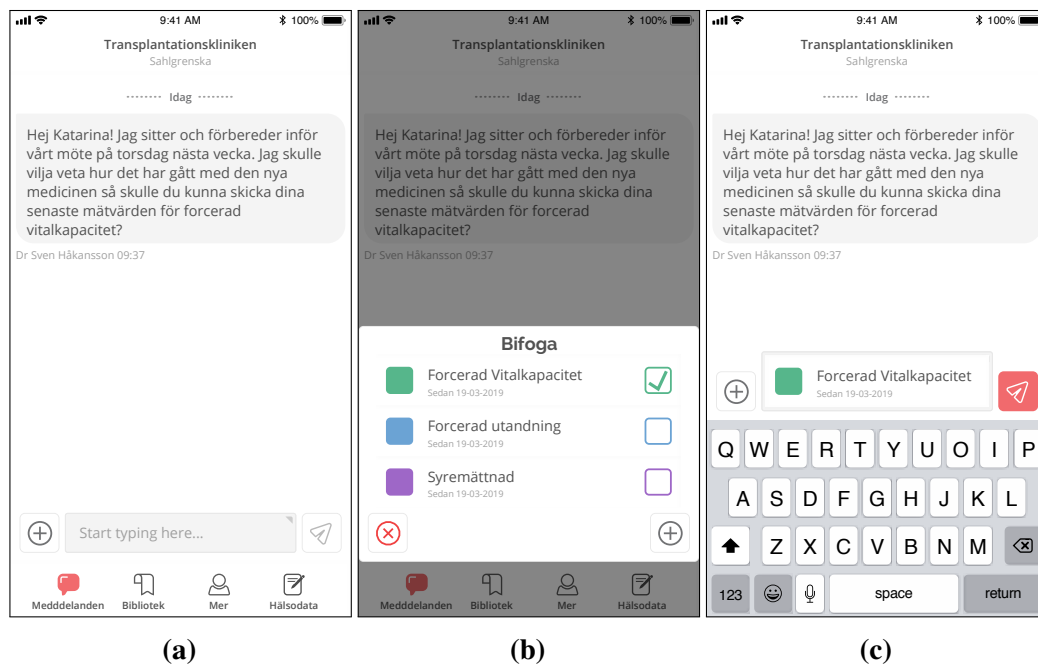
The resulting prototype will be briefly described below. Most of the screens will be shown and the design choices and the interactions will be described and motivated based on the design principles presented in the background. Lastly the overall user flow is presented for the reader to understand how the screens are connected and can be reached.

### 5.2.1 Home screen

The home screen was left unchanged from the mockup except one major feature. To the left of the text field there now is an additional button with a plus-icon. This indicates that there is a possibility of adding or attaching something in the text field. By pressing the button an overlay will show up where the current health data measurements can be shared.

By clicking on the checkboxes the user can then choose which data he or she wants to attach in the message. The interval for which the data will be shared is preset to the last time the user shared this health measurement. The home screen can be seen in figure 5.1.

The reasoning for implementing this feature was that the user should be able to quickly share their data with the healthcare professional without having to navigate through the entire app. The feedback received on the mockup saying it takes too long for the user to reach the input page was applied to this function as well.



**Figure 5.1:** (a) Home screen. (b) Attach health data overlay. (c) Attached health data in message field.

## 5.2.2 Health data main screen

Because of the input from the design team on the mockup the graphs were expanded to fill a larger part of the screen. This would increase the visibility making the users much more easily interpret the data presented to them. Because of the research put into how the data should be presented it was decided to change the bar graphs to line graphs. Since the measurements would be discrete and manual inputs it still felt important to convey that the input were set at specific time. Because of this the choice was made to include rings the at the specific time to make the user quickly see how often and at what time the user had registered a measurement.

As can be seen in figure 5.2 three different metrics were added to the prototype. This was made to show the user that multiple types of health data could be registered. To differentiate between the data in the graph a specific color was chosen. Buttons associated with the specific measurement were colored the same way to increase the affordance of them - implying that these buttons would affect the metric with the same color. The colors chosen were already part of the EC style guide but was not currently used in the app.



The main screen shows the latest weeks measurements but the user can toggle between the week, month and year to make the user be able to view the trends between different time periods.

The reasoning for the overall layout of the main screen was to keep the design simple and keep the visibility of the most used functions as high as possible. The minimalist approach was done to not overwhelm the user with unnecessary information, confusing them. The most prioritized functions were restricted to seeing the overall trend, adding a new measurement, share the data with your physician. The visibility of the more advanced and seldom used functions would therefore be lowered and were put in the detailed view of each metric.

Instead of having one button for adding a new measurement like on the mockup the choice was intentional in making separate buttons for each health data metric. By doing so the user would now easier know how to achieve the task of adding a new measurement for this specific metric.

To increase exploration of the system and letting the user find all of the health data each section belonging to one metric was designed to be slightly smaller than the average iPhone screen. This would make the user see the top of the next metric inviting user scrolling down to find it.

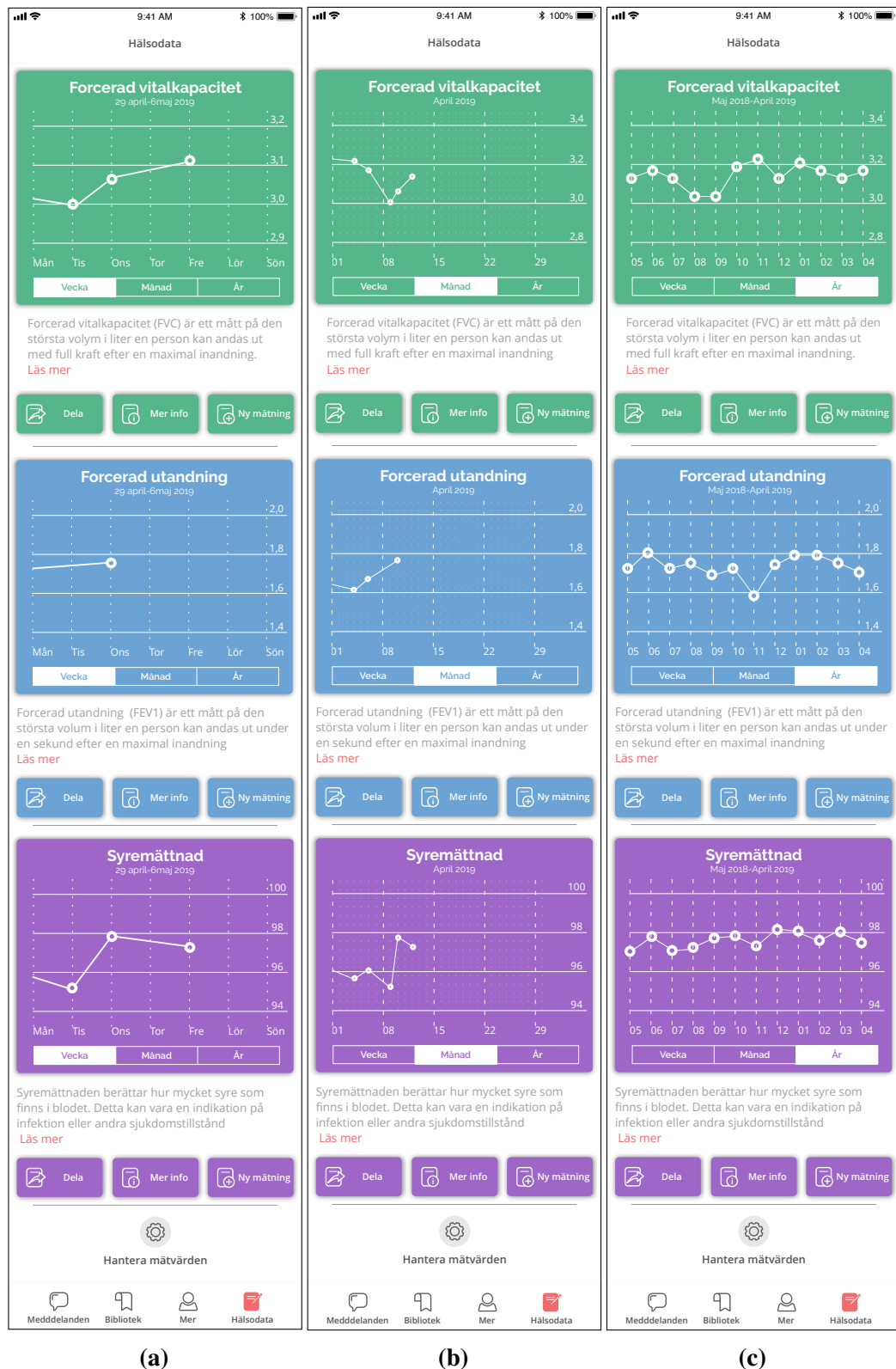
### 5.2.3 Health data detailed view

The design of the detailed view was revised from the design of the mockup. The detailed view can be seen in figure [5.3a](#) and [5.3b](#). Instead of just having a list of every registration the user first see a calendar element showing the latest month. Every registration the user has made is marked with a circle around the date indicating that a registration had been done. If the date is pressed a popup show up above the date with the measurement for that specific date and an icon indicating if a note was written with the measurement.

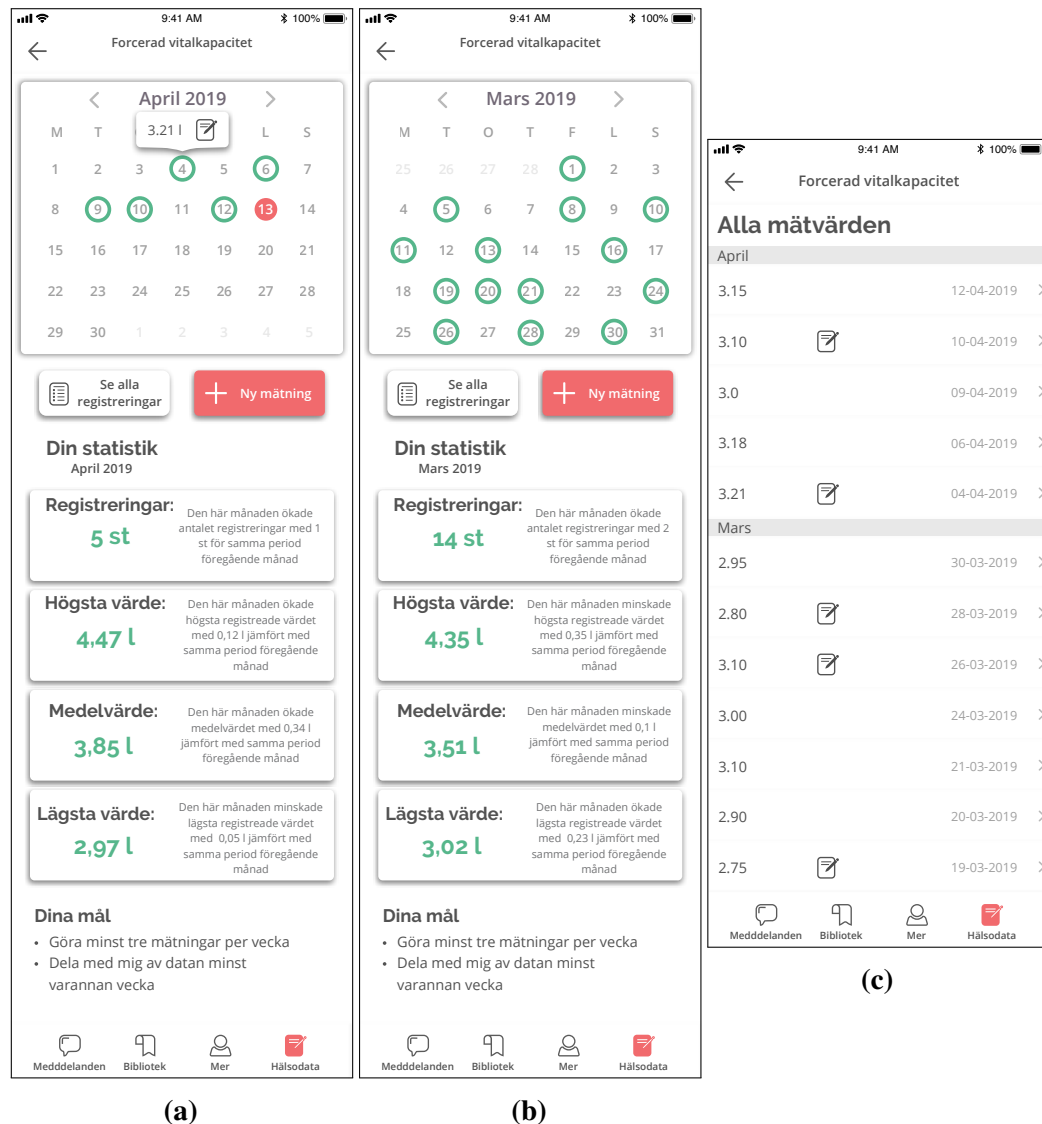
Below the calendar element two buttons were placed. These are "See all registrations" and "New measurement". The button for adding a new measurement was colored with the EC peach color as this would increase the visibility. This button was also put on the right side to be closer to the thumb (of a right handed person), making it the most easily accessible button on the page. The button for seeing all registrations was toned down by letting it have the same color as the background. This was to decrease the visibility of that function since the use of it would be limited and only occasionally clicked.

Below the buttons relevant statistics of the metric was put. This was added to adhere to the need for more advanced statistics and additional information presented in the ideation chapter. The statistics include: number of registrations, highest recorded value, mean value and lowest recorded value. Besides the statistic an explanatory text describes how each value has changed from the previous month.

To keep the consistency in the coloring all of the registrations and the statistics were in the same color as the graph on the health data main page. By using the same colors the user would also get feedback that the specific metric detailed page using this color had been accessed. Since this would be something a user might do daily the distinct coloring would soon be closely associated with the specific metric making the user recognizing it faster.



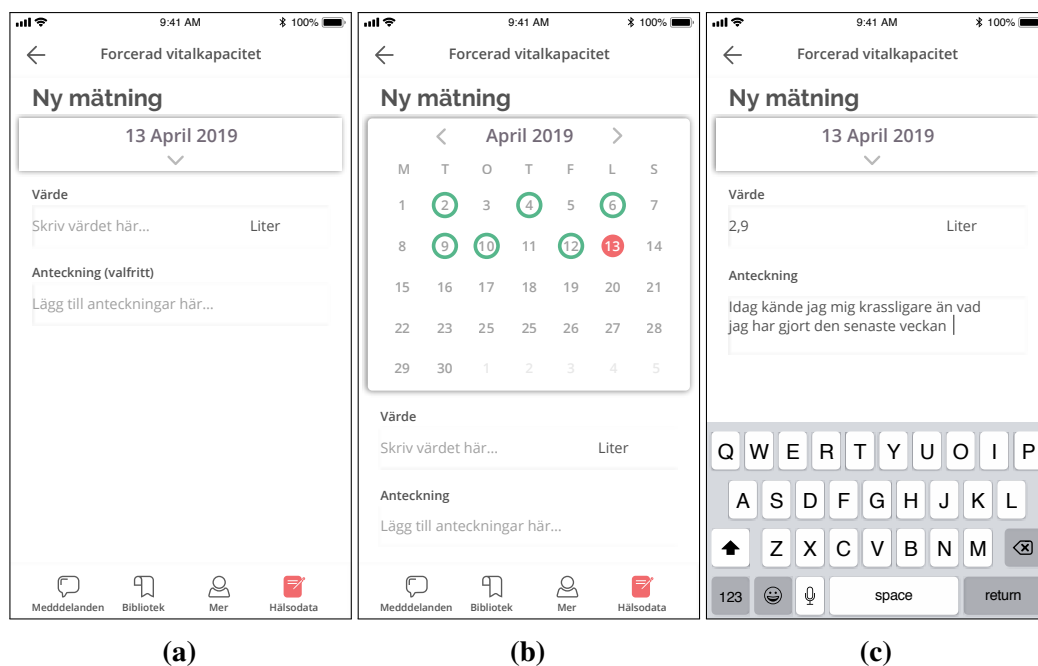
**Figure 5.2:** Health data main screen. (a) Week view. (b) Month view. (c) Year view



**Figure 5.3:** Health data detailed view of forced vital capacity. **(a)** View showing current month with popup showing the value of April 4. **(b)** Screen of previous month. **(c)** List of all registrations for forced vital capacity.

## 5.2.4 Adding new measurement

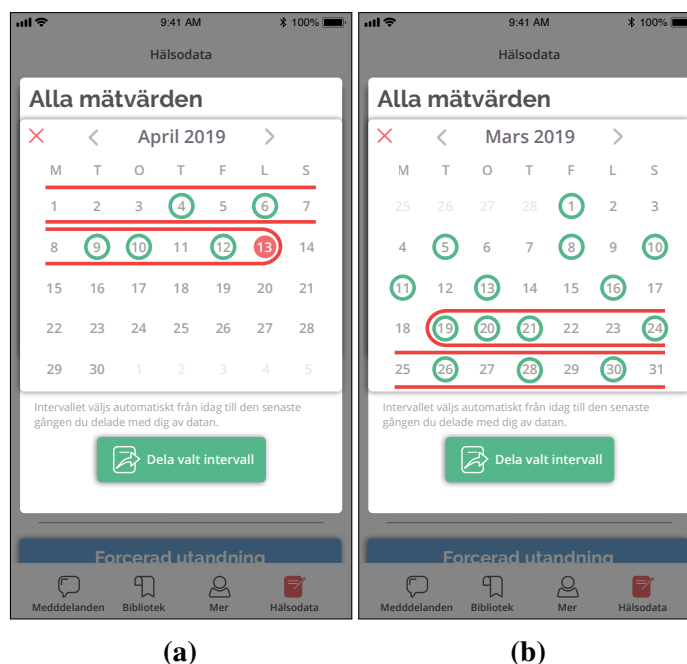
The screen for adding a new measurement can be reached from either the health data main screen or the detailed view. The screens can be seen in figure 5.4. The process of adding a new measurement should be as easy and straight forward as possible. Therefore the screen was designed to be minimalistic in its layout, not having any other elements asking for attention. The date picker was reused from the calendar in detailed view to keep the consistency and familiarity of the interface. While adding a measurement the user can, if they choose to, write notes that could be of importance for either the user in the future or for the healthcare professional that reviews the data.



**Figure 5.4:** Adding new measurement. **(a)** Main screen. **(b)** Calendar for picking the date. **(c)** Filled out measurement with a note.

## 5.2.5 Sharing health data

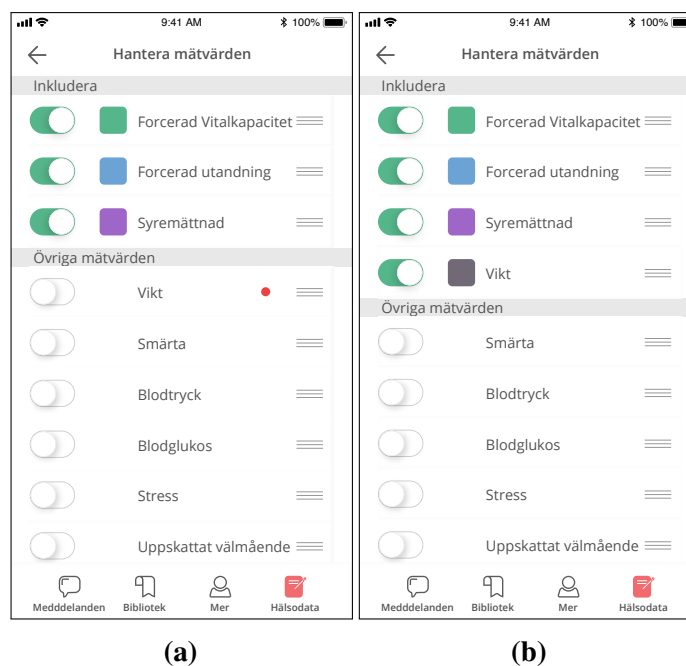
To quickly share the latest registered values has already been described in the section about the home screen. However the user can choose to do this from the detailed view by pressing the "Share" button. By doing so the user is presented with the overlay seen in figure 5.5. From this view the user can choose the interval for sharing which was not possible with the quick share button on the home screen. The interval is automatically set from today to the last date this metric was shared which also is explained in a text below the calendar. As described before the button and the marked dates are the same color as the graph on the health data main screen to inform the user what metric is being shared.



**Figure 5.5:** Share health data overlay. (a) End of the chosen interval. (b) Beginning of the chosen interval.

## 5.2.6 Managing measurements

From the health data main view the user can reach the screen where the metrics are managed by scrolling down and pressing "Manage metrics". From here the user can activate new health data measurements, arrange them in certain orders and deactivate them. As can be seen in figure 5.6 a color is always associated with the metric. This color is repeated throughout the prototype as described in previous sections. The colors can be chosen from a predetermined set of colors but this was not incorporated in the prototype. Once a metric is made available by the healthcare profession a red dot indicating that it can be activated on the page is shown which can be seen in figure 5.6a



**Figure 5.6:** Manage measurement screen. **(a)** Red dot indicating that "Weight" can be activated by the user. **(b)** Weight has been added to the health data screen. The chosen color for this measurement has been chosen.

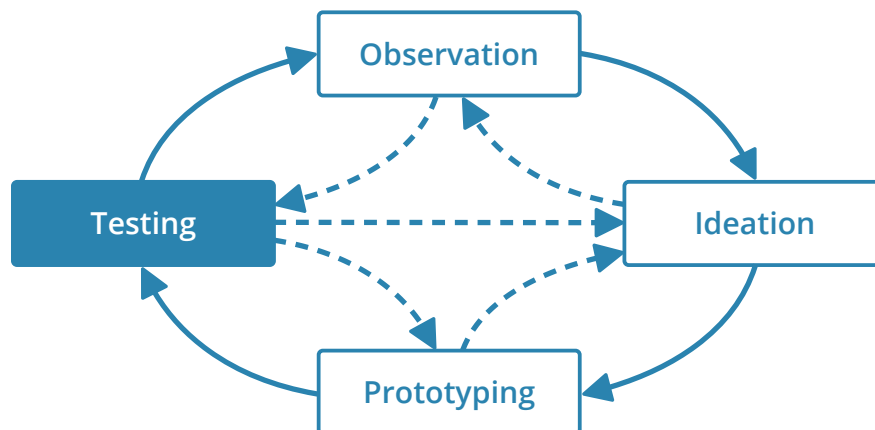


# Chapter 6

## Testing

---

*Testing is the last activity of the human centered design process. The prototype developed in the previous activity is now evaluated by conducting user tests, gaining valuable information about how the design choices are perceived by the users.*





## 6.1 Usability testing

With the prototype finished the usability testing of it could begin. The aim was to test the prototype on the end users, i.e people with chronic respiratory diseases. Because of the limited time and the difficulty accessing this group of people other test subjects were used instead. A total of seven test participants were recruited to do the usability tests. These participants consisted of students or people working at EC.

The tests were conducted separately from each other with only the test subject and the facilitator present. The test subjects were asked if they wanted to perform the test on their own smartphone or if they wanted to lend an iPhone 6 to conduct the tests on. The user could then reach the prototype by entering the URL to the uploaded prototype on the inVision homepage.

During the sessions the facilitator sat slightly behind the test subject as to see how they navigated through the prototype as described in [37]. While going through the test the facilitator read the task instructions out loud to the test subject, waiting for him or her to complete the task before continuing to the next task.

To understand how the participants were thinking during the sessions they were asked to "think aloud" which is a technique for gaining insights of the cognitive process the users make while testing a product [22, 37, 39]. By asking the participant to motivate their choices and describing their mental process of coming to a certain conclusion the usability could be analyzed with qualitative data to complement the SUS test.

As the prototype was constructed to make it possible to complete the tasks in multiple ways the choice was made to not count the amount of clicks or the time required to complete each task. Because of the use of the think-aloud method it was more important of noting the testers reactions and thoughts about the interface as they happened [37]. As an alternative the test subjects could have recounted their thought process after the tasks were all completed, while also counting quantitative data. However the risk of not getting the test subjects unfiltered reactions or forgetting important thoughts was deemed to high to use this as a method.

Directly after all the tasks were completed the test subject was handed and asked to fill out the SUS questionnaire described earlier and seen in appendix C.

As there are not a predetermined way of completing each task a description of how the user should behave and navigate UI can not be described. However two wireflows describing how the different screens are linked together are shown in figure 6.1 and 6.2.

## 6.2 Testing scenarios

The hi-fi prototype was constructed in two parts and therefore two testing scenarios were constructed for each part. The scenarios give more background to the character and makes the user get into the role of the user [37]. The scenarios and tasks were developed by going back to the personas finding constructing scenarios of how and when a user would make a measurement, trying to emulate a regular situation.

Before the test subjects were asked to perform the tasks a short background to the scenarios was read to the user aloud before the testing could begin. The background scenario and the tasks will be described below.

## Background

57 year-old Katarina has been sick in Cystic Fibrosis since birth. Because of this she has had contact with the healthcare regularly. Since the last year Katarina has used an app by Engaging Care to communicate with her doctor at the health center. Today is Saturday the 13th of April 2019.

### Part 1 - Forced vital capacity

1. Find out what types of health data you are currently measuring
2. What result did you get in forced vital capacity the 4th of April this year?
3. How many registrations of forced vital capacity did you make last month?
4. Did you make a note when you registered your forced vital capacity the 4th of April this year?
  - If so, what does the note say?
5. Go back to the messages screen. Follow the task presented by your doctor.
  - The message reads: "Hi Katarina! I'm preparing our meeting on Thursday next week. I would like to know how it's gone with the new medication so could you send me your latest registrations for forced vital capacity?"

Today, the 13th of April you woke up and felt worse than usual. Because of this you decided to make a spirometric measurement to see if the forced vital capacity was affected. Your result was 2.9 liters.

6. Go and register this measurement with a note of that you woke up and felt unwell.

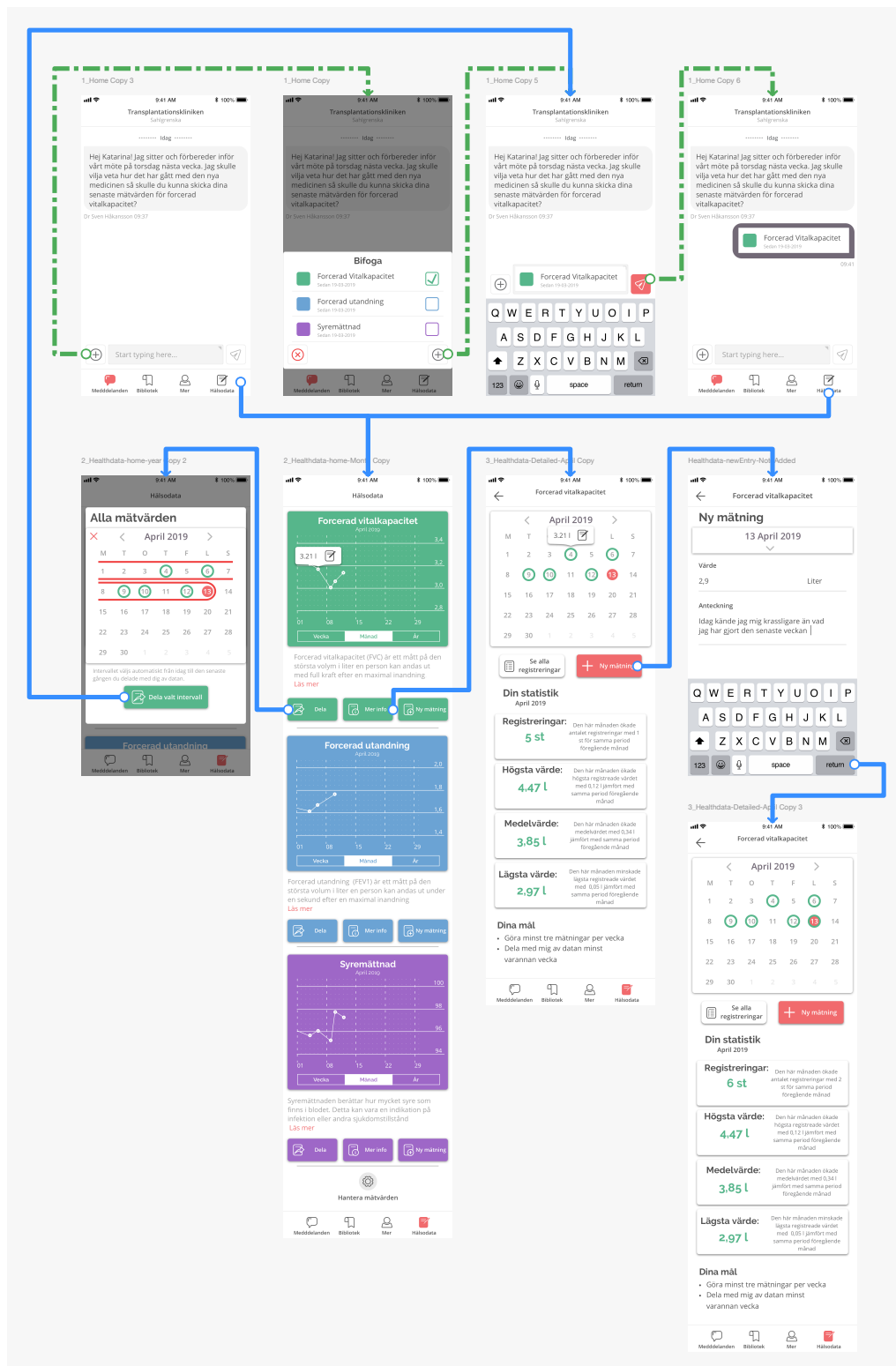
### Part 2 - Managing metrics

At the latest check-up Katarina told her doctor that she would like to use the app to keep track of her weight.

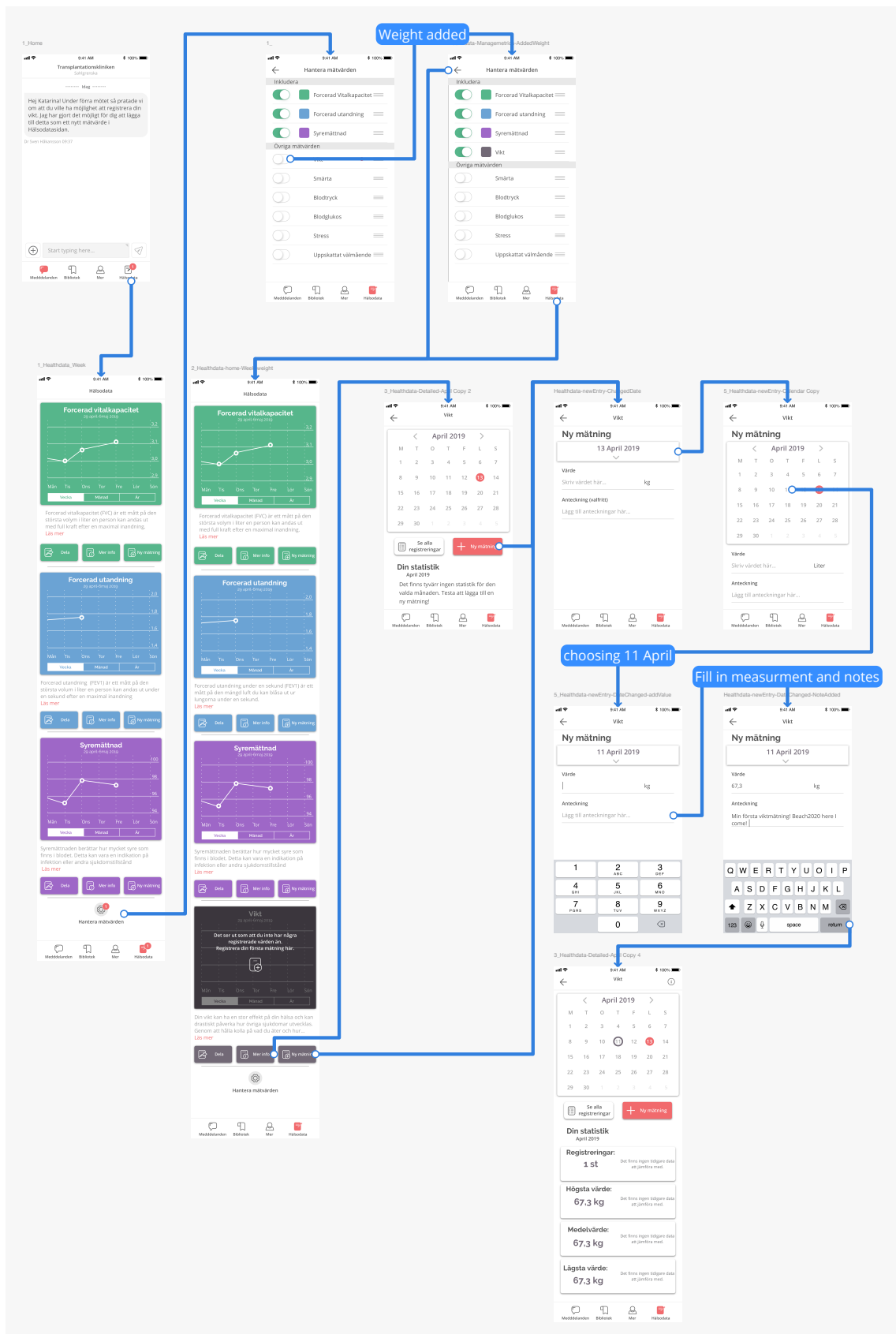
7. Go to the messages screen. Follow the task presented by your doctor.
  - The message read: "Hi Katarina! During our latest meeting we talked about the possibility for you to register your weight. I have made it possible to add this as a new metric on the health data screen."
8. Register your first weight measurement on the 11th of April 2019. You then weighed 67.2 kg. Add a positive note along the measurement.

## 6.2.1 Wireflow of the prototype sections

The users were not instructed to how to navigate the prototype and could chose to complete the tasks however they wanted. Figure [6.1](#) and [6.2](#) shows wireflows of the two parts of the prototype and how the tasks could be completed.



**Figure 6.1:** Part 1. Wireflow of the sequence for a user to send their forced vital capacity to their doctor and adding a new measurement



**Figure 6.2:** Part 2. Wireflow of the sequence for a user to add weight as a metric in the prototype.

## 6.3 Results of usability testing

### 6.3.1 Think-aloud protocol and other comments

#### Task 1.

All of the participants found the health data page and scrolled down to see that there were additional metrics. The task was constructed to see if the users would respond, needing to scroll down to find all of the graphs. When asked if it was clear that they had to scroll down to see the full layout of the screen they all answered yes and attributed that to the fact that the top of the next graph was visible.

#### Task 2.

To find the registration on the 4th of April the test subject had to either toggle to the month view on the graph and press the date, go to the detailed view and press the date or go to the all registrations page. Most testers tried to press the graph in some way but since only the area around that specific date was clickable some gave up after not succeeding on the first try. Some testers thought the entire graph was clickable and would lead to a detailed list of all the registrations. When not finding the popup as seen in figure [6.1](#) the rest of the testers pressed the more info button and either pressing the date on the calendar or going to the list with all registrations.

#### Task 3.

All participants except one went straight to the health data detailed view to see the amount of registrations. One participant instead tried to change the month shown in the graph on the main screen to try to manually count the registrations. As this was not possible because the view only showed the current month the participant then started to count the marked registrations on the detailed page before finding the statistics below the calendar.

#### Task 4.

All participants found the list of registrations where the entry could be seen and the note was read. However some participants tried to press the pop-up thinking it would lead directly to the registration screen.

#### Task 5.

None of the participants pressed the plus sign to the left of the text window in the chat as their first try to share the health data. Instead all navigated to the health data screen where the share button was pressed. Some participants commented on that they had already seen the "share" button on the health data main screen when doing previous tasks which might have influenced them to solve the task this way instead of attaching the data in the chat screen. However, once the task was finished some participants now noticed the plus sign and realized that it could be an alternative way of completing the task.

### **Task 6.**

All of the participants successfully found their way to add a new measurement. However, half of them did it directly from the health data screen while the other half navigated to the detailed view first. No participants had any problem filling out the registration but when the new measurement was going to be sent in people reacted on the fact that clicking enter on the keyboard automatically made a registration when all of the fields were filled in. Most of the participants were surprised by this and some suggested a dedicated "send" or "ok" button. One subject commented: "Then I have an extra step where I can review everything I've written and see that everything is OK". "I am not sure my registration was sent in correctly" was also said during this step indicating that there were not enough feedback informing the participants that the information had been received.

### **Task 7.**

All test subjects noticed that a notification had been added to the health data icon in the bottom navigation bar and subsequently pressed the button. Almost all scrolled down immediately to find the manage health data and pressed it since a notification had been added to the icon as well. However, some test subjects found it hard to find what the notification indicated. Once found, all of the participants managed to add the weight metric but some complained that there was not enough feedback that this had been done, wanting the user to be sent to the detailed page of the added metric immediately.

### **Task 8.**

Most of the participants tried to press the grayed out weight graph to add another measurement. The text overlaying the graph proved to be ambiguous and invited the participants to click on it. Since that was not possible the participants then either entered the detailed view to press the "new measurement" button or doing it directly from the health data screen. Every test subject managed to change the date from today to the 11th of April with the drop down calendar which they found intuitive.

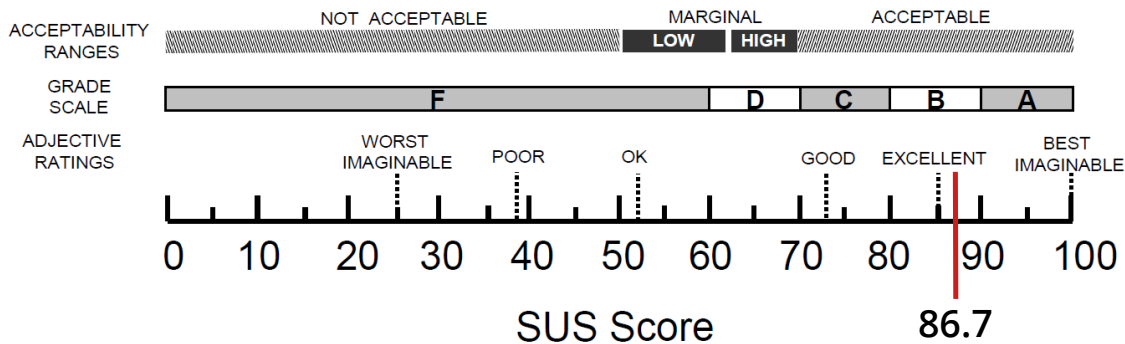
## **Overall comments**

- "I want to be able to see the values in the weekly view on the graph. This is not as important on the monthly or yearly view"
- "I would like to have a larger font explaining the date and interval on the graphs"
- "The explanatory text for each metric could be more visible"
- "The text explaining how the interval is automatically set can be above the calendar to make it more visible"

### **6.3.2 SUS-score**

The individual scores from the SUS evaluation ranging from 0-100 was calculated using the equations described in the methods section. The mean of all the scores was also cal-

culated which resulted in  $SUS_{Mean} = 86.7$ . On the added adjective scale this score places between "excellent" and "best imaginable". The scale with the resulting score can be seen in figure 6.3.



**Figure 6.3:** SUS with the added result from the user tests. The result of 86.7 is marked in red.

## 6.4 Proposed improvements

Based on the feedback received on the usability testing a few improvements could be implemented before repeating a similar usability test. However, based on the limited time of the project the changes could not be done before the project had to end.

- Increase the font size of the graph elements to increase the visibility.
- Implement a swiping feature on the graphs making the user be able to quickly see data further back without having to go to the detailed page.
- Make the whole graph clickable, leading to the detailed page.
- Make the popup with the data and note icon clickable, leading to the chosen date in the all registrations screen.
- Increase the overall feedback of the system, showing the user what was just done. Possibly with a popup or a status field.
- At the add measurement screen the user should have an extra step after writing the note to review the registration. By adding a "send" button at this step the user would be more confident and would align better with the questions asked during the cognitive walkthrough.
- Move the "Manage metrics" button to the top navigation bar making it easier for the user to find it.

# Chapter 7

## Discussion

---

*This chapter will start with a discussion of the overall design process and the methods used throughout the thesis. Following, a general discussion about the use of digital tools in healthcare is presented. The chapter ends with a discussion on some ethical considerations associated with the thesis and a suggestion for future work.*

### 7.1 The design process

This thesis was based on the human centered design process and its activities described by Don Norman in the book "The Design of Everyday Things" [5]. There are many different approaches to the human centered design process and even more to the design process as a whole. Various types of methods can be used to achieve the same goal which is why Norman's design process was mostly used as an overall guide where methods from other sources were incorporated as well. The four basic activities of the design process: observation, ideation, prototyping and testing proved to be a good method of dividing the journey from the presentation of the problem to a finished prototype. A more in depth discussion of each activity will be presented below.

#### 7.1.1 Observation

The main source of information for this thesis was the use of patient interviews. The initial contact with the patients was established through one of the collaborating clinics who previously tested the EC platform in a pilot study. The clinic contacted was happy to facilitate the contact with the patients but required some clearance which took unexpectedly long time. Because of the limited time for the thesis the number of patient interviews therefore had to be settled at a total of five. A larger sample size would probably have yielded a better representation of the user group.



The selection of which patients were interviewed were left entirely to the healthcare professionals working at the clinic. They were cooperative in finding patients with different demographics which was for the most part successful resulting in a sample which consisted of 2 women, 3 men in a range of ages from 20-62. However, the patients willing to be interviewed for this thesis are probably more active and interested in their disease than the average patient. This could have affected the data, indicating that the average patient is more active and positive to the thought of a digital tool for registering health data than the whole population.

All of the patients interviewed had some sort of chronic respiratory disease and had underwent a lung transplant. This is not a representative sample of the overall population or who the EC product is aimed to but only a small sample of the overall end users.

Since the platform developed by EC is being used by both patients and healthcare professionals an obvious limitation of this thesis is the omission of the caregivers. If the feature presented in this thesis is going to be implemented a similar process has to be done with the healthcare professionals. The reason for excluding the caregivers were due to the time restraint.

The overall impression on the use of self-management from the interviews correlated with the results from the literature studies in the beginning of the project. Self-management is a method for increasing the motivation, knowledge and interest in the recovery process which ultimately result in healthier patients.

The use of personas in this thesis proved to be very successful. The choice of including this method was partly to quantify the interview data but also to use as an evaluation tool in the development process. It should be noted that the mapping of variables in the persona generation is a subjective method even though it is grounded in the interviews. Since only one person performed this task this could be seen as a source of error.

As it became evident that the access to the patients was heavily restricted the personas worked as a substitution where they could be consulted on design choices and were used for evaluation of the concepts. The personas could also be seen as an intermediate goal since the personas can be reused for future projects.

## 7.1.2 Ideation

The goal going into the ideation activity was to follow the two major recommendation by Norman: to generate numerous ideas and to be creative without regard for constraints. These ideas proved to be very successful in producing concepts to continue with. A total of three main concepts were conceived but a large number of sketches with individual UI elements were also produced. During the various stages of the development these would serve as inspiration and some were incorporated later in the development.

The ideation activity was completely based on the author's own creative ability where sketching interfaces with pen and paper was the main activity. Other methods could have been included in this activity to generate more ideas. Brainstorming, affinity diagramming and writing scenarios based on the personas are examples of alternative methods that could have gained more and potentially better concepts in the end [22, 37]. These could also have been done in groups where end users would have been invited to better establish the concepts in the end user. In hindsight, collaborating with other people in this stage would probably have resulted in more varied and better concepts but due to the time restraints it

was decided to do it alone instead. Still, in this activity it was shown again that creating personas was a fairly good substitute as they were used to evaluate the concepts to further develop in the prototyping activity.

The decision to make a mockup in this stage was to explore one of the main research questions on how to incorporate the function in EC platform. Before this step no considerations had been made to fit the design to the overall look of the EC platform.

### 7.1.3 Prototyping

The prototyping activity of the design process was overall successful since a functional interactive hi-fi prototype was ultimately produced. In hindsight it is questionable why the mockup produced in the ideation action was not turned into a prototype and tested before a new rendition was made. By doing so the iterative aspect of the HCD process could have been further utilized and performing multiple usability tests. This could also have been extended to the development of the hi-fi prototype and several iterations of the prototype could have been made. This however would require that smaller sections of the prototype was finished and tested separately from each other.

The limitations of using Sketch to develop the prototype became apparent when making the hi-fi prototype in this thesis. Because of the heavily usage of health data in the interface much of the presentation had to be faked. This is not uncommon when developing prototypes but since the testing scenarios featured several tasks where the user interacted directly with the data a more natural feel could have been developed. An alternative could therefore have been to code the prototype or made it using alternative prototyping tools which extends the interactive aspects of the prototype. However, because of the time restraints this was not possible.

It was decided to include the overall brand style guide in the hi-fi prototype and build the health data feature largely based on the conventions laid out by the design team at EC. This was not a requirement from EC but a conscious decision from the author based on multiple reasons. Firstly: One of the project goals was to answer the question of how this feature in the best way be incorporated in the EC ecosystem and by using the established design language this would be more apparent. Secondly: The app would look more consistent with the rest of the design, making it possible to include already developed features in the prototype. Lastly: the challenge to adhere to a set style was seen as interesting

### 7.1.4 Testing

The finished prototype was tested using two different usability test gaining both quantitative and qualitative data about the usability of the prototype. The results from the SUS evaluation with an average score of 86.7 showed that the prototype had high usability. The score of 86.7 puts the rating between "Excellent" and "Best imaginable" on the adjective scale. As the goal was to produce a usable product which provides a good user experience the results were very positive.

It should be noted that the selection for the usability tests were not taken from the same population as the interviews. As most of the test subjects were between 20 and 30 years old this is not representative of the end users as they tend to be older. The user tests were conducted with people working at EC and students which might have given a

biased evaluation. All of these people had some former relationship with the facilitator which could have affected the results, making them rate the usability higher than the true perceived usability.

Another source of error is the amount of tests conducted. 7 user tests were performed which is on the low end of what can be expected of a usability test. However, some sources argue that 5 user tests are enough. These sources say that approximately 80% of the usability problems will be identified with 5 or more usability tests like the SUS evaluation [40, 41].

By using a version of the think-aloud protocol additional feedback on the interface was received. This method was harder to do than expected as many of the test subjects were silent at multiple steps of the scenarios, forcing the facilitator to speak up. This is a common complaint of the method [22, 37].

Usability tests were used once the hi-fi prototype was finished and was not utilized before that step. Only smaller evaluations were used to go forward with the process. As the HCD process promotes iterations tests could have been done at various stages of the process e.g after the concept stage. This would yield additional feedback and some of the complaints of the system could have been found earlier.

## 7.2 The use of digital tools in healthcare

The relevance of digital tools in healthcare is an important topic to discuss. The introductory chapters in this thesis described at length the benefits and positive aspects of digitizing the healthcare. However, the progression of patient self-management is not just positive as it can be hard for the healthcare professionals to go through the massive amounts of data, distinguishing between reliable and unreliable sources.

Therefore it is understandable that healthcare professionals could be hesitant in promoting self-management with third party devices. However, since the chronic disease management includes self-management with provided and approved medical devices, the possibility of sharing that data digitally is still a promising concept. If the combination of using provided medical devices with a digital tool for sharing the registered data was welcomed by the whole healthcare community the outcome of many peoples diseases would be better.

## 7.3 Ethical considerations

Having access to patients health data is a sensitive matter and should be handled with utmost care. EC is GDPR compliant and adhere to the national laws in each country where the platform has been launched. However, since no health data is being shared today in the way that is proposed in this thesis additional research into the requirements have to be done before the function is going to be implemented. A proposal is to have the health data stored locally on the patients' smartphone until it is manually shared to the healthcare professional. By doing so the user could manually approve each shared data set agreeing to it being handled within the system.

From the interviews it emerged that some patients felt an increased level of stress as

a result of the regular measurements. The pressure to keep a constant or continuously better results generated anxiety which is why one patient had to be exempted from the measurements at home and only did them at the regular revisits. This is something that should be acknowledged as a potential risk with these types of tools are being used and a feature to hide all statistics could be used to prevent this from happening.

All of the data gathered for this thesis has been anonymized to protect the identity of the interviewed patients and the test subjects.

## **7.4 Future work**

The finished prototype presented as the end result in this thesis is not a feature that can be implemented without further work. As the prototype developed only is a representation of what the final feature could look like

As a human centred design process was applied in this thesis the continuation of this project can be done fairly easy. The conclusions and results made in this thesis can be built upon, creating an increasingly more usable product which can be integrated in the EC platform. As a proposal the first step would be to refine the prototype based on the feedback received during the user tests and then performing additional testing. More interviews should also be a priority going forward, gathering opinion from other user groups.

Even though the focus of this thesis has always been on the end users there is a group of users that has not been actively pursued in the development of this feature - the healthcare professionals. To make the feature fully functional this user group has to be acknowledged and a similar process has to be made to create an interface for receiving, storing and analyzing the health data provided by the patients.



# Chapter 8

## Conclusions

---

*This final chapter presents the conclusions drawn from the project. The conclusions are written as responses to the research questions asked in the initial stages of the project.*

Initially in this thesis three main research questions were posed

- Can a digital tool be used to provide a better user experience for patients and healthcare professionals in the process of registering and sharing health data?
- How can this digital tool be designed to best fit the needs and wants of the end users?
- How can this potential feature in the best way be incorporated in the EC platform?

To answer the first question research of how patients and healthcare professionals worked with health data today was done. The use of digital tools is proposed to be one of the most important emerging techniques for improving self-management and providing a patient centered healthcare. By switching from an analogue workflow to a digital, a better user experience can be obtained. The possibility of sharing this information with healthcare professionals could provide faster feedback and comments on the progression. Additionally, being able to share health data prior to an appointment could lead to more effective meetings.

To answer the second and third question a hi-fi prototype of a suggested patient interface for registering and sharing health data was created by applying a human centered design process. By using the data gathered from the patient interviews and evaluating the prototype in all stages of the development to the end users a result with high usability was produced. User tests with 7 test subjects showed that the prototype developed reached a score of 86.7 on the SUS scale which is well above the average usability score.

It should be emphasised that the resulting hi-fi prototype produced in this project is not being presented as the best solution to fit the needs and the wants of all end users but should be seen as one example of many obtaining this goal. Instead, the *way* of producing this

prototype is highlighted. The findings of this thesis confirm that the human centered design process is a highly successful method of producing products centered around the users needs and by developing solutions with the user in mind user satisfaction is increased.

# Bibliography

---

1. SKL. *Vision e-hälsa 2025 – gemensamma utgångspunkter för digitalisering i socialtjänst och hälso- och sjukvård* (2016).
2. McKinsey&Company. *Värdet av digital teknik i den svenska vården* (2016).
3. WHO | 2.1 *The global burden of chronic diseases* [Accessed 2019-01-25].  
[https://www.who.int/nutrition/topics/2\\_background/en/](https://www.who.int/nutrition/topics/2_background/en/).
4. Thoraxkirurgi, V. O., Care, S. E., Forsberg, A. & Lennerling, A. Pilotstudie | Engaging Care | Mitt liv min hälsa | 2018 (2018).
5. Norman, D. A. *The Design of Everyday Things* ISBN: 9780465067107 (Basic Books, Inc., New York, NY, USA, 2002).
6. Piwek, L., Ellis, D. A., Andrews, S. & Joinson, A. The Rise of Consumer Health Wearables: Promises and Barriers. *PLOS Medicine* **13**, e1001953. ISSN: 1549-1676 (2016).
7. McGeady, D., Kujala, J. & Ilvonen, K. The impact of patient-physician web messaging on healthcare service provision. *International Journal of Medical Informatics* **77**, 17–23. ISSN: 13865056 (Jan. 2008).
8. Arwidson, J. & Lidé, S. *Den digitala patienten är här - men är vården redo?* (2016).
9. Mertens, L., Braeken, M. A. & Bogaerts, A. Effect of Lifestyle Coaching Including Telemonitoring and Telecoaching on Gestational Weight Gain and Postnatal Weight Loss: A Systematic Review. *Telemedicine and e-Health*, tmj.2018.0139. ISSN: 1530-5627 (2018).
10. Bernell, S. & Howard, S. W. Use Your Words Carefully: What Is a Chronic Disease? *Frontiers in Public Health* **4**, 159. ISSN: 2296-2565 (2016).
11. Socialdepartementet. *Nationell strategi för att förebygga och behandla kroniska sjukdomar 2014-2017* tech. rep. (2014), 1–16.
12. SKL & Regeringen. *Överenskommelse - Insatser för att förbättra vården för personer med kroniska sjukdomar m.m.* (2016).



13. European Respiratory Society. *Forum of International Respiratory Societies. The Global Impact of Respiratory Disease – Second Edition* ISBN: 9781849840873 (Sheffield, 2017).
14. Hjärt Lungfonden. *Lungrapporten 2017* (2017).
15. Gibson, G. J., Loddenkemper, R., Lundbäck, B. & Sibille, Y. Respiratory health and disease in Europe: the new European Lung White Book. *European Respiratory Journal* **42**, 559–563. ISSN: 0903-1936 (2013).
16. Lorig, K. R. & Holman, H. R. Self-management education: history, definition, outcomes, and mechanisms. *Annals of behavioral medicine* **26**, 1–7 (2003).
17. McCorkle, R. *et al.* Self-management: Enabling and empowering patients living with cancer as a chronic illness. *CA: a cancer journal for clinicians* **61**, 50–62 (2011).
18. Lorig, K. R., Sobel, D. S., Ritter, P. L., Laurent, D. & Hobbs, M. Effect of a self-management program on patients with chronic disease. *Effective clinical practice: ECP* **4**, 256–262 (2001).
19. För vårdanalys, M. *Vården ur befolkningens perspektiv 2016* (2016).
20. Otulana, B. A. *et al.* The use of home spirometry in detecting acute lung rejection and infection following heart-lung transplantation. *Chest* **97**, 353–357. ISSN: 00123692 (Feb. 1990).
21. Arvola, M. *Interaktionsdesign och UX : om att skapa en god användarupplevelse 1. uppl.* ISBN: 9789144097640 (Studentlitteratur, Lund, 2014).
22. Jenny Preece Helen Sharp, Y. R. *Interaction design : beyond human-computer interaction 773.* ISBN: 0470018666 (Wiley, 2015).
23. Garrett, J. J. *Elements of user experience, the: user-centered design for the web and beyond* (Pearson Education, 2010).
24. Brooke, J. *SUS—a quick and dirty usability scale. 1996* 194 (1996), 4–7.
25. International Organization for Standardization. *ISO 9241-11, Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts* 1998. (2019).
26. Norman, D. A. & Draper, S. W. *User Centered System Design; New Perspectives on Human-Computer Interaction* ISBN: 0898597811 (L. Erlbaum Associates Inc., Hillsdale, NJ, USA, 1986).
27. Gould, J. D. & Lewis, C. Designing for Usability: Key Principles and What Designers Think. *Commun. ACM* **28**, 300–311. ISSN: 0001-0782 (Mar. 1985).
28. International Organization for Standardization. *ISO 9241-210:2010 - Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems* 2010. doi:[10.1039/c0dt90114h](https://doi.org/10.1039/c0dt90114h). (2019).
29. O’Grady, J. V. & O’Grady, K. V. *A Designer’s Research Manual, Updated and Expanded: Succeed in Design by Knowing Your Clients and Understanding what They Really Need* (Rockport, 2017).

- 
30. Cooper, A., Reimann, R. & Cronin, D. *About face 3: the essentials of interaction design* (John Wiley & Sons, 2007).
  31. Pruitt, J. & Adlin, T. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design* ISBN: 0125662513, 9780125662512 (Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 2005).
  32. Cooper, A. *The Inmates Are Running the Asylum* ISBN: 0672316498 (Macmillan Publishing Co., Inc., Indianapolis, IN, USA, 1999).
  33. Bangor, A., Kortum, P. & Miller, J. *Determining What Individual SUS Scores Mean: Adding an Adjective Rating Scale* 3 (2009), 114–123.
  34. Denscombe, M. *Forskningshandboken : för småskaliga forskningsprojekt inom samhällsvetenskaperna* Fjärde upplagan. ISBN: 9789144122885 (Studentlitteratur, Lund, 2018).
  35. Ferguson, T. & Frydman, G. The first generation of e-patients. *BMJ* **328**, 1148–1149. ISSN: 0959-8138 (2004).
  36. Laubheimer, P. *Wireflows: A UX Deliverable for Workflows and Apps* [Accessed 2019-04-19]. <https://www.nngroup.com/articles/wireflows/>.
  37. Martin, B. & Hanington, B. *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions* 10 (2012), 49–5403–49–5403. doi:[10.5860/CHOICE.49-5403](https://doi.org/10.5860/CHOICE.49-5403).
  38. Shah Priti & Hoeffner James. *Review of Graph Comprehension Research: Implications for Instruction* 1 (2002), 47–69.
  39. Nielsen, J. *Usability engineering* 362. ISBN: 0080520294 (AP Professional, 1993).
  40. Jakob Nielsen. *Why You Only Need to Test with 5 Users* [Accessed 2019-05-17]. <https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/> (2019).
  41. Virzi, R. A. *Refining the test phase of usability evaluation: How many subjects is enough? Special Issue: Measurement in human factors* 4 (1992), 457–468.



# Appendices



# **Appendix A**

## **Study information**

---

# Forskningspersoninformation till studie om uppföljande vård efter organtransplantation

Information till deltagare, forskningspersoner i studie om uppföljande vård efter organtransplantation i Sverige.

## Bakgrund

Engaging Care (EC) är ett företag som utvecklar en molnbaserad plattform för kommunikation mellan vårdgivare och vårdtagare. Med plattformen vill EC genom digitalisering effektivisera kommunikationsutbytet mellan vårdgivaren och patienten samt uppmuntra till ökad självständighet hos patienten. I en pilotstudie har EC identifierat ett behov av en funktion där patienten får möjlighet att dela med sig av hälsodata (vikt, temperatur, blodtryck, lungkapacitet mm.).

Jag som genomför studien heter Niklas Andersson och går sista året på civilingenjörsprogrammet på LTH med inriktning mot medicinteknik. Jag har sedan början på min utbildning intresserat mig av området e-hälsa och hur man med hjälp av digitala verktyg kan förbättra vården. Studien sker som en del i mitt examensarbete och är ett samarbete med Lunds Tekniska Högskola och Engaging Care.

## Syfte

Syftet med studien är att, med hjälp av intervjuer undersöka hur patienter och vårdpersonal upplevt informationsutbytet och kommunikationen innan, under och efter organtransplantation. Intervjusvaren kommer ligga till grund för en första prototyp av en tjänst för att dela med sig av hälsodata från patienten till vårdpersonalen.

## Förfrågan om deltagande

Vi vill med denna information fråga om du vill vara med i studien där vi med hjälp av intervjuer undersöker hur patienter och vårdpersonal uppfattat kommunikationen mellan dem och hur detta med digitala verktyg kan förbättras i framtiden.

## Frivillighet

Deltagandet i studien är frivilligt och som deltagare är du förbehållen rätten att när som helst, utan särskild förklaring, avbryta deltagandet. I sådant fall raderas all tidigare insamlad data och dina svar kopplas inte längre till undersökningen. Du kan, utan särskild förklaring, välja att inte svara på någon utav frågorna i intervjun.

## Genomförande

I studien kommer ett antal patienter som genomgått eller ska genomgå organtransplantation samt vårdpersonal på transplantationsavdelningen intervjuas. vid intervjutillfället kommer en blankett med informerat samtycke att delas ut. Intervjun beräknas ta 30-40 minuter men kan ta kortare eller längre tid beroende på hur utförliga svar som ges. En enkät kommer att delas ut i samband med intervjun som du kommer att ombeds fylla i.

## Behandling av intervjusvaren

Intervjun kommer att spelas in med hjälp av en mikrofon och anteckningar kan komma att göras. Intervjuer och utvärderingen av svaren sker i enrum. Intervjuer kommer att transkriberas. Svaren kommer ligga till grund för analys av användarna av ECs produkter och kan komma att användas för framtida projekt. Personuppgifter, datainsamling och behandling av resultat kommer att ske konfidentiellt och i enlighet med personuppgiftslagen. Dina svar och dina resultat kommer att behandlas så att inte obehöriga kan ta del av dem. Vid publicering av resultaten kommer endast data publiceras utan att kunna härledas till forskningspersonen.

### Kontaktperson för intervjun

Niklas Andersson  
0763-203310  
niklas.andersson@engaging.care

### Handledare Lunds universitet

Johanna Persson  
046-2224358  
johanna.persson@design.lth.se



LUND  
UNIVERSITY





# **Appendix B**

# **Informed Consent**

---

# Information om informerat samtycke

## Bakgrund

Engaging Care (EC) är ett företag som utvecklar en molnbaserad plattform för kommunikation mellan vårdgivare och vårdtagare. Med plattformen vill EC genom digitalisering effektivisera kommunikationsutbytet mellan vårdgivaren och patienten samt uppmuntra till ökad självständighet hos patienten. I en pilotstudie har EC identifierat ett behov av en funktion där patienten får möjlighet att dela med sig av hälsodata (vikt, temperatur, blodtryck, lungkapacitet mm.).

## Syfte

Syftet med intervjuerna är att få en ökad förståelse över patienters attityd kring sin sjukdom, hur patienterna ser på självmonitorering av hälsodata samt på hur återbesök på klinikerna idag fungerar. Detta för att kunna utveckla verktyg för att förbättra kommunikationen mellan patienter och sjukvårdspersonal

## Behandling av intervjuvaren

Intervjun kommer att spelas in med hjälp av en mikrofon och anteckningar kan komma att göras. Intervjuer och utvärderingen av svaren sker i enrum. Intervjuer kommer att transkriberas. Personuppgifter, datainsamling och behandling av resultat kommer att ske konfidentiellt och i enlighet med personuppgiftslagen. Dina svar och dina resultat kommer att behandlas så att inte obehöriga kan ta del av dem.

## Frivillighet

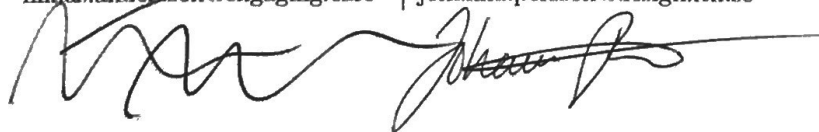
Deltagandet i studien är frivilligt och som deltagare är du förbehållen rätten att när som helst, utan särskild förklaring, avbryta deltagandet. I sådant fall raderas all tidigare insamlad data och dina svar kopplas inte längre till undersökningen. Du kan, utan särskild förklaring, välja att inte svara på någon utav frågorna i intervjun.

### Kontaktperson för intervjun

Niklas Andersson  
0763-203310  
niklas.andersson@engaging.care

### Handledare Lunds universitet

Johanna Persson  
046-2224358  
johanna.persson@design.lth.se



## Samtycke till medverkan i intervju

Genom min namnunderkrift samtycker jag härmed att medverka i intervjun.  
Jag är fullt införstådd med att:

- Min medverkan i intervjun är helt frivillig och att jag kan avbryta min medverkan när som helst, utan att behöva ge en anledning
- Jag ger mitt tillstånd till behandling av personuppgifter enligt de instruktioner som står i informationsbladet.
- Ljudupptagning från intervjun kommer att spelas in med hjälp av mikrofon samt att anteckningar från intervjun kan komma att göras.
- Datan från intervjun kan inte knytas till mig som person.

### Kontaktperson för intervjun

Niklas Andersson  
0763-203310  
niklas.andersson@engaging.care

### Ansvarig från Lunds universitet

Johanna Persson  
046-222 43 58  
johanna.persson@design.lth.se

Ort, Datum .....

Signatur .....

Namnförtydligande .....



**LUND**  
UNIVERSITY



# **Appendix C**

## **System usability scale**

---

## System Usability Scale

Strongly  
disagree

Strongly  
agree

1. I think that I would like to use this system frequently

1	2	3	4	5

2. I found the system unnecessarily complex

1	2	3	4	5

3. I thought the system was easy to use

1	2	3	4	5

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5

5. I found the various functions in this system were well integrated

1	2	3	4	5

6. I thought there was too much inconsistency in this system

1	2	3	4	5

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5

8. I found the system very awkward to use

1	2	3	4	5

9. I felt very confident using the system

1	2	3	4	5

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5