UX Redesign of Digital Tool in Primary Health Care

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Abstract

The demand in health care is increasing due to a growing population with more elderly and chronically ill people. In addition, the patients expect easy access to health care. To be able to meet the growing demand in the health care, digitization plays an essential role. For the digitization to be successful, a good integration of new digital tools in existing systems is of great importance. Also, the tools must be designed for the intended users and their needs.

The master thesis was performed in collaboration with Vårdinnovation Sverige AB. The aim with the thesis was to improve the user experience of Vårdexpressen – a digital tool for patients and healthcare professionals. An iterative human-centred design process was used throughout the project to develop a redesign of the user interface. The needs and behaviours of the patients in primary health care were discovered in the early stages of the design process. Additionally, usability issues in the current user interface of the system were identified. A prototype, based on a specific patient case, was created in Adobe XD to solve the usability issues and meet the identified user needs and behaviours. The prototype was, through usability tests with 12 participants, shown to provide a better usability than the original design.

Keywords: User Experience, eHealth, Primary Health Care, Interaction Design, Usability Testing

Sammanfattning

Efterfrågan inom hälso- och sjukvården ökar på grund av en växande population med allt fler äldre och kroniskt sjuka personer. Dessutom förväntar sig dagens patienter en lättillgänglig vård. För att möta den tilltagande efterfrågan spelar digitalisering en viktig roll. För att digitaliseringen ska lyckas är en god integrationen mellan nya digitala verktyg och befintliga system av stor betydelse. Dessutom bör verktygen utformas för de avsedda användarna och deras behov.

Examensarbetet har utförts i samarbete med Vårdinnovation Sverige AB. Syftet med projektet var att förbättra användarupplevelsen av Vårdexpressen – ett digitalt verktyg för patienter samt vårdpersonal. Under projektets gång har en iterativ och människocentrerad designprocess använts för att designa om verktygets användargränssnitt. Patienters behov och beteenden i primärvården kartlades i ett tidigt stadium av designprocessen. Vidare identifierades användbarhetsproblem i verktygets ursprungliga användargränssnitt. En prototyp skapades i Adobe XD för att lösa användbarhetsproblemen och för att möta användarnas behov och beteenden. Prototypen påvisades, genom användbarhetstester med 12 deltagare, ha en bättre användbarhet än den ursprungliga designen.

Nyckelord: Användarupplevelse, eHälsa, Primärvård, Interaktionsdesign, Användbarhetstestning

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Lund, May 2020
Lisa Swanberg and Olivia Samuelsson

Contents

Chapter 1
Introduction

In this chapter, the challenges and possibilities of digitization within the health care are described. This is followed by a presentation of the company Vårdinnovation Sverige AB and the digital healthcare tool Vårdexpressen. Furthermore, a description of the goal and research questions of the thesis is given. Also, delimitations and related works are mentioned.

1.1 Digitization in health care

We are facing a future with a growing gap between the resources and demand in health care. The resources need to be sufficient for the growing population with more chronically ill and elderly people [1]. At the same time, today's patients expect to quickly and easily access health care with high quality. To meet the increasing demand, the healthcare system needs a reform according to the Swedish Government [2]. For this reformation to be possible, the patient perspective needs to be strengthened. The healthcare system must be based on the individual's needs to a greater extent. There is also a need for an increased transparency in what the patient can expect from the health care. Last but not least, the digital revolution needs to break through and become an integrated part of health care. Digital solutions in health care enables the population to monitor their health, make preventive moves and thereby take a larger control of their own situation [3].

A central part in the digital revolution is to develop a more robust primary health care concerning resources and competences. Primary health care is the core of health care and the first-line care for the entire population. However, primary health care suffers from a noticeable sub capacity [2]. Further, most of the adverse events in the primary health care is due to diagnostic errors [4]. Interventions in primary health care can create great benefits for the entire healthcare system. One approach in the reformation of primary health care is digi-physical health care [2]. This approach makes the patient's choice seamless. The patient can turn to the same care provider digitally or via an appointment. The reform demands traditional clinics to work with integrated digital technologies, as well as digital health service

providers to offer in-person health care.

The digitization can give great benefits to the patients, healthcare professionals and the society. But to succeed, it is important to focus on those who are going to use the technology and their experience of it. At the end of the day, the patient is the main focus in health care. The digital revolution leads to new interactions, foreign to many patients. It is of great importance that the systems are well designed and based on the patients' needs. It is thereby of interest to investigate how the primary users – *the patients* – experience the digital revolution and how they handle new methods the reform brings about.

1.2 Vårdinnovation

The company Vårdinnovation Sverige AB [5] aims to improve the primary health care for both patients and healthcare professionals. Their ambition is to simplify the healthcare professionals' workflow by providing support and guidance. This in turn, leads to increased medical quality and a reduction of unnecessary costs.

The company delivers a digital healthcare tool called Vårdexpressen that is integrated in the existing clinical workflow at health centres. The tool is designed to facilitate the patient management and automate documentation. The aim is to streamline the patient's visit and increase the patient's participation in their own health care. A pilot implementation of Vårdexpressen was conducted in 2019. The tool was implemented at nine health care units in Region Skåne [6]. During the pilot period, a total of almost 12 000 patient visits were carried out. The patients' age varied between 0 and 107 years old. A patient survey was conducted during the pilot period. The survey responses indicate that the patients' overall experience of the system was positive. However, the survey response rate was rather low. Moreover, the survey did not gather in-depth information about how the patients interact with the product's user interface. [5]. This motivates further user studies and investigations of patients' user experience of Vårdexpressen.

1.3 Scope

The main goal of this thesis is to evaluate and redesign Vårdexpressen to obtain a better user experience for the patients. To achieve a better user experience, an analysis of the patients' needs and behaviours is made along with an evaluation of the current user interface. Further, a redesign is created to enhance the user experience and usability of the system. To achieve the goal with the thesis, following research questions are investigated:

- What are the needs and behaviours of persons in contact with primary health care?
- Does the user interface in Vårdexpressen match the patients' needs and behaviours?
- Are there any obstacles in the user interface that create uncertainty among the patients?
- How can Vårdexpressen be redesigned to best fit the patients' needs and behaviours?
- Did the redesign of Vårdexpressen result in an improved user experience?

1.4 Delimitations

Vårdexpressen is in this thesis evaluated from an interaction design perspective. The focus is put on the usability and user experience. The digital system has different user interfaces, depending on whether the user is a patient or a healthcare professional (nurse, doctor or medical secretary). In this thesis, only the patient interface is evaluated. Thereby *the user* in the thesis refers to the patient. Vårdexpressen is a web application, available both from devices at home and from tablets at health centres – in multiple languages. This study is limited to the Swedish tablet version that is used at the health centres, both when it comes to user study and prototype design. The study is further limited to users with no disabilities.

The system is similar to a questionnaire where the questions are generated based on each patient case. To get around the complexity of the system, some constraints are applied. A limited number of health issues are available in the system, which leads to a limited number of paths through the system. Additionally, the prototype is developed for one patient case only.

1.5 Related works

Previous reports have been made to understand the effects of digitization in health care. According to Region Stockholm [7], digital tools within health care can provide time and cost savings and improve the quality of the provided care. If information about the patient's medical condition is collected digitally, the healthcare professionals can spend more time on the patient's needs instead of having to ask basic questions. Digital retrieval of medical history includes more accurate and consistent questions than traditional methods. This leads to an increased chance of capturing important information about the patient [8]. It is also found that the chance of capturing sensitive information about the patient increases since some patients experience they can be more honest to a computer than a human [9].

Hess et al. [10] have made a study on patients' difficulties in using a touch screen tablet in primary health care. It was found that one third of the patients reported some difficulty when answering the questionnaire on the tablet. The study showed that people with multiple medical conditions or high age were more likely to report difficulties when using the tablet.

Chapter 2
Theoretical background

This chapter covers the background and theory needed to understand the process of the thesis. First the primary health care in Sweden is described, followed by a section about digital solutions in this area. Then follows some definitions of design theories.

2.1 Primary health care

The Swedish healthcare system is divided into *out-patient care* and *in-patient care*. The primary health care is part of the out-patient care. Out-patient care means that the patient is allowed to go home after contact with health care. While for in-patient care, the patient needs to be admitted to the hospital [11]. The primary health care is the basis, the first-line, of the Swedish healthcare system [12]. It is defined as health care which does not require hospital competence or resources or other special competences [13]. According to the Health and Medical Services Act [14], this applies without delimitation when it comes to disease, age or patient groups. It is each county council's assessment to decide what is included in the primary health care and which cases that require hospital resources.

In 2010, *the care choice reform* within primary health care was carried out. This is a regulation which says that the patient has freedom of choice between all providers in the primary health care in their county council. In 2015 the patients' freedom of choice was extended to include all county councils. This freedom of choice also applies to digital health service providers [2].

2.1.1 First-line care tasks

Conventionally, a nurse at the health centre has four main tasks in the first-line care [15]:

- **Medical history taking**

Collect and identify health issues. The medical history of a patient is also called anamnesis.

- **Triaging**
  Assess the right level of care and urgency. Based on the patient's need for medical attention [16].

- **Self-care advising**
  Advise and assist the patient to self-manage the health issue.

- **Referral**
  If the nurse's competences and resources are inadequate for the patient's health issue, the patient is referred to another level of care.

With the digital revolution taking place right now, these tasks can be – fully or partly – automated. In this thesis, the focus areas are *anamnesis* and *triaging*, since the system Vårdexpressen deals with digitization and automation of these two tasks.

Digital medical history taking

Today, the medical history taking is performed by a nurse by telephone or in an examination room at the health centre. A digital or automated history taking implies that the patient answers questions asked from a machine. The patient's answers are summarized. This summary is then analysed either by the machine, the healthcare professional or by both – resulting in an anamnesis.

Efficiency is achieved as the patient and the machine perform the major work in the history taking. The healthcare professional, often a nurse, can spend less time summarizing, drawing conclusions and other administrative tasks. Thereby, they can spend more time on the patients and their needs [15].

Digital triaging

The medical telephone counselling today links different symptoms to different urgent degree with help from a directory tool. The urgent degrees declare within which time frame the patient is advised to seek care. The urgent degrees are in turn connected to different levels of care [15].

A digital triage tool can automate parts of the assessment of healthcare needs by linking the patient's anamnesis, urgent degree and directory information. The outcome of the tool then depends on the referred level of care. If the recommendation is self-care, the tool may present information about this to the patient. If the proposal is further healthcare contact, the tool may put the patient in a queue for digital contact with a healthcare professional at the right level of care or suggest online appointment booking for a physical visit at a health centre [15]. If the tool is used for patients whose history taking is conducted at the health centre (not beforehand by telephone) the outcome may result in a recommended patient journey for the visit at the health centre or possible, further contact with other clinics.

Question of responsibility

It needs to be clarified who is responsible for the final assessment when using digital tools within the health care. For simple cases, the tool may be used without healthcare professionals being involved. However, in most cases the tool may be used for qualified support and supplement to the final and manual assessment by a nurse or doctor, who is responsible for the decisions [15].

2.2 Vårdexpressen

Vårdexpressen [5] is a digital tool developed by Vårdinnovation Sverige AB. It is used for medical history taking and triaging within primary health care. The solution automates the documentation and facilitates the medical decisions for the healthcare professionals. The aim is to give the healthcare professionals more time for the patient and decrease the number of administrative tasks. All of this increases the chance of making the right decisions regarding the diagnosis and treatment.

The patients begin their care process by answering questions digitally about their symptoms. The questions are continuously adapted to the patient based on e.g. sex, age, symptoms, habits and underlying conditions. The answers are summarized as an anamnesis with relevant information about the patient to the healthcare professionals. The triage system supports the healthcare professionals in leading the patient to the correct level of care.

In this thesis, a test environment of Vårdexpressen from January 2020 is used. This system is further in the thesis referred to as *the original design*. Examples of parts in the original design of Vårdexpressen can be seen in Figure 2.2. The original design is used for evaluation of the current system, and also as a reference to the developed redesign. In the final evaluation of the redesigned prototype, the usability tests compare the original design and the redesign.

2.2.1 Patient flow

In this section, the patient's care process with Vårdexpressen is further described in five steps. The patient flow can be seen in Figure 2.1.

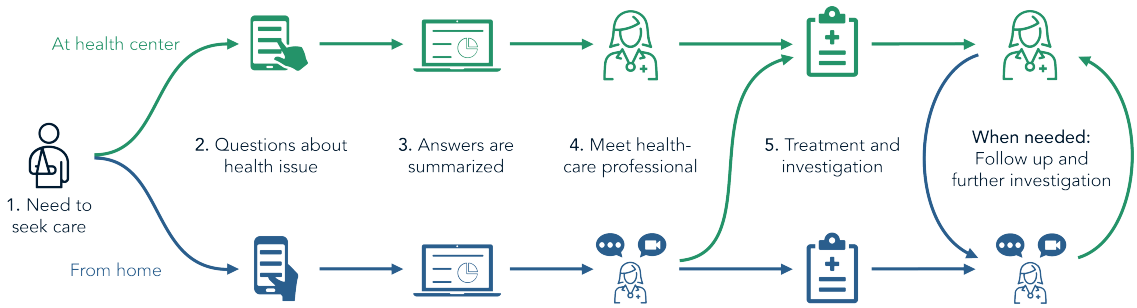


Figure 2.1: The patient flow with Vårdexpressen from home (blue path) and at the health centre (green path).

Step 1: Need to seek care

When the patient arrives at the health centre, he or she is guided to a tablet with the web application Vårdexpressen available. The patient registers with his or her personal identity number or date of birth (Figure 2.2a). Patient hosts are available in the waiting area to guide the patient in the process.

It is also possible to use the system from a device at home. In this case, the patient gets help directly in a chat or video call, or gets sent to a health centre if needed.

Step 2: Questions about the health issue

After registration, the patient chooses his or her main health issue from a number of alternatives. The selectable health issues in this version of the system can be seen in Figure 2.2b. Several questions about the patient's medical background and lifestyle are asked to the patient. For example, if he or she has any chronic diseases or uses any pharmaceuticals by prescription.

Thereafter the patient answers questions about his or her current health issue, for example how long he or she has been suffering from it. The questions are similar to the ones that a nurse or doctor would ask in the examination room. In the system, the questions are usually presented as multiple-choice questions but sometimes as e.g. free text answers or sliders. The answers are sent to the healthcare professionals (Figure 2.2c & 2.2d) for them to diagnose and treat the patient in the best possible way.

Step 3: Answers are summarized

When the patient has sent the answers in, he or she waits in the waiting room to be called by the nurse. The answers are summarized and presented as a medical record text to the healthcare professionals. While the patient is in the waiting room, the healthcare professionals prepare for the meeting by reading this text.

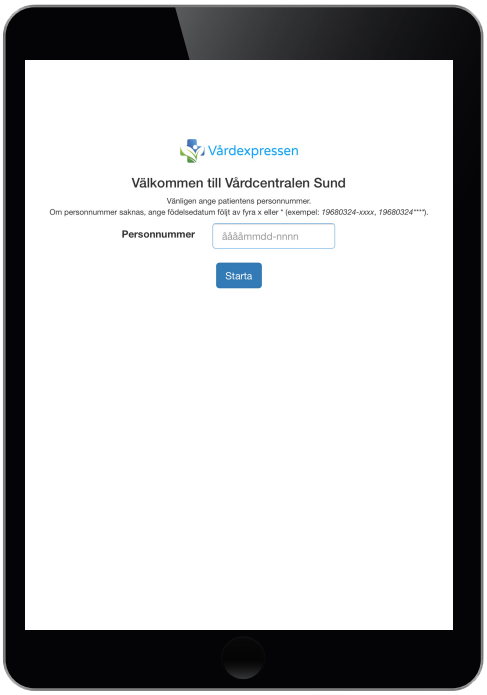
Step 4: Meet healthcare professional

When the healthcare professionals sign in to Vårdexpressen, they see an overview of all the patients and in what stage each patient is in the care process. Apart from the summarized answers forming the basis of the medial record entry, the healthcare professionals also get advice about which examinations, laboratory tests and treatment that may be relevant for each patient.

Step 5: Treatment and investigation

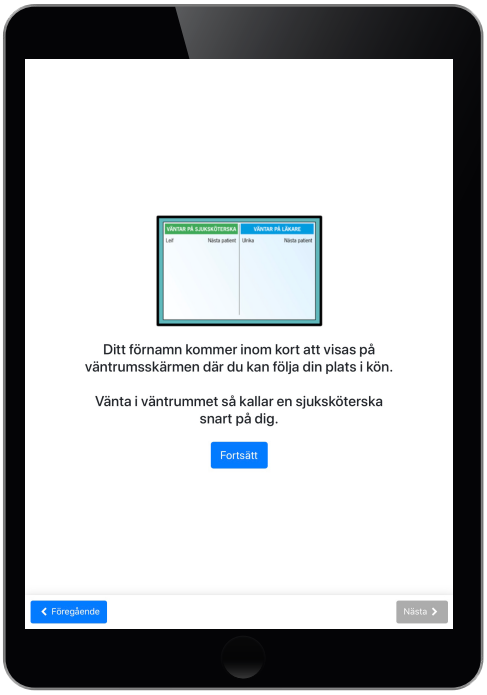
Based on a medical assessment of the patient's medical condition and the recommendations given in Vårdexpressen, a diagnosis and a treatment can be given to the patient. If the nurse believes that a doctor appointment or a laboratory sample is needed, the patient can be sent to healthcare professionals with appropriate skills.

The prepared medical record entry, along with possible corrections or additions made by the healthcare professionals, is sent to the patient's medical record when the visit is completed.

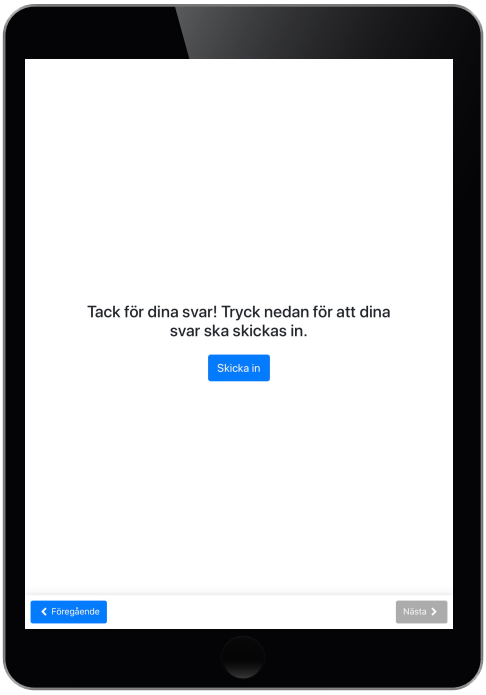


(a) The log in page

(b) Select health issue page



(c) The second last page



(d) The last page

Figure 2.2: Examples of pages from the original design of Vårdexpressen.

2.3 Design theory

Since this thesis is based on a the interaction design process described by Preece et al. [17] and has a user experience perspective, a few theories and aspects regarding design are presented below to give the reader the necessary background on the topic.

2.3.1 User experience

The international standard on ergonomics of human-system interaction, ISO 9241-210 [18], defines *user experience (UX)* as followed: "User's perceptions and responses that result from the use and/or anticipated use of a product, system or service". In other words, user experience is how the user feels and reacts before, during and after using a product. The product should be engaging, helpful, motivating and rewarding [17].

An important aspect in UX is the *usability* which involves how easy the users can achieve their goals when using a product. Usability is defined in ISO 9241-11 [18] as "the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

The *user interface (UI)* is all the components of an interactive system that presents the information to the user and gives the ability to accomplish certain tasks. The UI should have an appropriate design to achieve a good user experience [18].

2.3.2 User-centred design

In a *user-centred design* approach, the focus is put on the users and their needs and goals in each phase of the design process. This approach involves three principles: early focus on users and tasks, empirical measurements and iterative design. These are also the main principles in interaction design. To obtain empirical measurements, user testing is conducted to be able to observe and analyse the users' performance and reactions when interacting with the prototype. Problems found during the user tests are corrected. Then a new round of user tests are conducted where problems are corrected and so it goes on. This is referred to as an iterative design process [17].

Human-centred design

In user-centred design, a lot of focus is put on how the users are interacting with a product. However, *human-centred design* has greater focus on the users' emotional and psychological preferences [19]. In human-centred design, the main focus is on the users' needs, capabilities and behaviours [20]. The aim is to make the interactive system useful and usable which in turn leads to improved productivity and user well-being [18].

2.3.3 Nielsen's 10 usability heuristics

To provide a good UX, Nielsen [21] has created a collection of design principles. These principles work as a rule of thumb when identifying possible usability problems in a user interface. Followed are the 10 principles:

- **Visibility of system status**
  The user should always be informed about what is going on, through appropriate feedback and within reasonable time.

- **Match between system and the real world**
  The system should speak the users' language, with words, phrases, and concepts familiar to the user, rather than system-oriented terms. It should follow real-world conventions, making information appear in a natural and logical order.

- **User control and freedom**
  The system should have undo and redo options and a clearly marked emergency exit to be able to leave an unwanted state.

- **Consistency and standards**
  The user should not have to wonder whether different words, situations, or actions mean the same thing. The system should follow platform conventions.

- **Error prevention**
  The system should prevent errors from occurring by eliminating error-prone conditions or present a confirmation option to the user before they commit an action.

- **Recognition rather than recall**
  Make objects, actions, and options visible to minimize the user's memory load. Instructions for use of the system should be visible or easily retrievable.

- **Flexibility and efficiency of use**
  Provide accelerators that may speed up the interaction for the expert user. Allow users to tailor frequent actions.

- **Aesthetic and minimalist design**
  Dialogs should not contain information that is irrelevant or rarely needed.

- **Help users recognize, diagnose and recover from errors**
  An error message should be expressed in plain language. It should indicate the problem and suggest solutions.

- **Help and documentation**
  Provide help and documentation that should be easy to search and focused on the user's task. Concrete steps should be listed and the documentation should not be too large.

2.3.4 Triangulation

Triangulation means that something is investigated from at least two perspectives to be able to validate the results in a study [17]. By combining methods or sources, accuracy can be ensured and weaknesses of a method or source can be compensated for [22]. The most common triangulation form is *methodological triangulation*, which means that data is received from different data gathering techniques. Other triangulation types are *triangulation of data*, *investigator triangulation* and *triangulation of theories* [17].

2.3.5 System Usability Scale

A System Usability Scale (SUS) is used to assess a system's usability. The SUS consists of a questionnaire with ten statements. The statements are alternately positively and negatively worded. The respondent is asked to score the ten statements on a 5 point Likert scale, ranging from Strongly Disagree to Strongly Agree. Followed are the statements presented to the respondent [23]:

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

Calculation of SUS score

A usability score, also called the SUS score, can be calculated from the answers to the statements. The score is a single number between 0-100 that represents the overall usability of the system [23]. By calculating this score, it is possible for two versions of a system to be compared in terms of the usability [24].

To calculate the SUS score, the respondents' scores for each of the ten statements are converted to a new number – also called the score contribution. These score contributions are added together, and then multiplied by 2.5 to convert the final SUS score range from 0-40 to 0-100 [25]. The score contributions from each statement are calculated different depending on whether the statement is odd-numbered or even-numbered. For the positively worded statements (1,3,5,7,and 9), the score contribution is the scale position minus 1. For the negatively worded statements (2,4,6,8 and 10), the contribution is 5 minus the scale position [23].

Interpretation of SUS score

A SUS score above 68 is considered above average [25]. To simplify the interpretation of the SUS score ranging from 0-100, Bangor et al. [26] added an adjective rating scale. The additional scale consists of adjectives such as "poor", "ok" and "excellent". Besides the adjective scale, a grading scale consisting of the letters A-F was also added by Bangor et al. since this is a familiar grading scale from school. The scales in relation to one another can be seen in Figure 2.3.

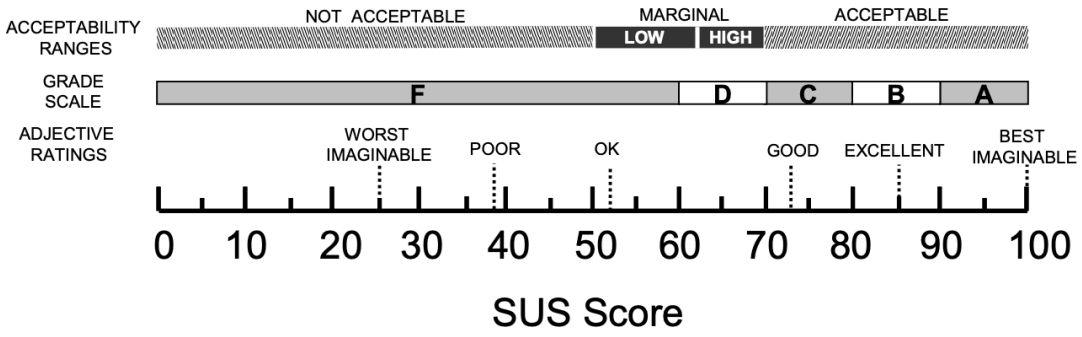


Figure 2.3: The SUS scale in relation to the added adjective rating scale, as well as the letter school grading scale [26]. The SUS score 68 is considered to be the average.

2.4 Design process

The methods used throughout this thesis are based on the process of interaction design, described as four basic activities by Preece et al. [17]. As the design development does not start from a blank sheet, the process is somewhat adjusted to fit the specific process of this thesis. The process activities can be visualized in relation to one another in Figure 2.4. The chapter structure of the thesis is also based on these four activities, described below:

1. **Discovering the needs**
   The first activity is about understanding the users by gaining information about them and how they behave and interact with the system. The understanding is achieved through data gathering and analysis. When the needs are found, it is possible to decide what the system should provide to meet these needs.

2. **Designing alternatives**
   The designing activity is about generating possible solutions to the findings from the discovery phase. This step includes finding alternative concepts for the design. The concepts should describe how the design makes the user understand how to interact with the system [17].

3. **Prototyping**
   The next step in the designing phase is to visualize the ideas. Creating prototypes for the users to interact with is the most efficient way of evaluating concepts [17].

4. **Evaluating**
   During the evaluation, the usability and acceptability of the product are measured [17]. The evaluation aims to declare if the defined problems were solved and what parts that can be further developed and improved.

Since the goal is to enhance the patients' user experience of the system, a human-centred design approach is important during the design process. Thereby, the emphasis is put on finding the right problems to solve in a way that meets the human needs [20]. To be able

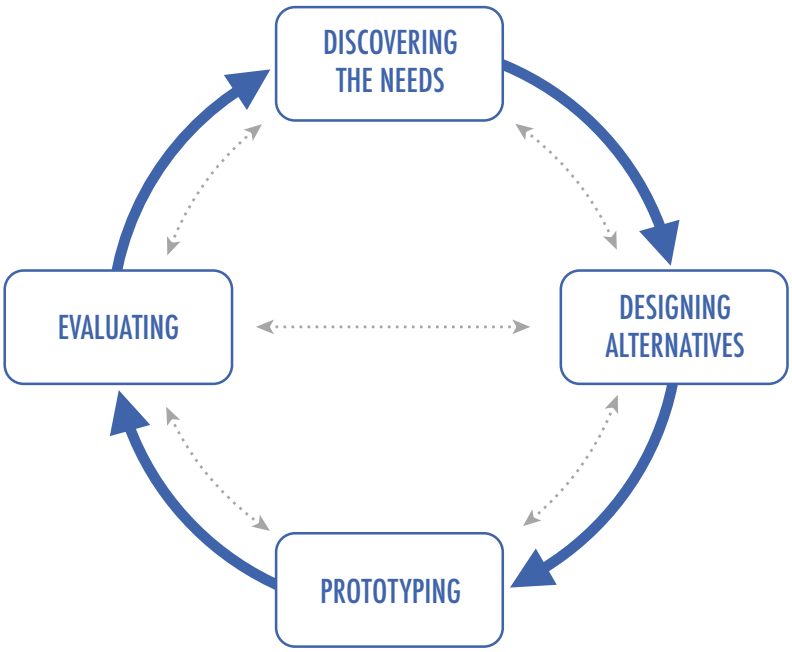


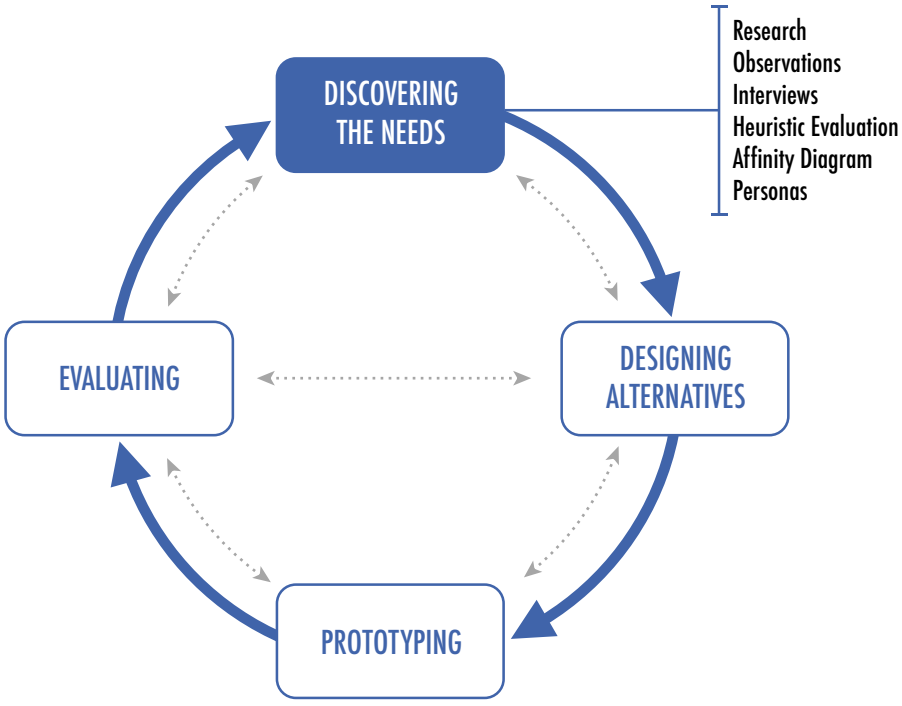
Figure 2.4: The design process based on the four basic activities of interaction design described by Preece et al. Blue arrows indicate the main direction of the process. Grey arrows indicate the iterative approach in the process.

to ensure that the right problems are solved, the design process must be of iterative nature. This means that the activities are not following each other linearly, but also that each activity are iterated until enough information is obtained to move on to the next step. The iterative nature of the process is emphasized in Figure 2.4 as the dashed grey arrows.

Chapter 3

Discovering the needs

The initial step of the design process was to discover the user needs and to evaluate the original design. Information about the users and the current system was obtained through multiple methods: research, observations, interviews and a heuristic evaluation. This lead to a method triangulation which generated a lot of data from different perspectives. The data was analysed and summarized in an affinity diagram. Lastly, personas were created to represent the findings in this chapter.



3.1 Research

The discovery phase started with a literature study where the aim was to get deeper knowledge in the patients' needs, attitudes and expectations when being in contact with health care. The essence of the findings is presented below.

3.1.1 Behaviours and needs of patients in contact with the health care

Health care has traditionally categorized patients based on their diagnosis, age and gender. However, each patient has their own characteristics, needs and behaviours and they can thereby be divided into other groups. According to the Swedish Association of Local Authorities and Regions [27], the Swedish population can be divided into four different groups based on the persons' needs and behaviours when in contact with health care. The healthcare services should be designed to meet the needs and behaviours of the four different groups. This will provide a more person-centred care. Presented below are the four patient groups described by the Swedish Association of Local Authorities and Regions. Additionally, the last sentence in the description of each patient group describes their behaviours and needs in a waiting room and which solutions (e.g. digital tools) that suits them.

Independent and dedicated

According to Vitabäck et al. [28], approximately 45 % of all the patients within primary health care are *independent and dedicated*. They are engaged in their own health and they often have an active lifestyle and eat healthily. They have a confidence in their ability to find a solution to their health problems, and they only contact the health care if they cannot find a solution or explanation on their own. When in contact with the health care, they are rational, motivated, well prepared and very involved in their own health care. They follow the healthcare professionals' advice if they believe that the given recommendations and treatments give results, [27]. The patients in this group are very likely able to check in online before the health centre visit. They can probably also describe their symptoms and get a first assessment digitally. This would make the actual visit in primary health care more efficient. It would also make it possible to sort out visits that are not necessary [15].

Worried and dedicated

The *worried and dedicated* group makes up approximately 24 % of the patients within primary health care [28]. They take great responsibility for their own health and are aware of their eating and exercise habits. They are often worried about their present and future health and are actively seeking information about it. They can also be worried about not being listened to by the healthcare professionals or not getting the right help. Their anxiety quickly decreases if they experience that they get a good connection with the healthcare professionals [27]. A waiting room host can provide a helping hand to these patients when checking in digitally at the health centre, and answer simple questions [15].

Traditional and unconcerned

The *traditional and unconcerned* people are calm and not worried about possible future health problems. About 25 % of the patients in primary health care are part of this group [28]. These persons often eat unhealthily and have a passive lifestyle. If they experience a health issue, they can wait a long time before contacting the health care. However, they have a high confidence in the health care and do not question the healthcare professionals' decisions, but they like to feel informed and involved when in contact with the health care [27]. A traditional reception desk in the waiting room instead of a digital entry makes it easier for this patient group [15].

Vulnerable and worried

According to Vitabäck et al [28], approximately 6 % of patients in the primary health care are part of *vulnerable and worried* group [28]. These patients have a low self-confidence, high level of stress and anxiety when in contact with the health care. They do not trust their own ability when it comes to health care and they feel that they have no control over their own health. They often have a low confidence in the healthcare system since they believe that the healthcare professionals will not listen to them. Either it takes a long time before they contact the health care, or they go directly to the emergency room for help. These patients would need a personal support to be able to navigate properly in the healthcare system since they might not have enough knowledge in how the healthcare system works or how to use digital tools [27].

3.1.2 Value of digital anamnesis and triaging tools

Conventional, the incoming flow of patient in the primary health care is manually managed by the healthcare professionals through triage. This manual management brings a raft of challenges. Each healthcare professional in the care chain needs to get informed about the patient's anamnesis. This implies that each patient needs to tell their story to every new healthcare professional they meet. This workflow overloads both the resources in the health care as well as the patients. An automation of some parts in the patient flow has the power to create additional value for both healthcare professionals and patients.

A survey regarding what is important for healthcare professionals as well as patients in the primary health care has been carried out by Visiba Care [29]. The survey was carried out through user interviews and usability tests of an automated solution for triage and anamnesis. The conclusions are presented below, in terms of what values a digital healthcare tool provides for the healthcare professionals and patients.

Value to healthcare professionals

The value given to the healthcare professionals if the triage process is automated is the simplified ability to guide the patient to the correct level of care if the solution provides decision support. There is also value in receiving a detailed anamnesis before meeting the patient. The healthcare professionals gets a deeper insight in the patient's situation, which in turn saves time and resources. Lastly, the transferring of patient information may be simplified between the different professions in an automated process [29].

Value to patients

To make the patient confident using the a digital tool, it needs to be simple and easy to use. The clearer the communication is between the system and the patient, the more trust the patient puts in the process and the result. When a system asks questions for the patients to answer, it is of importance how simple and relevant the questions are according to the patient. Additionally, fewer questions make the patients feel more secure. The survey carried out by Visiba Care about their automated triage and anamnesis solution showed that patients feel more secure if they receive 10 questions about a specific case, rather than 100 medically exhaustive questions [29]. The survey also showed that the patient often feels satisfied already after the initialisation of contact with the health care. This is described as a feeling of handling the ball over to the healthcare professionals' court. This feeling is shown to apply to synchronous (e.g. face-to-face or phone call) as well as asynchronous communication (e.g. text messages).

3.2 Field observation

This part of the discovery phase involved understanding how the system (Vårdexpressen) is used at the health centre and the tasks performed. Observation is a data gathering technique which can be used in early stages of a development process to help the observers understand the user's needs, goals and actions [17]. A field observation was done early in the design process to understand the context, tasks and goals of the users. The main goal was to get an insight into the system and its context.

3.2.1 Procedure

The observation was carried out at a medium-size health centre in a small town in Skåne. The system was new to the patients as well as the healthcare professionals since the health centre was in the implementation phase with the system. This made it easier to understand which aspects of integrating Vårdexpressen that were particularly important. Also, potential problems that may arise were identified. There was one nurse, one doctor and one medical secretary working with the system during the observation session. The session lasted for two hours. An observation normally generates a large amount of information. Therefore, a framework was prepared and used to structure and focus the observation [17]. Following framework and questions were used:

- **Who** are the users of the system? Which professions and in which situations are they interacting with the system?
- **Where** is the system used? In which situations?
- **What** are they doing with the system? Which tasks are performed and how? How long time does it take?

3.2.2 Findings

During the field observation, information was gathered about how Vårdexpressen is integrated in the overall process at the health centre. Details about where the system is used, who the system is used by and how the system is used are described in Section 2.2.1.

3.3 Usability observation

Ten usability observations were conducted to capture the users' needs and user experience with the current user interface in Vårdexpressen. The users were observed interacting with Vårdexpressen. The aim with the observations was to understand the users' actual interactions and problems, rather than what they think their problems and attitudes are. The observations were not conducted in field, i.e. in a healthcare environment, since the use of the system in Region Skåne was paused during the observation period.

3.3.1 Participants

Participants of various ages, genders and backgrounds were recruited within the acquaintance circle of the researchers. The sample selection was made to represent the wide range in patient demographic at a health centre. Three men and seven women participated in the observations. The participants had various medical and technical background. In Table 3.1, the participants are divided in three groups based on their age. This division was, in retrospect, made since the age of the participants was strongly correlated with how they interacted with the system. The young adults, as well as the mid-aged persons had a lot of experience with technology. The elderly participants had very low to moderate experience with technology.

Table 3.1: Participant demographics for the usability observations.

Group	Age	# Participants
Young adults	20-25 years old	5
Mid-aged	54 years old	2
Elderly	78-82 years old	3

3.3.2 Procedure

Each session started with two open-ended questions about the participant's expectations when visiting a health centre. Then the participant were told to pretend that they are in the waiting room at a health centre seeking care for one of following health issues:

- Cough, runny nose or nasal congestion
- Sore throat
- Pain or pressure in the chest
- Acne

- Urinary tract infection

The participants were advised to choose the health issue they have experienced before to make the situation as realistic as possible. Then they used the original design of Vårdexpressen on a tablet to answer to questions about their health issue. In the end, the participants were encouraged to discuss the system and their experience of it. Each session lasted for 10 to 40 minutes.

One of the researchers moderated the observations while the other researcher took notes. The participant was placed between the moderator and note taker. During the observation, the tablet screen and sound were recorded. Additionally, attitudes and difficulties the participants met when using the system were noted. The participants also got to see the generated anamnesis, i.e. the information about their health issue that is supposed to be presented to the healthcare professionals.

3.3.3 Findings

Findings regarding patient attitudes and fears are presented in this section. Findings regarding the UI are presented in Section 3.6 Affinity Diagram.

Expectations

It was very important for all the observed persons to get the help they need when they visit the health centre. They want to get the right diagnosis and treatment within a reasonable time. Three of ten pointed out the importance of getting listened to and being taken seriously. They do not want to be sent home before they have received the help they need. Six out of ten participants said that they do not want to wait for too long in the waiting room before meeting the healthcare professionals. Only one of the three elderly persons said that it is important to receive help quickly, while the other two valued the human connection and the right help more. One of the mid-aged participants emphasized that the waiting room should not be too crowded.

Attitudes and fears

In general, the young adults (50 % of the participants) had a good attitude regarding the system during the observations. The elderly persons were more sceptical and had more troubles using the system. Two of the elderly participants did not understand the concept with Vårdexpressen and were afraid that they would not meet a healthcare professional if they used the system. According to them, it is very important to be able to express their problems and feelings to a human being and build a trust between each other.

Three of the observed persons felt impatient because of the rather large number of questions and information pages. However, the general attitude to Vårdexpressen was positive. All participants could see benefits with using the system. They were especially positive about the fact that the nurse or doctor already has the necessary information when they meet them.

3.4 Heuristic evaluation

Heuristic evaluation was performed on the original design of Vårdexpressen to evaluate its usability. The evaluation was conducted by the researchers individually. This was followed by a debriefing where the findings were discussed and summarized. The evaluation was conducted according to specific usability principles, also called Nielsen's 10 usability heuristics (Section 2.3.3). The aim with a heuristic evaluation is to find and explain usability problems in a system, and also to suggest solutions to the problems [17]. However, the suggested solutions are not presented in the findings below but in later activities of the design process.

3.4.1 Findings

The results of the heuristic evaluation is presented as a list of problems in the UI. The identified problems are categorized in the different heuristics.

Visibility of system status

- The system does not give enough feedback on previous answers.
- It may be hard to understand the remaining time or number of questions.
- There is no visible indicator of the user's position in the queue or the fact that he or she is placed in queue during the questionnaire. The user only receives this information in the beginning and in the end of the system.
- It may be hard to understand that there are different sections in the system.
- Text fields are hidden under the option *Other* in multi-choice questions. The text field is sometimes not marked when chosen.
- It is not clear how to seek care for a relative, such as for a child as a parent.

Match between system and the real world

- It may be hard for the user to understand the purpose of the system and connect the questionnaire to the real life. It may be hard to understand that the questionnaire is the first step in the care visit.
- The user might not understand that the questions asked are based on previous answers. If an incorrect answer is inserted, the next questions will be affected.
- The figure of the screen does not show how the real screen looks like in the waiting room when there are multiple patients in the queue (Figure 2.2c).

User control and freedom

- There is no emergency exit.
- It may be hard to know when it is not possible to go back to the previous question or section. There are security blocks in the system that prevents the user to go back due to patient safety. These security blocks are not clearly mediated to the user.

Consistency and standards

- The button colours are not used consistently which can be confusing for the user. Sometimes when a button is disabled (cannot be pressed), it is blue when it should be grey.
- How to proceed to the next question is not consistent:
  - Sometimes when choosing an alternative the user proceeds in the system automatically, sometimes the user needs to press the button to proceed.
  - There are sometimes two *Next* buttons; one near the question and one in the bottom bar.
  - The *Next* button is sometimes changed to *Skip* if the question is not mandatory.
  - It is sometimes possible to proceed from a slider answer with the button *Selected answer*. This button is not always present in the slider answer.
- Inconsistent markings of chosen answers in a multiple-choice question. There is a difference between the marking where the user can input their own text in the option *Other* and the predefined answers.

Error prevention

- The send button in the end of the system (Figure 2.2d) can be easy to miss. The second last page (Figure 2.2c) presents information about that the nurse will call the patient's name when it is his or her turn. This indicates that the questionnaire is completed. The user then needs to press the continue button on this page to be able to find the send button on the last page.

Recognition rather than recall

- It is hard to remember the exact name of your pharmaceuticals. It is not possible to search on group name for all pharmaceuticals groups, e.g. oral contracetives.

Flexibility and efficiency of use

- There are no short cut buttons, for example *I do not have any chronic diseases.* You have to read the small print to be able to know how to proceed.

Aesthetic and minimalist design

- It is too much information and too many slides in the introduction of the system.
- The font choice of the initial information slides could be more aesthetic appealing.
- There are duplicates of the same button (*Next* buttons).

Help users recognize, diagnose and recover from errors

- All error messages do not suggest a solution. For some mandatory questions in the system, the error message says *This question is mandatory* and has no explanation on how to complete the question.

Help and documentation

- There is no help button or option.

3.5 Interview

In total, four open interviews were held during the discovery phase of the process. The informal format of an open interview was appropriate since general viewpoints about the user experience of the system were of interest [17]. The questions were open which gave the interviewees flexibility in the format and content of the answers. The aim of the interviews was to gain a better understanding of user experience problems in the current system and also how the company works with these problems today.

3.5.1 Participants

Three males and one female were recruited for the interviews. The age of the participants ranged from 20 to 49 years old. The interviewees consisted of two employees at Vårdinnovation Sverige AB and two employees at two different health centres in Region Skåne. The employees at Vårdinnovation Sverige AB were a social scientist and a client experience associate. The health centre employees were patient hosts that guide and help patients with Vårdexpressen in the waiting area. The sample selection was based on recommendations from the supervisor and CEO at the company. It was considered important to gain inputs both from the company and the field.

3.5.2 Preparations

A list of topics and open-ended questions were formulated before the interviews. The list consisted of areas of interest to understand the patients' mindsets and struggles concerning Vårdexpressen. Followed are some examples of the open-ended questions:

- What are the patients' experience of Vårdexpressen?
- How well do the patients understand the purpose of Vårdexpressen?

- What are the largest difficulties in the system today?

3.5.3 Procedure

The interviews with the patient hosts were conducted by telephone, while the interviews with the employees at Vårdinnovation Sverige AB were face-to-face interviews. During the interviews, notes were taken and audio was recorded. The purpose with the audio recording was to be able analyse the gathered data from the interview in retrospect. Informed consent was given from all interviewees. Each interview lasted for 25-45 minutes.

Data analysis

An initial processing of the collected data was done before the data analysis could start. The data processing included expansion of notes and transcription of relevant parts of the audio recordings. Since the data was mainly qualitative and exploratory, a thematic analysis was performed. This is a way of examining the data to find and analyse themes in the data. A theme is defined as an important topic of the data in relation to the goal of the interview [17].

3.5.4 Findings

The interviews provided essential information about current problems and attitudes of patients who have used the system. A summary of the themes discussed is presented in this section.

Age

There is a general difference in behaviour for young and elderly users. Young people are usually very tech-savvy. They do not meet any direct obstacles; they tend to sit down in front of the tablet and go through the system without further ado. They usually have no problem with the large amount of questions that needs to be answered. However, a problematic behavioural pattern that can be seen among the younger users is how they want the process to go very fast. Nor do they reflect to a greater extent on why they seek health care. This results in younger patients tending to act a bit careless.

It is common that elderly people are not very tech-savvy. Elderly people are generally afraid of technology and think it is complicated. This leads to an initial fear when approaching the system. The patient host may help them overcome this initial fear by telling them "We can try together? I am here to help you". This support often makes the elderly user less scared and makes them able to get through the system. Afterwards, they often feel that things went well. For the most part, the elderly people desire human contact and want someone (the patient host) to sit next to them during the process. Many of the elderly patients prefer to talk about their problems and have someone listening to them, rather than using the tablet. In contrast to the occasional carelessness among the younger users, the elderly users tend to be very careful with their answers. When they fail, it is due to other things than carelessness. Another aspect that came to light during the interviews was that touch screen pens may help elderly people with shaky hands.

Scepticism

Scepticism is common among the elderly users. The most sceptical patients express this by asking questions like "Will this replace the doctor?" or "Will I not be able to meet anyone?". The biggest problem for the sceptical patient is not using the tablet, but the whole process the system makes them go through. The scepticism and stubbornness gets in the way for users who is capable of completing the task if they only dare to try.

Illness and stress

The patients arriving at the clinic are seeking health care because they are ill or have a health issue. No one is thrilled to visit a clinic. Patients in the primary health care are additionally often stressed. They may have had to take time off from work to make it to the drop-in reception, or they may need to make it back to work before lunch. This stress makes the users prone to click through the system too fast and negligently. Which in turn, causes error to possibly occur. One of the interviewees pointed out that some patients do not realise that the system makes the time in the waiting area meaningful and valuable. The interviewee also denotes how this is hard to convey to the patients.

Another effect of the stressed behaviour among the patients is the fear of ending up last in the waiting queue if they are too slow at the tablet. The interviewees experience that most patients calm down when they receive the information about their queue spot being reserved as soon as they have entered their personal identity number in the tablet. Most patients release the stress slowly once they are up and running and realize that they are in the queue to the nurse.

According to several of the interviewees, there is also a problem that people get tired after a while due to the amount of questions. Then they just click something, not always the correct answer, to finish quicker. Which in turn leads to an incorrect anamnesis presented to the healthcare professionals.

Break blocks

Two main break blocks were identified in the system during the interviews. The break blocks are referred to as places in the system where the patients often tend to need support from the patient hosts. If the system is supposed to be autonomous in the future, with no need for patient hosts, these break blocks have to vanish. However, the interviewees emphasise that the goal is to make the patients feel secure and not anxious or stressed, rather than decrease the registration time by eliminating the break blocks.

The first break block is the medical background and lifestyle chapter in the system. Many patients want to tell about their problems immediately. However, the questions about the health issue which brings the patient to the clinic are asked after the background questions. The reason for the background chapter to appear before the health issue chapter is the algorithm structure; the system base the health issue questions on the background information. The interviewees describe how many patients find this bothersome.

The second break block is the chronic diseases and pharmaceuticals chapter. One problem with the questions in this chapter appears when patients do not know what pharmaceuticals they are taking. There is also an issue with attitude and questioning from the patients, where they think this information is already available in their medical record or saved in the

system from previous usage. But the medical record and Vårdexpressen is not integrated in this sense. Hence, it is essential that the patients answer these questions to get the best possible care. One interviewee mentioned that some patients fill their current health issue instead of their chronic diseases which is asked for in the question. As mentioned for the first break block, many patients want to tell their problems right away. But in these cases, it results in the wrong answer, in turn resulting in the wrong anamnesis.

Balance in information

One of the interviewees mentioned how there is a trade off in the number of asked background questions: *"It is important to find the sweet spot. Maybe we should have a few more questions than the patient find comfortable, but not so many questions that the patient experience answering them disincentive."* In the system, there is a balance between how much information the user is willing to receive and give. Receiving of information includes reading instructions and questions and how these are processed by the reader. Giving of information includes the number of questions answered and how well these questions is answered. One of the interviewees describes the balance as: *"Maybe it is better that people read 100% of half of the information, then 0% of all the information."*

The goal is for the patient to understand the purpose of the system, and how it can help them get better care. One of the patient host interviewees declared that once patients understand what the purpose of the system is, they are positive about it. With no understanding, they think it is unnecessary and tough to answer the large amount of questions. One of the largest problems according to all four interviewees is the fact that the patient does not read the information. Almost every patient skips the introduction pages. It is very rare for a user to read the information about how the system works.

The user interface

Some aspects regarding the user interface of the system were highlighted during the interviews. The main issues are presented in the following list:

- The user sometimes miss submitting their answers.
- The user skips questions by mistake when the system automatically proceeds at the same time as the user press the next button.
- The user sometimes miss that it is possible to scroll down to see more options in a list.
- The security blocks are not well communicated to the user, resulting in the users not knowing they cannot go back in the system at certain points.
- It is not clear how to seek care for more than one issue in the system.

3.6 Affinity diagram

With a thematic analysis, qualitative data can be examined to be able to identify patterns in the data. A common method is to do an affinity diagram where ideas and thoughts are

organized into a hierarchy. The thoughts are often written on notes and related notes are grouped together [17].

An affinity diagram was made to identify and categorize the findings from the observations, interviews and heuristic evaluation. The findings were written down on sticky notes and organized into groups of similarity. The affinity diagram resulted in ten groups (Figure 3.1). Further on, six focus areas emerged from these groups, presented in Table 3.2.

Table 3.2: Focus areas emerged from the affinity diagram.

1	Overview
2	Information
3	Navigation
4	Questions with a time perspective (sliders)
5	Questions with text field (keyboards)
6	Questions regarding chronic diseases and pharmaceuticals

Figure 3.1: The affinity diagram with findings from observations (yellow notes), interviews (pink notes) and heuristic evaluation (orange notes). Each focus area is represented by a white paper with the area heading written on it.

3.6.1 Findings

The findings from each focus area (Table 3.2) which came out from the affinity diagram are summarized and presented in this section. These findings originate from empirical interviews and observations together with the theoretical heuristic evaluation.

Overview

One persistent problem with the system is the lack of feedback to the user regarding remaining time or remaining number of questions. There is a progress bar in the bottom of the screen, but this is not noticed by many users (can be seen in the footer in Figure 3.4b). Thereby, many users request an indicator of their position in the system and how much time is left. Additionally, the user sometimes struggles with the time perspective on the asked questions. This may be due to the unawareness of where in the system the user is and by that, in which context the questions are.

There is also an issue with the security blocks in the system. The purpose with the blocks is to prevent patients to see each other's private information, for example if a patient leaves the tablet and another person gets hold of it. The blocks make it impossible to go back in the system and change answers. This is not mediated to the user properly, which creates a confusion whether it is possible to go back or not. Lastly, the overall size of the body text is perceived as slightly small. In combination with the amount of empty space on the pages, this is something that can be easily adjusted.

Information

The system gives a lot of information to the user in the system, especially in the beginning. This information is barely read by the user, which is a great problem for the understanding of the system among the users. Parts of the observed users felt that the language used in this information is too formal. There is insufficient information between the parts which the system is divided into. This lack of information results in the user not knowing in which context forthcoming questions should be placed in. It has also been observed that the information at the end (Figure 2.2c) is slightly unclear. Many people forget to send in their answers, since they miss the send in button at the very last page (Figure 2.2d).

Navigation

Forward navigation in the system is inconsistent. Sometimes the system automatically proceeds to the next question when the user chooses an answer, while sometimes the user has to press the next button to proceed. This allows the user to skip questions unintentionally, and unconsciously, when the system automatically proceeds while the user simultaneously press the next button. On some pages, there are duplicates of the next button. Sometimes only one of them can be used, and the other one is disabled (grey). This inconsistency can create confusion for the user. Additionally, the next buttons have different text along the system. Such as next, continue, start and skip. This inconsistency can be seen in Figure 3.2 where there is one blue continue button and one grey next button.

Questions with a time perspective

Questions with a time perspective, e.g. "How long have you had acne?", is often answered with a slider in the system (Figure 3.3). Mainly elderly persons have trouble using the slider. They find these questions harder to answer, compared to the questions with answers presented in a list. Since the elderly population often is unfamiliar with tablets and other digital devices, they generally do not understand that the marker in the slider needs to be moved to be able to

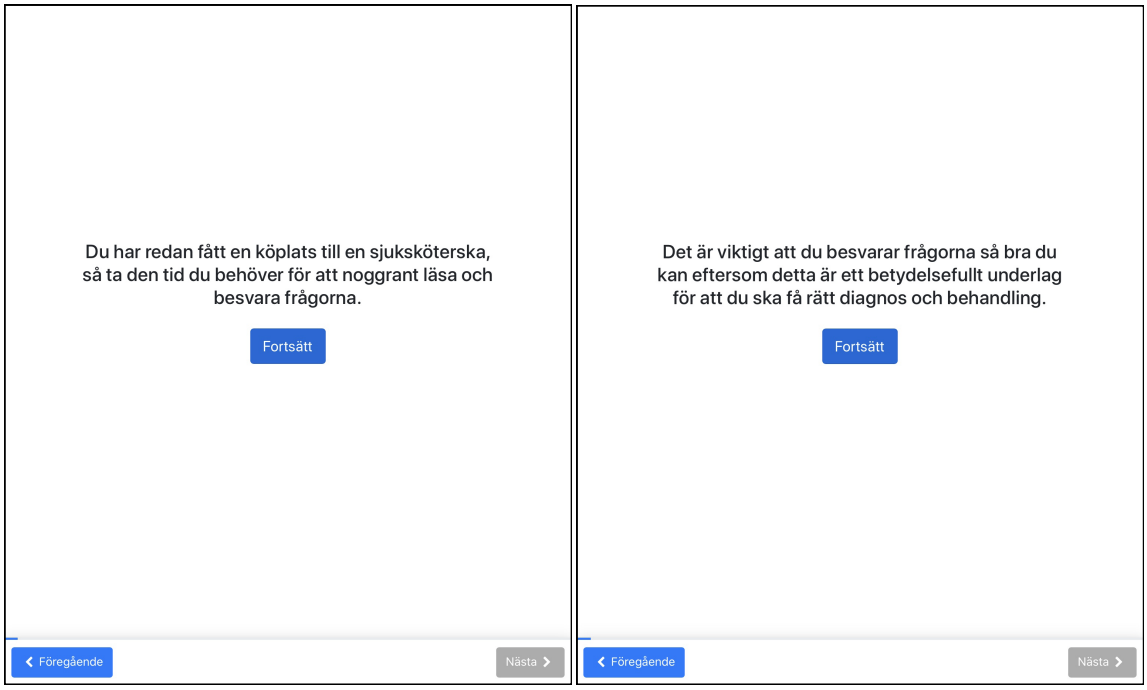


Figure 3.2: Examples of information slides in the beginning of the system.

choose an answer. The length of the time interval was found unreasonable considering which questions that were asked. For example, it is probably not possible to have a sore throat for 50 years. Also, the non-linear time steps in the slider may be experienced as confusing.

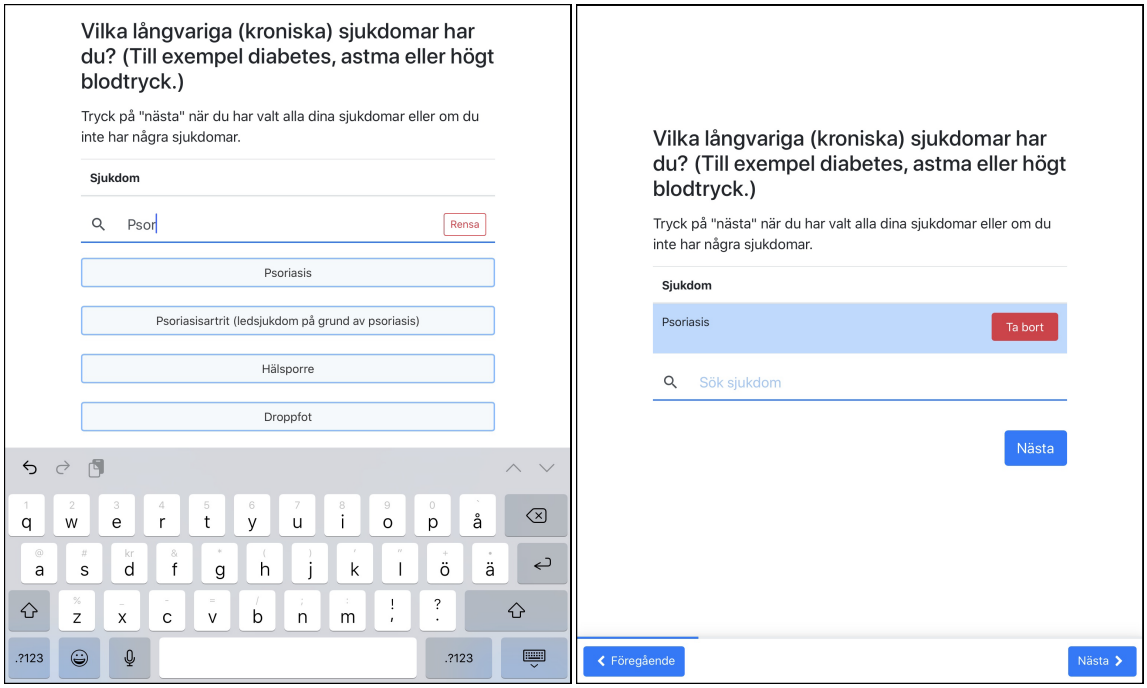
Figure 3.3: Example of question with time perspective including the slider.

Questions with a text field

Some of the questions are answered by inserting text or numbers in a text field, for example when the patient logs in and inserts their personal identity number (Figure 2.2a). The elderly people have trouble in understanding how to find the keyboard, to be able to write in the text field. Additionally, it can be hard to find the right key on the keyboard when inserting the personal identity number due to the large variation of keys available in the keyboard.

Questions regarding chronic diseases and pharmaceuticals

In Vårdexpressen, the patients answer to which chronic diseases they have and which pharmaceuticals they use. A lot of patients are curious about why they need to answer these questions. They believe that the healthcare professionals have access to this information in the medical record or pharmaceutical list. It is often difficult for the patients to remember the names of their pharmaceuticals. This slows down the process significantly. Additionally, it is not possible to search on all group names for pharmaceuticals, such as oral contraceptives or asthma medicine. Also, it is common that the user do not understand that the disease or pharmaceutical must be chosen from the alternatives that appears in the list (Figure 3.4a). Furthermore, it is unclear how to add more than one disease or pharmaceutical in these questions (Figure 3.4b).



(a) List appearing when searching for disease.

(b) One disease (psoriasis) is added.

Figure 3.4: Example of the question regarding chronic diseases for a patient with psoriasis.

3.7 Personas

As the last step in the discovery phase of the design process, personas were created. Personas are models of the users used to describe behaviours, attitudes and goals which are identified during the discovery and research phase of a project [30]. Each persona is defined as a fictive individual, but is a combination of multiple real users who participated in the data gathering. According to Preece et al. [17] the personas are supposed to guide the designer in whether a particular design decision will help or burden the user. Personas are also supposed to remind the designer that real persons are going to use the end product.

To model the users, it was decided to create two personas. During the discovery phase two archetypes emerged: the young user with a lot of technology knowledge and the elderly user with almost no technology knowledge. It was consequently natural to choose these archetypes as a foundation for the two personas. The four different patient groups presented by the Swedish Association of Local Authorities and Regions [27] were also considered and used during the development of the personas. The construction of personas was additionally based on medical user stories created by doctors at Vårdinnovation. Each persona was given a specific medical case for a patient seeking care for a certain reason at a health centre. The resulting personas Marcus and Berit can be seen in Figure 3.5 and Figure 3.6.

The personas are further used in the iterative design process to create the design alternatives and later on, the final prototype. The system Vårdexpressen includes numerous questions for numerous health issues. For this reason, it was decided to base the prototype on one patient case – the persona Marcus Wallin. Thereby, only one health issue and a set of questions were implemented in the prototype due to the time frame of the thesis. This decision simplified the complexity in Vårdexpressen. The persona Berit is still considered in all design decisions since she is the least tech savvy of the two personas and might have trouble with using the current user interface in Vårdexpressen.

I don't want acne on my wedding photos.

Goals

- Get help and treatment fast
- Continue to swim and work out regularly
- Prevent ill-health
- Be involved and informed regarding his health and healthcare
- Get a dream wedding this summer with all his friends and family

Marcus Wallin, 28

Patient seeking care for acne

GENDER	Male
FAMILY	Engaged
OCCUPATION	Engineer
LOCATION	Malmö
INTERESTS	Swimming, travel

Scenario

Marcus has experienced acne the last five months. It appears as red rashes all over the face, with small papules. The acne gets worse by swimming. He has done a lot of research online about his problems, but has not found a solution. Now Marcus is anxious about having a bad complexion at his wedding this summer. He decides to contact his local health center to get rid of his acne. He is motivated and well prepared for his visit at the health center.

Frustrations

- Be sent home without getting any help at the healtch center
- Afraid that the nurse would not listen to all the information he has prepared
- Be stuck in a waiting room for a very long time at the health center

Medical background

DIAGNOSIS

- Psoriasis
- Asthma

MEDICATIONS

- Betnovat
- Inhaler

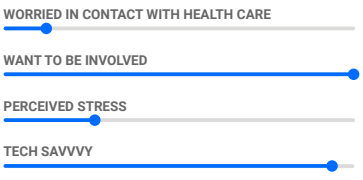


Figure 3.5: Persona 1, Marcus Wallin.

I want to meet a healthcare professional that sees and hears me.

Goals

- Get listened to and taken seriously
- Eat healthy and take a walk every day
- Get a personal connection with the person she is talking to
- Someone to take care of her when in contact with the healthcare

Berit Lind, 81

Patient seeking care for urinary tract infection

GENDER	Female
FAMILY	Married 3 kids 7 grandchildren
OCCUPATION	Retired teacher
LOCATION	Höganäs
INTERESTS	Sewing, crossword puzzles

Scenario

Berit has experienced pain and suffering with the urination the last four days. She feels a strong need for frequent urination, approximately every third hour. Additionally, she has a lower back pain. Berit is afraid she suffers from kidney stone disease.

Frustrations

- Everything turning digital these days, afraid of computers and what they might do
- To not meet a physical healthcare professional who sees her and how she feels
- When the one she is talking to has their phone up at the same time, e.g. when her grandchildren texts during dinner

Medical background

DIAGNOSIS

- Depression
- Hypertension

MEDICATIONS

- Antidepressant
- Antihypertensive drug

WORRIED IN CONTACT WITH HEALTH CARE

WANT TO BE INVOLVED

PERCEIVED STRESS

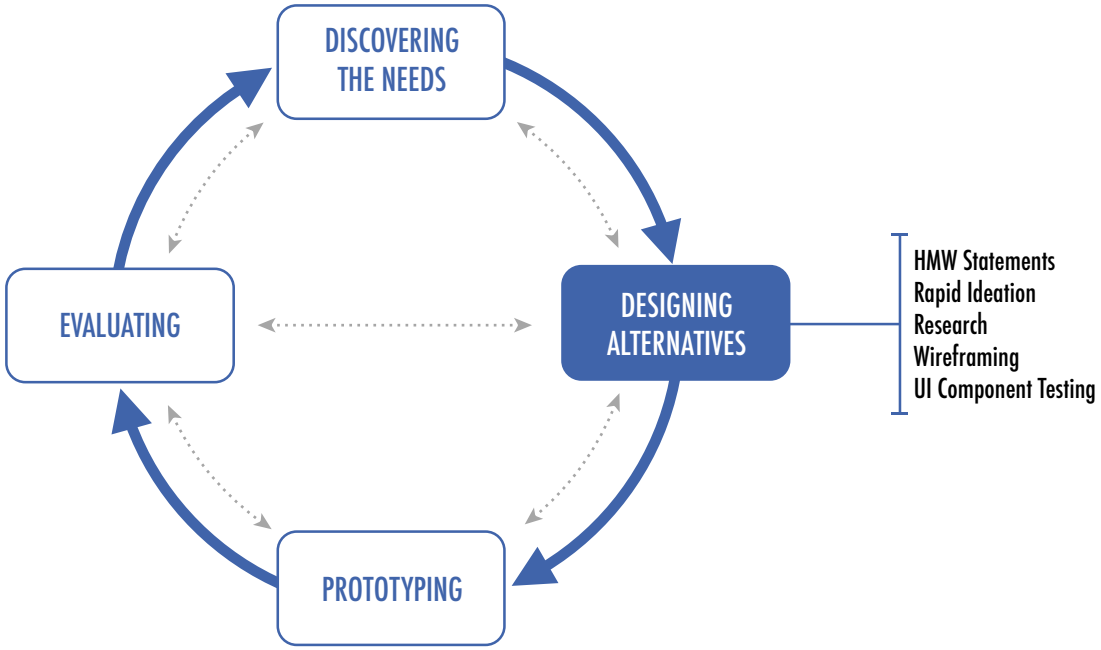
TECH SAVVVY

Figure 3.6: Persona 2, Berit Lind.

Chapter 4

Designing alternatives

The second step in the design process was to design alternatives. In the previous activity, problems regarding the current system were found. In this step, solutions to these problems were generated through iterative brainstorming and sketching.



4.1 How Might We statements

How Might We (HMW) is a method used to summarize discovered insights, problems and user needs. Statements are created to brainstorm new ideas and turn problems into opportunities [31]. To create the statements, following template is used:

How might we – *intended action* – **for** – *primary user* – **so that** – *desired effect* – **?**

HMW statements were created to reframe the discovered problems in each focus area (Table 3.2). For each focus area aspect, the sentence "How might we..." was completed. The HMW statements were created so that the *desired effect* counteracted the problem. The *intended action* was the action that can be done to reach the desired effect. The *primary user* was the patient user group that experienced the specific problem the most. Followed are examples on HMW statements that were created:

- HMW redesign the slider for elderly persons like Berit (Figure 3.6) so that they are able to use it?
- HMW change how information is given to the patients so that they absorb it better?
- HMW give feedback to the patients so that they feel more safe when using the system?
- HMW implement a concept for the users so that they are aware of their current position in the system?
- HMW improve the system navigation for the users so that they experience less confusion?

4.2 Rapid ideation

Brainstorming is a well-established technique to generate as many ideas or solutions to problems as possible [17, 32]. One technique of brainstorming is rapid ideation. The goal with rapid ideation is to generate a lot of ideas to a specific topic within a short amount of time [33]. Rapid ideation was conducted by the two researchers to be able to generate ideas and solutions to the challenges summarized in the HMW statements.

4.2.1 Cycle 1

The first rapid ideation session was called "sky is the limit". The session had a ten-minute time limit and was conducted to get a wider perspective. Ideas regarding the whole concept of the system was generated, not just solutions to certain problem areas. Ideas were generated without regard for constraints. Solutions that are undoable due to technical restrictions in the system were not rejected. Rather, all ideas were allowed and encouraged.

4.2.2 Cycle 2

A time limit was set to five minutes. Before each five-minute session, a new HMW statement was presented to set the focus of the session. Each individual wrote down thoughts and ideas on how to solve the HMW statement. When the time limit had passed, each person gave a brief overview of their ideas. The ideas were then discussed, reviewed and summarized.

4.2.3 Cycle 3

The second rapid ideation cycle gave a lot of new ideas. Hence, a third cycle was conducted to make the ideas more elaborated. Focus was put on how the ideas can be visualized in the system. The time limit was set to ten minutes. This cycle generated sketches of component alternatives, sometimes combined with task flows (Figure 4.1).

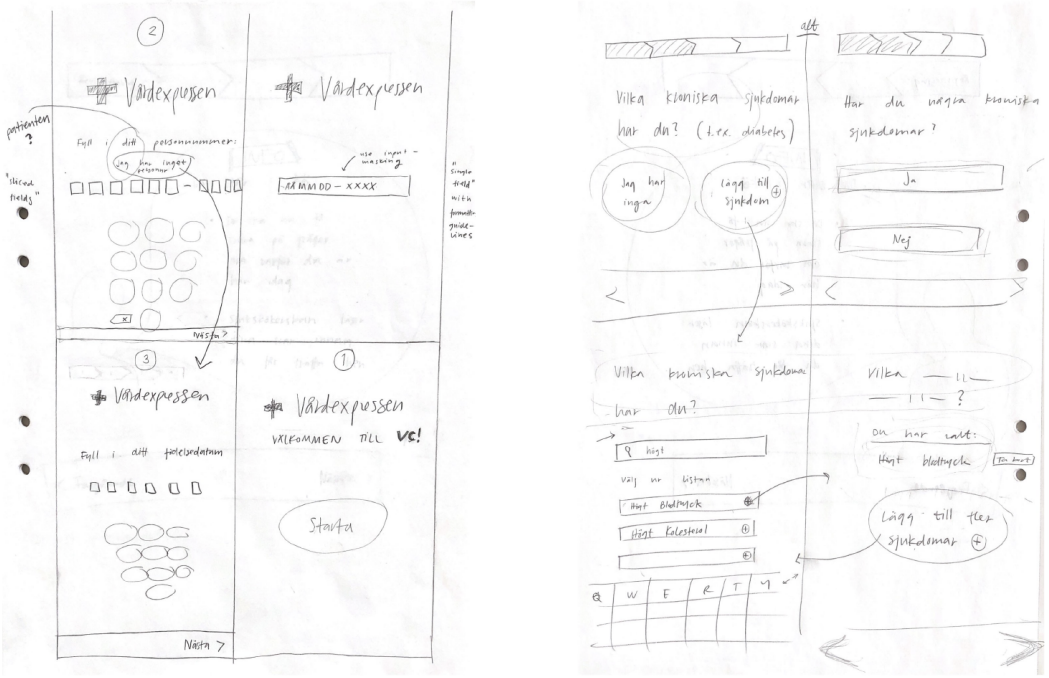


Figure 4.1: Sketches from the third cycle of rapid ideation.

4.2.4 Resulting ideas

Ideas generated during the three cycles of rapid ideation are here presented.

Keyboards and keypads

During the rapid ideation, the idea that all questions with a text field should have a fixed keyboard was generated. This idea would solve the problem of patients not able to find the keyboard. For example, there should be a fixed numerical keypad always visible on the log in

page. This since only the numbers 0-9 and a backspace button are needed to enter a personal identity number. Therefore, a complete keyboard is found unnecessary.

First and last pages

The first page is the log in page in the current system. A page before the log in could be introduced. This page could be a welcome page that is more informal than today's first page. This page may have a friendlier ambience, maybe by a sketched nurse that gives information to the user. This concept may be used further in the system to enhance the personal treatment throughout the system. Personal ambience may also be introduced by addressing the user by name and by using sympathetic phrases.

Also, it should be possible for the user to choose whether they seek care for themselves or if they are helping someone else to seek care. Additionally, it should be possible for the user to say that they do not have a personal identity number. Then the date of birth can be easily used to log in.

Furthermore, the last two pages were reviewed during rapid ideation. It was decided that they should merge into one page since some of the patients miss that their answers are supposed to be sent in on the last page. Also, the animated TV that is shown on the last page should be more realistic, e.g. by showing the real queue and adding the patient's name when the answers are sent in.

Chapters

A lot of the observed persons did not see the progress bar and wanted to know the remaining time or number of questions in the system. The idea of dividing the system in to different chapters was generated during rapid ideation to solve this problem. In this concept, the chapters are visible at all time in the header. The current chapter is clearly marked. It should be easy to overview which chapters that are passed and which chapters are yet to come. The position in the queue to the nurse may be presented between each chapter, or it may always be visible in the header. Before each chapter, a summary of the answers in the previous chapter may be given to the patient. Additionally, the patient should be informed that it is not possible to go back after entering the new chapter due to security reasons.

Navigation

Considering the navigation in the system, it was decided that it should only be one way to proceed or go back in the system. In the current system, the user proceeds in different ways, e.g. automatically by choosing an alternative. To avoid confusion due to different proceeding methods, a new concept was generated during rapid ideation. The idea is to always press the next button to proceed, when an answer is selected. The next button is placed in the footer of the system. A button in the upper left corner is used to go back in the system.

Icons and buttons

Icons can be added to some pages in the system to introduce new functionalities to the system. On pages with a lot of information, an info icon may be added to hide parts of the information and instead allow interested users to go into detail and read more. An exit icon, e.g. a cross,

may also be added to all pages to be able to exit the system. The exit button should be connected with a pop-up asking the user if they are sure about exiting the system.

Icons can also be added to some pages to clarify an intended action. For example, an add icon, a plus sign, can be added for each item in the list of chronic diseases and pharmaceuticals. This would imply that the disease or pharmaceutical is added from the list. Some users did not understand that the item must be chosen from the list in the current system. Some users also found it difficult to access the keyboard. An “Add disease” button instead of the text field saying “Search disease” would facilitate for these users.

Slider

Some of the patients, especially elderly people like Berit (Figure 3.6), have trouble with using the slider in the questions with a time perspective. For these people, it may be easier to choose an alternative from a list instead (as in the majority of the other questions). This would be made possible if a time interval is first selected, e.g. "a couple of days". Then a list with the alternatives 1-7 days would be presented to fine-tune the answer. Another alternative is to make improvements on today’s slider, e.g. include arrows on the marker (< >) and show the chosen answers just above the marker, following along with the sliding motion.

4.3 Research and inspiration from other systems

Other systems, e.g. digital healthcare applications, questionnaires and web pages were reviewed to get inspiration and more ideas for the prototype. The check-out procedure in various e-commerce applications, e.g. the sports retailer Stadium and the fashion and cosmetic retailer ASOS, were investigated. This knowledge was used when designing the chapters in our prototype to make sure that the users are familiar with the design. Furthermore, research was made on how buttons, sliders and multi-selecting lists are used in other questionnaires and how these components should be designed to ensure a good UX.

4.4 Wireframing

In the second cycle of rapid generation a lot of sketches were created. These sketches were mainly made for separate components or functions for the system. To get a better overview of how these components can be placed and activities can be performed in the system, wireframes were created.

A wireframe is an initial structural level design, displaying the layout, structure and content [17, 34]. Wireframes can have varying levels of abstraction. They can either illustrate a part of a system, or illustrate the total overview [17]. Usually, colours and styles are disregarded and main focus is put on how to understand functionalities, where to place key elements and how the user interact with the components in the system [34]. When details such as colours are eliminated, the designer is forced to study the layout and functionality of each component on every page. With this approach, it is easier to focus on the structure needed to achieve the best possible UX [34].

4.4.1 Designing wireframes

The wireframes were created based on the persona Marcus Wallin (Figure 3.5) seeking care for acne through Vårdexpressen. Low-fidelity sketches were created for each page in the system's flow, starting with Marcus registering and ending with him sending his answers in. The wireframes are presented in Figure 4.2. The sketches were, more or less detailed, rough paper sketches including the most basic contents. No colour or style decisions were made on the pages. The aim was to map out the functionalities on the different pages in the system. On some pages, different options were visualized and smaller comments were added if explanations or additional thoughts were considered needed.

The wireframes worked as a placeholder for where components may be placed in the system and how they may be connected to one another. This created a sense for how the user flow in the future prototype could look like.

4.5 UI component testing

Different UI component alternatives that aroused during the brainstorming sessions were introduced to three persons. The alternatives were presented as simple computer created sketches printed on paper. For example, different alternatives on how to answer questions with a time perspective were presented (the components in the current system can be seen in Figure 3.3). All the alternatives presented in the test can be seen in Appendix A.

Each individual was observed while interacting with the component alternatives on paper. After the observation, the individuals gave their opinions on each component alternative. The observations and the feedback were summarized. A decision was made on which alternatives to proceed with in the design process. The tests resulted in two main findings. To fill in personal identity number, a numeric keypad was the best alternative of the tested ones. For questions with a time perspective, the slider and list were considered easiest to use.

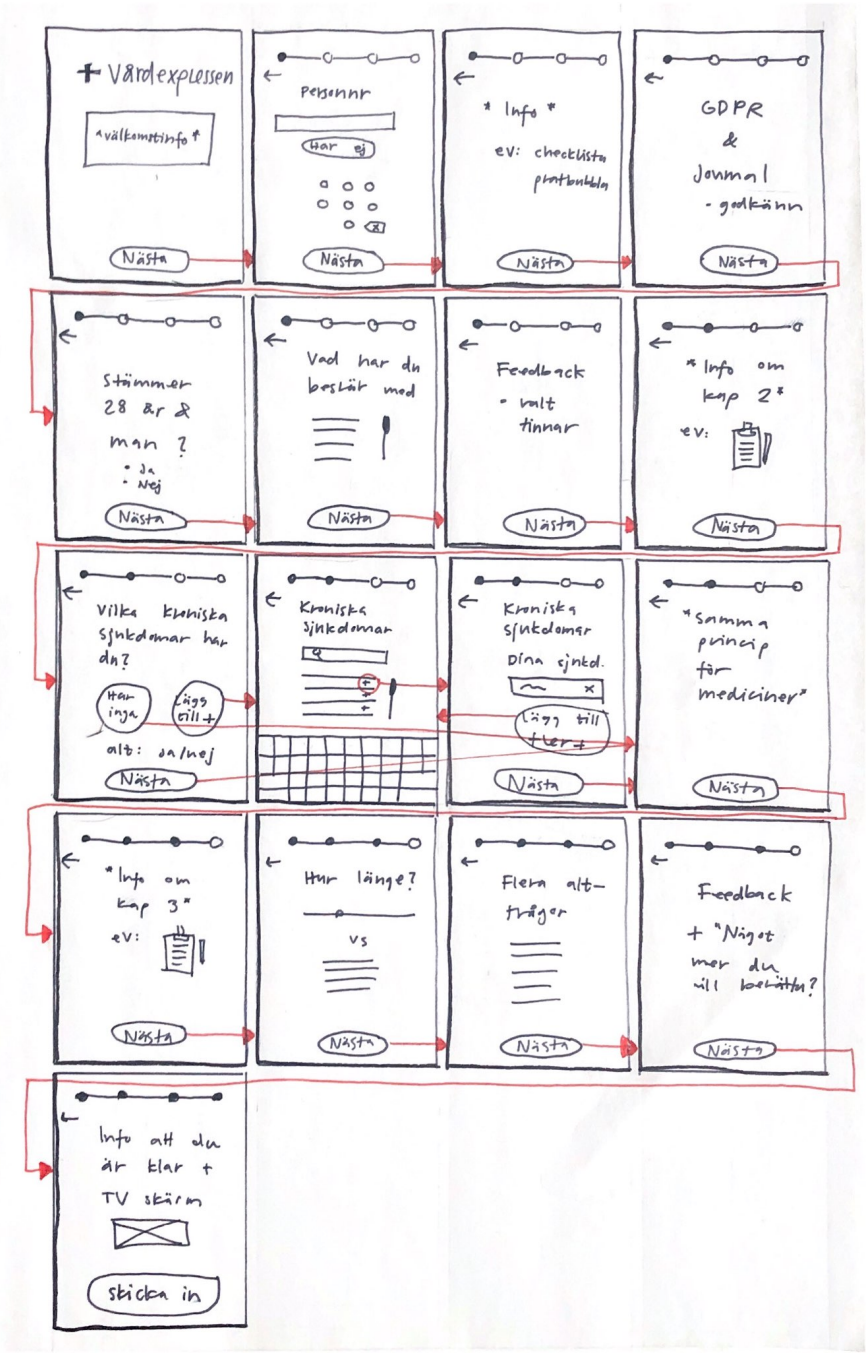
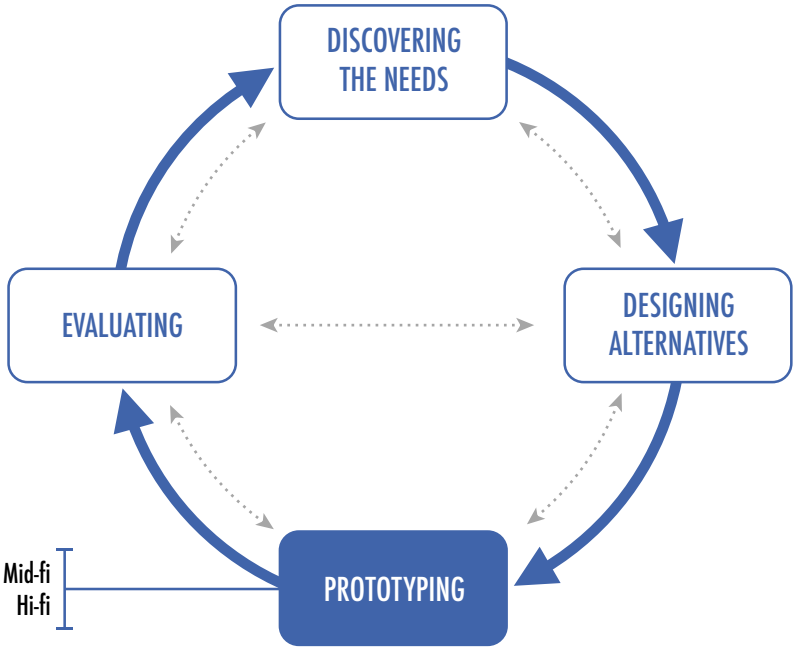


Figure 4.2: The wireframes based on the persona Marcus Wallin.

Chapter 5

Prototyping

The third step in the design process was prototyping. During this activity, design alternatives were created as mid-fi artboards. Last of all, a hi-fi prototype was created to be able to test the ideas and concepts on real users.



5.1 Design aspects

In the development of the prototypes, the design profile in today's user interface in Vårdexpressen was taken into consideration. Vårdinnovation Sverige AB has a selected colour palette that they use in their communication both internally and externally to obtain consistency. A dark blue and a dark green colour are the most used colours by the company. These colours were used in the prototypes for it to be consistent with today's system. Also, the same concept as in today's system was used, which is that questions are answered as in a questionnaire.

A classic easy-to-read sans-serif font was chosen for the prototypes. Headings (often the questions for the patient) were made bold and rather large, as in today's system to emphasize the questions in the system. All font sizes are made as big as the design allows them to be. This strive to make all text easy to read by all users.

5.2 Mid-fi prototype

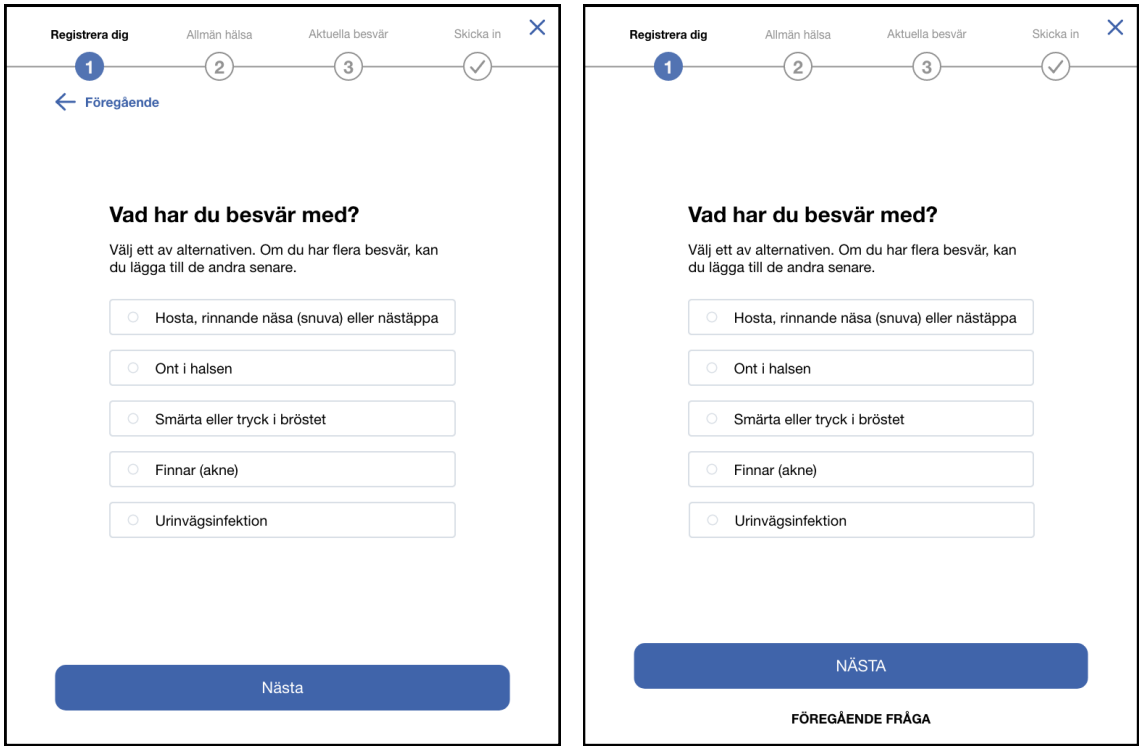
A medium-fidelity (mid-fi) prototype was developed to create a step between the sketches from previous step in the design process and the hi-fi prototype. A prototype of medium fidelity is often digital and uses details, e.g. symbols, logos and colours [35]. The step from sketches to the mid-fi prototype was considered appropriate since a low fidelity prototype was not considered necessary. The questionnaire format is rather straight forward. Further, the generated ideas were based on the main concept in the UI of Vårdexpressen.

Digital designs were created which were neither interactive nor connected to each other. The designs were created in Adobe XD which is a user experience design tool, where artboards can be designed and linked together into an interactive prototype [36]. The artboards consisted of different design alternatives on components and pages that should be in the hi-fi prototype.

5.2.1 Skeleton structure

The design of the skeleton in the system was developed in the beginning of the mid-fi prototype process. The skeleton includes all components visible on nearly every page, with a few exceptions (e.g. when the keyboard is present). A design option was created for the presentation of chapters (Figure 5.1). The chapters are visible in the header on all pages, with the current chapter highlighted. This will make it possible to see where you are in the system and approximately how long time/how many questions that are left. The chapters are named and the first three ones are numbered. The last chapter was designed with a check mark instead of a number to emphasize that it is the last step and that all questions are answered.

Different options for system navigation were created. A blue and big next button was placed in the footer in all design proposals. The back-navigation buttons had different placements and designs in the different alternatives. For example, different colours, words and letter cases were considered. Two alternatives for the navigation design can be seen in Figure 5.1. One question was chosen to be present in the middle area of the skeleton, to be able to review the skeleton with content in it as well.



(a) Back navigation in upper left corner, with blue lower case text.

(b) Back navigation in the bottom, with black upper case text.

Figure 5.1: Example of design alternatives for back navigation in the mid-fi prototype. These artboards also show the chapter design alternative.

5.2.2 Specific parts of the system

When the skeleton of the system was designed, different alternatives of specific parts in the system were designed. These specific parts arose as somewhat problematic during the data gathering in the activity *Discovering the needs* (Chapter 3), referred to as focus areas in Table 3.2.

Welcome and log in pages

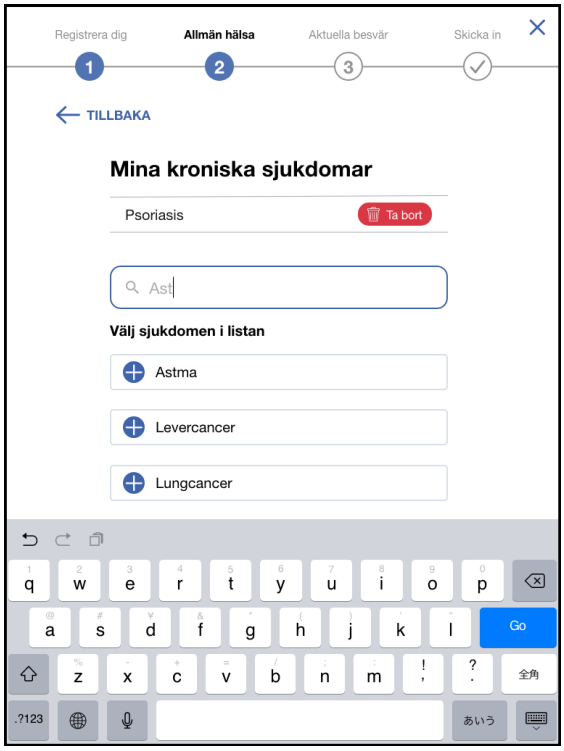
A first design proposal for the welcome page, as well as the log in page, was created in the mid-fi prototype. The welcome page was designed to be more informal and inviting than today's first page. This design decision was made with the worried patient group in mind, which includes the persona Berit (Figure 3.6). These people's anxiety reduces when they feel a good connection with the healthcare professionals at the clinic. Additionally, the keyboard on the log in page was changed to a fixed numerical keypad.

Chronic diseases and pharmaceuticals

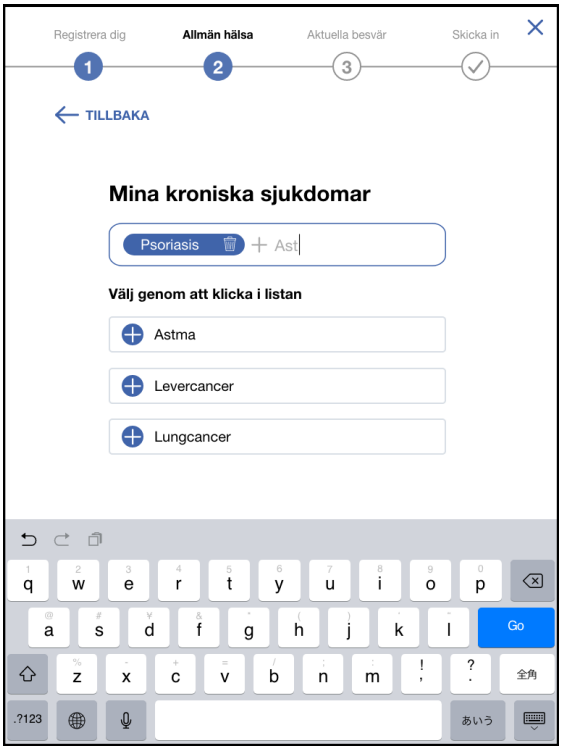
Three different alternatives were created for the questions regarding chronic diseases and pharmaceuticals. The alternatives (Figure 5.2) illustrated different options for selection and

presentation of items (diseases or pharmaceuticals). All the alternatives had a search field with an auto-suggestion mechanism that creates a list of search suggestions that the user chooses an item from. All alternatives also include an *Add disease* button. This button is added to assist non-tech-savvy users like Berit. When the button is clicked, the keyboard appears, which hopefully is easier than figuring out that the search bar needs to be pressed to write the name of the disease or pharmaceutical.

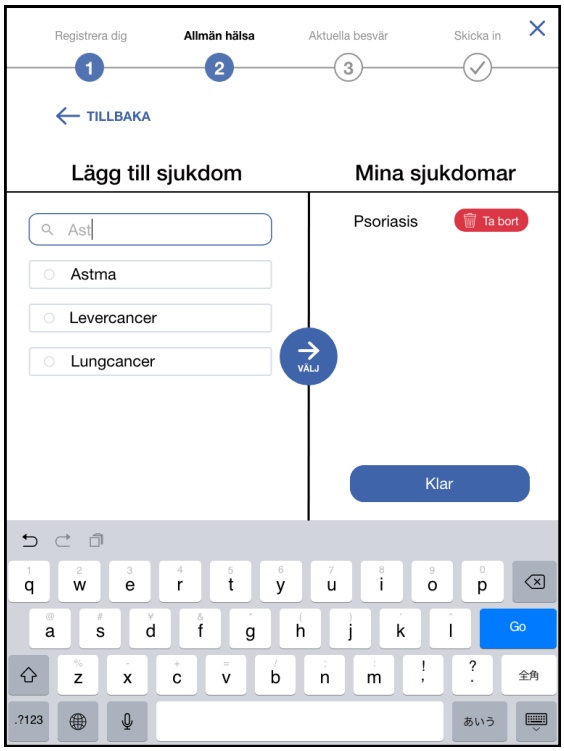
The first alternative (Figure 5.2a) is similar to the one used in today's system, the selected items are presented in a list in the top of the page. When the search field is active, the items are presented above this field for the user to get an overview of already chosen items. In the second alternative (Figure5.2b) the items are presented as pills in the input field instead. The text cursor is always present in the text field and a faded plus sign appears in the input field to indicate that multiple inputs are allowed. The third alternative (Figure 5.2c) is a dual list where items are selected and moved from the left list, to the right list. A drawback with this alternative is the fact that a selection needs two clicks instead of one as in the other two alternatives. On the other hand, the screen is split and thereby more utilized in a sense.



(a) Alternative 1, selected items presented in a list above the search field.



(b) Alternative 2, selected items presented as pills in the input field.



(c) Alternative 3, dual list where selected items are moved from the left list to the right.

Figure 5.2: Design alternatives from the mid-fi prototype for questions regarding chronic diseases and pharmaceuticals. Here, the selection of psoriasis and asthma is presented.

Time perspective questions

Three different slider alternatives were designed (Figure 5.3a). All the alternatives had equal time steps between each time point in the slider. A few details distinguished the different alternatives, such as a plus and minus characters in alternative 1 in Figure 5.3a. Other distinctions are how the markings below the time line are presented in the different alternatives. All slider designs are probably straight forward to use for a tech-savvy user, like the persona Marcus (Figure 3.5).

A fourth alternative is to choose in a list with time answers instead of using a slider (Figure 5.3b). This would facilitate for persons that are not used to digital technology, like Berit.

(a) Slider alternatives.

(b) List alternative.

Figure 5.3: Mid-fi design alternatives for time selection. Here, the patient Marcus answers that he has suffered from acne for five months.

5.3 Evaluation of mid-fi artboards

The mid-fi artboards were presented to and reviewed by five persons – the supervisor at the Department of Design Sciences, the CEO and a developer at Vårdinnovation Sverige AB, as well as three persons from the researchers acquaintance circle. The last three persons had low insight in the thesis. The age of the five participants ranged from 20 to 54 years old. The different design alternatives were compared, to find the most optimal designs. A summary of the feedback is presented below:

- The go back button should not be close to the next button (Figure 5.1b) as it may increase the risk of clicking the wrong navigation button. A go back button in the upper left corner is a better option (Figure 5.1a), it could be blue to indicate that it is clickable.
- When adding a chronic disease, the alternative that is most similar to the one in today's system (Figure 5.2a) was overall most liked. According to some persons, the two other options (Figure 5.2b and 5.2c) seem too complicated for elderly users or non-tech-savvy users.
- The next button should be grey before an alternative is chosen (Figure 5.1).
- Make the distance between the alternative buttons bigger to avoid the risk of miss clicking a button (Figure 5.1)
- It should be more clear that the numbers below the slider (Figure 5.3a) mean number of months.
- It may be difficult for some people to understand that the plus and minus signs next to the slider (Alternative 1 in Figure 5.3a) are clickable.
- The numerical keypad on the log in page was appreciated.
- The idea of having a more informal and friendly welcome page, with a nurse talking to the patient on it, was appreciated.

The received feedback determined which alternatives to proceed with in the next iteration of the design process. In this iteration, the hi-fi prototype was developed.

5.4 Hi-fi prototype

Interactions in the mid-fi artboards were added to create a clickable hi-fi prototype in Adobe XD. Hi-fi is an abbreviation for high-fidelity and means that it looks like the final product and are highly functional [17]. Since the real system (Vårdexpressen) is rather complex with a lot of possible paths, it was decided that there should only be one way to get through the hi-fi prototype as a user. This path was based on the persona Marcus Wallin and his acne problems (Figure 3.5). However, the user interface in the prototype was designed to fit the persona Berit (Figure 3.6) as well. Much emphasis was put on elderly patients easily being able to use the system. The prototype is developed for an iPad screen with the measurements 768 x 1024 pixels. Below follows a presentation of selected parts of the hi-fi prototype. The selection was made based on the previous defined focus areas (Table 3.2). The prototype in its entirety is thereby not presented.

5.4.1 Skeleton structure

All the buttons that are used to proceed in the system, most often *Next*, are placed in the bottom of the screen. The *Next* button is grey (disabled) until an alternative is chosen, then

it becomes blue (enabled). The users are never automatically directed further in the system by choosing an alternative, they must click on the next button to proceed.

A blue *Go back* button is placed in the upper left corner and an exit icon is placed in the upper right corner. The chapters in the system (Registration, General health, Current health issues and Send in) are presented in the header.

The answer alternatives are either radio buttons or check boxes (an example can be seen in Figure 5.6d). A radio button has a circle in it that gets filled in when the alternative is chosen. The check box button has a square that gets ticked when chosen. The check box button permits the user to choose multiple alternatives, while the radio button allows the user to choose only one alternative.

When a list includes more alternatives than the screen has space to present, the list of alternative is scrollable. To indicate that there are more alternatives, a vertical scroll indicator bar is placed right next to the list (this can be seen in Figure 5.6d).

5.4.2 Welcome and log in page

The first page the user meet is a welcome page (Figure 5.4a). This page shows an illustration of a healthcare professional that says "Welcome! While you wait for the nurse, you will answer questions about your health issues". This page was developed to create a friendly and calm ambiance for the patients, especially the worried patients like Berit. A rather large, blue button that says "Start" is placed at the bottom of the screen. After pressing *Start*, a new page is showed where it is possible to choose if it is you or someone else, e.g. a relative, that needs help (Figure 5.4b).

The log in page (Figure 5.4c) shows a big numerical keypad with the numbers 0-9 and a backspace button. The format of the personal identity number is guided by letters in the text field. The imputation of the number use input masking, the system provides the hyphen to the user at the correct place and keeps track of the format rules.

A button that says *I have no Swedish personal identity number* is placed close to the next button. This button allows the patient to log in with the date of birth instead (Figure 5.4d).

5.4.3 Information pages

After the log in is completed, information is given to the user that he has received a queue position to a nurse and that he will meet a doctor if needed (Figure 5.5a). The queue position is showed in the upper right corner. After this page, the patient must confirm that his personal data is processed according to the Data Protection Regulation (GDPR) and that the healthcare professionals are allowed to read his medical record and the medicines list (Figure 5.5b). Information about GDPR and the medical record is hidden in a button with an information icon saying *More info*. This makes the UI cleaner to the users not interested in the details. However, the information is still available to anyone who wants to read more about it.

When all the questions in a chapter are answered, feedback is given to the patient so that he is able to change his answers (Figure 5.5d). Before entering a new chapter, information about what the next chapter is about is given to the user by an illustrated healthcare professional (Figure 5.5c).

5.4.4 Chronic diseases and pharmaceuticals

Design alternative 1 from the mid-fi prototype (Figure 5.3a) was chosen for the questions regarding chronic diseases and pharmaceuticals.

5.4.5 Time perspective questions

A question was added (Figure 5.7a and 5.7b) before the slider for the user to choose a time interval before choosing an exact answer in the slider. Design alternative 3 from the mid-fi prototype (Figure 5.2a) was chosen for the slider. With this combination of questions the time unit (days/months/weeks/years) is chosen in the first question, this allows the slider in the second question to have even steps (where all steps on the time line has the chosen unit).

5.4.6 The end

In the end of the prototype, information is given to the user that all the questions are answered (Figure 5.8a). The system also tells the user how the answers needs to be sent in so that the healthcare professionals can read them. After the user has pressed the *Send in your answers* button, a last page is presented with a TV screen that shows the queue to the nurse and the doctor (Figure 5.8b).

Figure 5.8c shows the pop-up page appearing if the exit icon (the cross in the upper right corner) is pressed. The pop-up gives the user a second chance to think about if he really wants to exit the system or not. This prevents a possible exit error happening by mistake.

5.5 Evaluation of hi-fi protoype

A focus group was arranged with people working at Vårdinnovation Sverige AB to get feedback on the hi-fi prototype. A focus group is a discussion group or a group interview with a specific focus in mind [32]. This is a qualitative method that is good for gathering of multiple viewpoints [17, 22]. In this case, viewpoints on the prototype from different professions within the company was the goal with the session. An invitation to the focus group was sent to people from various teams at the company. Five persons were available at the given time and place. The participants (four males and one female) consisted of two doctors, one developer, one social scientist and one client experience associate. Their age ranged from 20 to 40 years old.

5.5.1 Procedure

One of the researchers acted as a moderator and kept the discussion on track, while the other researcher was responsible for the taking of notes. The session started with the researchers introducing themselves and explaining why the focus group was gathered. The participants were informed about the prototype which has been made on based on user surveys and evaluations of today's UI. The prototype was presented to the participants. They were simultaneously able to interact with the prototype on their own device. The prototype demonstration

went through a patient case, based on the persona Marcus seeking care. Specific topics were raised by the moderator to get feedback and comments on the UI. The discussion lasted for approximately one hour.

5.5.2 Summary of feedback

After the focus group session, the received feedback was summarized. The gathered viewpoints and comments are listed below:

- "This prototype is well designed and much clearer and easier to navigate in than today's system."
- "I really like to idea of dividing the system into different chapters. The feedback between each chapter makes sure that the given information is correct."
- "The keypad is big and clear. The complete keyboard is not needed when entering numbers."
- "The images of the healthcare professionals makes it more personal."
- "It is a good idea to roughly choose a time span before choosing a specific time in the slider."
- "The previous chapters in the header could be faded to make it even more clear."
- "There should be a reset option for the slider."
- "The next button could appear in the bottom of a scrollable list so that the user does not miss any alternatives."
- "I think it is more efficient to proceed automatically when choosing an alternative in some of the questions, e.g. in questions with only yes/no alternatives."
- "It may be hard for the user to understand the difference between circles (radio buttons) and squares (check boxes) in questions including both types of alternatives."
- "An animation may be added to indicate when a new chapter is entered"

Some comments resulted in a new iteration where some adjustments were made in the hi-fi prototype. While some comments resulted in new points of view not chosen to be implemented in the prototype due to the time limit of the thesis. However, these comments were still processed.

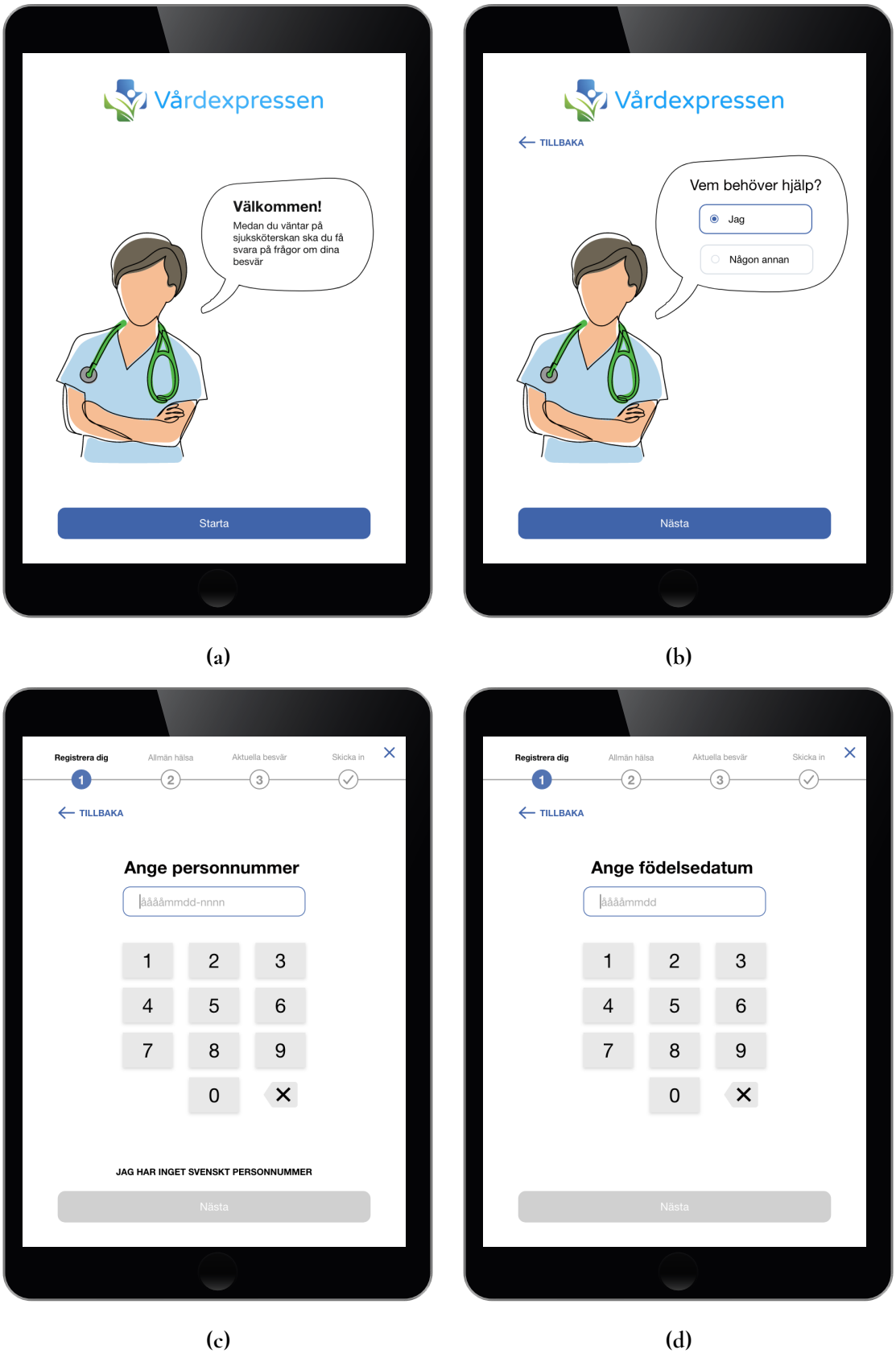


Figure 5.4: Welcome and log in pages from the hi-fi prototype.

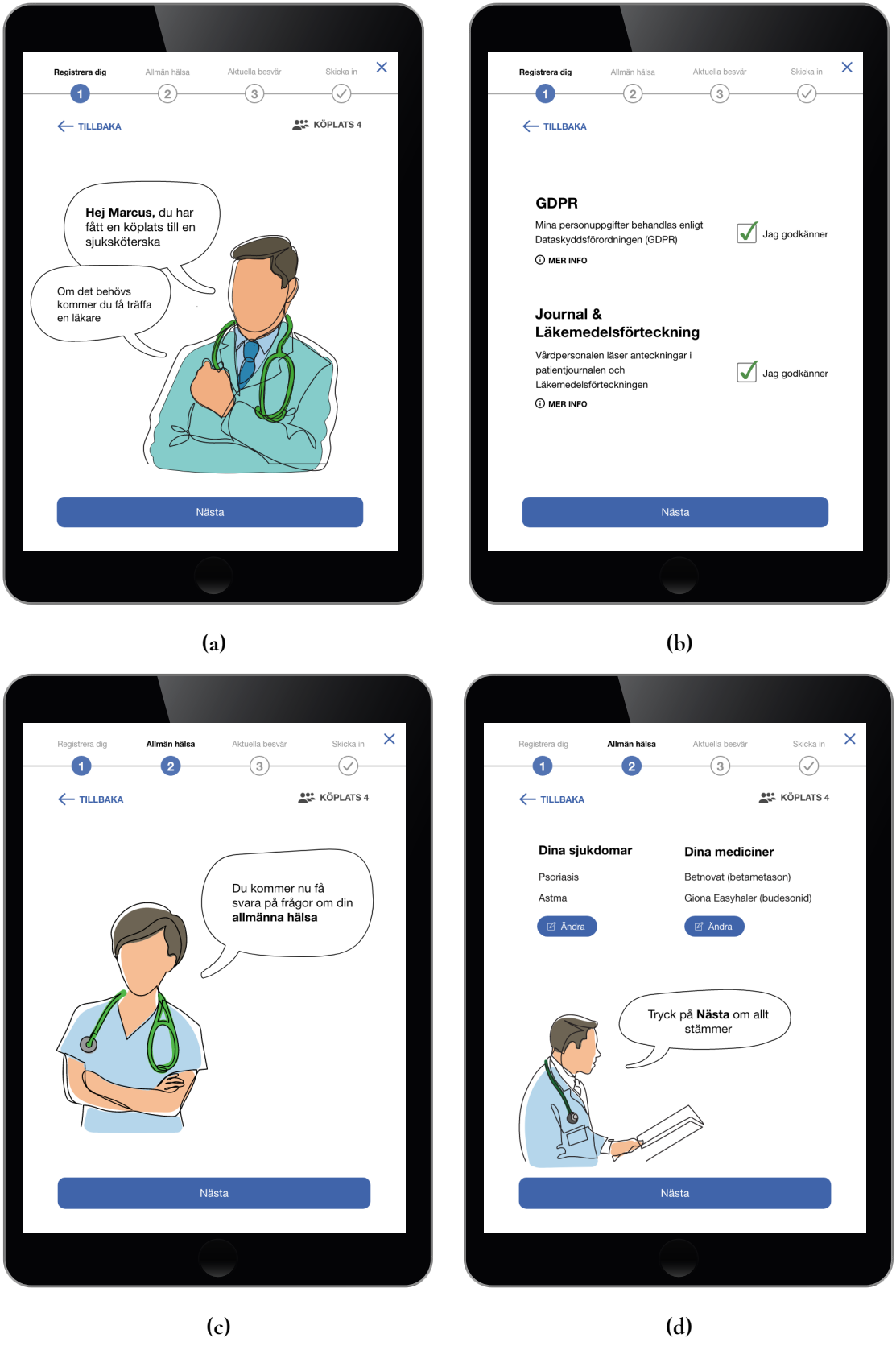


Figure 5.5: Informative pages from the hi-fi prototype.

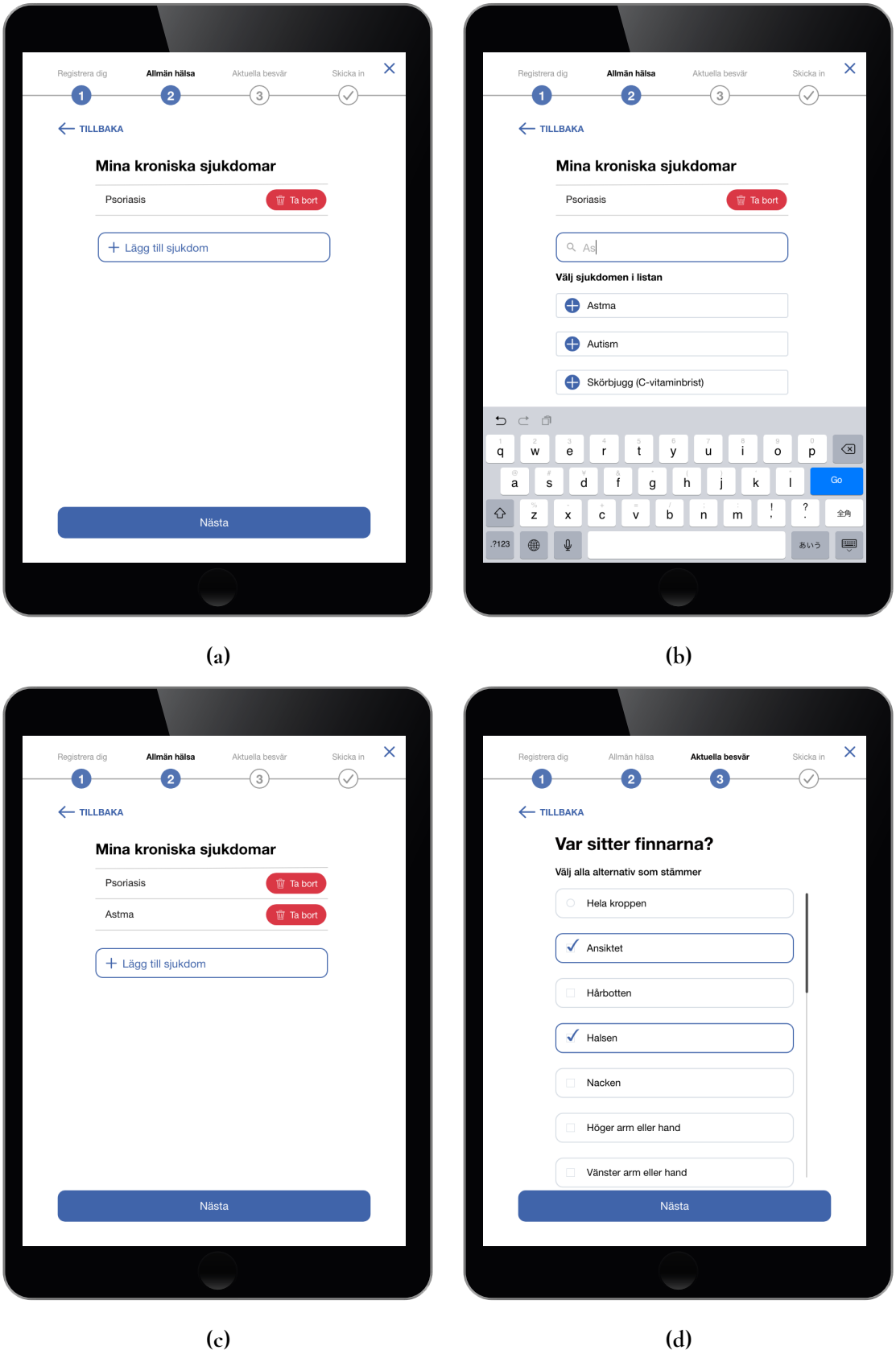


Figure 5.6: (a) (b) (c) Example of pages from adding chronic diseases. **(d)** Scrollable list with a mixture of radio and checkbox buttons.

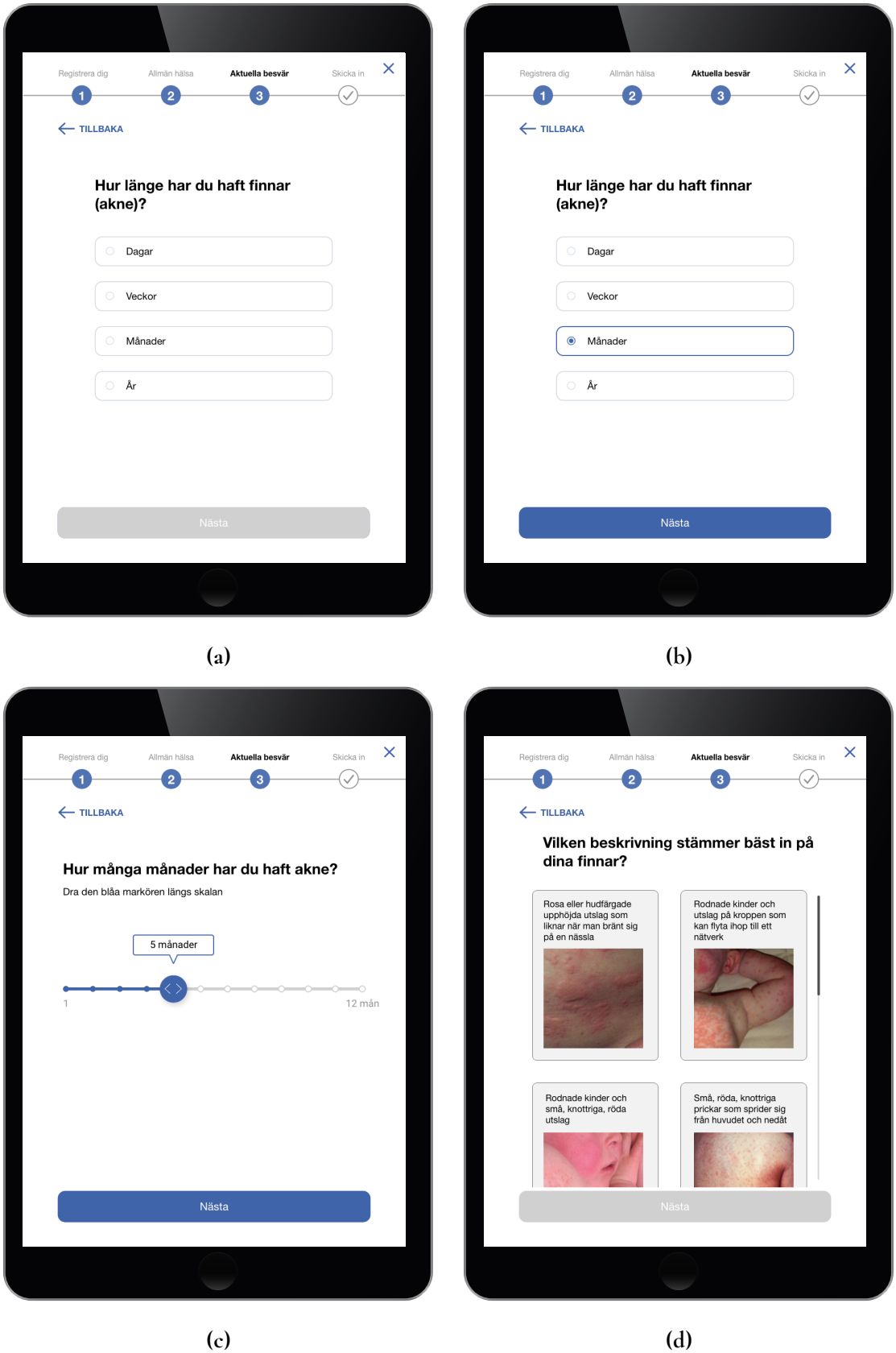
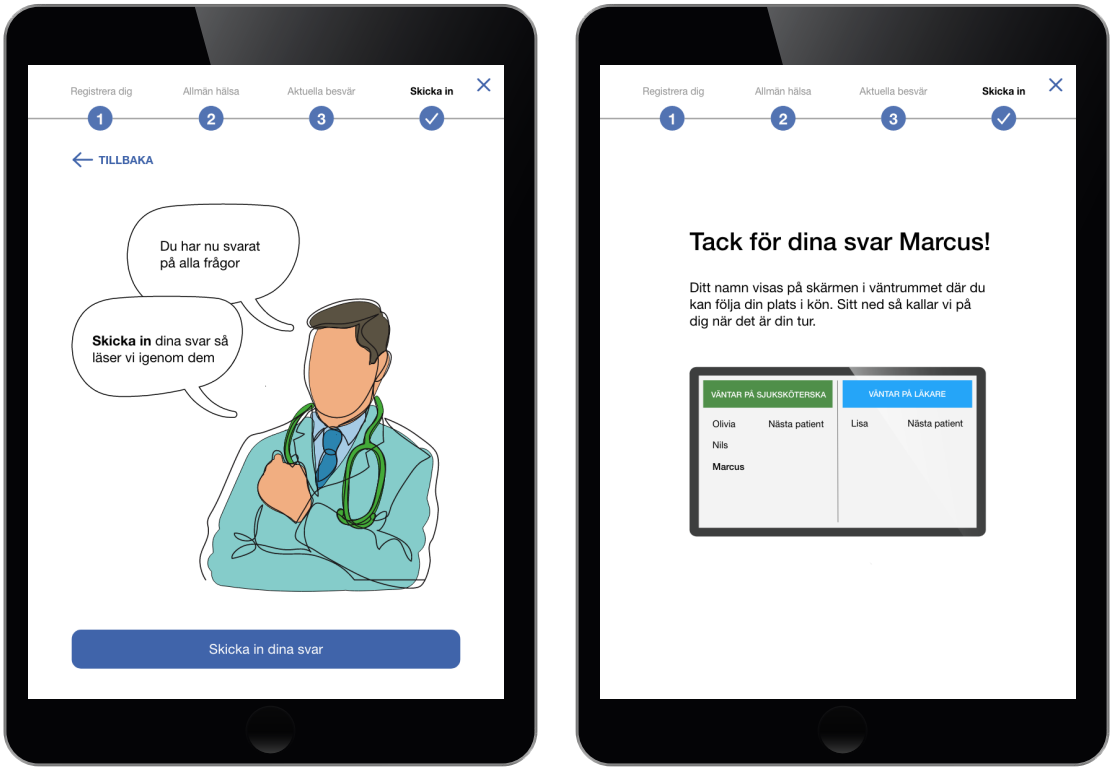


Figure 5.7: (a)(b)(c) Questions regarding time. **(d)** Question regarding the acne characteristics.



(a) (b)

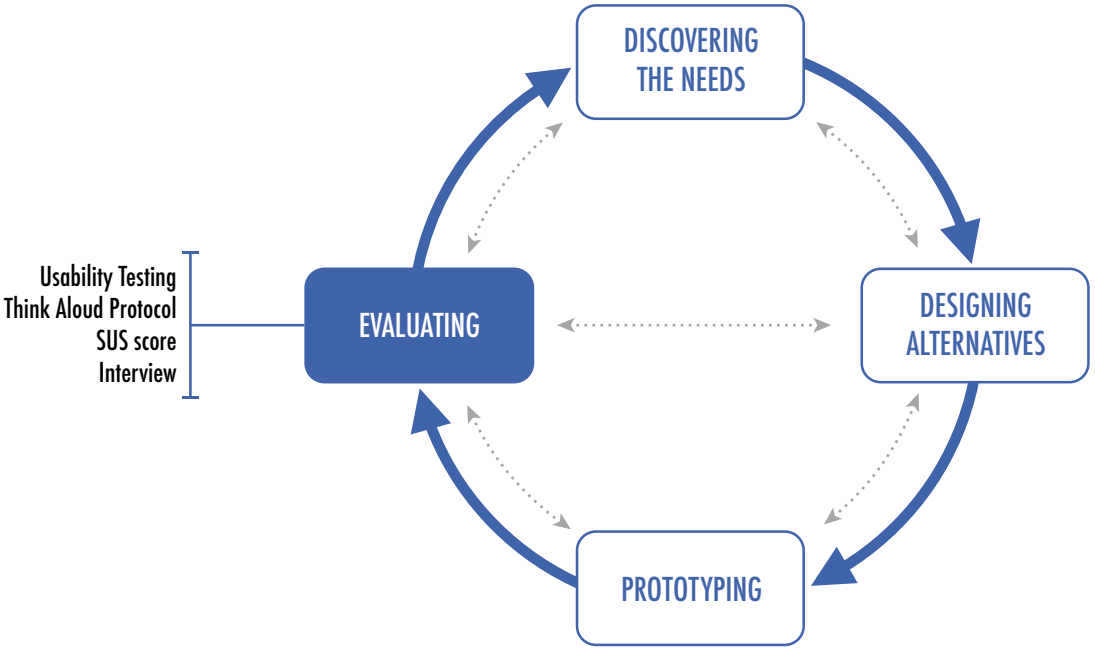
(c)

Figure 5.8: (a) & **(b)** Last two pages from the hi-fi prototype. **(c)** Exit pop-up.

Chapter 6

Evaluation

The last step in the design process was to evaluate the hi-fi prototype. This was done by conducting usability tests along with SUS questionnaires and interviews. The goal with the usability study was to determine whether the redesign was a better choice for the intended users than the original design.



6.1 Usability testing

Usability tests were conducted to be able to evaluate the developed hi-fi prototype. According to Preece et al. [17], the aim is to test whether the product is usable by the intended user, in order to achieve the tasks for which it was designed. Usability testing also aims to evaluate whether users are satisfied with their experience. Two versions of Vårdexpressen were tested during the evaluation:

A. Original design
A test environment of Vårdexpressen from January 2020.

B. Redesign
The hi-fi prototype created in this thesis.

The results from the usability tests for each version were compared, to get an understanding of whether the created prototype has improved the user experience and usability.

6.1.1 Participants

The aim was to test the prototype on a group of people with a large age range and a majority of elderly persons. Because of the corona virus pandemic, it was difficult to access elderly people during the test period. For that reason, only persons under 55 years old were included in the usability tests. A total of 12 test participants were recruited to participate in the usability tests. Their demographics can be seen in Table 6.1. According to Preece et al. [17], 5 to 12 is an acceptable number of participants.

Table 6.1: Participant demographics for the usability tests

Age	Gender	Occupation
54	Woman	Doctor
24	Woman	Student
25	Woman	Student
25	Man	Student
54	Man	Doctor
25	Man	Engineer
21	Woman	Student
23	Man	Student
22	Man	Student
23	Woman	Nurse
27	Man	Student
24	Man	Student

6.1.2 Set up

The usability tests were conducted on an iPad, upon which both audio and screen was recorded. The test subject was seated with the iPad between the test moderator and the observer. The

moderator and observer had one laptop each for script reading and note taking. The moderator followed the test script, welcomed and instructed the participant through the test session. The moderator was responsible for asking the semi-structured interview questions in the debriefing after the tests. The moderator also counted the number of slips and errors the test subject made during the test. The observer was responsible for observing the test subject and taking notes during the observation. Notes were taking on difficulties the test subjects had and also what they said in the think aloud protocol as well as in the interview.

The tests were not conducted in field, i.e. at a health centre, because of the corona virus pandemic. Instead the tests were performed in a calmer home environment.

Metrics

Two quantitative measures were used during the tests. Even though the number of participants may not serve a statistically significant result for these measures, they are still a good indicator of potential problems. Following measures were used:

Time on Task: time needed to complete the task

Number of Errors: how many mistakes or slips the participant made during the test

Test scenario

The tests were based on a test scenario. The scenario was created from the persona Marcus Wallin (Figure 3.5). The participant answered the questions in Vårdexpressen according to the test scenario. Additional information about Marcus was given to the participant, e.g. his date of birth and chronic diseases (psoriasis and asthma). The final test scenario is presented in its entirety in Appendix B. The background of the scenario is presented below.

Your name is Marcus Wallin. You are 28 years old and originate from Denmark. You have a Master of Science in engineering and work at a technology company in Malmö. You have experienced problems with acne for the last 5 months. You have searched a lot on the internet about how to get rid of your problems. Today, you have decided to go to your local health centre to get help. Right now, you are in the waiting room at the health centre where there is an iPad in front of you. You are able to answer questions on the iPad about your health issues while waiting to see a nurse or doctor.

6.1.3 Pilot test

Prior to the usability test series with the participants, a pilot test was conducted a few days before the first test. A pilot test is a trial of the test, allowing possible problems to be identified in advance to be able to correct them [17]. It may be advantageous to test the prepared materials, equipment and documentation beforehand, in a setting that looks like the real test. Except from finding possible problems with the test set up, a pilot test provides good practice for the moderator and observer. The pilot test was also conducted to be able to confirm that a person with no involvement in Marcus or Vårdexpressen understands the scenario and is able to get in the character with no difficulty. The scenario was somewhat adjusted after the pilot test. For example the personal identity number in the scenario was changed into date

of birth. This adjustment makes the test include the task of registering without a Swedish personal identity number.

6.1.4 Test procedure

A graphic summary of the test procedure can be seen in Figure 6.1 and is in this section further described. The test session started with the participant reading and signing an informed consent (see Appendix C). This was followed by a presentation of the test arrangement and test scenario (see Appendix B). Before the tests started, the participants were told to think aloud during the usability test. Think aloud protocol is a technique were the test participants are asked to verbalize what they think, feel or do as they do the test tasks [22]. The technique gives the observer a deeper insight into the participant's cognitive process. Nielsen [37] describes the technique as *a window on the soul* letting the observer see what the user really thinks.

Six of the test participants started with the original design (version A), and the other six started with the redesign (version B). The time it took to complete the task in each version of Vårdexpressen was noted. Additionally, difficulties and missteps were noted. After completion of each version, a system usability scale questionnaire was given to the participant. A semi-structured interview was conducted after both versions had been tested. During the interviews, additional information was collected about how the test subject experienced the difference between the two system versions.

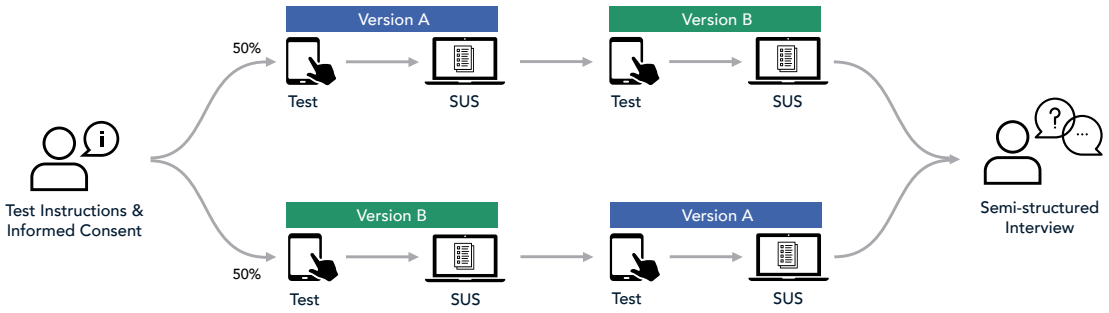


Figure 6.1: Schematic illustration of the test procedure. Every other participant started with A and the others started with B.

6.2 Results from the usability tests

A lot of data, both qualitative and quantitative, was collected in the usability tests. The data was analysed and summarized to identify usability problems. In this section, the results from the usability tests are presented.

6.2.1 System usability scale score

The individual SUS scores for each version of the system were calculated according to the procedure described in Section 2.3.5. The mean SUS score of all 12 tests, for both the original design and the redesign of Vårdexpressen, were calculated. The score for the original design (version A) is 74.2, referred to as "Good" according to the added adjective scale described in Section 2.3.5. While the redesign (version B) scored 90.4, placing between "Excellent" and "Best imaginable" in the adjective scale. The results are visualized on the SUS scale in Figure 6.2. However, the mean SUS score differs depending on which system the participants started with, this can be seen in Table 6.2.

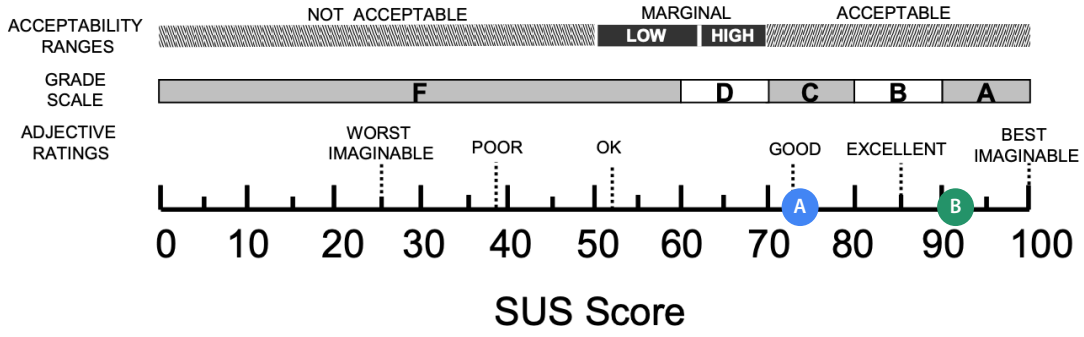


Figure 6.2: The SUS scale with markings from the result of the usability tests, for version A (blue) and B (green). The mean score for the original design (A) = 74.2 and the mean score for the redesign (B) = 90.4.

Table 6.2: The mean SUS score for the test participants who started with the original design (A) versus the redesign (B).

SUS score	A	B
Started with A	79.6	87.9
Started with B	68.8	92.9

6.2.2 Observations and think-aloud protocol

During the usability tests, errors and difficulties were noted by the test observer, resulting in a lot of test data. In this section, this testing data is analysed and presented.

Issue identification and prioritization

These usability issues were organized into a table according to a template described by Lewis and Sauro [38]. The table states where the issue happened, the task the user was engaging in when the issue occurred and a description of the issue. Also, the number of participants that experienced the issue was noted and converted to issue frequency by dividing the number of occurrences by total participants. Additionally, a tag was added for each issue explaining

where it originated from. Three tags were used: UI (user interface), prototype limitation and scenario design. To prioritize the usability issues, the severity of each usability problem was calculated. The grade of severity is influenced by three parameters [39]:

Task criticality Impact on the business or the user if the task is not accomplished.

Issue frequency (%) How many times an issue has occurred among the participants.

Issue impact How much the issue impacts the user trying to accomplish the task. Following problem severity rating systems was used to assign an impact value to each issue:

5 (Blocker) The issue prevents the user from accomplishing the task

3 (Major) It causes frustration and/or delay

2 (Minor) It has a minor effect on task performance

1 (Suggestion) It's a suggestion from the participant

Since almost all the questions (tasks) in Vårdexpressen are important to be able to get a correct anamnesis, the task criticality is rather high for all tasks. Therefore, it was chosen to exclude this parameter in the severity calculations. The severity of each issue was thereby calculated by multiplying the issue impact and issue frequency. The maximum severity is 5, occurring when an issue is assigned as a blocker and occurred for all 12 test participants.

A total of 28 usability issues were identified. The issues were sorted according to their severity. A prioritization cut-off at the average severity – 0.4 – was determined to collect the most severe issues. Seven issues were above the cut-off, presented in Table 6.3. These issues are considered as the most important findings from the observation and think aloud protocol when testing the prototype.

Issue interpretation

The most severe usability issue (Issue #1) was the input of date of birth in the wrong place. Five of the twelve participants tried to log in with the given date of birth in the wrong text field (i.e. the personal identity number text field). Issue #2 concerned the scenario design. 50 % of the participants had a slightly hard time to find the correct image and description for the acne.

Two of the identified issues (Issue #3 and Issue #4) originated from limitations in the prototype; the slider not being fully interactable, the keyboard being hard coded for the scenario and only including lowercase letter keyboard.

The last two issues (Issue #5 and Issue #6) were related to choosing an alternative in a list in the UI. 30% of the participants experienced Issue #5 and found it difficult to distinguish between different alternatives. Issue #6 was also experienced by 30% of the participants, where they were searching for more alternatives than the ones visible on the screen. Due to this, they tried to scroll even though there were no more alternatives and no scroll functionality on these pages.

Table 6.3: Issue prioritizing table.

ID	Where	Task	Description	Tag	Impact	Frequency	Severity
1	Log in	Log in with date of birth	Entered the date of birth in the personal identity number text field	UI	5	0.4	2.1
2	Image question	Choose how the acne looks like	Hard to find the image that matches the acne description	Scenario	3	0.5	1.5
3	Slider	Choose 5 months	Slider is not fully interactable	Prototype	3	0.3	1.0
4	Name question	Write the name in text box	Not possible to change the keyboard to capital letters with the shift key	Prototype	2	0.4	0.8
5	Fears & expectations question	Express the worry before the wedding	Difficult to find the right alternative	UI	2	0.3	0.7
6	Lists	E.g. answer that the acne is aggravated by bathing	Wanted to scroll through the list even if there were no more alternatives	UI	2	0.3	0.7

6.2.3 Time on Task

The time each participant needed to complete the task in the two different versions of the system was noted. Sauro [40] implies that for a sample size smaller than 25 participants, the best way of representing the typical value for the task time is by calculating the geometric mean:

$$\left(\prod_{i=1}^{n} x_i\right)^{\frac{1}{n}} = \sqrt[n]{x_1 x_2 \cdots x_n}$$

The geometric mean is used instead of the more common, arithmetic mean since task time data most often is positive skewed, due to the individual variance of the participants; some participants needed much longer time to complete the task than the other participants. For a larger sample size the median value of the times would be a good estimation of the typical time value [40].

The mean task time for each version – A and B – was calculated. Since the participants tested the two versions in alternating order (participant 1 started with A, participant 2 started with B and so on), two additional mean values were calculated for each version: the mean time on task for participants starting with the original design and the redesign, respectively. Since the participants learn both the scenario and system structure in the first test, the task time in the second test is shorter. All the calculated times on task are visualized in Figure 6.3. In general, the participants completed the task faster in the redesign. The time on task for the first version each participant tested was in average longer than the time in the second version. This is an expected result when the participant is new to the scenario and the task. The second test proceeds smoother and faster when the situation is more familiar. However, the difference is vastly greater for participants who started with the original design (A). Both when it comes to time difference between A and B, and the actual task time. The time difference is 57 seconds between the versions when starting with the original design, compared to a difference of 3 seconds when starting with the redesign. The total time, when the task times for both versions is summed, is approximately 20% shorter when starting with the redesign. After all, this result implies that the redesign may be more straight forward to use.

6.2.4 Interview answers

A semi-structured interview was conducted after the usability tests as a debriefing of the test. Additionally, the SUS questionnaire for each version included the questions "Do you have any other comments? Something that was particularly good/less good?". The answers to these questions are also presented in the summary of the interview responses. Followed are the interview questions and a summary of the answers to these questions. Version A is the original design and version B is the redesign.

How did you experience the log in, in the two various versions?

- "The keypad with only numbers in B was easier to use than the complete keyboard in A."

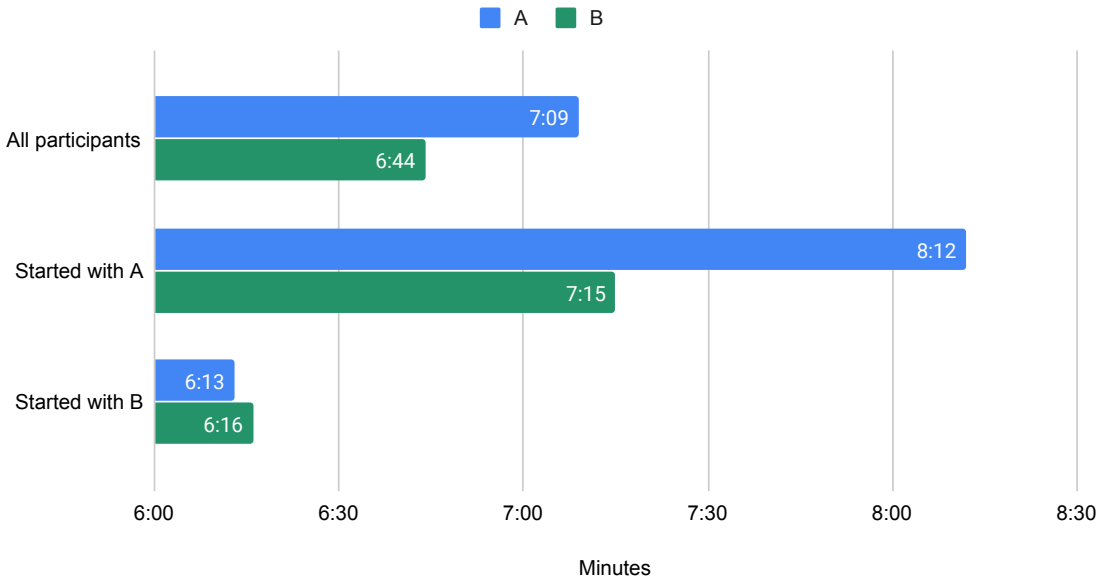


Figure 6.3: Mean Time on task for the original design A (blue) and the redesign B (green). The top bars show the mean time for all participants. The four bottom bars show the mean time for the participants staring with A and B, respectively.

- "There was a button in B that I could press to say that I had no personal identity number. In A, I had to read the small text to know how to insert my date of birth."
- The button *I have no Swedish personal identity number* was a bit difficult to see and understand that it was clickable. Maybe it should be blue instead of black.

How did the different versions communicate the information?

- "I experienced that it was a lot of text to read in A. I think it can be difficult to focus on what the text says, especially in a waiting room. Also, elderly people can have difficulties with their vision."
- "It was not as much text in B which made it easier to focus."
- "I like that I received feedback on my previous answers in B."
- "I might feel stressed if the queue position showed in B turns 0."

Do you have any thoughts regarding the design and layout?

- "I like the speech bubbles and illustration of healthcare professionals in version B. It feels more personal and welcoming."
- "It feels like talking to a nurse and not just a system when I see the pictures in B."
- "I did not understand the difference between circles and squares in the alternatives."
- "It felt more exciting to use B. My inner rewarding system gets activated."

- "It was nice with the added colours and bigger buttons in B. In terms of design, B is more attractive."

How did you experience the chronic diseases and pharmaceuticals pages in the two various versions?

- "Did not notice any differences between the versions."
- "I did not know if I had to press the plus icon to add something from the list in B."

How did you experience the time perspective questions (sliders) in the two various versions?

- "I have no problems with using the exponential slider in A, but an elderly person may find it difficult to use."
- "It felt like I had more control when choosing a time span before using the slider in B."
- "It feels unsafe to mix time units in the slider in A. But I think the question before the slider in B when choosing time unit was unnecessary. I want the solution in B on a single page."

Did you see how long time or how many questions that were left in both versions? Did you understand what part of the system you were in during the test in the different versions?

- "I did not notice this in any of the versions."
- "The chapters in B showed roughly how many questions that are remaining"
- "I noticed the progress bar in A, but I could not see the remaining time or number of questions in B."
- "It was easier to get an overview of the system with the timeline (chapters) in B."

How did you experience the navigation in the two different versions?

- "The navigation did not feel consistent in A. Sometimes I automatically moved on when I pressed an option, sometimes I had to select an option and then press the next button."
- "It feels safer to always choose an option and then press the next button to proceed in version B. Then I can double check my answer before I continue."
- "I like to have the next and go back at the same height as in A, so I do not need to look for the go back button if I want to change an answer."

Which version do you like the most?

- "It was easier to understand B and it felt more pleasant and personal."
- "I liked the user interface more in B."
- "I think I like A more because it feels more efficient. I do not need all the pictures in B, and I think it is faster when I proceed automatically by choosing an alternative."

Chapter 7

Discussion

The design process was based on four basic activities – Discovering the needs, Designing alternatives, Prototyping and Evaluating. In this chapter, discussions of each activity and its results are presented. Additionally, events that have limited the design process are mentioned. Furthermore, a discussion will be held from a future perspective.

7.1 Limitations

During the design process, a few obstacles were met on the way which are to be discussed in this section. The things that appeared were not expected at the beginning of the process so planning ahead would not have helped. Especially two things that appeared had a big impact on the process. First event that affected the process was that Region Skåne paused the use of Vårdexpressen in the primary health care. This resulted in only one observation conducted at a healthcare centre. Therefore, only a few real patients were observed when using Vårdexpressen although the initial plan of the project was to observe a larger number of patients.

Second occurrence that had an impact on the process was the Corona Virus Disease (COVID-19). The pandemic led to that the prototype could not be evaluated by any elderly persons. Instead only people we usually meet in our everyday life were recruited as test subjects, which may have influenced the test results. Testing on elderly people would have been very profitable since some of them had a lot of difficulties when using the original system. The redesign was especially based on these difficulties found early in the process, before the pandemic broke out.

7.2 Discovering the needs

Observations, interviews and a heuristic evaluation were conducted to discover the needs and behaviours of the users and to evaluate the original design. A lot of different needs and behaviours were found among the patients in the primary health care. Also, a number of issues in the original design in Vårdexpressen were found in the observations and heuristic evaluation. However, the heuristic evaluation was conducted by only two people. To be able to identify the majority of the usability problems, a higher number of participants in the heuristic evaluation would have been required. According to Preece et al. [17], 3–5 evaluators can identify up to 75 percent of the total usability problems in a heuristic evaluation.

7.3 Designing alternatives

During this activity, a lot of new ideas and concepts were created to meet the user needs and prevent the obstacles and errors in the original design. The ideas and concepts arose particularly during brainstorming sessions, but also through research. Other methods could have been used in this activity to generate more ideas. Furthermore, several persons could have been involved in the brainstorming sessions to generate additional ideas.

During this activity, it was decided that the rest of the design process should be based on the persona Marcus 3.5 and his patient case. This turned out to be a good choice. Focusing the design on this specific case enabled the concepts and solutions to be very focused and detailed. Instead of including all possible paths and questions in the system, a concept was developed for this particular case. The aim is to apply this concept to all cases in the future, with some minor adjustments. If more time would have been available, designs would have been developed for multiple user scenarios, not just for the patient Marcus.

In addition, the development of the wireframes was a proper way of getting an overview of the patient case and design ideas. Placing out all ideas and components in the correct order facilitated the next activity – *Prototyping*.

7.4 Prototyping

The tool in which the prototype was made in had a number of limitations. Adobe XD could not implement certain functions very well, such as a slider, which probably affected the user experience. Two of the identified issues (Issue #3 and Issue #4) originated from limitations in the hi-fi prototype. These limitations were known before the tests were conducted, but were considered to be allowed for the prototype to be evaluated. These issues derive from limitations of the software used to create the prototype, as well as the time frame of the thesis. These types of issues are straightforward to adjust in a situation where the prototype is translated into a fully functional product. Issue #3 and Issue #4 could thereby be negligible when reviewing the usability of the system. The concepts worked in entirety, but with minor limitations.

Only one way through the system was created in the prototype due to the time restraints. If a test person has not experienced that particular health issue (acne) that was implemented in the prototype, it can be difficult to get in to character and answer the questions. Another

thing that was influenced by the time restraint was the number of iterations. In an optimal scenario, multiple iterations, prototype versions and evaluations should have been made to ensure an even better UX.

7.4.1 Identified issues

Half of the prioritized issues were tagged as UI issues, which may need a design change for the usability to be improved for these tasks. Below follows a discussion about each one of them.

Issue #1 occurs in the log in page. The issue is probably due the fact that the user does not read instructions properly and instead goes for the trial-and-error method. Also, the users may not recognize the *I don't have a personal identity number* button as a button. Since it is placed in the bottom of the page, the user starts filling in the "wrong" text field at the top of the page before noticing the button. The *I don't have a personal identity number* button was designed as a text button because it should have low emphasis since most of the users have a personal identity number. This makes the personal identity number the default log in mechanism.

Issue #5 and #6 occur when the users need to find the right alternative among many alternatives in a long list. For some users, it was difficult to separate the answer alternatives from each other. The reason for several and moderately similar alternatives is that the healthcare professionals inquire for these alternatives in the system. Another aspect of issue #5 and #6 was understanding when you can scroll in a list or not. This aspect may be explained by the distance between the next button and the list of options. A small distance affords that more options are hidden under the next button, triggering a desired scroll action among the users. Also, some users are trying to find an alternative they think is in the list, but is actually not.

7.5 Evaluating

Usability tests were conducted to evaluate the prototype. The environment that the usability tests were performed in was not representative of the environment the system would actually be used in. The users would probably feel more stressed in a health centre. They may also have difficulty focusing due to illness if they actually experience the health issue. It was not possible to replicate these aspects during the usability tests. However, they might have experienced the situation slightly stressful considering that they were observed and filmed.

The participants in the usability tests had to learn the test scenario persona and his symptoms before conducting the usability test. As mentioned before, it can be hard to get into character. This may influence both the time on task and number of errors. Another thing that influenced the result, and especially the SUS answers, was the order the participants did the usability tests in. It was showed that the SUS answers on each version differed depending on if they tested version A or B first.

Another aspect that might have influenced the measured time of task is the fact that the test participants were asked to "think aloud". Some test persons had a lot of thoughts they wanted to tell about which may have resulted in longer task times. However, the think aloud method may have helped some test participants to solve the task and perform faster as it allows them to think more clearly [40]. Studies on this aspect have been done with mixed

results, in other words it is hard to tell if the think aloud may have influenced the measured time. Another aspect that might have a small impact on the time on task is that some text fields in the prototype were filled in automatically in the prototype.

By including test subjects with a more varying age and degree of touchscreen experience, a more accurate result of the user experience would have been achieved. To fully confirm the evaluation of the prototype, additional tests are needed.

Issue #2 arose due to flaws in the test scenario composition. The participants had troubles with finding the correct image and description for the acne (the question presenting this can be seen in Figure 5.7d). An image in the test scenario, in addition to the text describing the acne, may have been helpful for the persons who did not know how Marcus's acne looked like. Usually, when a person seeks care for something self-experienced they know things like this by heart to a greater extent, in contrast to when acting according to a test scenario. Three of the test persons did not understand that there were more pictures to scroll through which was the reason for why they did not find the correct image.

7.5.1 Usability test results

Following discussion concerns the usability test results. The results from the SUS questionnaires, measured time on task, as well as the debriefing interviews are reviewed.

SUS

The result of the SUS evaluation indicates that the redesign provides better usability than the original design. The original design got the grade C, while the redesign was rated with an A. This result indicates that the redesign meets the users' needs and behaviours to a greater degree than the original design. It was also found that version B, i.e. the redesign, received a higher system usability scale value regardless of whether the participants started with version A or B.

If one looks at the SUS score for the group of participants starting with the two different versions separately in Table 6.2, it is clear that the result of the SUS is affected by the participants performing the same task twice. The version the participant started with scored higher than the average for that version. Correspondingly, the version the participant finished the test with scored lower than the average for that version. The result may also have been affected by the fact that the second time a participant answer to the SUS questionnaire, they have the previous tested version to compare with.

Time on Task

The time on task results presented in Figure 6.3 can be interpreted as the original design being more difficult to assimilate than the redesign. When starting with the redesign (B), the original design (A) thereupon runs smoother since the user learned the system effectively in the redesign (B). On the other hand, when starting with the original design, the task time was longer for both versions which can be interpreted as that it is harder to grasp system A.

A short time on task can not guarantee that the results are good alone. The quality in the answers is the most important, not the fact that the system is finished quickly. Yet, in combination with SUS scores, the results confirm that the redesign (B) is the better alternative.

Debriefing interviews

The debriefing interviews at the end of each usability test session gave a lot of valuable insights. These insights are here discussed.

- The change into a numerical keypad was appreciated and made login easier in the redesign. The questions including a text field was one of the six focus areas in the process. This result shows how one of these text field questions is made more easy to use for the participants, thereby the usability of the log in is enhanced.
- Both the feedback of previous answers and the way information is conveyed in an easier manner was appreciated. It was experienced as more human and inviting than the information given in the original design. This meet the needs of many of the elderly patients, like Berit (Figure 3.6).
- The opinions that arose in the interviews regarding the slider were divided. Some participants liked how the task was performed in the original design, while some preferred the redesign. However, it is not possible to fully comment on this result until usability tests have been performed on elderly people since they were the ones who experienced the most difficulties with this particular function and task.
- The chapters in the top of each page in the redesign were not noticed by very many participants. This concept is common in similar systems, so maybe they took it for granted or may have noticed them unconsciously.
- The navigation was perceived as more safe in the redesign. The participants expressed it as everything happen on the user's terms. This result confirms the accomplishment of redesigning the navigation in a more consistent and user centred way, which was one of the focus areas throughout the thesis.

7.6 Future

Next step in the design process would be to find design solutions to the identified issues. There are still some parts in the design that can be improved, e.g. the questions with a mix of radio buttons and check boxes, the log in with date of birth and the slider.

Also, new features can be added to the prototype, e.g. a progress bar between the chapters which came up as a suggestion from one of the supervisors. Some functionalities in the prototype can also be added, e.g. that it should be possible to choose between multiple health issues, to cover all possible question types of the system. After adding the solutions and new ideas in a second iteration of the prototyping activity, more usability tests need to be conducted. Most relevantly, usability tests with elderly participants are needed (when the future allows such meetings).

When a number of iterations are performed and when a good user experience is ensured, the next step would be to incorporate the ideas in to the current version of Vårdexpressen. This product would have to allow good user experience on all types of devices, unlike the prototype created in the thesis which was limited to tablet screens.

Chapter 8
Conclusion

This chapter presents the conclusions from this thesis stated in Scope 1.3. The conclusions are presented as answer to the research questions. Additionally, an assessment is made on whether the main goal is achieved or not.

What are the needs and behaviours of persons in contact with primary health care?
During the *Discovering the needs activity*, a number of needs and behaviours of patients in the primary health care were identified. According to the participants in the usability observations, it is most important to get the help they need, i.e. the right diagnosis and treatment, when they visit the healthcare centre. Further, it is important to receive help within a reasonable amount of time. It is also of importance to feel listened to by the healthcare professionals.

Does the user interface in Vårdexpressen match the patients' needs and behaviours?
There are some parts of the UI that do not match the users' needs and behaviours. These parts create usability issues that induce confusion and uncertainty among the observered persons in the usability observations. In addition to this, a general difference between young and old patients when using Vårdexpressen was found during the usability observations and tests. The younger persons generally had a good attitude regarding the system. However, some elderly participants in the usability observations found some parts in the UI quite difficult to use. There were parts in the system that the participants could not proceed from or answer correctly. Some of the elderly persons were also sceptical and afraid that they would not meet a healthcare professional if they use the system. Additionally, some of the observed persons felt impatient due to the rather large number of questions and amount of information in Vårdexpressen.

Are there any obstacles in the user interface that create uncertainty among the patients?
A number of obstacles or problems in the original design were found during the observations, interviews and heuristic evaluation in the beginning of the design process. These are referred to as focus areas in the thesis. The focus areas are specific parts in the system where the users

tended to experience confusion or get impatient. The six areas were: the overview in the system, information intermediation, system navigation, questions with a time perspective or a text field and the questions regarding chronic diseases and pharmaceuticals.

How can Vårdexpressen be improved to best fit the patients' needs and behaviours?
Specific focus areas were found in Vårdexpressen in the early stages of the design process. If the usability issues in the focus areas are solved, there is a greater chance that the patients' needs and behaviours are met. When designing new alternatives and developing the prototype, the aim was to redesign the focus areas and to improve the overall user experience of Vårdexpressen. The users, i.e. the patients, were always the main focus during the design process.

Did the redesign of Vårdexpressen result in an improved user experience?
Based on the usability tests, the redesigned UI of the developed prototype is believed to create a good UX for the patients in primary health care. Thereby, the goal of the project is considered to be achieved. However, some parts in the UI can be further improved and new features can be added to meet the users' needs and behaviours even more.

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Appendices

Appendix A
Component testing alternatives

a) Välja tid

Hur länge har du haft ont i halsen?

Dra markören på skalan eller tryck på plus (+) eller minus (-) för att välja ditt svar.

Dra markören på skalan för att välja ditt svar.

Tryck på plus (+) eller minus (-) för att välja ditt svar.

1 timme

8-12 timmar

3 dagar

1 vecka

1 månad

3 månader

30 minuter
1 timme
8-12 timmar

3 dagar

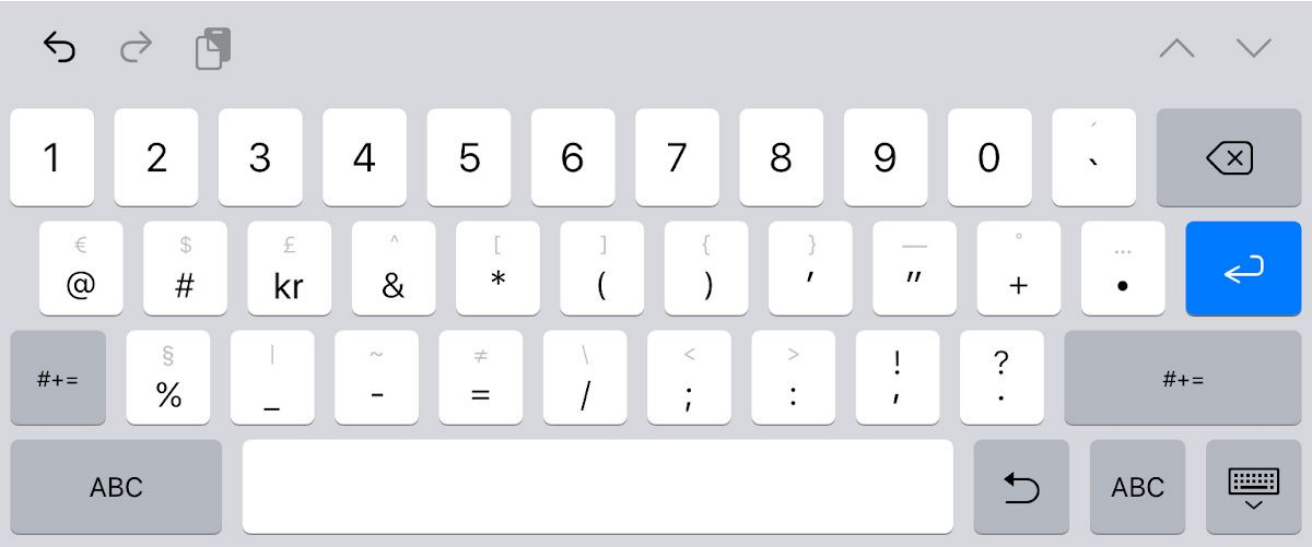
1 vecka
1 månad
3 månader

b) Textfält för siffror

Fyll i ditt personnummer

Personnummer ååååmmdd-nnnn

Starta



Fyll i ditt personnummer

Personnummer ååååmmdd-nnnn

Starta


Fyll i ditt personnummer
Personnummer
ååååmmdd-nnnn
Starta

Appendix B
Usability test plan and scenario

Användbarhetstest

Bakgrund

Vårdinnovation Sverige AB utvecklar ett digitalt hjälpmedel till primärvården som kallas Vårdexpressen. Hjälpmedlet är till för att effektivisera arbetsflödet för vårdpersonalen, samt öka patienternas deltagande i sin vård. I vår studie har en designförbättring av Vårdexpressen utvecklats i form av en prototyp. Prototypen ska nu testas av ett antal personer för att utvärdera användargränssnittet.

Genomförande

I detta användbarhetstest kommer du få:

- Utföra en uppgift enligt ett testscenario i två versioner av ett system på en iPad
- Svara på en enkät efter varje genomförd uppgift
- Medverka i en intervju angående uppgifterna du utfört

Testscenario

Du heter Marcus Wallin, är 28 år och kommer från Danmark. Du är utbildad civilingenjör och jobbar på ett teknikbolag i Malmö. Du har de senaste 5 månaderna haft problem med finnar. Du har sökt mycket på internet kring hur man kan bli av med problemen och har idag bestämt dig för att gå till din vårdcentrals öppna mottagning för att få hjälp.

Just nu befinner du dig i väntrummet. Där finns det en iPad där du ska svara på frågor om dina besvär medan du väntar på att få träffa en sjuksköterska eller läkare. På sida 2 finns all information du behöver för att kunna svara på frågorna i iPaden.

Om dig

- Födelsedatum: **19920101** (du har inget svenskt personnummer)
- Du är okej med att dina personuppgifter behandlas enligt GDPR och att vårdpersonalen läser anteckningar i journal och läkemedelsförteckning
- Söker vård för **akne**

Allmän hälsa

- Har de kroniska sjukdomarna **Psoriasis** och **Astma**
- Inte allergisk mot någon medicin
- Tar **Betnovat** (betametason) mot psoriasis och **Giona Easyhaler** (budesonid) mot astman på recept

Aktuella besvär

- Haft besvär med finnar i **5 månader**
- Finnarna sitter i **hela ansiktet** samt på **halsen**
- Finnarna ser ut som **röda utslag med några mindre varblåsor**
- Har varken ärr eller mörkare hud efter tidigare finnar
- Har **fet eller oljig hy**
- Aknen blir värre av **att bada**
- Tar inga mediciner, salvor eller krämer mot finnar, varken just nu eller tidigare
- Finnarna har gjort dig **nedstämd**
- Du planerar inte att vara i solen den närmaste tiden
- Du är orolig för **att ha dålig hy på ditt bröllop**

Appendix C
Informed consent

Samtycke till medverkan i användarbarhetstest

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

- Tester syftar till att utvärdera en prototyp av webbapplikationen Vårdexpressen.
- Min medverkan i testet är helt frivillig.
- Jag kan avbryta min medverkan när som helst, utan att behöva ge en anledning. I sådant fall raderas all tidigare insamlad data och mina svar kopplas inte längre till undersökningen.
- Sessionen kommer ljud- och skärminspelas, samt att anteckningar kan komma att göras.
- Datan kommer bli helt anonymiserad och behandlad i enlighet med personuppgiftslagen och kan inte knytas till mig som person.
- Mina svar och resultat kan komma att användas i syfte att förbättra Vårdexpressen.

Om du har några frågor eller vill återkalla ditt samtycke, vänligen kontakta Olivia Samuelsson på olivia@vardinnovation.se.

Ort, Datum .....

Signatur .....

Namnförtydligande .....