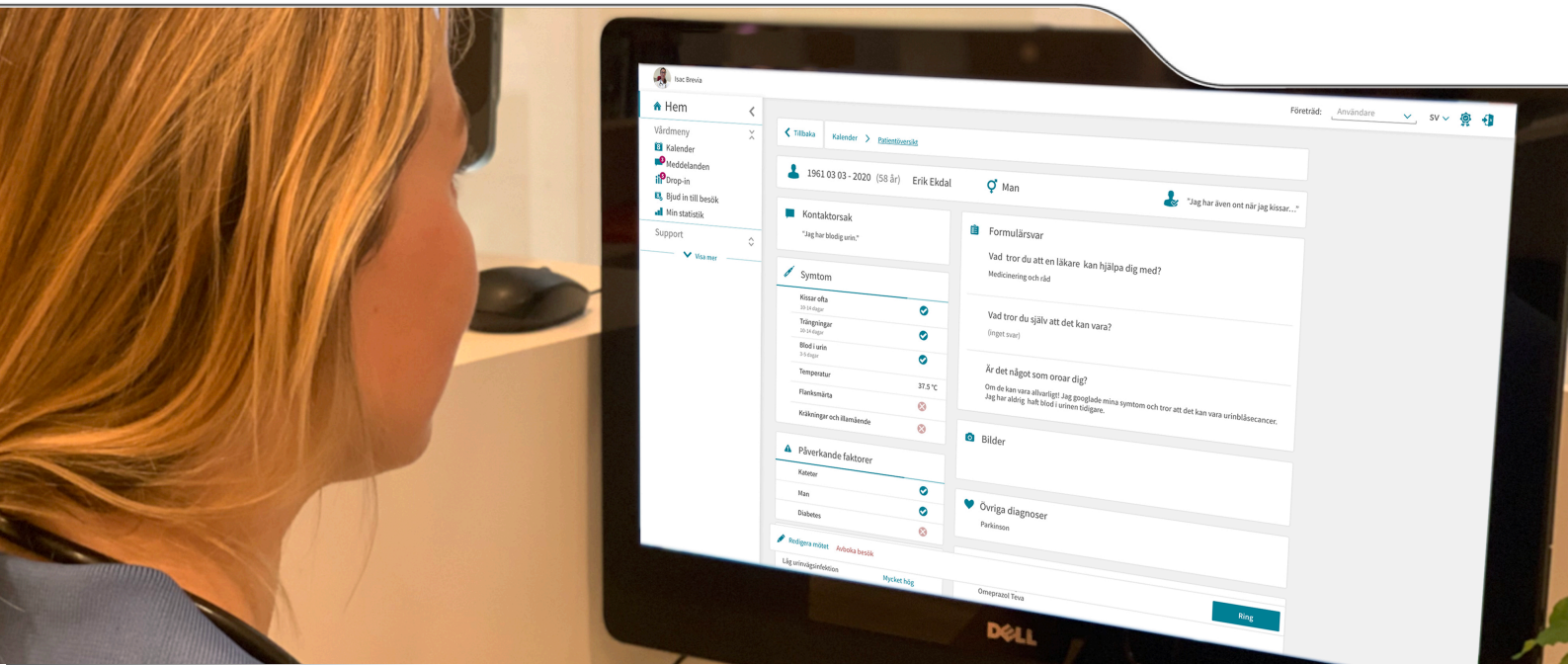


# CHALMERS



## Information Visualisation in Digital Healthcare

*User Experience Design of an Information Tool to Support Healthcare Providers in Digital Consultations*

Master's thesis in Industrial and Materials science

**SOFIA PERNBERT & MALIN WISTRÖM**

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SUPERVISOR & EXAMINOR: MariAnne Karlsson

## **Information Visualisation in Digital Healthcare**

User Experience Design of an Information Tool to Support Healthcare Providers in Digital Consultations

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Gothenburg, June 12th, 2019.

Sofia Pernbert & Malin Wiström



# ABSTRACT

Digital solutions can help the healthcare system to meet the upcoming demands from an increasing population and some of the administrative work should be transferred from the care providers to the patients. Digital tools can both automate administration and routine cases, and also function as decision support for deciding the right level of care or decision for diagnosis.

This master thesis aim was to facilitate information management for healthcare providers in digital healthcare. The project was delimited to primary healthcare, general practitioners as users and the scenario where a patient is recommended to book a digital video consultation after interaction with a chatbot. The purpose was to understand what information is useful for the doctors, why it is useful and also how it should be presented to support the doctors before and during a consultation.

Interviews were conducted with healthcare providers from both digital and physical healthcare to understand the process, improvement areas and the users' primary goals, needs and wishes. The main goals are to efficiently utilise the time, assess the patient's problem and to increase patient satisfaction. The most significant improvement areas are access to relevant patient information, standardised information management and trust to digital systems.

In the next phase, three draft concepts were tested together with users and based on insights from that user study, the final concept called Information tool was developed. The final solution consists of two parts; the Patient overview and the Consultation view. The purpose of the solution is to support the healthcare provider in fulfilling her/his goals, create new habits and to trust the digital systems.

The final concept had more information about AI technology and the calculations, which the chatbot is based on, than the first concepts which generated more satisfied users in the study. It was also important to provide some time to the users to get used to the interface since they normally get less patient information provided. The final concept, according to the user tests, supports the doctor before, during and after consultation as long as (s)he trusts the information.

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# GLOSSARY

Throughout the report medical terms are used, some of them with several definitions. This list describes the meaning of the words in the context of this report.

<b>Anamnesis</b>	Patient's account of her/his own medical history.
<b>Bayesian Network</b>	Also called Decision network and is a graphical representation of probability. It is built up of a set of variables and their conditional dependencies.
<b>Carebot</b>	The AI-driven chatbot that the patient interacts with as the first contact with healthcare to get a recommendation on an appropriate level of care.
<b>General Practitioner</b>	Doctors with specialist competence in general medicine.
<b>HP</b>	Short for healthcare provider in this report.
<b>ICE</b>	Ideas, Concerns and Expectations. Referring to the patient's own ideas about her/his condition, if the patient is worried about something and what expectations the patient has on the consultation.
<b>Intern Physician</b>	A physician with a medical degree, but not yet fully licenced to practice medicine unsupervised.
<b>Medical Records</b>	Register where healthcare professionals write their assessments and measures regarding each patient's contact with care.
<b>Premature Closing</b>	A cognitive error where the physician fails to consider reasonable alternatives after an initial diagnosis is made
<b>Primary Healthcare</b>	In Sweden, the part of healthcare that is responsible for providing the initial care outside the hospitals and to refer patients if necessary. Patients' first entrance to healthcare, health centres etc.
<b>Resident Physician</b>	A licensed physician who undergoes training to become a specialist in a particular medical field.
<b>SBAR</b>	A tool to facilitate structured communication among HPs to reduce the number of injuries within healthcare. The acronym stands for Situation, Background, Assessment and Recommendation

**Triage**

Assessment of a patient's medical severity and appropriate level of care based on anamnesis, symptoms and sometimes vital parameters.

**Symptom Checker**

An online digital tool which suggests a diagnosis based on symptoms and other influencing factors.

# CHAPTER ONE

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introduction

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## 1.1 HEALTHCARE

The primary healthcare experiences difficulties in meeting the imminent demands from the increasing elderly population (Ministry of Health and Social Affairs, 2016). The population of people over 85 years old is expected to increase with 130 per cent from 2015 to 2050 (Inera AB, 2017). As people get older, the number of chronic diseases normally increases and 85 per cent of people over 65 years in Sweden have at least one chronic illness followed by 66 per cent that has two or more chronic diseases. The total costs for Swedish healthcare in 2017 were 285,5 billion SEK (Sveriges kommuner och landsting, 2018) and half of these are connected to chronic diseases (Ministry of Health and Social Affairs, 2016).

According to the Ministry of Health and Social Affairs in Sweden (2016), the efficiency within healthcare is determined in the meeting between provider and receiver. One of the main prerequisites for high efficiency is the involvement of the patient in the different processes of healthcare. For the healthcare providers (HPs), there is usually no direct access to reliable and clinically useful information that provides guidance on diagnostics and treatment in the meeting with the patient. It is also common with superfluous information in the medical records as information is often repeated and it is shown that a majority of the notes in the records are typically repetitions (Ministry of Health and Social Affairs in Sweden, 2016). It seems like there is a high level of uncertainty among HPs about what information should be documented, how and by whom. The level of satisfaction among patients decrease clearly with the number of interactions since the patient does not experience being seen (Inera, 2017). Patients prefer longer conversations with the first contact with healthcare, not quickly being forwarded to another HP.

To meet this increasing demand for healthcare services, it is argued that some of the administrative work has to be transferred from the care providers to the patients. Self-service, self-care and digital healthcare contacts will, therefore, become more important (Inera AB, 2017). If patients create their own digital medical history, this will save time for the medical staff. However, this is seldom followed up with a structured digital care chain which results in the effects being relatively small. Additionally, the use of the internet in Sweden is steadily increasing and access to the internet at home increases foremost for the elderly (Internetstiftelsen i Sverige, 2018). Nine out of ten Swedes have a smartphone today and the usage of video calls or video chats has increased with 25 per cent in three years.

The thesis was conducted together with the digital healthcare company Visiba Care. Visiba Care offers a digital platform for healthcare organisations that want to start their own digital health centre. Currently, the company is developing a chatbot which will collect the information this project have been focusing on.

### 1.1.1 Aim

The aim of this project was to facilitate information management for healthcare providers in digital healthcare. The preparation time for an HP before a consultation is very limited and it is therefore of importance to understand what information is most useful for the HP and why.



As well as to understand how it should be presented to support the providers and improve the quality and efficiency of healthcare.

### 1.1.2 Questions posed

In order to fulfil the aim the following questions were posed:

- Why is medical history repeated in healthcare processes?
- How can the information presented in the digital platform cover the need for the doctor in getting to know a patient and get a hold of her/his general condition?
- How does trust in the digital platform system affect the acquisition of information for healthcare providers?
- When in the process of consultations is a certain type of information required? Does it differ in the different tasks?

### 1.1.3 Delimitations

The project was limited to focus primarily on what information should be presented, and secondarily how. This was due to a parallel project that dealt with the information gathering through a chatbot based on AI technology, from now on called Carebot. The project was for the same reason limited to the HPs and their 'side' of the interface and not focus on the patients' side of the interface. Delimitation has also been set to only manage the information provided to the professionals through the digital platform and not through the medical records and previously collected documentation. This is because the medical records belong to a separate system that is currently not possible to integrate with the platform since it is owned by an external company. The project will be delimited to primary healthcare in Sweden with the ambition that the findings could serve as a basis for other healthcare areas as well in the future.

## 1.2 DESIGN PROCESS

The project was divided into four phases, each resulting in a set of design implications for the next phase, see figure 1. The focus in the different phases moved from problem identification to problem solving and a solution.

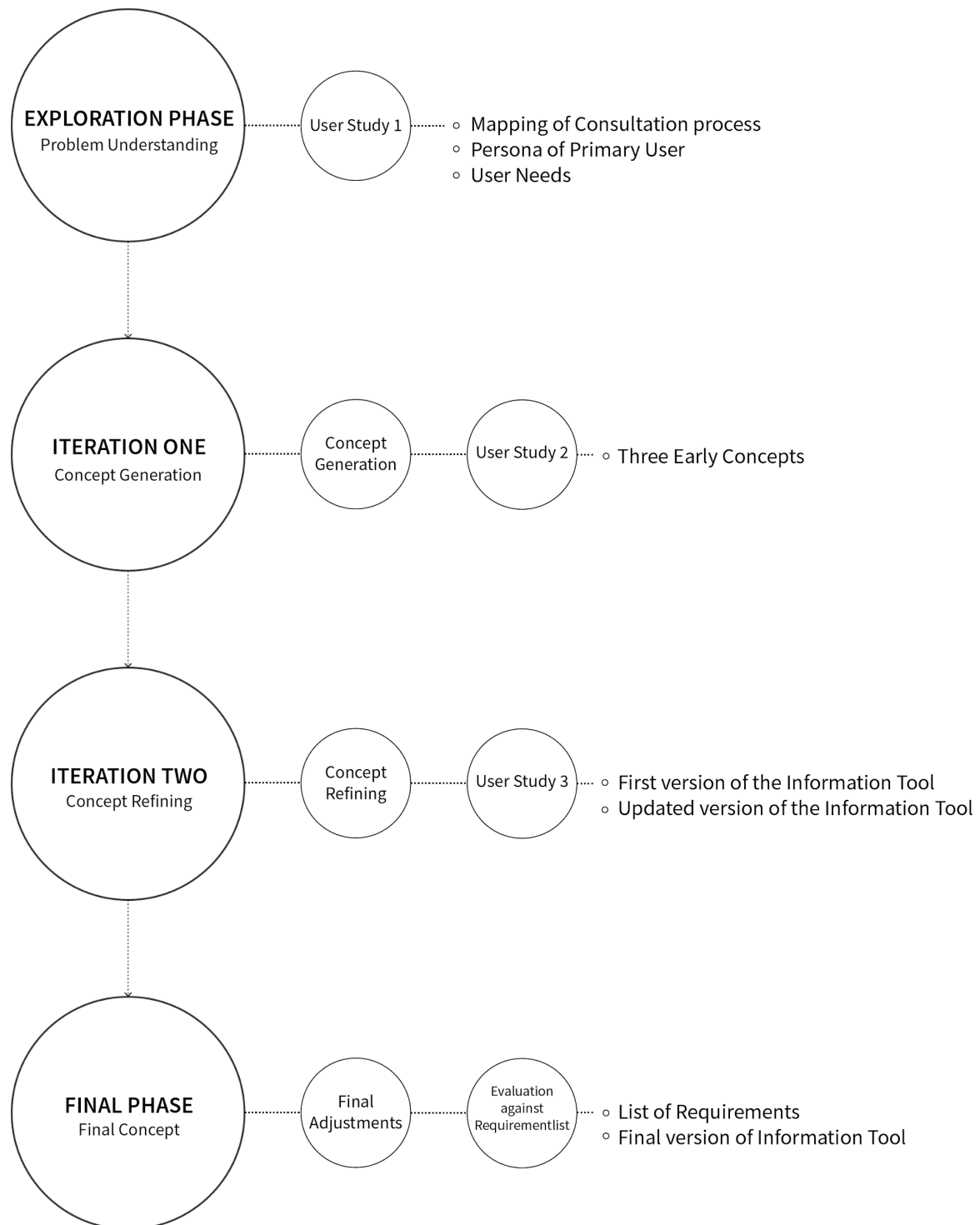


Figure 1. Project phases

# CHAPTER TWO

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background

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## 2.1 PRIMARY HEALTHCARE SYSTEM

According to the Swedish Health and Medical Services Act (HSL, SFS 2017:30), primary care in Sweden refers to health and medical care activities where care is provided without delimitation in terms of diseases, age or patient groups. Primary care is responsible for such basic medical treatment, preventive work and rehabilitation that do not require the hospitals' medical and technical resources or other special skills. According to the Ministry of Health and Social Affairs (2016), there is no other statutory definition of primary care, but they suggest that a better definition would include to be the patient's first contact with care, be easily accessible, be responsible for emergency care that does not require hospital stay and also to refer patients to other care if needed.

There are different ways for a patient to enter the primary healthcare system. The patient journeys within the system are described in figure 2. A patient can either contact the healthcare by calling a healthcare centre and speak to an assistant nurse, visit a healthcare centre at a drop-in or, as is becoming more and more popular, contacting the healthcare online by for example chatting with a chatbot. Either way of contacting, the patient will first be triaged to the appropriate level of care which can be self-care, emergency care or an appointment with a HP either digitally or physically. By self-care is meant that the patient can treat themselves with for example non-prescription drugs or by going home and rest. Each contact a patient has with healthcare has to be documented in the patient's Medical Records. Medical Records are provided by different external companies depending on the healthcare centre and hospital and are not standardised for all facilities.

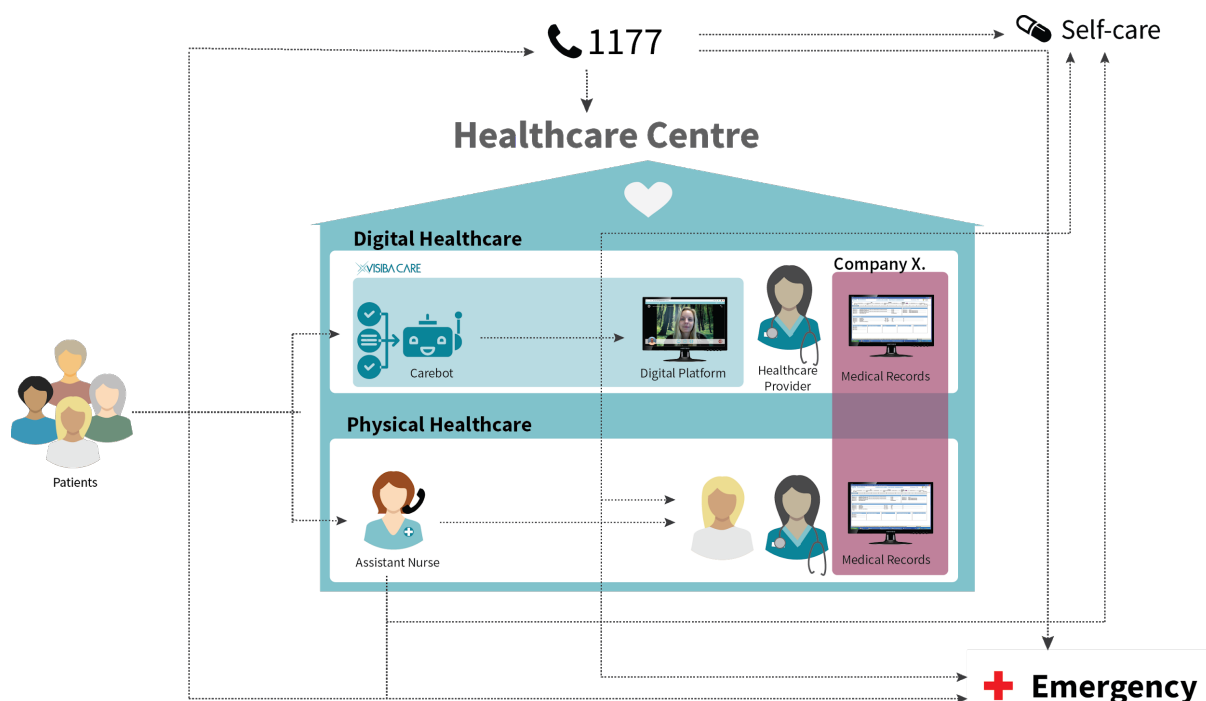


Figure 2. The patient journey in primary healthcare

## 2.2 DIGITAL HEALTHCARE

Digital tools can both automate administration and routine cases and function as decision support for e.g. triage or decision for diagnosis. Hereby, time can be saved for both parts involved (Vårdrapporten, 2018). If the digital systems would be implemented systematically, the costs for healthcare in Sweden would decrease with up to 25 per cent over 10 years (Vårdrapporten, 2018). There are many good examples, from both Sweden and internationally, that demonstrates how intelligent digitalisation improved both availability and efficiency with no loss of medical quality and patient satisfaction. Nevertheless, it is not evident for the healthcare staff how the digital solution would help them (Vårdrapporten, 2018), it is rather experienced as complicated and time-consuming.

However, the technologies in digital healthcare is argued to be successful in improving care, boosting engagement, reducing costs, and create a new standard of care for patients (Business Insider Intelligence, 2018). Artificial intelligence faces technological and feasibility challenges that are unique to the healthcare industry (CB Insights, 2019). Researchers at Stanford developed a deep-learning algorithm that proved in tests its ability to diagnose pneumonia with better accuracy than human radiologists (Business Insider Intelligence, 2018). The American telehealth company MDLIVE found that their chatbot was 50 per cent more effective than traditional efforts in boosting account registrations. AI will be able to quantify and measure atypical risk factors that previously were difficult to study (CB Insights, 2019). The ability of AI to find patterns will continue to pave the way for new diagnostic methods and identification of previously unknown risk factors. The possibilities seem to be endless when it comes to using AI for early diagnosis, driving decisions in drug design, enrolling the right pool of patients for studies, and remotely monitoring patients' progress throughout studies. However, the technologies are depending on medical experts for training and accuracy.

### 2.2.1 Visiba Care

Visiba Care is a digital healthcare company with a leading position in the Swedish market with customers from both the public and private sectors (Visiba Care, 2017). The company offers a flexible digital platform for healthcare organisations that want to start a digital health centre. Healthcare providers are able to use the platform for managing their calendars, booking and performing video consultations and indicating themselves as available in the digital waiting room. The platform is available on web browsers and as an application for mobile or tablet.

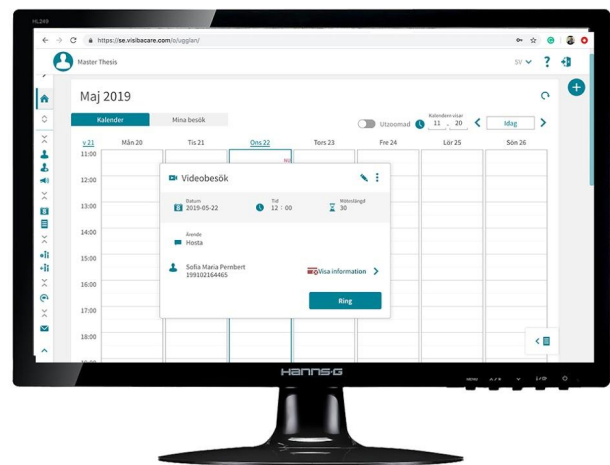
## 2.2.2 The Platform

Visiba Care's digital platform consists of numerous features that are constantly updated, but this project has been focusing on the case where an HP is preparing for and performing a video consultation (see figure 3). When meeting a patient in the platform, the HP first visits the calendar where (s)he manages her/his bookings. Here (s)he can find some basic information about the patient and either chose to call the patient or in some cases access a form that the patient has filled in before the meeting to provide additional information. This form will henceforth be referred to as the Patient form.

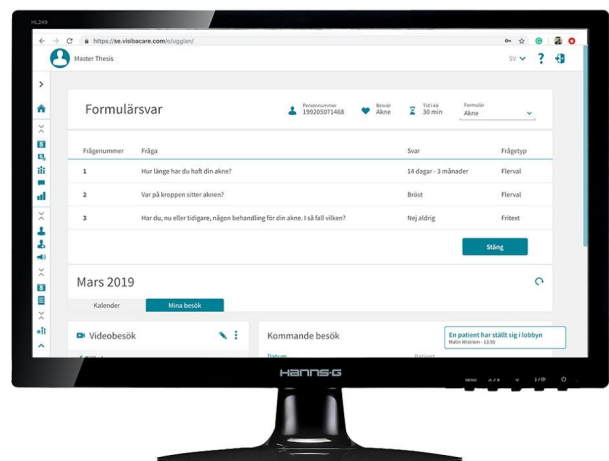
The content of the Patient form is flexible and differs between healthcare centres but, in general, the form either concerns the patient's ideas, concerns and expectations for the meeting or is specific for the illness the patient has sought care for to provide the HP with more detailed information. The information is presented in a table with a question, answer and if the question was multiple choice or free text.

During the video consultation, the HP has the patient on a large landscape view and ability to chat with the patient (see Figure 3).

### Calendar view



### Patient Overview



### Consultation View

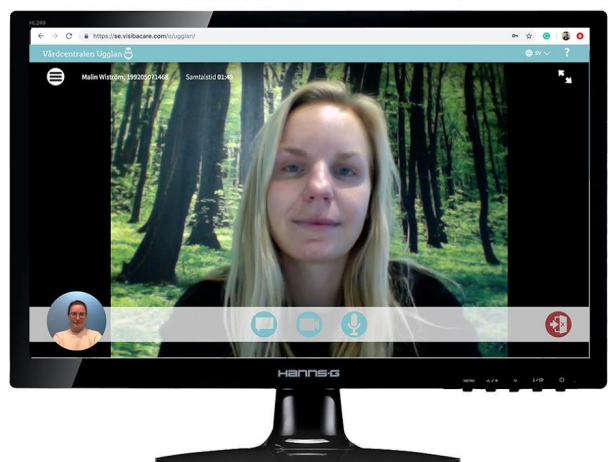


Figure 3. The digital platform

### 2.2.3 The Carebot

Currently, Visiba Care is developing a digital triage tool called Carebot. The patient interacts with the Carebot via a chat which works as a symptom checker where the patient can get a recommendation on what level of care they should seek. The digital assessment is based on a Bayesian network. The network is made up of nodes which are interdependent. In this case, these nodes are diagnoses, symptoms and risk factors. With the help of the Bayesian network, probabilities for different diagnoses can be calculated taking all influencing factors into account. The diagnoses, symptoms, risk factors and their conditional probabilities are derived with the help of a medical team and are continuously updated. Every diagnosis in the network starts with an initial probability and depending on how the patient answers the questions posed by the Carebot, the probability of the diagnosis will change. Different symptoms and risk factors have different effects on the final probability of different diagnoses.

Since the Carebot was developed parallel with this project, the limitations of the technology changed during the process. The technology limitations at the end of this project were that the Carebot could only consider symptoms and risk factors when performing the triage, not other factors such as medications, allergies and other diagnoses of the patient. For instance, if smoking is considered as a risk factor for a specific diagnosis, the Carebot will ask about it. If smoking is not considered as a risk factor, the Carebot will not ask about it and the information will not be provided for the HP in the digital assessment. The Carebot is able to ask about additional information such as medications or allergies and present it for the provider, but this information will not affect the digital assessment in this phase of the development. Additionally, the Carebot is not yet able to ask include questions related to psychological aspects such as concerns and expectations in the digital assessment.

# CHAPTER THREE

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exploration phase

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## 3.1 INTRODUCTION

The Exploration phase served as a base for the initial problem definition as well as for mapping the work procedure of healthcare providers in primary healthcare. The goal for this phase was to understand how HPs in primary healthcare use the patient information that is available today and what information that is of importance and why. Another goal was to understand how the procedure is structured and what 'pain points' and positive events the doctors experience throughout the procedure. The focus was on mapping the procedure before and during a consultation with a patient, to understand what steps they undergo, how they are organised and why they are organised in that way.

## 3.2 METHODOLOGY

In the following sections, the process of the exploration phase is described, see figure 4. Interviews with HPs were performed to understand the consultation process as well as the needs and wishes of the users; i.e. healthcare providers within primary care. The results were analysed with the KJ method and common themes were identified.

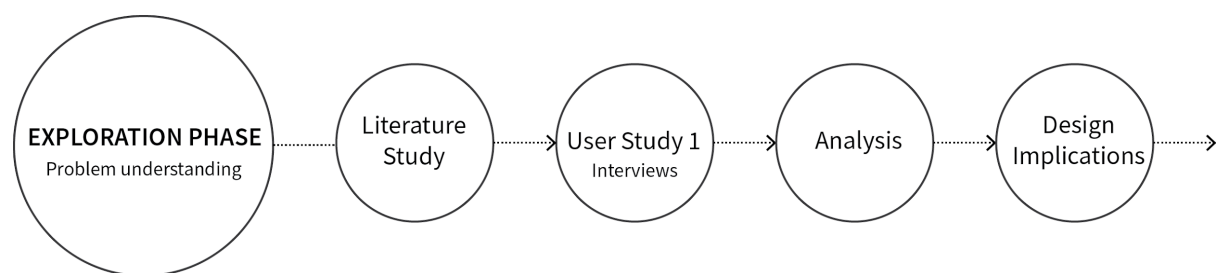


Figure 4. Process for exploration phase

### 3.2.1 User study 1

The first user study was conducted to support the understanding of the problem by interviewing experts in the area of primary healthcare in Sweden. The main focus was on the management of patient data as well as to understand the different processes where it is collected. Additionally, the purpose was to develop an understanding of how an HP utilises the information before the first consultation with a patient and what challenges (s)he experiences in the understanding of the collected information.

#### 3.2.1.1 Participants

Since the assumed users of the solution for managing patient information are doctors in primary healthcare who work digitally, the interviewees that were selected for the User study were doctors with previous experience of digital healthcare, but also potential future users, such as doctors with little or no experience of working digitally. In total nine HPs were interviewed, four of whom had experience from video consultations in a digital context. Since this first project phase was explorative to its character and focused on understanding the problem, a broad set of HPs was selected in terms of age, gender and years of working

experience in order to reflect the medical profession in Sweden (for full participant list, see Appendix 1).

### 3.2.1.2 Interviews

The interviews were semi-structured to provide the opportunity to adjust the questions as the problem understanding moved forward at the same time as the interviews needed to have a structure in order to stay focused on the problem space that was already defined.

Two interview guides were developed, one was used when interviewing doctors with digital experience and the other when interviewing doctors with no digital experience, see Appendices 2a and 2b. The main parts of the interview guides were relatively similar to assure that the main areas of interest were covered; the process before and during the consultation and the purpose of each task, pain points, positive events, what kind of information that is useful and critical decisions. The main difference was a scenario that was inspired by the ACTA method which is developed to capture cognitive and behavioural aspects of expert performance (Militello, Hutton, Pliske, Knight & Klein, 1997). The scenario was customised to simulate the situation in which the interviewees are used to work either physically or digitally.

A pilot study was performed with one doctor before the main part of interviews were held. In the pilot study, the interview guide was tested to determine if the questions would render useful answers and to get a professional's view on the relevance of the material and the questions. The material was updated accordingly. The interviews were mainly held over a video call, except for one interview that was held in a professional's office to gain insights into the user situation in the actual use context.

During the interviews, one interviewer was leading the conversation and one was taking notes and supported the first interviewer if needed. The interviews were recorded, with the permission of the users and transcribed in full to ensure that no valuable data were lost.

### 3.2.2 Data Analysis

The collected data was analysed in two different ways. First, a KJ analysis was conducted to identify and understand patterns in how the HPs work today. Second, a Hierarchical Task Analysis (HTA) was completed to map the consultation process. All interesting statements and opinions from the interviews were written down on Post-it notes which were first grouped into thematic clusters in the KJ analysis and later used in the HTA to understand each task that the HP undertakes in the process.

The problem space was then visualised by means of an Opportunity Solution Tree. The idea of an opportunity solution tree is to visualise learnings, discoveries and decisions made during a project and it shows the plan of reaching the desired outcome (Torres, 2006).

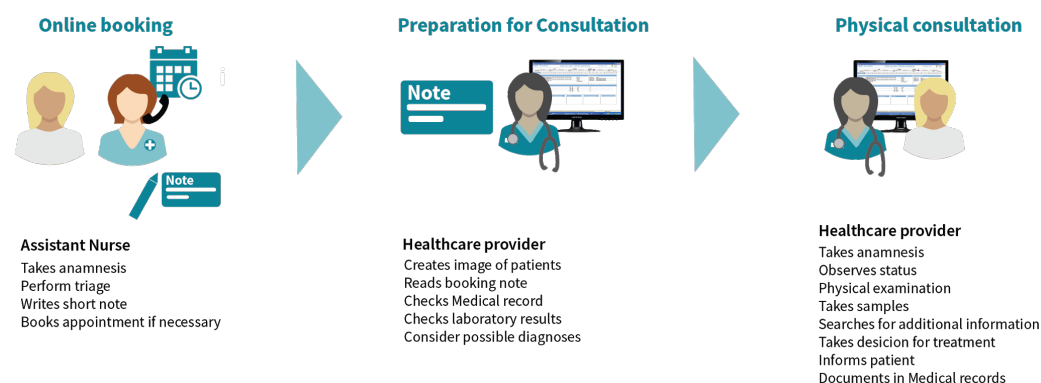
## 3.3 RESULTS FOR EXPLORATION PHASE

The study resulted in a mapping of the consultation process, important areas of information and functions and a persona of the primary user. The following section describes findings regarding both the physical and digital consultation since the purpose of both processes is the same.

### 3.3.1 The consultation process

The consultation process was mapped by means of an HTA (see Appendix 3). Figure 5 describes the steps that are undertaken in a physical or digital context in order to perform a consultation and asses the problem(s) of a patient. The future scenario, which this project was focusing on, with a Carebot is also visualised below.

#### PHYSICAL CONSULTATION



#### DIGITAL CONSULTATION

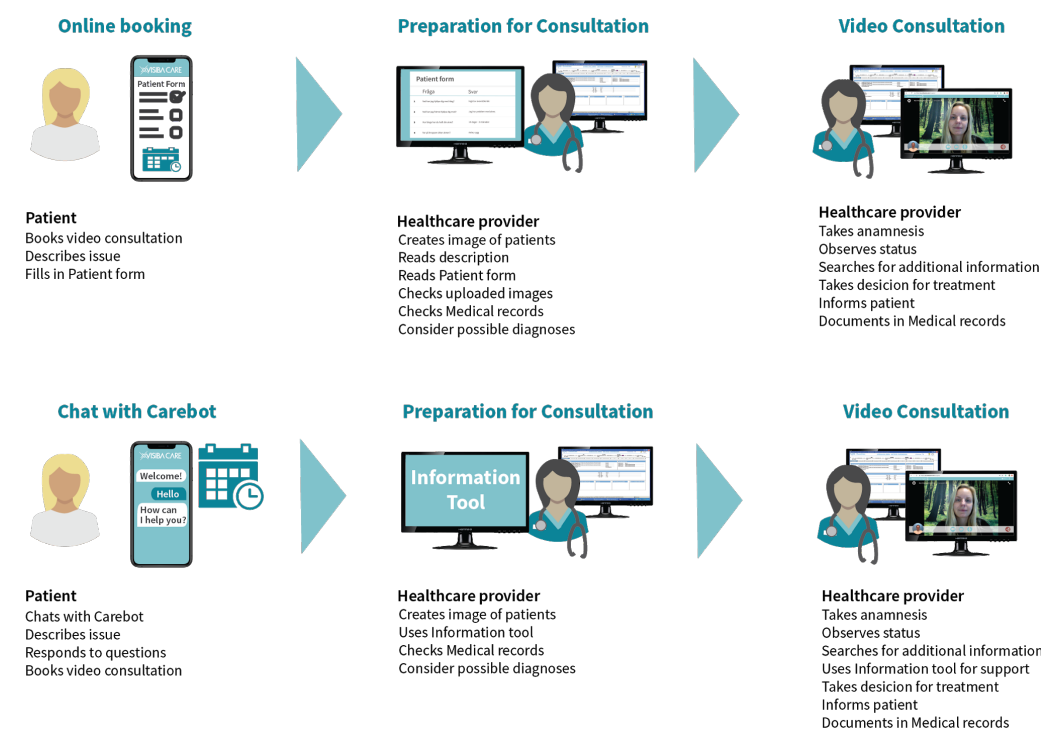


Figure 5. The different consultation processes

The process starts with the patient initiating contact with healthcare, either digitally by booking a time online and filling in a form about the issue, starting to describe their own anamnesis. Another way to start the process is by calling a healthcare clinic and being scheduled by an assistant nurse who starts taking a short anamnesis. In the next step, the general practitioner goes through a set of different tasks in order to prepare for the consultation with the patient. The doctor ends the consultation by deciding what outcome it will lead to, explaining to the patient what (s)he believes the problem is caused by and what next step will be. Lastly (s)he dictates or writes the relevant information in the medical records.

### 3.3.2 Preparation for consultation

The purpose is to prepare for efficient utilisation of the consultation time, decrease the time to take the anamnesis and to increase patient satisfaction. The HP tries ,already before the meeting with the patient, to think about possible outcomes of the consultation, read other HPs' notes from earlier visits, determine what (s)he is able to contribute with, discuss with colleagues if needed and decide if help will be required for the assessment.

The HPs who participated in the interviews described what information they needed to take the anamnesis. This information concerns:

- Reason for contact
- Symptoms
- When the problem started
- If it is the first contact with healthcare
- If the problem is recurrent
- What has been done before
- What medications have been tried
- If anything makes it better or worse
- Possible triggering factors
- What tests that have been taken
- Other diagnoses or allergies
- Earlier prescriptions or referrals

The doctors explained in the interviews that before the meeting they try to determine how to approach the patient by searching in their medical records to find out if the patient has frequent contacts with healthcare and therefore might be an anxious person. They also check if the patient has any previous diagnoses or takes any medications. It is also beneficial to the HP to know before the meeting what ideas, concerns and expectations the patient has in order to take care of the patient in an efficient and professional way.

The possibilities to prepare for a consultation vary between different HPs depending on how and where they work. The extent of the medical records varies depending on where in Sweden the HP is located. For example, the region of Jönköping has a relatively well working medical records system where the HP has access to all the patients' interaction with care regardless of what hospital or healthcare centre the patient has previously visited.

In the region of Västra Götaland, the HP only has access to the patient's interactions with the specific healthcare clinic where the patient currently is seeking care. When explaining a case to a fellow colleague the HPs used a standard called SBAR. The acronym stands for situation, background, assessment and response. SBAR is a communicative tool used to create structure in the communication between healthcare professionals (SKL, 2018). It is used to increase patient safety by reducing the risk of information being forgotten or misinterpreted.

According to the HPs in the user study, the positive aspect concerning how the patient information is presented today was that it is short and focused on the problem at hand. The professionals working digitally expressed that the form in the digital process is useful because it helps the patient develop on what they first told. It also helps the patient to know what is important and to explain this in a structured way.

The Interviewees described it as difficult to find the relevant information in the medical records since the information is presented in chronological order and not sorted after issue. They lacked a summary of the current issue where they could find all related information in one place. Another difficult aspect was trust. The HPs expressed a certain distrust to the notes taken by the nurse due to the risk of missing or misunderstanding information for each person it passes. Also in digital cases, when the patient provides their own data before a consultation, the quality of that data differs from case to case and there are many factors that affect the outcome. Patients have for example different levels of writing skills and might not know what information is relevant. A patient can also forget to mention a diagnosis they have when they are under treatment since they do not experience the symptoms anymore. The interviewees also said that they do not trust the patients to remember what medications they are taking.

There were several wishes expressed by the HPs during the interviews. They wanted to have the medical records categorised after disease or issue, rather than in chronological order, and desired that the patient would be well prepared before the meeting by perhaps getting guidance prior to the consultation on what information to have ready.

### 3.3.3 Asses the patient's problem

The doctors want to make sure that they got it right from the start and therefore reduce any ambiguity in the information from the patient. The strategies that are used to understand the information correctly are to let the patient speak freely since this can provide a good holistic picture of the patient as well as of the current issue. The ability to "read between the lines" was a recurring comment during the interviews.

### 3.3.4 Efficient utilisation of consultation time

When meeting with a patient, it is important to know how to approach the patient and what treatments the patient can handle. Sometimes, other medications or diagnoses can affect what treatments are possible to consider. Due to time limitations, the doctor wants to assess the problem as fast as possible without missing vital information. Before and during a

consultation, it is of high priority for the doctors to eliminate any risk factors, deciding whether the patient's problem is dangerous or not. It is more important to decide what treatment a patient should be given, if any, rather than deciding on the diagnosis. The doctor is also legally accountable for the treatment and therefore need to make sure that the information provided by the patient is complete and accurate.

This information concerns both the medical history and state of the patient. The doctor takes the anamnesis and regardless of the information provided before the consultation, there are always some standard questions that are asked depending on the issue. The doctors are listening for warning signals, how the issue affects the patient's everyday life and how urgent the situation is. A general anamnesis normally consists of the questions described under 'Preparation for consultation' earlier in this chapter but questions vary depending on the current problem.

### 3.3.5 Increase patient satisfaction

The purpose of building a relationship with the patient is to get a deeper contact and to gain trust from the patient, a trust to both the doctor and the system. It is of importance that the patient feels satisfied after a consultation and not worried. Otherwise, there is a risk that the patient will come back sooner than necessary. To build a relationship, the HPs want to show the patient that they are updated and concerned about the current case. Many doctors ask the patient why they are seeking care even though the doctors already know. This is to both confirm the information provided when booking the appointment, but also to let the patients feel that they are able to express everything they want. Some providers in the study mentioned that they start the consultation with a summary of the provided information, to control the validity, speed up the tempo and to show that (s)he cares. It is common that a patient brings up her/his actual concern at the end of a consultation which makes it hard for the HP to manage the issue in the desired way.

### 3.3.6 Persona

By structuring the user's actions, needs, feelings, and wishes, a persona (Figure 6) was created and used as a reference against which to evaluate ideas and concepts against before presenting them to real, potential users.



Figure 6. Persona of primary user

## 3.4 DISCUSSION AND DESIGN IMPLICATIONS

Three areas that were interesting to dig deeper into when understanding the problem and identifying the information with high importance were identified; *personal information*, *medical information* and *information systems* (3.4.1-3.4.3). The problem space identified in User study 1 was visualised with an Opportunity Solution Tree (3.4.4) that formed the basis for the idea generation in the next phase of the project.

### 3.4.1 Personal information

The *personal information* has the purpose to make the patient feel satisfied, to build trust in the doctor and the system, and to cover all concerns of the patient to make sure that all relevant information is provided. The *medical information* (cf. 3.4.2) has the purpose to support the doctor in deciding diagnosis and subsequent treatment. These two areas of information are obviously closely linked to each other; the doctor needs both sources to be able to provide healthcare of high quality.

The main focus for a doctor is to assess a patient's problem in a short amount of time and, at the same time, listen to the patient's concerns and expectations to be able to make him or her satisfied. If the patient has any concerns, expectations or ideas about the illness, this information is very helpful for the HPs since these factors normally helps the doctors satisfying the patient. The doctors want to build a relationship with the patient to gain trust. It is common therefore that the doctor wants to show that (s)he is updated on the case to communicate that (s)he cares. Many doctors also do this by asking the patient why (s)he is there – even though they already know. However, patients often bring up the actual concern at the end of the consultation which makes it difficult for the doctor to manage the concern in the desired way. The doctors in this study did not have an answer to why this happens, but one theory was that the patient needs some time to relax and this may happen first at the end of a consultation.

To understand what type of a patient it is, for example, if (s)he is a worried person, some doctors searched in the medical records to see how often the patient seeks healthcare and why.

In situations where the patient explains the problem her-/himself, as in the digital setting, there is a risk that the patient does not know what information is relevant. Many participants in the study claimed that information about tobacco/alcohol habits, family situation, and physical habits is also of high importance and it might affect both physical and physiological aspects.

Many HPs experience that the booking note does not always match with the issue explained by the patient during consultation and, further that the history might vary over time. According to Doctrin (2018), there are three central areas within healthcare with a mutual effect on each other: resource utility, patient influence and availability, and medical quality. The main focus of Swedish healthcare has been medical quality and resource utilisation and not as much on patient influence and availability. Since these areas are so



closely connected, medical quality and resource utilisation will most likely gain considerable benefits by letting the patient have a greater impact and increase the availability of care. By letting the patient perform a greater part of the collection of information, i.e. the anamnesis, the HPs will be able to put more energy on the assessment and guidance of the patient (ibid.). There is a clear opportunity for improvement to let the patient have a greater responsibility in supporting the HPs with relevant information. Design implications to test for the next phase were to create a summary of information, to build trust to the information and to provide what mood the patient might be in.

Design implications to test for the next phase were to create a summary of information, to build trust to the information and to provide what mood the patient might be in.

### 3.4.2 Medical information

Medical information consists of information about the current problem, symptoms, medications, allergies and earlier diagnoses. In general, this information is found in the medical records, a short note from booking and/or in the actual meeting with the patient. Medications, other diagnoses and allergies all affect what treatment a patient can handle. It is crucial for an HP to eliminate any risk factors and many of the participants in the interviews did this in a structured way before and during a consultation. Eliminating risk factors facilitates the process of deciding treatment as well as directing questions and use the time more efficiently. It is also important to not miss out if the issue of the patient can be dangerous or, in fact, an emergency. Even if anamnesis information would be provided before a consultation, the majority of the doctors in the interviews explained that they still would confirm the information at the start of consultation since the problem can change over time or the first information might be incorrect.

The lack of sufficient time before and during consultation has negative consequences: poor healthcare quality, insufficient reading when preparing for a meeting and inadequate collection of anamnesis (Doctrin, 2018). In a study made by Doctrin with over 700 HPs, almost half of the participants from primary healthcare believed that the most severe consequence was insufficient reading when preparing for a meeting and 21 per cent believed that the lack of time increased the risk of the wrong diagnosis. This means that the need for a supportive Information tool could generate considerable benefits if implemented correctly.

The structure and idea of an SBAR were tested in the next phase to understand if it could be supportive for the doctors and in that case how.

### 3.4.3 Healthcare Information Systems

The information systems within healthcare manage a vast amount of sensitive data and it is important that the right information will reach the right person. The information systems within Swedish healthcare varies a lot depending on the region if considering availability, technology and structure. In general, the doctors in primary healthcare are provided with a

short note about the current problem, either from a nurse in the physical context or directly by the patient in the digital context. The doctors can use this information together with the medical records to prepare before the meeting with the patient. However, there is no standard in how the nurse takes the note or how the patient describes his or her problem and the quality of the information therefore fluctuates. Coupled with the medical records and the variety of availability to patient data, it becomes difficult for the HPs to find a structured way to work and to provide the level of care they have the ability to. One of the main pain points for the doctors is the structure of the medical records since there might be medical information missing depending on what health centres the patient has been to visiting.

Some regions have developed more advanced systems to facilitate collaboration between healthcare centres in the region but there is still information missing if the patient visited a centre outside the region. This is especially a problem concerning medications and earlier diagnoses. In a comparison of primary healthcare in ten countries made by Vårdanalys (2017), only half of the asked general practitioners in Sweden declare that they get feedback from the specialised care which puts Sweden in the last place in the study. According to the same report, 17 per cent of the participants in the study stated that the lack of a good information transfer system has a negative impact on the quality of healthcare on a daily basis and 70 per cent believes that it has a negative impact at least once a week. In another study made by PwC (2016), 98 per cent of over 1000 HPs explained that a compiled list of medications for each patient available for all actors would be useful for resource utilisation when asked about digital tools. Additionally, 96 per cent believed that a coherent system for medical records where all healthcare staff could see patient data from all healthcare centres would be useful. There was a big frustration among the participants in the study regarding the use and interaction of the different healthcare information systems.

A design implication for the next phase was to test how the Information tool might be able to support the HPs in using other systems as well.

### 3.4.4 Opportunity Solution Tree

The Opportunity Solution Tree is organised in goals and sub-goals that were identified from the themes and associated pain points being potential opportunities for improvement. On the highest level 'Efficient utilisation of consultation time', 'Increase patient satisfaction' and 'Assess the patient's problem' are listed. These were identified as the main goals for a consultation. To reach these goals a set of sub-goals, each connected to one or more of the main goals, were identified (see Figure 7). Below the sub-goals are the identified opportunities generated from both the goals and the interviewees' needs and pain points, since the method suggests that a systematic approach requires that multiple solutions that deliver on the same opportunity are to be considered (Torres, 2016). The interviewees own wishes and suggestions for solutions were analysed and connected to opportunities or translated to new opportunities. These new opportunities were used to produce new alternative solutions.

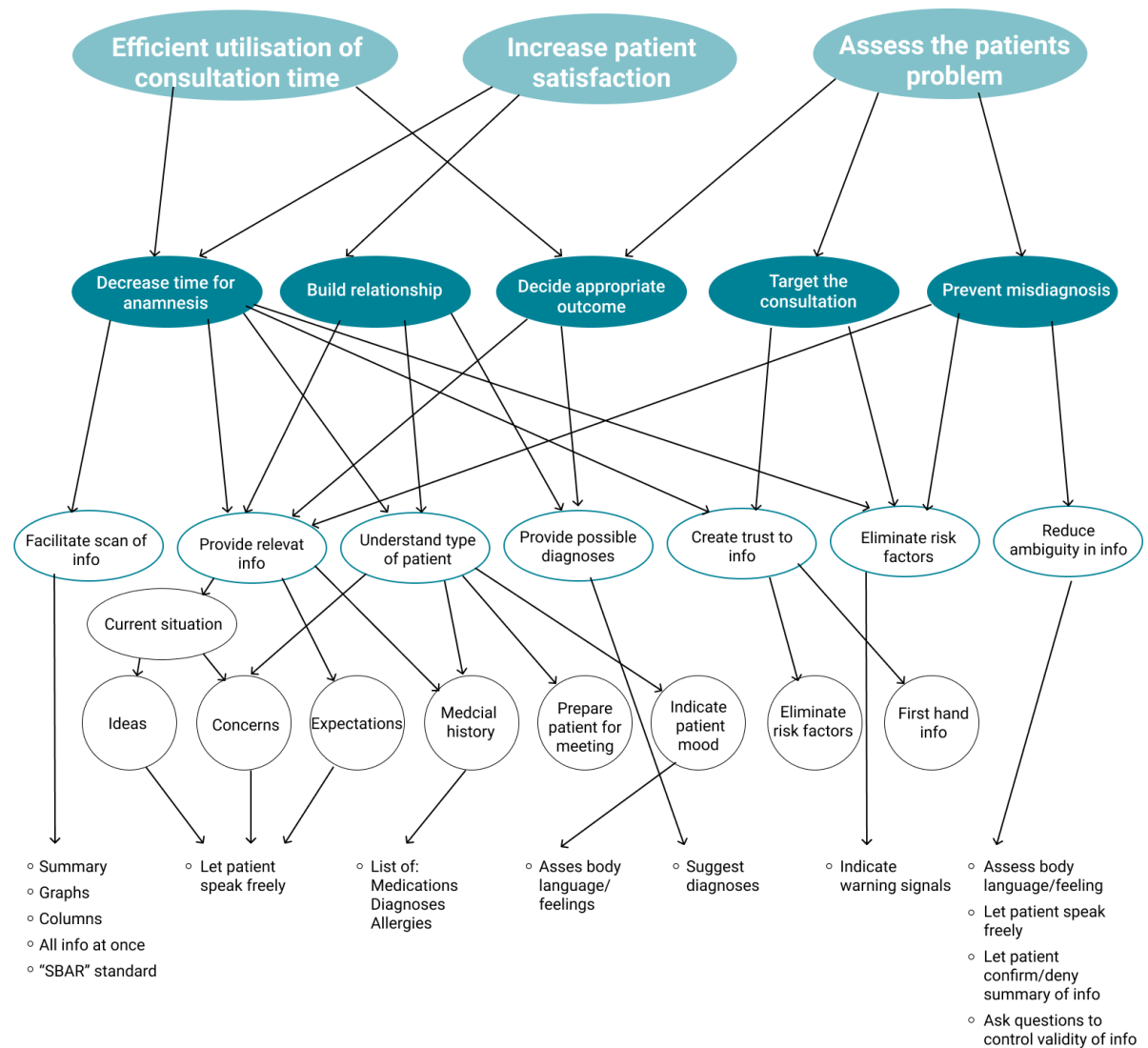


Figure 7. Opportunity Solution Tree

## 3.5 CONCLUSIONS

The purpose of the exploratory phase was to understand how the HPs in primary healthcare use available information today, what information that is of importance and why, as well as understand how the work procedure is structured and what pain points and benefits the doctor experience throughout the consultation procedure.

In conclusion, how HPs organise and use information are many times subjective and closely connected to habits but also depend upon what kind of and how much information is available.

The kind of information that is most important before and during a consultation is

- (i) the *personal information* about the patient, such as expectations, concerns and ideas, and
- (ii) the *medical information* about the patient, such as medications, allergies and other diagnoses.

The importance of these two types of information varies depending on the issue and type of patient. Some issues demand more medical background information and some patients are more anxious than others. The most frustrating occasions for the doctors in the consultation process are when it is difficult to find information in the medical records and the lack of a summary of the patient's medical history which makes it difficult to get an overview of the patient. Yet, when the patients provide their own data before a consultation, the quality of that data differs and there are many factors that affect the outcome. The HPs want to have information provided short and concentrated on the problem, relevant information from the patient and a clear structure in the presentation of the information.

# CHAPTER FOUR

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iteration one

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## 4.1 INTRODUCTION

Based on insights and mapping of the process in the Exploration phase, the next project phase explored different solutions for the identified user needs and problems. The purpose of this phase was to generate and test conceptual solutions to confirm if the needs and problems were correctly understood and to translate these needs into requirements for the final solution.

## 4.2 METHODOLOGY

The following sections describes the process of the Idea generation, see figure 8. Three concepts were developed and used as mediating tools in the interviews that were carried out in a second user study. Interviews were carried out to obtain qualitative data and a survey to obtain more quantitative data. The survey was made to clear out any ambiguity in the interviews. Building on the findings in User study 2, a requirement list was developed that served as a base for the concept development in the next project phase.

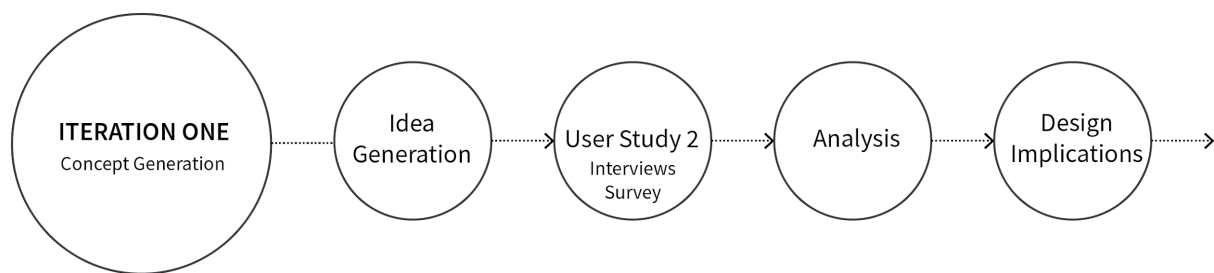


Figure 8. Process of iteration one

### 4.2.1 Idea Generation

The goal of the Idea generation was to develop three early concepts of the Information tool for HPs to be used before and during a video consultation. The full solution consists mainly of two parts, the *Patient overview* before the consultation and the *Consultation view* during the consultation. The concepts served as mediating tools in the interviews with professionals to confirm if the user needs and problems identified in the Exploration phase had been correctly understood and to extract valuable opinions about possible solutions to the problems.

The Opportunity Solution Tree, see figure 9, was here used as a visual aid for the development to get a good overview of the problem space and to see how solutions were connected to different opportunities. With the Opportunity Solution tree as a starting point, the 'How Might We'-method was used to explore different solutions for each opportunity.

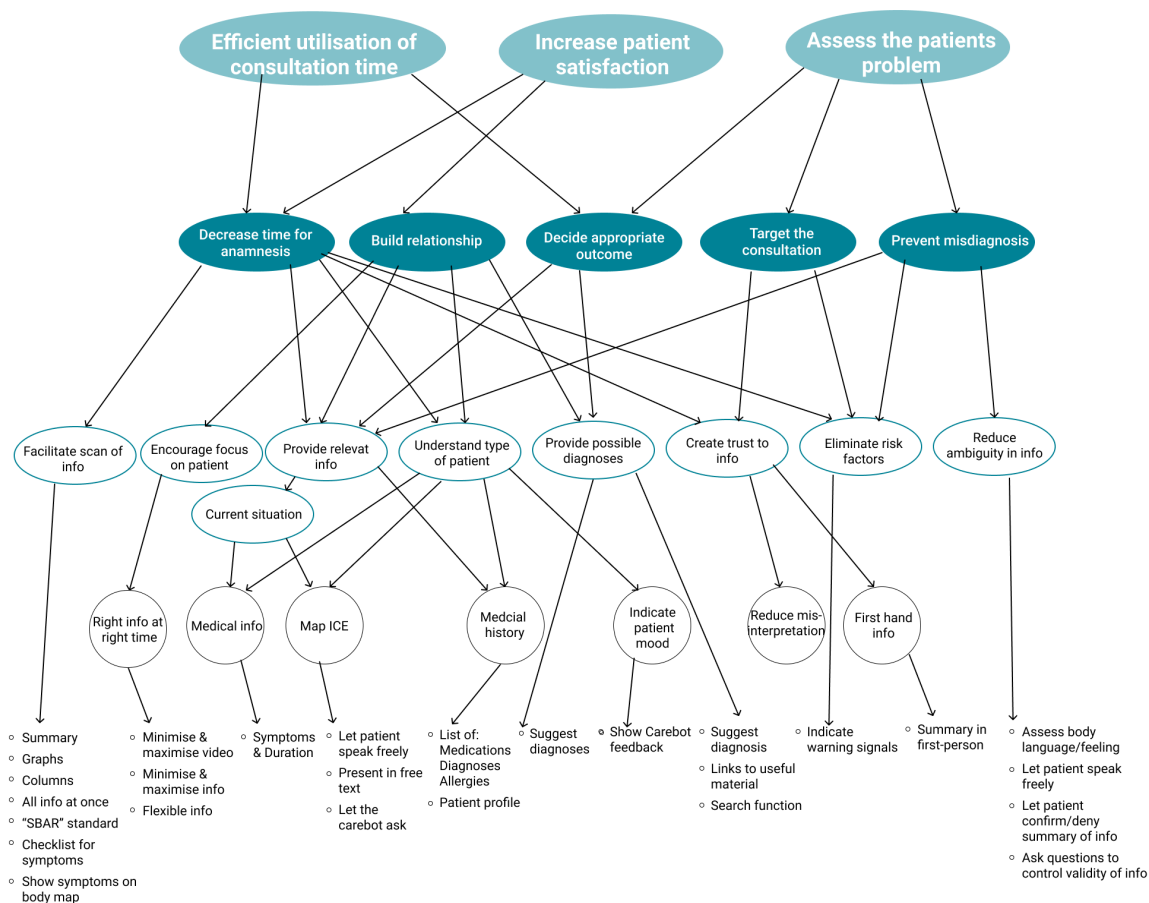


Figure 9. Updated Opportunity Solution Tree

The different solutions were first visualised in the online prototyping tool Figma as individual modules and the modules were then combined to create the three different concepts of interfaces that are presented in the following section.

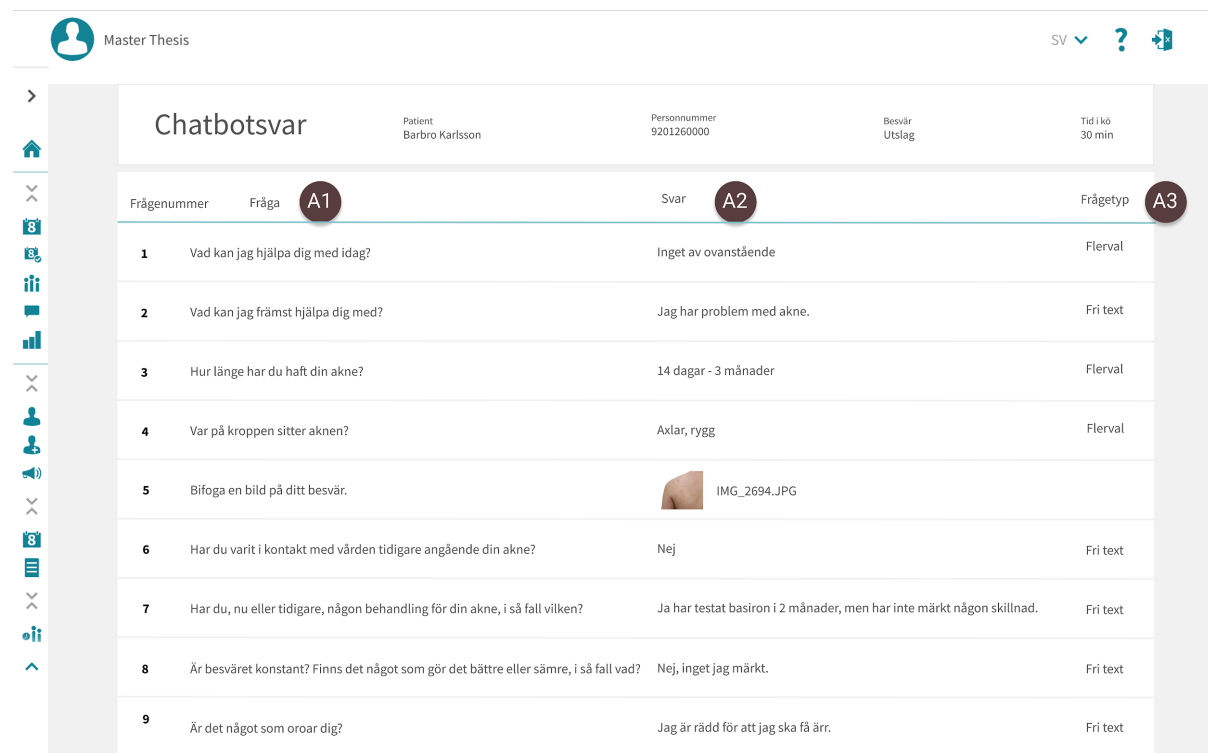
## 4.2.2 Early Concepts

The three concepts are described in the following sections. Each concept consists of a Patient overview before the consultation and a Consultation view during the consultation. The concepts are presented in Swedish since the idea is that the users will use the tool in the language that they are using in their daily work and the participants of the study all work at Swedish hospitals.

### 4.2.2.1 Reference concept

The first concept can be seen as a direct translation of the current solution for presenting the patient data with 'question and answer' structure, now gathered from the Carebot instead of in a digital form. The concept was called *Reference concept* since its purpose was to test a structure which was similar to the current solution in the platform. The solution was created as a reference to enable the interviewees, especially the ones with no previous experience of working digitally, to compare the generated solutions with the already existing

solution. It was also considered important to understand the users' experience of the current interface to see what strengths and weaknesses it had and if anything should be transferred to the new solution. For instance, the 'question and answer'-layout received a lot of positive feedback from digitally experienced HPs in the Exploration phase which made it interesting to test how it appeared compared to new ideas.




Chatbotsvar			
Patient Barbro Karlsson		Personnummer 9201260000	Besvär Utslag
		Tid i kö 30 min	
Frågenummer	Fråga	Svar	Frågetyp
1	Vad kan jag hjälpa dig med idag?	Inget av ovanstående	Flerval
2	Vad kan jag främst hjälpa dig med?	Jag har problem med akne.	Fri text
3	Hur länge har du haft din akne?	14 dagar - 3 månader	Flerval
4	Var på kroppen sitter aknen?	Axlar, rygg	Flerval
5	Bifoga en bild på ditt besvär.	 IMG_2694.JPG	
6	Har du varit i kontakt med vården tidigare angående din akne?	Nej	Fri text
7	Har du, nu eller tidigare, någon behandling för din akne, i så fall vilken?	Ja har testat basiron i 2 månader, men har inte märkt någon skillnad.	Fri text
8	Är besväret konstant? Finns det något som gör det bättre eller sämre, i så fall vad?	Nej, inget jag märkt.	Fri text
9	Är det något som oroar dig?	Jag är rädd för att jag ska få ärr.	Fri text

Figure 10. Patient overview, Reference concept

The Reference concept consisted of patient information collected by the Carebot and presented as a table in the Patient overview before the consultation (Figure 10). Each question (A1) asked was presented with the corresponding answer (A2) and the type of question (A3), for example, multiple choice. The Consultation view, see figure 11, consisted of a video call where the HP could see her-/himself as well as the patient, the functions to turn on and off the video, the microphone and additionally the possibility to chat with the patient.



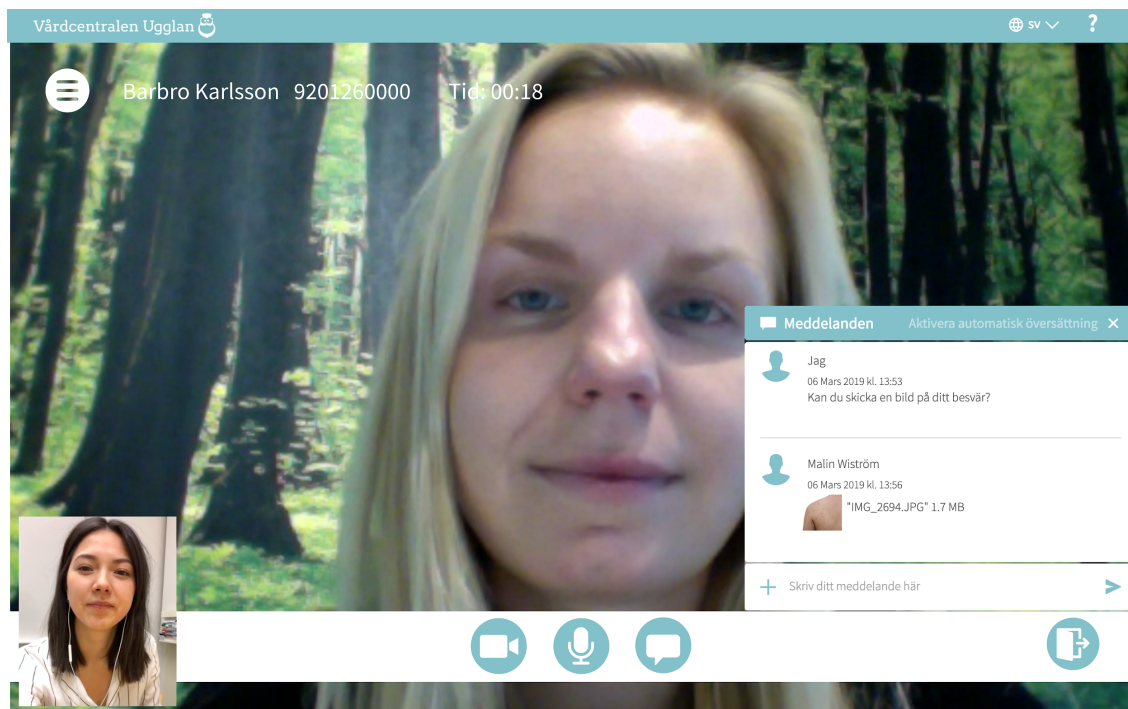


Figure 11. Consultation view, Reference concept

#### 4.2.2.2 Personal concept

The Personal concept had the purpose to support the HP to get an idea of who the patient was and what mood (s)he might be in after the interaction with the Carebot. The concept was called *Personal concept* since it had a focus on personal information to evaluate if this information was as useful to the HPs as identified in User study 1. The Personal concept gave the patients more responsibility since they had to provide more information and fill in their own user profile with data for the HP. The provided information would then be available to the HP before and during the consultation.

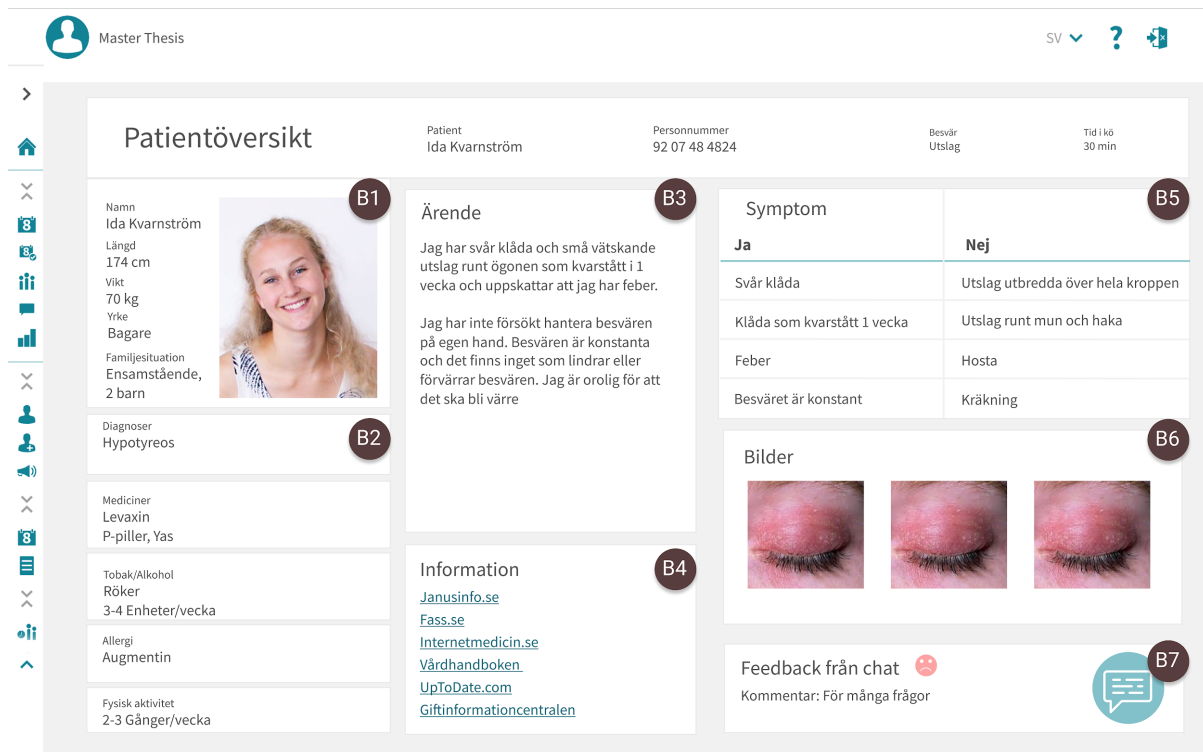


Figure 12. Patient overview, Personal concept

The Patient overview in the Personal concept (Figure 12) consisted of a patient profile module (B1), where personal information about the patient was displayed along with an image of the patient. The patient's medical information was also presented (B2); medications, other diagnoses, allergies, tobacco/alcohol habits, family situation, and physical habits. This was something that many participants of User study 1 claimed to be of high importance. The intention was to find out in what way this would help the HP and how important it is to have this information available.

One module had a short summary of the conversation with the Carebot (B3) describing the current case, the symptoms, what the patient has tried already to make it better and if the patient is worried for something in particular. The summary was written in first-person as an attempt to make the information perceived as first-hand information and the purpose was to test if this would affect the HP's trust to the information. A set of medical links to useful resources of information (e.g. internetmedicin.se) was presented (B4) since many doctors often use these sources for additional information prior to or during the consultation. The purpose of the links was to determine if having them easily accessible would add value for the HP or not.

The symptoms that the Carebot asked about were presented in a table divided into 'yes and no'-answers (B5). Another module contained images of the issue (B6) that the patient has provided before the consultation. Lastly, there is a module for patient feedback that the patient could provide after the interaction with the Carebot (B7). The HP was also able to access the chat history in this module. The idea of the module was that the HP would be able to get an idea of what mood the patient might be in based on how satisfied (s)he was with the interaction with the Carebot. This could potentially provide the doctor with a 'hint' if the patient would be upset and provide a possibility to address this during the consultation.

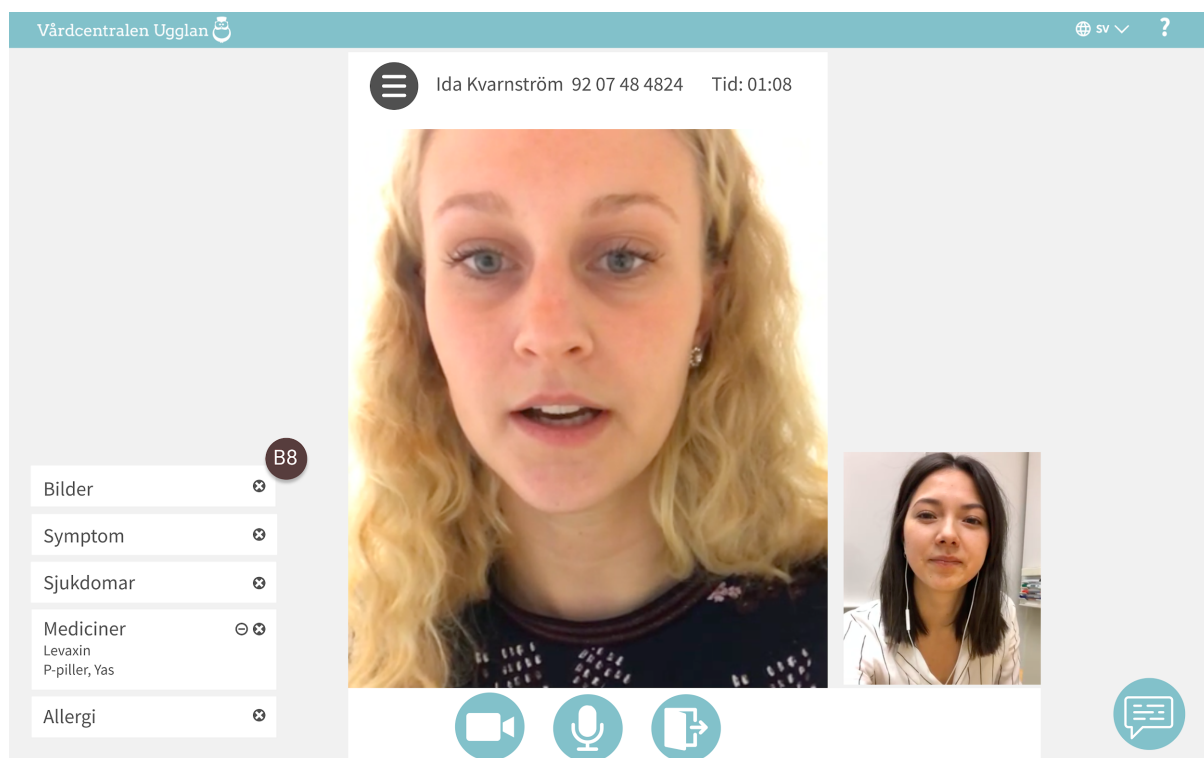


Figure 13. Consultation view, Personal concept

The information that was presented before the consultation would also be available in the Consultation view (B8), see Figure 13. The user had the possibility to minimise and maximise information as desired. In this concept, the possibility to chat during the consultation was removed to see if that was a function actually needed since nobody mentioned it in User study 1.

### 4.2.2.3 Medical concept

The Medical concept was more focused on the current problem and has been inspired by SBAR (see User study 1). The concept was called *Medical concept* since the main focus was on the current problem and not the history of the patient. The idea behind the Medical concept was to present the information in a structured way so that the HP knows what (s)he can expect to find where. Under each headline, a short explanation about the patient's status was found.

**Patientöversikt**

Patient: Bernt Andersson | Personnummer: 6007184824 | Besvär: Utslag | Tid i kö: 30 min

**C1: Kontaktersak**  
Utslag som ökar i omfång, har haft besvär i 5-7 dagar.  
Födelsemärke som ändrat färg.

**Bakgrund**  
Patienten har testat kortisonsalva för utslagen, men det har inte hjälpt. Har inte haft besväret tidigare.  
Patienten har inte haft hudcancer tidigare, har ingen ärftlighet för det och har inte bedömts av läkare tidigare.

**Föreställningar**  
Patienten vet inte vad det kan vara.

**Förväntningar**  
Vill bli av med sina utslag så snart som möjligt och avgöra om födelsemärket är farligt eller ofarligt.

**Farhågor**  
Är orolig då födelsemärket har förändrats.

**C2: Symptom**  
Rodnad  
Måttlig smärta ☒  
Utslag som ökar i omfång ☒  
Födelsemärke som ändrat färg ☒  
Fever ☐

**C3: Bilder**  
[Image of a skin lesion] [Image of a skin lesion] [Redigera]

**C4: Placering: Utslag**  
[Body map showing skin lesion location]

**Placering: Födelsemärke**  
[Body map showing birthmark location]

**C5: Föreslagna diagnoser**

Diagnos	Sannolikhet
Diagnos 1	86 %
Diagnos 2	54 %
Diagnos 3	51 %

Figure 14. Patient overview, Medical concept

The module with headlines (C1) managed the reason for contact, the background for the current matter and also the ideas, concerns and expectations, something that was proved to be important to many HPs in User study 1. Since the SBAR tool normally is used to report from one HP to another, the text was written in third-person to make it feel like a report from another caregiver. The symptoms (C2) were here displayed in a checklist, the symptoms confirmed by the patient were marked with a checkmark whereas the symptoms negated were not. A symptom marked with red colour indicated that the symptom can be associated with more severe disease and that the HP might need to pay extra attention to it. The module with images (C3) had an additional function for the HP; to be able to edit an image. The idea was that this would facilitate the communication between the doctor and patient. Another visualisation used was the body map (C4) where the patient could indicate where on the body the symptoms were located and the healthcare professional could see this on the body map instead of as written text. The purpose was to investigate whether these visualisations helped the HPs to get a better overview and to process the information in a faster way. Since the AI system will be based on probability for different diagnoses, the last module with suggested diagnoses (C5) was interesting to discuss in terms of whether or not it creates value by providing good guidelines or if it creates a bias to the suggested

diagnoses (see Figure 14). This concept had more information available during the consultation to investigate if it would be helpful or distracting and why that would be the case (Figure 15).

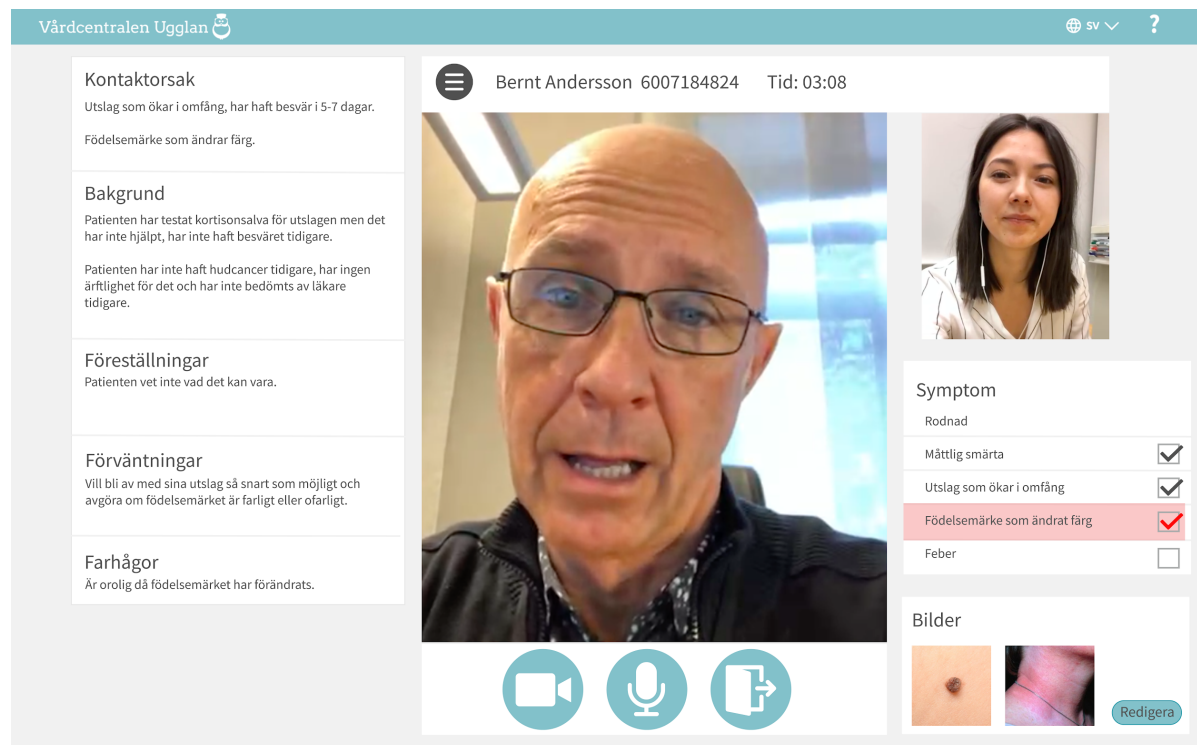


Figure 15. Consultation view, Medical concept

## 4.2.3 User Study 2

The created concepts were first evaluated against the Persona developed in the Exploration phase to ensure that they, in theory, would meet the needs of the user. However, to get a deeper understanding of the user needs and to gain feedback on possible solutions, a second user study, User study 2, was conducted. The study consisted of two parts, one interview study concerning the content and presentation in the three generated concepts and one survey comparing different combinations of the different modules. At this point in the development, the user research was focused on understanding whether the problem statement was correct, if the user derived the expected value, how well the primary elements served the users and if the modules worked as intended (cf. Cooper et al., 2014).

### 4.2.3.1 Participants

Since the purpose of User study 2 was to confirm the findings of the Exploration phase and to evaluate the generated ideas, a group of participants similar to the ones who participated in User study 1 was selected. The selection consisted of six professionals, three men and three women aged between 26 and 44 with varying previous experience of physical and digital consultations (see Appendix 1 for full participant list). The selection was a mix of a 'between-subject' and a 'within-subject' approach, in that half of the

interviewees had participated in the first user study. By interviewing some of the participants from User Study 1 the hope was to confirm that their needs and wishes had been accurately interpreted and investigate if the suggested solutions solved their problems. By introducing new participants, the hope was to identify additional user needs as well as ensure that the solutions that fulfil the identified needs from the previous study also are valuable to users who have not been taking part in the development. It was a within-subject study in the sense that all participants evaluated all three concepts. This was to minimise the random noise, meaning that existing differences between the concepts stay undetected which, according to R. Budiu (2018), is the most important advantage of using within-subject designs. The selection for the survey consisted of 35 participants, 23 women and 12 men, aged between 20 and 74. The participants were mainly doctors within primary healthcare, but there were also other doctors, nurses and medical students with varying years of experience (see Appendix 1 for full participant list).

#### 4.2.3.2 Interviews

The interviews in User study 2 were performed to gain qualitative data on how this patient information should be presented to provide the best support for the HP before and during consultation and to elicit opinions about the suggested solutions and suggestions for possible alternative solutions. The interviews were based on a scenario where the participants were asked to use the concepts, one at a time, to prepare for a consultation with a fictive patient. For each scenario, the participants were asked to explain how they would use the concept and its features when preparing and performing a video consultation (the interview guide is found in Appendix 4). The scenarios were followed by questions about what information the participants used, what they used it for, if they would change the way they work if they had access to the information and how they perceived the different presentations of the information. Finally, they were asked to combine the different modules to represent their preferred view of patient information.

#### 4.2.3.3 Survey

Because of the differences in opinions collected during the interviews, it was decided that the collection of quantitative data could benefit the analysis and validity of the data. Three features, suggested diagnoses, links and feedback after chatbot, received a range of positive and negative input which led to the decision to have general 'yes or no'-questions about these in the survey with the hope to get a clearer result. The other part of the survey was created by using Discrete Choice Analysis together with the statistical software JMP Pro.

#### 4.2.3.4 Discrete Choice Analysis

A Discrete Choice Analysis (DCA) was conducted since it focuses on individual behaviour, preferences and choices (Sánchez-Díaz, 2018). The interviews provided a holistic view of both advantages and disadvantages in presenting certain information and why. Therefore, the DCA indicated the best opportunity areas for improvement.

The method is based on trade-offs as in a market setting and it is useful for product optimization (Sánchez-Díaz, 2018). In this study, a stated preference (SP) study was chosen which includes experimental design and a questionnaire in which the users were asked to select their preference among a set of hypothetical alternatives, see Appendix 5. In this case, a set of hypothetical alternatives was created for how to present information before a consultation. Chosen attributes, levels and design implication can be found in Table 1 and Table 2.

Table 1. Chosen attributes and coherent levels for the DCA

Symptom	Current Case	Patient Profile	Placement on Body
Checklist	First-Person	Bar info	Show in Picture
Yes/No Columns	Headlines	User Profile	In text
Warning flags Yes/No	Third-Person		
Warning flags Checklist			


Table 2. Design generation






Number	Decision for layout
2	Attributes that can change within a choice set
2	Profiles per choice set
12	Choice sets per survey
1	Survey
1	Expected respondent per survey







There were two options in each choice set, see the example in figure 16. Every option had the modules 'Images' and 'Medical Information' since there was already sufficient knowledge about the importance of these features from the Exploration phase as well as from the qualitative interviews. The survey had the purpose to collect more feedback about the most discussed features and functions in the interviews. The answers from the survey were collected and then analysed using the JMP software.



Här presenteras patientens symptom på olika sätt, samt sättet att beskriva besvärets placering.


Master Thesis

## Patientprofil

Personnummer  
197610244275

Name  
Anna Andersson

Ålder  
174 cm

Vikt  
70 kg

Diagnos  
Förskrivning  
Enkeltstående,  
2 barn

Diagnos  
Hypotyreos

Mediciner  
Lexmark  
P-giller, Yas

Sjukhus/hälsö  
Röken  
3-4 enheter/vecka

Ämne  
Augmentin

Fysisk aktivitet  
2-3 Gången/vecka

## Ärende




Patienten har svår klåda och små  
våtdånande utslag runt ögonen samt  
kvartsstätt i vecka och uppskattat att hon  
har feber. Hon har svår smärta.


Patienten har inte förskott hänta  
beskrivningen på egen hand. Beskrivningen är  
konstanta och det finns inget som lindrar  
eller förklarar besvären. Patienten är  
orolig för att den ska bli värre.






## Symptom







Ja	Nej
Svår klåda	Utslag utbredda över hela kroppen
Klåda som kvartsstätt i vecka	Utslag runt mun och hals
Feber	Hösta
Besväret är konstant	Kräkning




## Bilder


Master Thesis

## Patientprofil


Personnummer: 19762024475

namn: Anna Andersson

Ålder: 174 cm

Vikt: 70 kg

Sex: Kvinna



Diagnoser: Encefalopati, 2 barn

Placering: Hypotyreos

Hälsöversikt: Läkemedel: P-piller, Yas

Sjukhistoria: Rökstopp: 3-4 färdigheter/vecka

Allergi: Augmentin


Fysisk status: 2-3 gånger/vecka

## Ärendet

Patienten har svår klåda och små välskandade utslag runt ögonen som kvarstår i 1 vecka och uppträder att hon har feber. Hon har svår smärta.

Patienten har inte föregående hälsöversikt besvär på egen hand. Besvären är konstanta och det finns inget som lindrar eller förbättrar besvären. Patienten är orolig för att det ska bli värre


## Placering: Utslag



## Symptom

Svår klåda	<input checked="" type="checkbox"/>
Klåda som kvarstår 1 vecka	<input checked="" type="checkbox"/>
Feber	<input checked="" type="checkbox"/>
Svår smärta	<input checked="" type="checkbox"/>
Kräkningar	<input type="checkbox"/>

## Bilder



34



## 4.3 RESULTS FOR ITERATION ONE

The results include both qualitative and quantitative data from the user study.

### 4.3.1 Interview results for Reference concept

The overall opinion was that the information provided on the screen would help the providers to prepare for the presentation. Five out of six interviewees stated that the information gave them a good overview of the patient. They commented that with access to this information they would have to ask fewer and more focused questions and they would not have to look through the medical record of the patient. They also claimed that they could start the meeting in a more efficient way by summarising the patient's information and have them confirm it instead of asking all the questions again.

Regarding the overview in Reference concept, four out of six interviewees considered it clear and easy to assimilate the information when presented as questions and answers. They commented that it is appropriate for less complex cases, but that it for more complicated cases with longer free text responses could be more difficult to get a good overview. Negative comments about the presentation were that the table structure, presenting all the questions to the left and the answers to the right, makes it difficult to read (due to the strenuous eye movement), and that it is important to have a big screen if information is to be presented like this to avoid having to scroll up and down.

Several interviewees wanted to see the alternatives for the multiple choice questions and they wanted to know if the patient had the possibility to pick more than one alternative. The participants believed that they could trust that the patient picked the correct alternative, but felt that they wanted to see what alternatives the patient had chosen between to avoid confusion.

Some interviewees commented that they were missing information about patients' previous diagnoses, allergies and medications. Reasons for this were, for example, that a skin problem could be a side effect from medication or that they needed to know if the patient is allergic to any medications that the HP plan to prescribe. The main reason for wanting this information already before the meeting was that it would urge the patient to write down the medications when having access to the packaging where they can find the exact name and information about the medication.

When being presented with the Consultation view, four out of six interviewees said that the information available in the Preference concept would be enough and that they did not lack any information.

### 4.3.2 Interview results for Personal concept

All participants in the interviews were positive to the holistic view presented in concept two, the presentation was described as easy and quick to read. According to the doctors in the study, this amount of information from a patient would generate a higher quality of healthcare. One doctor explained that with access to all this information the medical record would only be used to understand how often and for what the patient normally seeks healthcare, this in order to understand the type of patient. It was also mentioned how this information would help them save time during the consultation by allowing them to prepare relevant questions before and only control the provided information during the consultation and not ask all questions again. Half of the participants said that with this information, they would start the consultation with a summary of what they had read to control the validity with the patient, and also show that they care.

The patient profile was appreciated by all participants, especially the access to the information concerning medications, earlier diagnoses and allergies. The information supports the HP in how to target the consultation and to ask relevant questions. The information about occupation, family situation, exercise habits and tobacco/alcohol habits was seen as positive and helpful in preparing for a consultation. To get access to information about the patient's working situation indicates for the doctor if there are any risk factors to consider, such as physical stress or exposure of substances. Since the patient profile is supposed to be filled out by the patient, the credibility of the information was discussed during the interviews. It can be helpful for the doctors when the patient has to formulate the problem beforehand and to look up what medications and diagnosis they have at the moment. "In many cases, when the medical records are not available, many doctors ask the patient to fill out the information which I find highly trustworthy", one doctor explained.

There were different opinions concerning the decision to write the summary of the patient's answers in first-person or in third-person since it was created by the Carebot. Some of the doctors found it misleading with the first-person perspective since the actual summary is not written by the patient her-/himself. Another reason for choosing the third-person perspective was the habit of HPs. When a patient has been triaged by a nurse to see a doctor, the information is forwarded in a third-person format why the HPs felt more used to this form of presentation. One-third of the participants preferred the first-person form, mainly because they found the information easier to grasp when it felt as it came directly from the patient, even if the Carebot made the summary. In general, the doctors appreciated the summary of the current case. It would support them at the start of the meeting to confirm the information and not repeat the same questions as the Carebot. Some doctors brought up the perspective of the patient and pointed out the importance of creating a user-friendly and positive experience for the patient.

The doctors were positive to the links in the presentation, but at the same time believed it took up unnecessary space. The suggested links were considered useful and many HPs have these resources as bookmarks or opened websites on their computers, which might make the option superfluous in the presentation. One suggestion was to create hyperlinks

for the medications and diagnoses that would create a shortcut directly to a relevant source.

The module with feedback from the Carebot did not produce any clear likes or dislikes and the majority of the doctors did find it unnecessary and others were not sure what to use it for. One doctor said that the idea was good but it might be better to ask the patient directly how they experienced the chat and if they would like to add any information.

Access to chat history in the presentation and during the consultation had a similar result as the module with feedback. It was regarded as useful since it is possible for the HPs to reduce any ambiguity if something is unclear in the summary or if the doctor would like to see what questions the patient has answered but they also considered it as complicated and time-consuming.

A majority of the interviewees liked the list of symptoms, especially compared to the Reference concept where it was described in written text. Yet, the doctors found it confusing or needless with both 'yes and no'-symptoms since there is a risk of many 'no-symptoms'. One doctor mentioned that there is a risk that you register the symptom even though it is presented as non-present.

The overview of the Consultation view received the same positive feedback from the participants. The possibility to expand/minimise/remove the modules of information was especially popular and the majority of the doctors preferred this layout. Uploaded images were considered especially useful here if the image quality of the video consultation would be poor.

### 4.3.3 Interview results for Medical concept

The Medical concept was perceived as more structured and clear by half of the participants. Some doctors experienced it as confusing which might be connected to the fact that the Medical concept presented two different issues. Half of the interviewees thought that the current case was well summarised, structured and easy to read. They expressed that the headings made it easy to read and that the headings would be useful for more complicated cases when a lot of information is presented at once.

Regarding the symptoms, majority of the participants preferred having the symptoms presented in a checklist. They commented that the checklist was more clear than the 'yes/no'-list since the visual differences between yes and no were too small. They liked that the checklist made it easy to see what symptoms the patient actually had.

A majority of the participants claimed that the warning flags gave them a better overview. They said that the flags would provide an indication of the severity of the problem and that, when warned for symptoms connected to a severe diagnosis, they would make a plausibility assessment. One doctor said that 'it makes you react' and that a good idea could be to indicate the severity of the symptoms with, for example, a different colour, which is how lab results are presented today. The same participant also brought to attention that

there is a risk that, if the bot fails to connect a symptom with a warning flag, the absence of the flag could lead to that the HP does not perceive the severity of the patient's status and misses something if (s)he only scan for the flags.

The question if the participants wished to have suggested diagnoses based on the patient's interaction with the Carebot received varying responses. Some participants thought that a suggested diagnose would help them, especially if they had no idea what diagnosis the patient could have. They believed that they would trust the AI system's suggestion, but that they wanted to have some kind of explanation of why a particular diagnosis was suggested. Other participants were negative to diagnoses being suggested since they thought it was confusing and wanted to reach the conclusion themselves. The participants believed that if they were presented with diagnoses it could lead to premature closing where they would focus only on trying to eliminate the suggested diagnoses and therefore miss to investigate all other possible diagnoses. They also mentioned the fact that the patient's ability to respond to questions would affect the accuracy of the AI system's ability to suggest diagnoses.

The opinions about having the placement of symptoms visualised on a body map were not very strong. Half of the interviewees were unsure if it would be necessary or helpful even if they liked the way it looked. They said that it could be helpful if the symptom was diffusely spread over the body, but less helpful if it was just on one spot.

A majority of the participants thought that it was favourable to have access to some of the information from before the consultation also during the consultation. They wanted to have some access to background information about the patient, the reason for contact and any images that the patient sent in. They expressed that having the information easily accessible in the same window as the video conversation helped them to keep the focus on the patient. However, they expressed that there was too much information in the Medical concept. Five out of six participants felt distracted by the amount of information and thought that it would affect the consultation. Four out of six interviewees expressed that they preferred the option of being able to minimise the information and only access it when needed. This would help them to easily access the information while avoiding to lose focus on the patient. One doctor suggested: "Instead of minimising the information there could be a function where the video could be maximised to full-screen".

#### 4.3.4 Results from the survey

The results from the survey were divided into three parts; statistical results from the software JMP Pro, 'yes and no'-answers from the general questions and the participants' comments on the respective questions.

##### 4.3.4.1 Discrete Choice Analysis

In the JMP analysis, three out of four attributes were significant when 35 HPs had participated in the stated preference survey (see Table 3). When analysing the effect summary 'Symptoms' did not have a statistically significant effect on the choice of preferred

layout. It was clear that the 'Current case' was the most relevant attribute determining layout choice in the presentation since it had the highest LogWorth. 'Current case', 'Patient profile' and 'Placement on the body' all had a statistically significant effect in the selection of the preferred solution (p-values < 0.05).

Table 3. Effect Summary

Source	LogWorth	P-Value
Current Case	0.2271	0.00536
Patient profile	0.1774	0.01684
Placement on the body	0.1701	0.01989
Symptom	0.524	0.29927

The estimated parameters showed that the participants in the survey preferred a layout with the 'Current case' as headlines, 'Patient profile' as a user profile and the 'Placement on the body' as a visualisation, see Table 4.

Table 4. Parameter Estimates

Term	Estimate	Std Error
Symptom[Checklist]	0.0981	0.1411
Symptoms [Yes/No]	-0.1112	0.1818
Symptom[Warning flag check]	0.2144	0.1648
Current Case [First-person]	0.1216	0.1397
Current Case [Headlines]	0.2923	0.2009
Patient profile [User profile]	0.1869	0.0801
Placement on the body [Written text]	-0.2410	0.1063

The most and the least preferable options were identified by using the multiple choice function in the software JMP Pro. The alternative with the highest probability to be chosen, 77 per cent probability, had the following attributes: 'Symptoms' as a checklist with warning flags, 'Current case' as headlines, 'Patient profile' as a user profile and 'Placement on the body' as a visualisation. The alternative with the lowest probability, 23 per cent, had the attributes 'Symptoms' as yes/no columns, 'Current case' written in third-person, 'Patient profile' as an information bar and 'Placement on the body' described in written text.

#### 4.3.4.2 General questions

The feedback for the general questions in the survey supported the ambiguous feedback from the interviews for the specific features 'Links to resources', 'Suggested diagnoses' and 'Feedback after interaction with the Chatbot', see Table 5.

Table 5. Answers for general questions

Question	Yes	No
Would you like to have useful links as a resource of additional knowledge?	24 (64,3%)	11 (31,4%)
Would you like to have suggested diagnoses and appurtenant likelihood?	16 (45,7%)	19 (54,3%)
Would you like to get the patient's feedback/opinion after interacting with the chatbot?	22 (62,9%)	13 (37,1%)

The main part of the respondents wished to have access to links to valuable resources before the consultation. Reasons were that this would save time when accessing information that they are already using on a daily basis. The links must lead to reliable sources and not be connected to companies. Other comments were that the links are useful but not a priority if they take up space from other and more important information. The respondents who were negative to the links argued that they already had easy access to this information via open tabs in their browser and that information that is considered as relevant changes over time and that a doctor must already know where to look for information.

The sceptical respondents to the suggested diagnoses felt that this will lead them to only investigate the suggested diagnoses and thereby miss out on other possible diagnoses. The respondents also questioned the credibility of the diagnoses, they wanted to know the background to the suggestions and what algorithm it would be based on since patients can have different symptoms and still have the same diagnosis. The respondents also wanted to make their own medical assessment out of habit. The respondents who were positive to suggestions of diagnoses argued that they would get support in their assessment and be supported to not miss unusual diagnoses and in addition, save time.

A majority of the respondents claimed that they wanted to receive feedback from the Carebot conversation. The HPs wanted to know the patient's experience from a service perspective, for example, if the patients felt that they have been asked irrelevant questions. They also wanted to use the feedback for continuous improvement. Respondents that were negative towards getting feedback from the patient's experience with the Carebot explained that they felt stressed since they could not do anything about it and that this feedback should be sent to the company developing the Carebot. Some brought up that they simply did not have time to take this into consideration before a meeting.

#### 4.3.4.3 Comments from survey

The respondents in the survey had the ability to leave a comment on each question. Regarding the current case, some respondents thought that first-person perspective resembled more a physical consultation, which made it easier to utilise since they are used to receive the information like that. Several respondents mentioned that it works if it is the patient's own words, otherwise they preferred a presentation from a third-person perspective. A majority of the respondents were positive to the User profile since it contained more information than what they were used to about the patient and gave them a good overview. However, one participant commented that (s)he did not like that it appeared as a Facebook profile and that it is more relevant to get relevant medical information rather than a picture. Other respondents believed that a photo of the patient could subconsciously affect the consultation. Comments about the warning flags were that they confused more than helped, it has to be presented together with a connected diagnosis to be helpful and that it otherwise increase the risk of misdiagnosis.

## 4.4 SUMMARY & DESIGN IMPLICATIONS

According to Cooper et al. (2014), it is important to start interaction design with a top-down approach when working on a design intended for complex behaviours and interactions. By starting with the 'big' picture and rendering solutions with no or low level of detail it is easier to stay focused on the fundamentals; serving the goals and requirements of the user. The findings from Iteration 1 will be discussed to easier grasp the big picture and the flow of information.

### 4.4.1 Preparation for Consultation

The HPs are not used to get access lot of patient data before a consultation which made it interesting to observe how the interviewees used the information in different scenarios. The information page presented before the consultation includes several opportunities for improvement and development which will be discussed below.

#### 4.4.1.1 Content

The general opinion about the content provided in the new concepts was that it was relevant and helpful for the doctors and that it would save time as they would be able to prepare questions in advance and to summarise the information for the patient so (s)he could confirm or deny its accuracy. Something that almost all doctors brought up was the fact that they always will start a consultation by asking why the patient is there, no matter how much they know on beforehand. This is something they are educated to do and it has the purpose to get more information, validate the information and at the same time show that they care. With all three concepts, several doctors said that they would be open for the alternative to start the consultation with a summary of what they know from the Patient overview and ask the patient to confirm and possibly add information if something is missing. This result was interesting since it might enable HPs to save time and still show how they care about the patient. Another important insight was that the doctors believed that this information would increase the quality of healthcare since they are able to be better prepared when meeting patients. The interviewees explained that the personal information about the patient and reason for contact must be presented in a distinct way because of its high importance, something which confirms the results from the first user study.

#### 4.4.1.2 Overview

The participants perceived the overviews of the module based concepts (Personal concept, Medical concept) well structured but the fact that two issues were presented simultaneously in the Medical concept might have affected the answers as some of the participants got confused. The initial positive reactions to the table structure in the Reference concept might have been because it was the first concept presented and the participants therefore were more focused on the content than the presentation of the information. The visualisations 'Placement on body' and 'Warning flags' were not perceived to be of any greater importance, but they contributed to the experience of getting a good overview according to the interviewees. This visualisation feature should be further



investigated to understand if it actually supports the HP or not. Another key insight was that the doctors wanted to have all the information available on one page.

#### 4.4.1.3 Current case

The arguments for if the *Current case* should be written in first- or third-person differed between the participants (approx. half of the participants preferred the one and half the other option). First-person was slightly more preferred in the survey but the arguments for presenting the information in third-person are that it comes across as more professional and objective and will by that be considered in the next phase. Both summaries of the *Current case*, with or without headings, were appreciated and the doctors in the interviews claimed that they would use it when starting a meeting to validate the information with the patient and to ask relevant questions. The summary with headlines, however, would be useful for more complicated cases when a lot of information is presented at once. Therefore it was considered as more applicable for a wider range of different cases. Altogether, the takeaways for next phase were to present the case in third-person (if collected by the Carebot) and with headlines.

#### 4.4.1.4 Patient profile

The feedback provided on the 'User profile' in the Personal concept indicated the importance of having access to information on medications, earlier diagnoses and allergies, because these are factors that support the HP in performing a more efficient and qualitative assessment of the patient problems. The information about occupation, family situation, exercise and tobacco/alcohol was also helpful but of secondary importance. The credibility of the User profile was considered high by a majority of the participants but they would confirm the information with the patient to make sure they have correct and updated information. The function to ask the patient to look up her/his medications at home and by that being prepared before the meeting with the doctor received strong positive feedback and was considered into the next phase. This function can provide information of better quality to the doctor and support the patient to prepare for the consultation.

#### 4.4.1.5 Symptoms

Design implications from presenting the different layouts for 'Symptoms' were that it is positive to get the symptoms summarised in a list and that the "no-symptoms" should be clearly marked to discriminate the information clearly from the symptoms the patient actually has. The warning flag that highlighted a critical symptom was appreciated since it gave an indication of the severity of the problem and was similar to how lab-results are presented. However, any absence of warning flags could make the doctor pay less attention and the interviewees also mentioned the importance of knowing the reason for the warning, if it was connected to some other symptom or diagnosis. The information about the risk factors, diagnoses and symptoms was therefore to be further investigated and developed in the next phase. The visualisation was also to be investigated to see if it is possible to create a clearer contrast between 'Yes' and 'No' answers.

#### 4.4.1.6 Body map

Many doctors liked how the 'Placement on body' map looked but did not know if it would be useful. Colin Ware (2012) explained in his book *Information Visualisation: Perception for Design* how the central claim of the multimedia theory is that providing information in more mediums of communication than one will contribute to a better understanding. Additionally, learning will be better by providing material in both visual and verbal cognitive subsystems. By that, the positive reactions to the body map might have to do with the fact that the participants liked the idea of having information presented in different mediums rather than actually being supported by the body map in the assessment.

#### 4.4.1.7 Suggested diagnoses

The module providing 'Suggested diagnoses' was debated and most of the professionals in the interviews were uncertain if the diagnoses would support them in any way. They rather believed that they would make them forget other possible diagnoses. The system which suggested the diagnoses also questioned; how the probability for the different diagnoses were determined, the patient's ability to affect the outcome when answering questions and the fact that patients with different symptoms can have the same diagnosis. At the same time there were professionals that considered the suggested diagnoses helpful if they for example had forgotten about unusual diagnoses. To be able to make a decision about the module with diagnoses, there had to be extended research about how the system can be explained to the users and if it then would be considered as useful or not.

### 4.4.2 During Consultation

The ability to have the information available during the consultation was overall considered positive, especially the function of minimising, maximising and removing modules because of the flexibility it provided. Even though the responses differed from doctor to doctor, almost all participants in the interviews believed that they might get distracted by all the information and wanted to be able to fully focus on the patient. The information was considered important since it can support the doctor in remembering information when taking anamnesis, setting a diagnosis (mainly the information about medications, other diagnoses and allergies) and deciding the treatment. Another function that was seen as crucial was the chat function since the HP is able to spell for example a non-prescription drug or if there would be trouble with a microphone.

#### 4.4.3 Future research

During the study, there were several areas that had interesting output but the results were vague. There was therefore a need for further research in these areas to be able to draw any conclusions regarding the final solution.

#### 4.4.3.1 Patient perspective

The perspective of the patient was brought up by several doctors. According to a report by EY (2018), one of the key opportunities from the wealth of data generated via direct customer engagement is personalisation. This thesis project was, however, limited to only consider the HP as the user even though the patient view is important as well since it affects the HP throughout the whole process. The doctors explained the significance of having a user-friendly experience for the patient; it should be easy to answer questions and to provide the right kind of information. This will most likely make it easier for the doctors to provide healthcare of higher quality. The user profile in the Personal concept was considered highly useful for the consultation but due to the technical limitations and the need to better understand the patient perspective, this module was not taken any further in this project. The patient perspective was not investigated further in the project but it would be of value to carry out further research about the patient as a user and link the two processes to find the most suitable solution for both accessibility and higher quality of healthcare.

#### 4.4.3.2 Feedback from Carebot and chat history

The module including the Feedback from Carebot was misinterpreted by many and the results were vague. Many participants in the survey believed it was used to improve the system but the purpose was to give the doctor a clue to the patient's mood. However, it was considered as unnecessary by a couple of the doctors and difficult to understand by some. The access to chat history was deemed as unnecessary by some and useful by others. Both these features can be investigated further to see if there are possibilities to develop them to become more convenient. Most likely these kinds of modules would be more useful for the developers and administrators of the system.

#### 4.4.3.3 Links to Medical Resources

The 'Links to Medical resources' received positive feedback in the study but obtained comments on how it could be adjusted to not use valuable space when not needed. The suggestion to create hyperlinks to medications and diagnoses as shortcuts directly to relevant sources was interesting since it can save time for the HP, when not having to do an additional search, while still being space efficient on the presentation page, where no additional module would be needed. This, however, would demand further research about what sites to use, concerning personal preferences by the doctors, reliability and technical feasibility. This further research will not be included in this project due to time limitation.

## 4.5 CONCLUSIONS

The second user study confirmed the main takeaways from Exploration phase; the importance of relevant medical and personal information when preparing for and assessing a patient's problem. The three generated concepts provided more patient data to the HP than they are used to today and which the doctors argued will improve the quality of the consultation and their working conditions. The central feature is to provide the information in a clear, consistent and summarised way and in a prioritised order. By supporting the doctors to decrease the time to take anamnesis, the consultations can become more patient-focused. The combination of visualisation and text was to be further tested to ensure that the visualisations provide a concrete value for the consultation process and not only generates a 'good feeling'.

Including an Artificial Intelligence system into the platform generates higher demands for transparency in order to build trust in the information presented and the technology behind it. Transparency is also crucial when collecting data from patients since the quality of the process will affect the consultation process, both considering the quality of the information and how the HP will use it. The habits of a HP are well established and must be taken into consideration when introducing a new tool to ensure utilisation.

# CHAPTER

# FIVE

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iteration two

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## 5.1 INTRODUCTION

The next project phase was the second iteration of the Information tool. The main purpose was to generate a final concept that will be possible to implement in a near future and that meets the formulated requirements. A second purpose was to identify areas of improvement for future development. The concept was developed and tested in two stages with a digital high fidelity prototype. This was to understand if the final concept met the identified user needs and utility from previous phases and if the updates affected the result.

### 5.1.1 Technical limitations

Until this stage, the project had not taken into consideration any of the technical limitations of the Carebot (see Chapter 1). The reason was to not miss out on any valuable input and opportunities for improvement when exploring the field. However, from this project phase and onwards the limitations were applied to the concept since the decision was made to generate a concept ready to be implemented with existing technology. Since the project was conducted parallel to the development of the Carebot, the limitations posed by the technology were updated continuously. At this stage of the project, the Carebot was limited to only being able to handle medical information such as symptoms, risk factors and connected diagnoses. All additional data about the patient was therefore needed to be collected separately. In addition, regulations of how to store patient data complicated the creation of a patient profile where patient data can be saved for future consultations. In this iteration the concept will therefore presume that all information will be collected in connection to the consultation.

## 5.2 METHODOLOGY

This second iteration consisted of the development of one final concept that was updated in two steps, see all steps in figure 17. The first version of the final concept was generated based on insights from User study 1 and User study 2. It was also discussed together with the project team for the Carebot and adjusted according to the technical limitations connected to the Carebot and platform. This first version was evaluated with a digital, high fidelity, prototype in a pilot study to test the material and update it accordingly. An updated concept and related prototype was then used in User study 3. The data was collected in a study where the participants used the interactive prototype in a simulated consultation with a patient and were then asked questions, mainly inspired by a User Experience Questionnaire (Team UEQ, 2018). The findings in this phase were used to create a list of requirements for the Information tool (Chapter 6) and to complete some further refinements of the final concept.

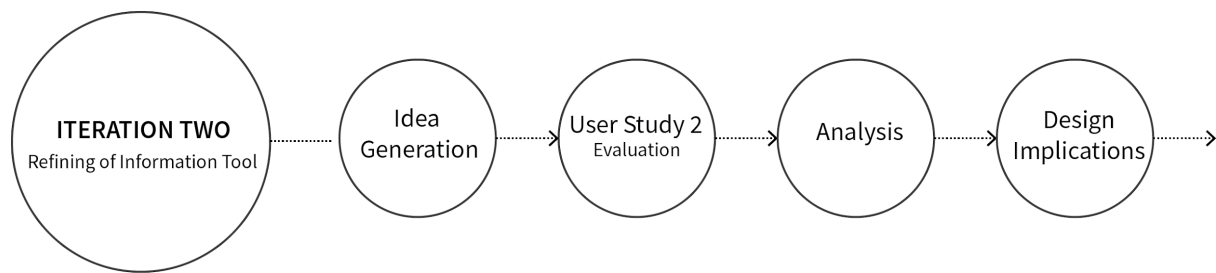


Figure 17. Process for iteration two

## 5.2.1 Idea generation

Ideas for the final concept were generated based on insights from the previous phases, the requirement list and the limitations defined by the Carebot project. Additional ideas were collected from a Creative session together with six other master students from the Industrial Design Engineering programme at Chalmers University of Technology. The Creative session was held to collect more ideas and thoughts from a broader perspective. The discussion was held after a short presentation of the persona, the initially identified problem areas and opportunity areas from Exploration phase and what information the doctors need to carry out a consultation (Figure 18). The questions discussed were: How do we create trust in the information? How do we create a clear overview of the information? How do we support the doctor in understanding what type of patient (s)he is facing?



**Peter, 45 år**  
Allmänläkare

Jobbar på Närhälsan Online och tar emot patienter i videokonsultation.

Han brinner för digital sjukvård och vill skapa nöjda patienter genom att vara väl förberedd inför varje konsultation, för att kunna ge god vård och skapa tillit till patienten.

Peter är frustrerad över att det är svårt att skapa sig en bild av patienten med hjälp av bokningsanteckning och journalsystem som är den information han har tillgänglig i dagsläget.

### Skapa en presentationssida

Hur skulle informationen från chatten kunna presenteras för att ge Peter bästa förutsättningen att ta till sig informationen.

Vi har identifierat följande olika funktioner som måste uppfyllas för att underlätta användandet av informationen:

- Skapa tillit till information
- Skapa en tydlig överblick av information
- Hjälpa läkaren förstå vilken typ av patient det är

Information som hjälper Peter att skapa sig en god bild av patienten är:

- Varför kontaktar patienten vården?
- Är det första kontakten för denna åkomma?
- Är problemet återkommande/konstant?
- Har något testats innan? I så fall vad?
- Finns det något som gör det bättre/sämre?
- Diagnoser, mediciner?
- Är patienten orolig över något?
- Vad tror patienten själv det kan vara?
- Vad förväntar sig patienten från dagens möte?

### Scenario

Peter ska ringa upp en patient för en videokonsultation och ska förbereda sig innan han ringer upp. Han har ont om tid på sig och vill skapa sig en uppfattning om patienten och dess åkomma, för att kunna bemöta patienten och hans problem på bästa sätt.

Patienten har chattat med en chatbot som i sin tur rekommenderade patienten att boka videobesöket med Peter. Den information som finns tillgänglig inför mötet är det som patienten har svarat på i chatten. Peter vill ha informationen om patienten presenterad på ett strukturerat sätt och att allt ska vara tillgängligt samtidigt.

Figure 18. Material for Creative session

The following suggestions were obtained during the creative session.

- Clear formulations in chat to ensure that the patient understands the question correct and knows how to respond.
- Show the summary of information for the patient so (s)he will be able to approve or not. This is to make sure that the information is correct and by that making it trustworthy for the doctor.
- Mark incomplete answers to support the doctor in noticing what information that needs to be completed or sorted out.
- Make it possible to remove some information or some modules to make it more personalised and by that easier for the doctors to bond with and trust the information provided.

Due to delimitations of the project and earlier findings, only one of these ideas was used in the concept; the ability for the patient to approve or reject the summary of information. The ideas concerning clear formulations in the chat and the personalisation of the final solution were not within the delimitations of the project and the idea to mark unclear information can be used in future research.

## 5.2.2 First version of the Information Tool

The first version of the Information Tool was a solution that has the ability to be implemented in the near future. It consisted of two parts, the Patient overview (Figure 19) and the Consultation view (Figure 20). The Patient overview was similar to the overview in the Medical concept in Idea generation phase but with personal medical information about the patient added since many interviewees said that they lacked that information in the Medical concept.



The screenshot shows a patient overview interface for a pilot study. The interface is divided into several modules, each labeled with a circled letter (D1-D6). The patient's name is Erik Ekdal, 58 years old, male, and the date is 1961-03-03-2020. The interface includes a sidebar with navigation icons, a top bar with user information (Isac Brevia) and a dropdown menu (Företag: Användare), and a main content area with the following modules:

- D1: Kontaktsak** (Reason for contact): "Jag har blodig urin." (I have bloody urine.)
- D2: Formulärsvar** (Form responses): A section for question and answer, including "Vad tror du att en läkare kan hjälpa dig med?" (What do you think a doctor can help you with?), "Medicinering och råd" (Medication and advice), "Vilka förväntningar har du på mötet?" (What expectations do you have for the meeting?), "Är det något som oroar dig?" (Is there anything that worries you?), "Om de kan vara allvarligt: Jag googlade mina symtom och tror att det kan vara urinblåscancer. Jag har aldrig haft blod i urinen tidigare." (If it can be serious: I googled my symptoms and think it could be bladder cancer. I have never had blood in my urine before.), "Vilka mediciner tar du?" (What medicines do you take?), "Elexir Ashwagandha och Omeprazol Teva" (Ashwagandha Elixir and Omeprazole Teva), and "Har du några diagnoser eller allergier?" (Do you have any diagnoses or allergies?), "Allergisk mot Augmentin" (Allergic to Augmentin).
- D3: Symtom** (Symptoms): A list of symptoms with checkboxes for 'yes' and 'no'. Symptoms include "Kissar ofta" (Frequent urination), "Trängningar" (Urgency), "Blod i urin" (Blood in urine), "Fever" (37.5 °C), "Flanksmärta" (Flank pain), and "Kräkningar och illamående" (Nausea and vomiting).
- D4: Riskfaktorer** (Risk factors): A list of risk factors with checkboxes for 'yes' and 'no'. Risk factors include "Kateter" (Catheter) and "Man" (Male).
- D5: Patient har godkänt sammanfattning** (Patient has approved summary): A section for patient approval, with a "Ring" (Call) button.
- D6: Möjliga diagnoser** (Possible diagnoses): A table showing the likelihood of each diagnosis based on the patient's answers.

Möjliga diagnoser	98 %
Låg urinvägsinfektion	98 %
Hög urinvägsinfektion	1 %
Urinblåscancer	1 %

Figure 19. Patient overview, Pilot study

The information was divided into two categories: medical and personal. This information would be collected through different technical solutions taking into consideration the limitations of the Carebot. The medical information about the current case could be collected by the Carebot and presented under the modules Reason for contact (D1), Symptoms (D3), Possible diagnoses (D6) and Risk Factors (D4). Visualisations in terms of, colors and symbols, were used to create a clear distinction between 'yes and no'-answers for both Symptoms and Risk factors. This was known to be important from User study 2. The likelihood for each diagnosis under 'Possible diagnoses' was presented in percentage to give the doctors an idea of how likely each diagnosis was depending on the patient's answers on symptoms and risk factors. The information in this concept was generated by a chat with the demo version of the Carebot. This made it possible to evaluate both the information provided as well of the presentation and utilisation of it.

The personal information could be collected through a digital form and presented under the module 'Form responses' as question and answer (D2). In this concept, the information collected in the form regarded ICE as well as some additional medical information such as medications, other diagnoses and allergies. The data collected through the form was the type of information that the Carebot was not able collect at this stage due to technical limitations. The patient was also able to upload images when relevant for the issue. In the upper right corner was a module that explained whether the patient had approved the information or not (D5). The patient also had the possibility to leave additional information in the same module if (s)he wanted to add something after the chat with the Carebot. The approval was supposed to create trust in the information for the HP and to give the patient an opportunity to deny or add information if (s)he believed that something was missing. If the patient had left a comment, the HP could find a notification next to the approval.

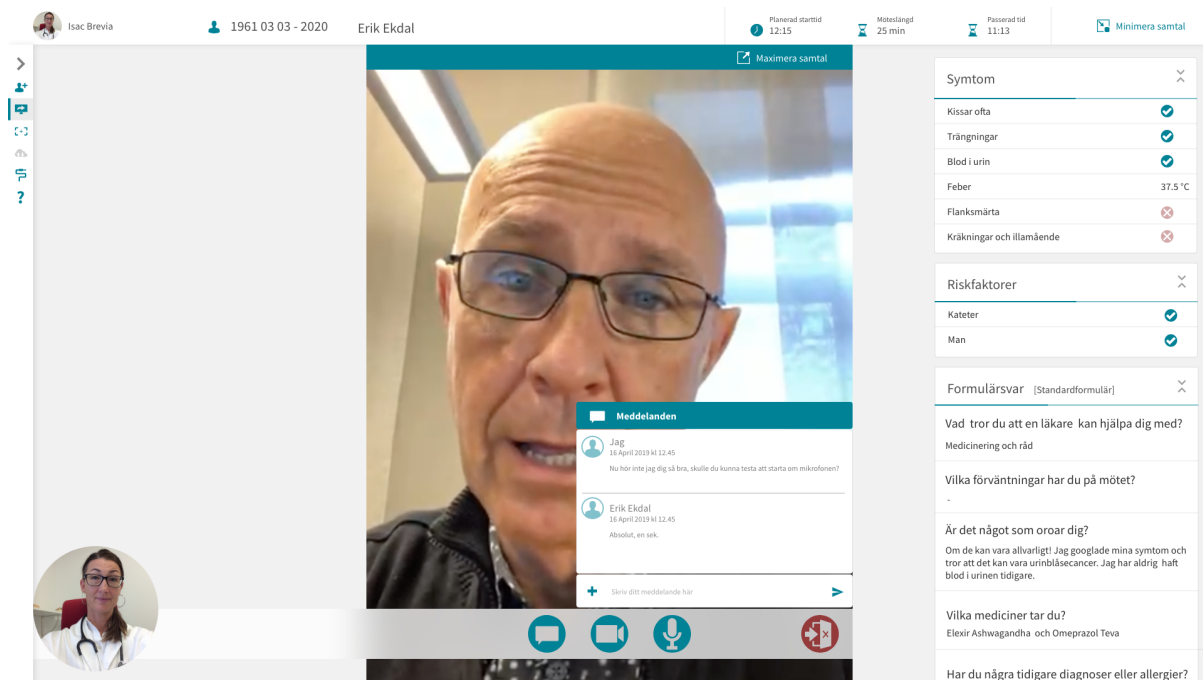


Figure 20. Consultation view, Pilot study

During the consultation, the view was similar to the Personal concept in the Idea generation phase, see figure 20. The flexibility of showing and hiding information was something that was appreciated by many participants in User study 2. It is also a function that meets the need of being able to customise the tool. Some doctors prefer a lot of information during the call whilst others prefer almost none. All information from the Patient overview (Figure 19), except the modules 'Reason for contact' and 'Comment' from patient, could be found to the right of the video of the patient. This information was removed since it can probably be memorised by the HP and there should not be too much information which might create distraction.

The prototype was created in the software program Adobe Xd which is commonly used by the company. This made it possible to easily integrate the prototype into already existing prototypes for the consultation and create a realistic experience of the complete consultation process.

## 5.2.3 Updated version of the Information Tool

The concept was updated with insights and feedback from the Pilot study, which is described in the section User study 3. The overview was updated, as were the modules 'Symptoms', 'Risk factors' and 'Digital assessment' (former Possible diagnoses).

Figure 21. Patient overview, updated version of the Information Tool

The Patient overview was refined with symbols for each module, see Figure 21, to help the users quicker recognise them without having to read (Cooper et al., 2012). The module called 'Symptoms' (E1) was updated with information about how long the patient has had a certain symptom since this affects the severity of the case according to earlier user studies in the project and the pilot study. The heading 'Possible diagnoses' name was changed to 'Digital assessment' (E4) to clearer communicate its purpose; i.e. to support the HP in the assessment. Background information on how the likelihoods are calculated and connected to symptoms and risk factors was desired by the interviewees in all studies where the diagnoses had been presented.

**Digital bedömning**

Låg urinvägsinfektion  
Hög urinvägsinfektion  
Urinblåscancer  
Övriga diagnoser

Nedanstående diagnoser är endast förslag baserade på patientens interaktion med chatbot.

Diagnoserna och är framtagna med hjälp av Ai-teknik som beräknar sannolikhet för diagnos baserat på symtom och riskfaktorer. Sannolikheterna är framtagna av ett läkarteam och verktyget valideras kontinuerligt.

Diagnoserna har visats för patient.

Figure 22. Additional information about the AI technology

To meet this user need, the Digital assessment was updated with information about how the calculation works as well as what symptoms and other influencing factors that are connected to certain diagnoses (E4), see example in figure 22. This information also communicate that the diagnoses are only suggestions, based on a set of assumptions, to avoid any misunderstanding from the HPs side perspective. The name of the module called 'Risk factors' was changed to 'Influencing factors' (E2) since factors that can be presented there, for example catheter, might affect the probability for a certain diagnosis, but is not by definition always a risk. Lastly, the layout for 'Approval from the patient' (E3) was changed since the HPs in the pilot study considered it important to be provided in the first overview, not hidden with a notification.

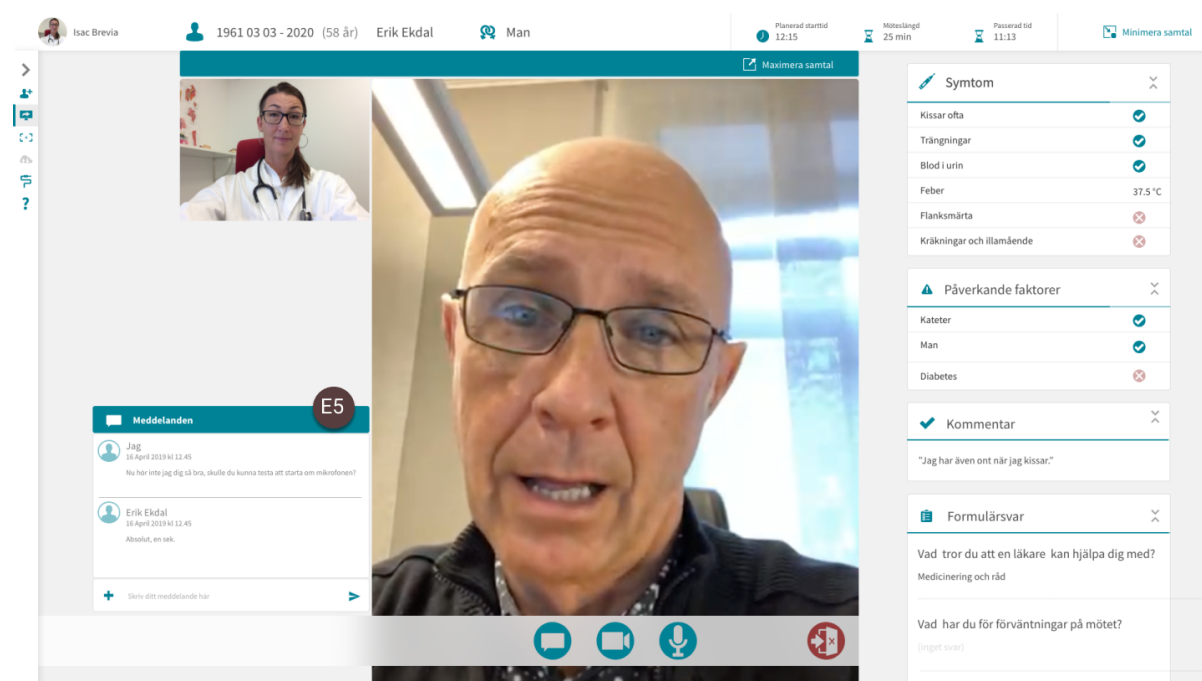


Figure 23. Consultation view for refined version of the Information Tool

The Consultation view (Figure 23) was not updated to the same extent as the Patient overview. The chat window was moved (E5) to not cover the face of the patient and the video of the HP was moved to the top of the screen. The video of the doctor was also changed into a square since this would better reflect what the patient sees and to avoid that unwanted objects in the background that the doctor could not see, were visible to the patient.

## 5.2.4 User study 3

The purpose of User study 3 was to test if the Information Tool met the identified user needs and the set requirements for an Information tool, ready to be implemented in a near future, and to evaluate the user experience of the Information Tool in an everyday context. Additionally, the User study was performed to identify areas of improvement for a long term solution. The study was performed in two stages. First a pilot study where a first version of the Information Tool was evaluated and then an actual study where an updated version of the Information Tool was evaluated to see if the updates improved the result. Since this was

the final user study within the context of the thesis project, the purpose of the pilot study was not only to test the design of the study itself. It was also held to gain valuable feedback for opportunities for improvements to the prototype to get the most out of the actual user study. Therefore the prototype was updated after each pilot interview. After the pilot study, only minor changes were made to the design of the study. Therefore the full process is only described once. One interview was held at a healthcare centre to understand how the HP used it, if it was easy to understand and to be able to guide the user through the different features.

#### 5.2.4.1 Participants

The participants for User study 3 were six HPs of different experience, gender and age. For the Pilot study, two male residential physicians with some digital experience were participating. In the 'actual study' two general practitioners, one residential physician and an intern physician were participating. Three men and one woman, all with varying digital experience. See full group of participants in Appendix 1.

The distribution of men and women was due to difficulty in finding female participants, but based on the results from previous user studies, this was not believed to affect the outcome. Four participants were completely new to the project and one was new to the concepts but was involved in the development of the Carebot and was therefore familiar with the presented information. This selection was made to avoid learning and transfer across conditions, since participants who are already familiar with a user interface from previous studies tend to be more efficient users in the new version of the concept (Budiu, 2018). Another reason was to avoid participants being extra positive to solutions in concept that they themselves suggested in previous studies.

#### 5.2.4.2 Interviews and evaluation

The interviews consisted of a scenario of a digital consultation where the participant interacted with the high-fidelity prototype, followed by an evaluation of the user experience based on criteria underlying from the User Experience Questionnaire (Team UEQ, 2018).

The participant was asked to prepare and perform a consultation with a fictive patient on the digital platform. The scenario started with the calendar view in the Visiba platform where the patient was waiting for the doctor to call. The patient had booked the consultation after interaction with the Carebot so the HP could access all patient data from the Patient overview. The participants were asked to 'think aloud' and explain what they thought and did in each step. The purpose of the scenario was to understand how the user would interact with the Information Tool in the context of a digital consultation, how they used the information and if they had access to what they needed to carry out an efficient consultation and deliver high quality care. Having completed the scenario, the participants were asked to rate their opinion of Information Tool using an instrument inspired by UEQ. The instrument (figure 24) consisting of altogether six items. The ratings were supplemented by a motivation for the ratings. After the first interview, some items were removed since they were considered redundant and received very similar answers.

Obstructive	○ ○ ○ ○ ○ ○ ○	Supportive
Complicated	○ ○ ○ ○ ○ ○ ○	Easy
Not Trustworthy	○ ○ ○ ○ ○ ○ ○	Trustworthy
Cluttered	○ ○ ○ ○ ○ ○ ○	Organised

Figure 24. UEQ evaluation instrument

The instrument was used to get the same focus in all the interviews and to obtain measurable opinions on the strengths and weaknesses of the Information Tool. The follow-up interviews were semi-structured to have the ability to elaborate on interesting answers and opinions. This time with more focus on getting all questions answered in order to see more clearly if the interviewees shared the same view (for the complete interview guide, see Appendix 6). This was considered important due to the low amount of participants validating the concept.

## 5.3 RESULTS - Evaluation of concept

The results are divided into three parts, the feedback on the first version of the Information Tool and the feedback on the refined version of the Information Tool.

### 5.3.1 Feedback on the first version of the Information Tool

The participants in the pilot study believed at first that it was difficult to get a clear overview of the concept. This was because there was a lot more information than what both participants were used to and one participant explained that there was a need to go through it systematically. One interviewee explained that the symptoms and risk factors supported her/him to easier find relevant information when searching in the medical records. (S)he also mentioned the importance of some kind of duration connected to the symptoms. The new feature that showed whether the patient has approved the summary of information or not was appreciated since it provides a higher level of trust. If the patient does not approve it, the interviewee believed that the summary should be erased and not presented for the HP.

It was of high importance for the participants to know how the information in the module Possible diagnoses had been extracted. In one pilot study interview, the doctor explained that healthcare professionals do not work with percentage as in this presentation, they rather use a kind of synthesis where they do a plausibility assessment. (S)he elaborated, “98 per cent is an extremely high probability, it means more or less that the others are excluded. I am eager to see some more background on how the algorithm came to these conclusions”. An alternative that the participant would prefer would be to present the likelihood with for instance “High likelihood” and “Low/Very low likelihood”. For the second pilot interview, the prototype was updated with “Low/High likelihood” instead of percentage for each suggested diagnosis. The participant here explained that (s)he wanted to get the

likelihood in percentage since this is how (s)he is used to receive statistics. The way the probabilities were presented in this concept made the interviewees feel that they could not trust the information since there was no background in how the Carebot calculated the probabilities. Similar feedback was given on the module Risk factors. The participants questioned why and for what diagnoses these factors were seen as risk factors. Furthermore, one participant did not agree on that the patient should get the suggested diagnoses presented after the interaction with the Carebot. (S)he did not believe that it is comparable to if the patient would choose to consult Google. That is the choice of the patient, but such information should not be provided by the healthcare center. There are many symptoms connected to for example cancer even if there is a small risk and it might just create worried patients. An HP must adjust the information according to the patient depending on each individual and according to the legislation in Sweden.

## 5.3.2 Feedback on the updated version of the Information Tool

The feedback from User study 3 is presented in this section, divided into Patient overview, Consultation view and after consultation.

### 5.3.2.1 Patient overview

The majority of the interviewees in User study 3 did find it useful to get the information about Symptoms and Influencing factors. It supported them in preparing questions for the patient as well as performing a more efficient search in the medical records. One doctor mentioned the important connection between an influential factor and the concern of the patient, "The catheter and the patient's anxiety makes me want to look up a little more information and check out if it can be cancer. I want to have a bit more updated knowledge to address that question, it is not especially common to get this issue in these cases".

The updated information connected to the Digital assessment met the needs of the interviewees. The information explaining why the diagnoses are presented was useful to create trust and understanding. One doctor expressed her/his concern that the diagnoses were presented to the patient as well, "I do not think that the patient should see the diagnoses and by that coming to the meeting with an already set idea. If we as doctors then disagree, there will be a discussion about who the patient should trust."

### 5.3.2.2 Consultation view

The participants claimed that they did not feel the need to ask the usual questions to the patient. Instead, they said that they could start the meeting by repeating the information to the patient, confirm it, and then be able to ask more focused questions since they already had many answers. One doctor still wished to ask the patient a more open question and motivated this with the therapeutic effect it has on the patients, who (s)he claimed to feel a need to talk about their problems. Another participant stated that the tool will save time since (s)he would not have to spend as much time preparing by memorising information about the patient since the information will be available during the consultation as well. The need for taking notes during the consultation was also believed to decrease which will allow

the doctor to focus fully on the patient. Lastly, several interviewees wanted to have the ability to remove the video of themselves during the consultation since it affected their concentration and made them watch themselves rather than the patient.

### 5.3.2.3 After consultation

A majority of the participants believed that the information would be helpful also after the consultation. They said it would be a good memory support when dictating for the medical records or that they could even copy the information directly to the records. One participant proposed to have a 'box' in the tool for taking notes during the consultation that also could be copied straight into the medical records. (S)he claimed that this would save her/him time when not having to transfer handwritten notes into the computer but also that it would allow her/him to keep her/his focus on the screen and the patient. Other participants were sceptical towards this idea and argued that they did not want to waste consultation time on writing record notes and that it would only be helpful if the tool could provide a proposal of a record note that could be directly exported to the medical record. They were also concerned that the 'box' would take unnecessary space in the interface.

## 5.3.3 Results from UEQ questionnaire

After completing the scenario, the participants rated their user experience in terms of predefined criteria. The results are presented below from both the Pilot study with the first version of the Information Tool and User study 3 with the updated version.

### 5.3.3.1 Patient overview

The tool was found supporting since it provided the professionals with relevant information so they could be well prepared for the meeting. One of the participants expressed hesitation regarding the Digital assessment since (s)he believed that it is within the competence of the doctor to assess the patient's symptoms. The same doctor was also afraid that showing the digital assessment to the patients would result in arguments with patients if the doctor had another opinion than the Carebot. Another opinion about the supportiveness of the tool was that it lacked visualisations that could speed up the utility of the information.

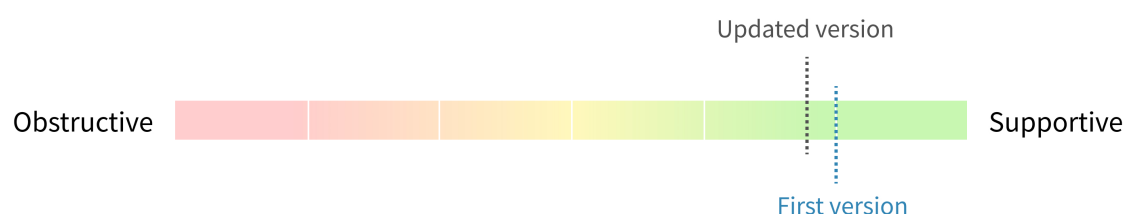


Figure 25.1. Average of participants' rating of supportiveness (n=6)

The general opinion was that the presentation provided a good overview and further that with a bit of practice, it would be easy to use. The added information of what symptoms and influencing factors that had led to the different diagnoses received positive feedback since



it made the Digital assessment easier to understand and it was also positive that all information only occurred once. One thing that made the concept perceived as more complicated was the order in which the information was provided, in that the form with the communicative data was presented first and therefore perceived to be of higher importance. This confused some of the participants who got caught in the idea of what the patient believed it could be, rather than investigating the actual symptoms and suggested diagnoses. “When I see this I immediately think it is cancer and if I am too fast I will miss the factor catheter and treat it as cancer”, one doctor expressed.

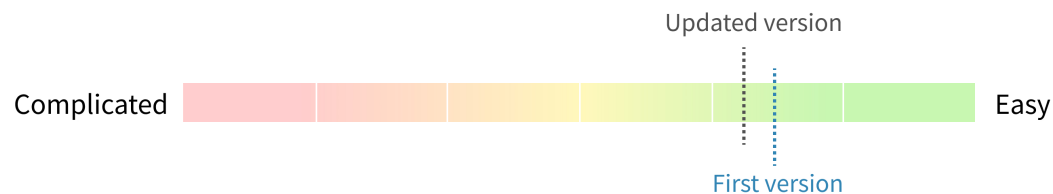


Figure 25.2. Average of participants' rating of simplicity (n=6)

All participants rated the trustworthiness of the concept as relatively high. They claimed that the relevant and structured questions contributed to credibility and the importance to ask about ICE was confirmed once again. The Digital assessment received better feedback when the participants could see the underlying factors of the assessment and they believed that transparency contributed to higher trustworthiness. However, one participant still stated that (s)he would not trust the Digital assessment without getting examples of how it was calculated. The same participant claimed that education on how the software works would make her/him trust the information more. It was found valuable that the patient had confirmed the information before it was shown for the professional.



Figure 25.3. Average of participants' rating of trustworthiness (n=6)

Although most participants perceived the Patient overview as organised this, was the criteria in which the concept received the lowest score and many comments for improvements. The positive feedback was that the neutral colours that made it be perceived as clear and serious. The probability scale from 1 to 10 also contributed to the professional appearance. On the other hand, one participant expressed that the neutral colours in combination with a lot of text with the same small font made the overview appear cluttered and gave all information the same weight why it was difficult to decide what information to focus on. Other participants commented on the amount of information at a first look, but after a few minutes, they got used to it and stated that no information was superfluous.

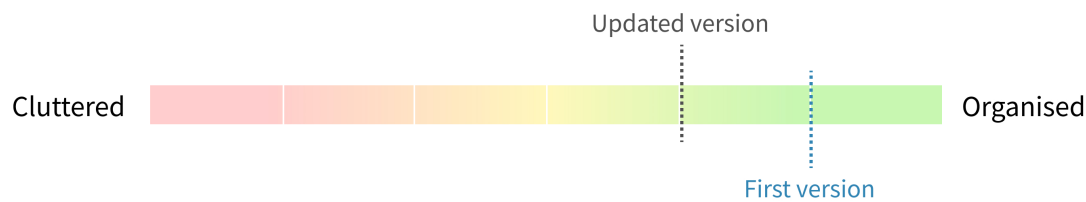


Figure 25.4. Average of participants' rating of structure (n=6)

### 5.3.3.2 Consultation view

During the consultation, the tool was rated as very supporting by all participants but one. The doctors found the information relevant and well organised. They also claimed that the information would be useful to support their memory both during the assessment and when dictating for the medical records. The information could be used to check that the patient's expectations are met and to double check so that the information the patient provides during the consultation matches what they wrote in the chat. In addition, the participants claimed that they could use the information without having to lose focus of the patient when going back to the overview or looking down in handwritten notes. They also appreciated the function to be able to maximise the video since that would let them focus on the patient which they stated would result in more verbal information from the patient. At the same time, one participant argued that the information was neither supportive nor obstructive. (S)he said that the information was irrelevant if it was not connected to the diagnoses. The same participant, wished to have the form presented in the top of the page so that (s)he would not forget what the patient's expectations on the consultation were. Other comments were that participants lacked the reason for contact and that the icon for gender was unclear.



Figure 25.5. Average of participants' rating of supportiveness (n=6)

The Consultation view was also rated to be easier to understand than the Patient overview. This was because there was no new information added that had not already been showed and also because there was less information than before. The participants found the Symptoms, Influencing factors and the Comment to be clear and easily understood, but were missing the diagnoses since they wanted the information to be consistent.

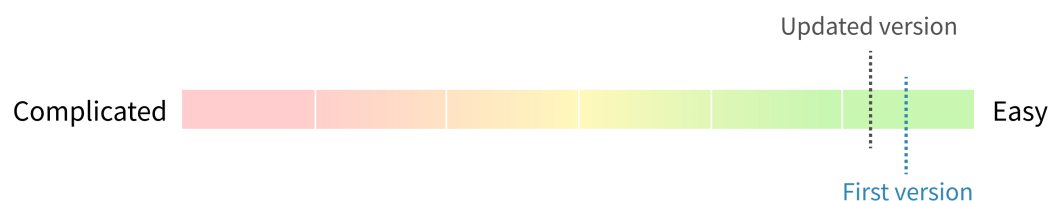


Figure 25.6. Average of participants' rating of simplicity (n=6)

The participants considered the Consultation view well organised since the information was presented in one column with clear descriptive headings. They found the placement of the patient video in the center of the screen and the patient information on the side as good prioritisation since they thought that the call should be in focus and the information should act as a support function. One participant claimed that having the facts from the Carebot first and then the more soft information as secondary was a good priority, but another participant was unsure and wished to be able to customise the view. In general, the participants were positive to be able to decide what information to show and be able to minimise the other. Other requests were to be able to see what effect different symptoms and factors had on the probability in the digital assessment and also to get more proactive information (or cues) on what to not miss during the consultation.



Figure 25.7. Average of participants' rating of structure (n=6)

## 5.4 SUMMARY & DESIGN IMPLICATIONS

This project phase took user needs, requirements and technology into account with the purpose to create a implementable solution. The results was analysed to generate areas of improvement for the finalisation of the concept.

### 5.4.1 The habits of the user

The fact that many interviewees in User study 3 changed their mind during the interview can most likely be connected to the habits of having access to less information structured in a different way, if structured at all. This is something that can be avoided by clearly describing the purpose of each feature in the Information tool and providing users with some time to get accustomed to the tool. This was therefore considered in the next concept. Even though a user will get used to the interface, there should be information available which describes each function or module. Focus was on how to design for learnability in the final concept.

### 5.4.2 Trust in the information

The importance of transparency for the Digital assessment and its calculations was confirmed and partly fulfilled. The information explaining the system behind the suggestions and the connection to symptoms and influential factors met the needs of most users in the study. The trustworthiness was the criteria for which the ratings showed most improvement since the interviewees now understood the background to the Digital assessment. Some participants, however, were still sceptical and wanted to be able to get more information about how each answer had affected the outcome. This is something the Carebot now was able to do according to the software developers and it was therefore to be considered to the finalisation of the concept. The concept will hereby be more useful, with even more information available to support less digitally mature users and in cases with more complex diagnoses. According to Cooper et al. (2012), users do not have to know all the details of how a complex mechanism actually works in order to use it, instead they create a cognitive shortcuts for explaining it. This might not be true for an Information tool that has the purpose to support a HP in an assessment. The responsibility of the doctor demands a greater availability to background information to support an actual decision for diagnosis and treatment. In a report from Patel, V.L. et al (2009), one can read about how scientists in a “data-driven world” have recognised a strong risk of concentrating on data gathering and analysis alone. Poor formalisation and systemisation of knowledge can result in accumulating data without knowledge extraction and/or knowledge exploitation. There is a strong need to apply AI-tools and methods besides data and guidelines. To deal effectively with tailored decision-making, there should be a combination of AI-tools and dogmatic guidelines to better handle complex planning, decision-making under uncertainty, and individual risk management. Altogether, more available information describing how the AI technology works and how diagnoses and likelihoods are determined was therefore considered in the final concept. Additionally, the approval of the information made by the

patient increased the doctors' trust in the information and the function was therefore to be kept to the next concept.

### 5.4.3 Structure and prioritisation

The structure and prioritisation of the different modules of information in the Patient overview received different reactions in the user study. The colour was seen as neutral and professional by some participants while others expressed that the colours and 'same small font' made it appear cluttered and non-prioritised. The choice of colour was made to fit into the current platform at Visiba Care and to keep internal consistency. In addition to this a more clear prioritisation and differentiation was to be made.

Different HPs have different preferences when it comes to how information should be prioritised. The prioritisation in the next concept was therefore defined by how the information modules relate to each other and how an anamnesis is taken based on findings in Exploration phase. The HP will hopefully get used to the interface and its layout and in a short time learn to know where to find the information (s)he find most useful. Another main takeaway was how useful the information was for dictation after the consultation and the importance of providing the same information before and during the consultation.

The Consultation view received better feedback regarding prioritisation and structure, this might be caused by the fact that the participants in the study already had seen the information once and that this information was now compressed into one column. The priority was also perceived as more intuitive here since the main focus should be on the patient and the information on the side of the video should be supportive.

### 5.4.4 Future research

Areas that are interesting for further development of the concept but not considered in this thesis project are presented in this section.

#### 5.4.4.1 Patient perspective

Especially one HP was worried about that the Digital assessment was presented to the patient and that there could be argumentation with the patient about who to trust, the computer or the doctor. This was addressed in Exploration phase as well, participants in the first user study explained that it is common that a patient uses Google to search for information and often has an already set idea when coming to a consultation. This leads to longer discussions to convince the patient that there might be other possible solutions as well. There are many opportunities for patients to look up their symptoms online, there are both guides and "symptoms checkers". If the doctor disagrees with the suggested diagnoses in the Digital assessment, it will be possible for her/him to prepare arguments for why (s)he disagrees and then most likely be more efficient when convincing the patient. The purpose of the Carebot, which is the function deciding on the proposed diagnoses, is to triage the patient to accurate level of healthcare. The diagnoses presented for the patient are not only more valid than a random Google search, they also explain to the patient why

the level of healthcare was recommended. How the diagnoses are presented, was considered in the parallel project of the Carebot to avoid misunderstanding.

#### 5.4.4.2 Proactive functions

Some interviewees wanted to have features in the interface that had a more proactive approach. One example was a feature that could create a summarised text of the patient information would be ready to easily transfer into the medical records. Another example was to have a possibility to write directly in the interface when taking notes to save time and focus. This was however not appreciated by all participants and its relevance has to be investigated further. There were also suggestions to receive more feedback from the system in what the next steps could be, what questions to ask and where to put the focus. This was not investigated further in this project due to the current limitations of the technology but AI technology will most likely be able to provide these kinds of proactive decisions in the future.

## 5.5 CONCLUSIONS

The outcome of the User Study 3 led to the conclusions that the structure of information should be consistent and compressed without being too cluttered. It is useful for a HP to be able to transfer information to the medical records in an easy way. Because of the habits of an HP, it is of high importance to provide an interface that is designed for learnability. This can be achieved by structuring the interface in a clear, consistent and visible way. The interface and provided information should be easy to understand supported by available descriptive information if needed by the user. If the user cannot understand the information, (s)he will not utilise it.

The ability to understand the information is also connected to the level of trust. The tested concept in this project phase confirmed that more explanatory information resulted in a higher level of participant trust and satisfaction. Due to the responsibility of the doctor and the intuitive process of deciding diagnosis and treatment, the ability to understand the system and information is crucial. The AI technology offers the doctor support in the diagnosis process as long as the doctor is willing to use the provided support. The support from the Digital assessment combined makes the consultation more efficient and effective according to the participants.

# CHAPTER SIX

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final concept

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## 6.1 INTRODUCTION

The concept was refined based on design implications from User study 3 and evaluated against a list of requirements that was developed based on the results from all previous phases. Reflections of the posed questions in Chapter 1, methodology and related areas are discussed at the end of this chapter.

New technological restrictions were taken into consideration. In relation to the solution these were that the way the platform is currently constructed, only two columns of information will be visible when used on smaller screens. This meant that the final concept could only consist of two columns if it were to be possible to implement in a short-term perspective. Updates to the technology were that the Carebot at this stage was able to ask about diagnoses, allergies and medications and sort them into the modules of the interface in an organised way, but the system could not take them into consideration for the digital assessment.

## 6.2 METHODOLOGY

The Information Tool was refined to meet identified user needs based on the design implications from Iteration 2 and the new technology limitations, see process in figure 25. The refining process focused on improving learnability as well as increasing the 'trustworthiness' of the digital assessment by providing the user with more information on how the diagnoses were calculated.

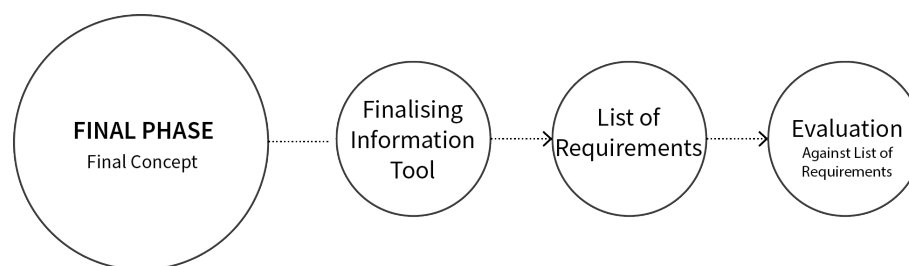


Figure 26. Process of the final phase

## 6.3 THE INFORMATION TOOL

If the Carebot triage the patient and recommends her/him to book a video consultation, the patient will immediately be provided with a form that asks her/him about ideas, concerns and expectations as well as about previous medical history such as diagnoses, allergies and medications. This is because the Carebot is not yet able to include that information in the digital assessment. The Carebot will sort the data from the form together with the chat data in the Patient overview. See all parts of the Information tool in figure 26.

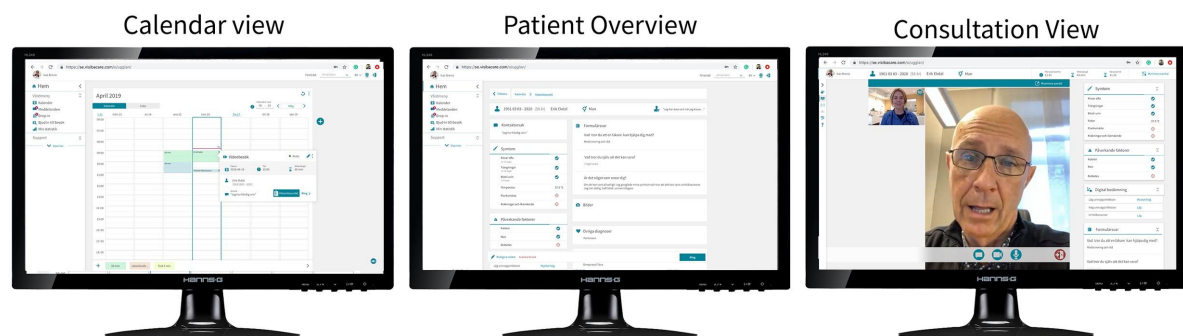


Figure 27. The final concept Information Tool

### 6.3.1 Patient overview

The Patient overview consists of the same components as in the updated version of the Information Tool (4.2.3) except for the added modules for Additional diagnoses, Medication and Allergies (Figure 27) that could be added as a consequence of the updates of the technology. The Patient overview has been reorganised into two columns. This was due to limitations of the construction of the platform but coincided well with the need for clearer structure and prioritisation of the Patient overview. In the final version of the Information Tool, the information has been prioritised so that only the most important information is shown when first entering the Patient overview. This was decided to be the information that the HPs have stated is needed to take the anamneses. Additional information, like digital assessment, can easily be accessed by just scrolling down on the same page. The Digital assessment was considered of a lower priority since many of the participants in the user studies have shown scepticism towards it.

The screenshot shows a patient overview interface for Erik Ekdal, born 1961-03-03, 58 years old, male. The interface is divided into several sections:

- Kontaktorsak:** "Jag har blodig urin."
- Symtom (F1):**
  - Kissar ofta (10-14 dagar): ☒
  - Trängningar (10-14 dagar): ☒
  - Blod i urin (3-5 dagar): ☒
  - Temperatur: 37.5 °C
  - Flanksmärta: ☒
  - Kräkningar och illamående: ☒
- Påverkande faktorer (F2):**
  - Kateter: ☒
  - Man: ☒
  - Diabetes: ☒
- Digital bedömning (F3):**
  - Låg urinvägsinfektion: Hög
  - Hög urinvägsinfektion: Mycket låg
  - Urinblåsecancer: Låg
  - Övriga diagnoser: Låg
- Formulärsvår (F5):**
  - Vad tror du att en läkare kan hjälpa dig med? Medicinering och råd
  - Vad tror du själv att det kan vara? (Inget svar)
  - Är det något som oroar dig? Om de kan vara allvarligt! Jag googlade mina symtom och tror att det kan vara urinblåsecancer. Jag har aldrig haft blod i urinen tidigare.
- Bilder (F4):**
- Övriga diagnoser (F6):** Parkinson
- Läkemedel (F7):** Elekir Ashwagandha, Omeprazol Teva

At the bottom, there are buttons for "Redigera mötet", "Avboka besök", and "Ring".

Figure 28. Patient overview, the Information Tool



The full content of information is illustrated in Figure 27. All medical information regarding the current case, symptoms (F1) and influential factors (F2), is placed to the left in direct connection to the Digital assessment (F3). These were arranged together since the Digital assessment is based on the symptoms and influential factors. All additional information that the HPs stated to be important to improve the quality of care can be found in the module with answers from the form (F5), images, other diagnoses (F6) and medications (F7).

Changes were also made to the appearance of the Digital assessment. The diagnoses are presented with an indication of probability on a scale ranging from 'Very low' to 'Very high' (F3). This was decided to be the most suitable way to indicate the probability since it reflects the result in a better way than percentage as the probability is based on many assumptions. A value in percentage would not reflect the result in an appropriate way when taken out of its context. The user can visit the full Digital assessment from a link placed at the bottom of the expanded diagnosis box if (s)he wishes to get more detailed information. In the information box, which explains the purpose of the digital assessment, a shortcut to additional information has also been added so that users that are curious or sceptical can learn more about the tool. This was found important in the user studies for users to be able to trust the information. Another feature that was added to make the interface more easily understood by the user was the possibility to hover with the cursor over features in the interface to receive a short explanation of their meaning. An additional feature, which is not visible in the prototype is the ability to click on the patient's ID number to copy and paste the number with less effort.

## 6.3.2 Full digital assessment

To further support the users in understanding the Digital assessment, an information page about the Digital assessment was added describing how the suggested diagnoses were calculated (Figure 28). The full Digital assessment contains both information about how the AI technology works in general and more specifically how it has calculated the probabilities for the different suggested diagnoses. This includes an initial value of each diagnosis based on how common the diagnoses is in general among the population, all the questions about symptoms and influencing factors that the patient was asked and in what order the patient was asked them, the patient's answer to each question and a value of how each answer affected the final probability.

[Tillbaka](#) [Kalender](#) [Patientöversikt](#) [Fullständig digital bedömning](#)

 1961 03 03 - 2020 (58 år) Erik Ekdal  Man

### Fullständig digital bedömning

Nedan visas de diagnoser som föreslagits för patient med tillhörande sannolikhet. För varje diagnos visas vilka frågor patienten besvarat, patientens svar och svarets påverkan på slutgiltiga sannolikheten. Påverkan är ett mått på hur sannolikheten för diagnosen förändrades av patientens svar, givet de tidigare svaren. Positiva tal betyder högre sannolikhet, och negativa betyder lägre sannolikhet.

Den digitala bedömningen görs med hjälp av ett bayesianskt nätverk. Nätverket är uppbyggt av noder, knutpunkter, som är beroende av varandra. I detta fall symptom och påverkande faktorer. Med hjälp av det bayesiska nätverket kan man beräkna sannolikheter för olika diagnoser, där hänsyn tas till alla faktorer som kan spela in. Faktorerna och dess betingade sannolikheter är framtagna med hjälp av ett läkarteam och uppdateras kontinuerligt. Varje diagnos i nätverket startar med en initial sannolikhet och beroende på hur patienten besvarar frågorna som Careboten ställer kommer sannolikheten för diagnosen att förändras. Olika symptom och riskfaktorer har olika stor påverkan på slutliga sannolikheten för olika diagnoser. [Visa mindre](#)

Gränserna för sannolikhet:

0	< Mycket låg	< 0.05
0.06	< låg	< 0.25
0.26	< Medel	< 0.74
0.75	< Hög	< 0.94
0.95	< Mycket Hög	< 1

#### Låg urinvägsinfektion

Initial sannolikhet: 0.034

Fråga	Svar	Påverkan
Ålder	65 år	-0.084 ▼
Kön	Man	-2.451 ▼
Blod i urin	✓	+3.956 ▲
Trängningar	✓	+0.113 ▲
Kissar ofta	✓	+1.709 ▲
Flanksmärta	✗	+0.078 ▲
Kateter	✗	+0.030 ▲
Ont att kissa	✓	+0.019 ▲
Slutlig sannolikhet:		0.922

#### Hög urinvägsinfektion

Initial sannolikhet: 0.023

Fråga	Svar	Påverkan
Ålder	65 år	-0.111 ▼
Kön	Man	-2.176 ▼
Blod i urin	✓	+3.449 ▲
Trängningar	✓	-1.567 ▼
Kissar ofta	✓	+1.709 ▲
Flanksmärta	✗	-2.225 ▼
Kateter	✗	-0.285 ▼
Ont att kissa	✓	+0.019 ▲
Slutlig sannolikhet:		0.007

Figure 29. Full digital assessment

In the full digital assessment view, the HP can obtain a value of the probability presented in combination with an explanation of how it was calculated (F9) to make the information transparent. The probability is described as very low, low, medium, high or very high (F8) depending on limitations provided by one of Visiba care's medical advisors. The idea is that this additional information will help the user to understand how the tool works and thereby build trust towards it. After using it a few times, the hope is that the information shown in the Patient overview will be sufficient, therefore will some of the explanatory text be hidden in the first view.

### 6.3.3 Consultation view

All information presented in the Patient overview is now also visible in the Consultation view (G2), with the same priority as in the Patient overview (Figure 29). This was to make the information more consistent, complying with a design implication deduced from User study 3.

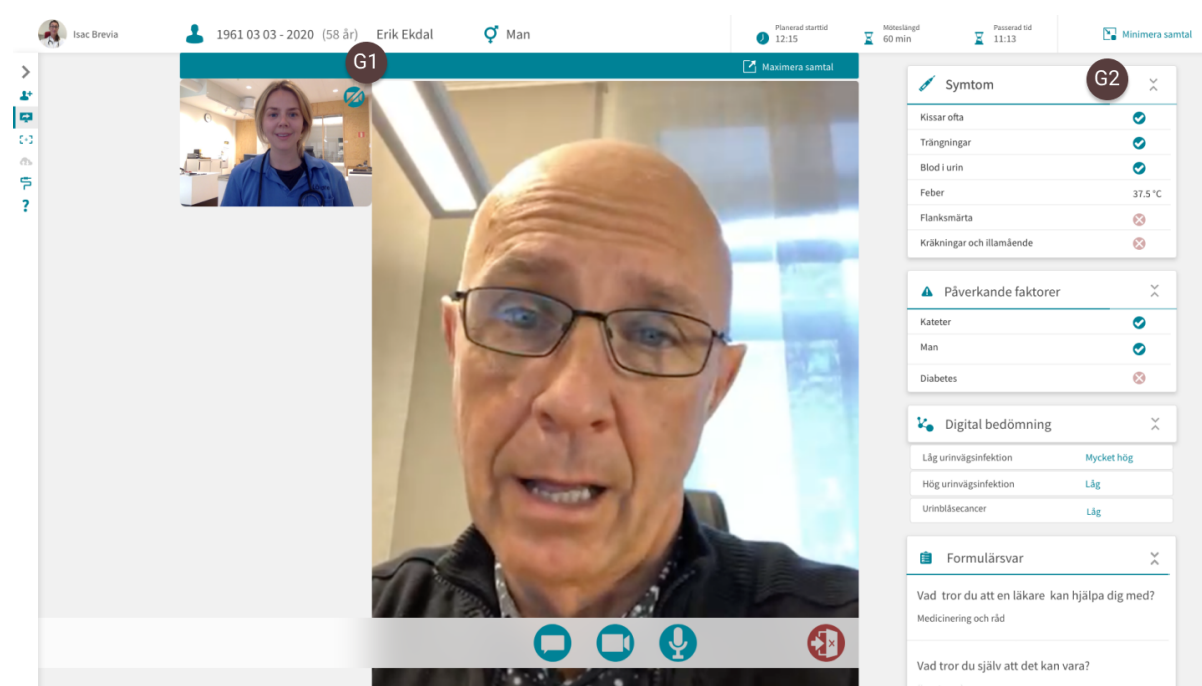


Figure 30. Consultation view, the Information Tool

Adjustments were made to the modules' function of maximising/minimising to mimic the same functions in the rest of the Visiba platform. The function of maximising a module is now only visible when hovering over the minimised module. This was made to increase the consistency of the interface, but also to make it appear less cluttered. The function of minimising the doctor's 'video box' was also added (G1), since this would allow the HP to focus on the patient without being distracted by seeing themselves.

## 6.4 LIST OF REQUIREMENTS

A list of requirements was created based on all the insights from the different development phases, see table 6. The requirement list was then used as a tool when evaluating the final concept, to based on the results from the different user studies get an over view on what requirements the final solution is meeting. The requirements are prioritised between one to three in importance and the list describes in what phase of the project a certain requirement was identified. The prioritisation were made after how often a need or issue were brought up by HPs during the user studies as well as how important fulfilling it was deemed in order for the user to be able to prepare and perform the consultation.

Table 6. List of requirements

Requirements	Priority	Retrieved from	Requirement met
<b>1. The information tool should support the user in efficient utilisation of consultation time.</b>	<b>1</b>	<b>US1</b>	
1.1 The information tool should assist the user to decrease time for taking anamnesis.	1	US1	✓
1.2 The information tool should encourage the user to develop new habits for a more efficient and effective consultation.	2	US2	✓
1.3 The information tool should during the consultation be adjustable to meet different preferences of the healthcare providers.	3	US3	✓
1.4 The information tool should support the user to faster come to a decision.	1	US1	✓
<b>2. The information tool should support the healthcare provider to perform higher quality of care.</b>	<b>1</b>	<b>US1</b>	
2.1 The information tool should support the user in the assessment and decision of diagnosis or treatment.	1	US1	✓
2.2 The information tool should present relevant medical information to the user.	1	US1	✓
2.2.1 Medical Data Medical data concerning patient medical background; medications, diagnoses and allergies.	1	US1	✓
2.2.2 Personal Data Personal data concerning the patient's ideas, concerns and expectations of the consultation.	1	US1	✓
2.2.3 Patient Background Patient personal background concerning profession, exercise, tobacco/alcohol and family situation.	2	US1	✗
<b>3. The information tool should support the user to understand the presented information.</b>	<b>1</b>	<b>US2</b>	
3.1 The verbal information should be combined with visualizations.	2	US2	✓
3.2 The information should have clear classification.	2	US3	✓

Requirements		Priority	Retrieved from	Requirement met
4.	The information tool should provide information in a structured way to support workflow of the user.	2	US3	
4.1	The information tool should ensure that the healthcare provider access the most relevant information first.	2	US3	✓
4.2	The information tool should support the user in getting a good overview of the patient.	1	US1	✓
4.3	The information tool should be able to customise the information depending on the illness of the patient.	3	US1	✗
5.	The information tool should support the healthcare provider to increase patient satisfaction.	1	US1	
5.1	The information tool should support the user to better approach the patient.	1	US1	✓
5.1.1	The information tool should help the healthcare provider to understand the patient's mood.	3	US1	✗
5.1.2	The information tool should help the healthcare provider to understand the patient's ideas, expectations and concerns.	1	US1	✓
6.	The information tool should enable trust to the information presented.	1	US2	
6.1	The information tool should communicate the same information to both the primary user, the healthcare provider, and the secondary user, the patient.	2	US3	✓
6.2	The information tool should be transparent in how data is collected and presented.	1	US3	✓
6.3	The information tool should indicate what symptoms and influencing factors that lead to the suggested diagnoses and how the probability of each affected the final suggestions	1	US3	✓
6.4	The information tool should provide an explanation in how the digital assessment tool works and how probabilities of diagnoses are calculated	1	US3	✓
6.5	The information tool should communicate its limitations and purpose to the user.	2	US3	✓
7.	The information tool should ease cooperation with other healthcare information systems.	2	US1	
7.1	The information should be transferable to the medical records.	2	US2	✓

## 6.5 EVALUATION OF THE INFORMATION TOOL

The evaluation against the requirement list was made with the assumption that the patient had responded to all questions asked by the Carebot.

### 6.5.1 Efficient utilisation

It was confirmed in User Study 3 that the information provided in the Information Tool supports the HP to start the consultation in a more effective and efficient way since (s)he is able to prepare questions and possible outcomes before the meeting with the patient (R1) (R1.4). The information is structured and prioritised in the same way as the doctor is taking an anamnesis to make it easier to adapt and use as a starting point when taking the anamnesis during the consultation (R1.1) (R1.2). The possibility to get more information about the AI technology and its calculations was proved to support the HPs especially the less digitally mature users. The last addition of extended information, Full digital assessment was not evaluated with users, but was requested by many in User Study 3 and is therefore hoped to improve the understanding of the tool. In the Consultation view the user is able to minimise and maximise the different modules of information depending on what (s)he prefers (R1.3).

### 6.5.2 Higher quality of care

The amount and structure of relevant information about a patient in the Information Tool is expected to support the HP in providing higher quality of care according to the participants in User Study 3 (R2). The medical and personal information combined with the Digital assessment should support the doctor in her/his assessment of the patient's problem and decision of diagnosis and treatment (R2.1). All relevant medical information is provided (R2.2) (R2.2.1, R2.2.2) except the information that fulfils requirement 2.2.3, Patient background. This information will only be provided to the HP if that information includes a factor that is important for one or more of the suggested diagnoses in the Digital assessment, i.e. smoking for lung cancer.

### 6.5.3 Understanding the information

The ability to understand the information is supported by visualisations in the different modules and the informative box that is visible when the user hovers the cursor over different functions in the interface. The available information about the Digital assessment and its calculations aims to support the understanding of the triage and why the suggested diagnoses are presented (R3)(R3.1). The different modules have clear headlines, symbols and explanatory texts if needed to communicate where to find specific information. This was expressed to be important for the participants in the studies (R3.2).



## 6.5.4 Organisation and prioritisation

The structure and prioritisation are based on how the HPs in primary healthcare take an anamnesis of a patient to support the workflow (R4) (R4.1). The crucial information about the patient (ID number, name, age, reason for contact) is placed at the top of the Patient overview (R4.1) (R4.2). The information is presented in such a way that modules that are related to each other are presented together, for example all modules that related to the Digital assessment (4.2).

## 6.5.5 Increased patient satisfaction

The interviewees in User Study 3 confirmed that the amount of information will support the HP in approaching and preparing for a consultation with a patient and that (s)he can more efficiently ask questions and assess the issue (R5). The information about ideas, concerns and expectations also support the doctor in understanding how to make the patient satisfied (R5.1) (R5.1.2). The requirement R5.1.1, was not prioritised and it was only partly fulfilled since it was difficult to collect the information in the bot as well as describe in text.

## 6.5.6 Trust to the information

There are two functions that were confirmed to support the HP to trust the information provided in the interface; the approval by the patient and the available information about the way the AI technology works and the way calculations are made(R6)(R6.3)(R6.4). The approval of the patient confirms that (s)he has seen and confirmed the accuracy of the Patient overview (R6.1) (R6.2). The Digital assessment has several functions with additional information which explains how the calculations of probability are made. The system is based on a number of assumptions; the information provided is only a suggestion, not a complete assessment but is intended as a support for the HP. There is also information that explains the main purpose of the Digital assessment; to triage the patient to the correct level of healthcare (R6.5).

## 6.5.7 Facilitate cooperation with other systems

The Information Tool supports the HP when searching for relevant information in external resources or the medical records according to the participants in User Study 3 (R7). The Information tool was also confirmed to be useful for the doctor when dictating for the medical records, or directly copy and paste the structured information in the Patient overview, after a consultation (R7.1).

# CHAPTER SEVEN

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discussion & conclusion

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## 7.1 RESPONSE TO POSED QUESTIONS

This section describes the insights from the project connected to the questions posed in the Introduction chapter. The questions were as follows:

- Why is medical history repeated in healthcare processes?
- How can the information presented in the digital platform cover the need for the doctor in getting to know a patient and get a hold of her/his general condition?
- How does trust in the digital platform affect the acquisition of information for healthcare providers?
- When during a consultation process is a certain type of information required? Does it differ in the different tasks?

According to the findings in this project, the medical history of a patient is repeated owing to the lack of standardised processes for collecting and documenting data from triage and patients' first contact with healthcare. The repetition is also a direct consequence of the HPs' habit of always asking the patient why (s)he is seeking care and the following standard questions for an anamnesis. These findings also revealed what information is most crucial in the Patient overview (see Chapters 2 and 3) to provide support to the doctor in getting to know a patient and grasp her/his general condition. If the information should provide support, the HPs need to trust the information to actually make use of it.

Trust is one of the most vital aspects considering the usability of the information. As mentioned earlier, the doctors will not use the information if they cannot trust it. This is because of the responsibility of the doctor, no matter what information the Patient overview will provide, the doctor will always be the one legally accountable for the decisions regarding diagnosis and treatment. The need for a different kind of information along the consultation process is mainly affected by the type of illness of the patient. Verbal information about the physical and psychological condition and visual information, in terms of for example images of symptoms, is important to different degrees depending on the case. In general, the same information is needed both before and during a consultation, the HPs want consistency and to easily find information during a video call. This will be easier if they have already seen the same information once in the Patient overview before the call. However, the information about the patient's expectations and concerns is more useful before and during a consultation whilst medical data about the patient and the case is important throughout the whole process; before, during and also after the consultation.

## 7.2 DISCUSSION

To replicate a qualitative study and its results is often very difficult to achieve due to the ingenuity of the researchers and the lack of standard procedures (Bryman & Bell, 2011). The investigators affect the outcome by affecting the responses of participants with their own characteristics as well as the fact that the main instrument of data collection is the researchers themselves and any interpretation will be profoundly influenced by the subjective learning of a researcher. This section discusses different aspects that have affected the outcome of the project, and the validity and reliability of the outcome of the user studies and by that also the final concept.

### 7.2.1 Choice of methodology

The interviews with HPs, that are the users of the system, were performed together with a hypothetical scenario with no access to the medical records which is something the doctors usually have. The scenarios used in the user studies only considered two kinds of patient problems, skin problems and urinary problems, which makes it difficult to ensure the usability for other kinds of problems in primary healthcare. However, complex problems with a psychological basis are often very unique in terms of patient data. The final Information Tool includes both information about the physical and psychological condition of the patient as well as the possibility to add images, which should be sufficient to manage most patient cases in primary healthcare, especially since the purpose is to be supportive, not decisive. In a real consultation the doctor will be able to talk to the patient, observe her/his movement(s) and general condition and ask complimentary questions if needed. This was not possible during the scenarios in the interviews which might have made it difficult for the interviewees to act and think as in a real use setting. Even though the majority of the doctors believed that the Information Tool would support them in creating a more efficient and effective consultation with a higher level of quality, this is something that has not been confirmed in a real use situation. The routines of a HP indicate however that the ability to adopt a hypothetical patient case should not be too difficult, especially for an experienced doctor, and therefore the Information tool is believed to be supportive to the user once (s)he gotten used to work with it.

The routines and habits did clearly affect the outcome of the interviews. The interface is supposed to be used on a daily basis by doctors working on the digital platform. When the interviews were carried out, the interface was not explained in advance and the participants in the user study were exposed to the interface(s) for the first time. This should have been done differently since this is not how the interface is supposed to be used. The doctors should be familiar with the interface, its structure and functions when adapting it to their digital consultation process. This means that the feedback could have been more aligned with the intended purpose of the interface, and that the learnability of the design should have been tested rather than its guessability. This was something that also is believed to have affected the participants' grading of how 'easy' or 'complicated', where the participants had to take into consideration the different modules of the interface and how to navigate between them, but also the information provided in the modules based on the

scenarios. It can, therefore, be discussed if another patient case with higher or lower complexity would have a different impact on this result.

The material used in the different user studies were continuously updated to get the most out of the next interview. This might have decreased the level of reliability, but the changes were made to utilise the time with each user in the most efficient way. The ability to be flexible and to get as much information as possible in the meeting with a doctor was considered as more important than being consistent in each detail. The changes were not major and common themes and patterns were still clearly identified in the data analyses.

The first concepts presented in User Study 2 were more high-fidelity than what would have been considered useful such an early phase of the design process. The high fidelity of the concepts made it difficult for the participants to focus on the aspects that the interview intended to concentrate on. The discussions often got stuck in details in the interface when the purpose was mainly to understand how the participants experienced the content, not only the layout. This might have affected the amount of useful feedback from User study 2. According to Cooper et al. (2012) the focus should in an early design phase, be on the 'big picture' and rendering the solutions without specific detail in a low fidelity manner. This can ensure that the focus will stay on the fundamentals: serving the persona's goals and requirements.

## 7.2.2 Selection of Participants

The outcome of the project may have been affected by the selection of participants in the user studies. For User study 1, a broad selection of HPs within primary care participated and who can be said to represent the target group for the tool. A lot of information was recurrent during the studies and therefore a saturation point was considered to be reached, why the group of participants is believed to have conveyed a fair description of the problem space. For User study 2 the design was a mix of between-subject and within-subject, to confirm previous findings but also to identify new needs. To avoid that participants were more positive to their own ideas from User study 1 new participants were added to User Study 2 and User Study 3. However, no such tendencies were noted during User study 2, where the participants from User study 1 seemed to be equally critical to their own ideas and suggestions as to other ideas.

For User Study 3 mainly new participants were selected to ensure that the same findings were not confirmed over and over again by a small number of recurring participants. The high values received in the rating of the the final version of the Information Tool could, therefore, be seen as a confirmation that the concept meets the expectation of users, including users who have not been part of the development. One participant, however, was involved also in the Carebot development and (s)he therefore had a wider knowledge about the background of the Digital Assessment. This is believed to have had an impact on the her/his attitude towards the interface. The hypothesis was that it would be easier for this doctor to trust the information and the doctor stated that (s)he did trust the information, but still rated the concept lower than all other participants. This could be an indication that previous knowledge or expectations somehow could have had an impact on the attitude of

the participant because (s)he is aware of the potential of the technology and might have some ideas already of her/his own. But since there are only a few people that have this knowledge, this was not considered as a problem. The participant also became more positive towards the interface after (s)he became more familiar with it, which indicates that the previous expectations of these specific users are possible to overcome.

The survey (in Chapter 4) was distributed to HPs over social media which made it difficult to fully control the selection of respondents, but by letting the respondents provide information about themselves the group of participants could be adjusted by discarding irrelevant respondents. However, the personal information did not consider the doctor's previous digital experience which made it impossible to compare preferences between experienced and inexperienced users. Previous digital experience could have affected the participants' attitudes towards for example suggested diagnoses. However, no other patterns could be found based on the different groups within the small total group so it was believed to not have affected the outcome significantly.

### 7.2.3 Ethical considerations

Digital healthcare can support the upcoming demands from increasing elderly population by offering a more available healthcare solution with better conditions for the employees if implemented correctly. With fewer resources, healthcare will be able to take care of more patients. The purpose of the Carebot and the Information Tool is to decrease the administrative workload on the employees within healthcare. The collected information, together with the functions in the Information Tool, will be used to increase the quality of care and to support the efficiency and effectiveness of the consultation process.

One of the main focus areas during this project was to understand how the doctors can trust and be supported by the Digital assessment. The suggested diagnoses are calculated by the Carebot when triaging a patient to the digital video consultation and a direct consequence of implementing more digital solutions to reduce the administrative workload for staff within healthcare. However, this could lead to an ethical dilemma if the Carebot for some reason miscalculates a diagnosis and the HPs or patients rely on the suggestion. Many doctors in the user studies felt that they might get stuck in their assessment when there were provided with the suggested diagnoses, that they easily could forget about other possible diagnoses and only think about the suggested ones.

The fact that the Carebot do the triage and recommend a patient if (s)he should go home and rest, book a physical or digital consultation or go to the emergency room is also something that can be questioned in an ethical perspective. The question is if the healthcare centre should be the one suggesting that action based on AI technology. Another aspect to consider is when the Digital assessment is seen as sufficient enough to be implemented in the digital platform. Factors that can ensure its credibility and risks that are connected to it should be extra considered since the trust to the system will be easily damaged and the consequences from an improper triage can be critical for the patient. It should also be considered who is responsible for the recommendation, what if a patient dies from a heart attack when (s)he was recommended to go home and rest. There is a risk

that the patient listens more to a digital recommendation when it comes from a healthcare centre compared to an online search. The responsibility will most likely still be on the patient which creates demands on the Carebot to clearly communicate that the suggested diagnoses and recommendation only should function as guidelines. This project focused solely on the perspective of the HP even though the patient perspective is closely linked to it. The Information Tool consists of several functions which communicate the purpose of the Digital assessment and that the main function of it only is to support the doctor in the assessment, not to perform the assessment.

## 7.2.4 Sustainability implications

The main aim was to facilitate the information management for HPs in digital healthcare which leads to a better quality of the service and increased utility. The increased utility of the tool is believed to lead to increased availability to healthcare, where digital healthcare can be used when possible and physical healthcare when needed. Less patients will have to travel to the physical location and hereby the use of digital healthcare could decrease the environmental negative impact of transport. The digital devices for using digital healthcare services will evidently use energy, these devices are however used in almost all patients everyday life anyway and one application will not make a large difference in environmental impact. The digital solution can also be seen as fully renewable since does not require any new physical material.

## 7.2.5 Future research

The Information Tool has been developed according to the identified user needs but has not been evaluated in a real use context. Given that the concept functions as predicted, there are still some aspects that might conflict with the goals of the user. One conflict is the need for the doctor to get to know the patient and 'read between the lines' by asking open questions and the patient's wish to not have to provide the same information on several occasions. This is something that would have to be investigated further with consideration to both patients and HPs. Another aspect that should be investigated from the patients' perspective is how the amount of data the patient must provide before a consultation affects their perception of the availability relative to the quality of the care provided. However, this is already somehow considered as the Carebot will be developed to adjust questions based on a patient's answers and only ask questions relevant to the information already provided.

Another area for future development is the ability of the Carebot and the Information Tool to manage several diagnoses at the same time. In User Study 2, the participants became confused by the patient who had two conditions indicated and this must be further researched. It is common that a patient has more conditions than one. So far, the Carebot cannot automatically understand if a patient has several different conditions or just one specific diagnosis with indistinct symptoms. Having several conditions at the same time is not unusual in primary healthcare, why this must be further researched both on the Carebot and presentation side to minimise confusion.

## 7.3 FINAL REMARKS

The most useful information for the HPs is the *medical information* concerning the current problem, medications, other diagnoses and allergies of the patient and the *personal information* concerning the ideas, concerns and expectations of the patient. It was confirmed in the user studies that this information supports the doctor when assessing the problems of a patient and when deciding diagnosis and treatment. The personal information also supports the doctor in addressing the wishes from the patient which generates more satisfied patients, who do not return earlier than necessary. The amount of information provided in the Information Tool supports the HPs to be more patient-focused, due to better preparation and less need to take notes, and by that be able to provide higher quality of care.

The information provided in the Information Tool is, according to the participants in User Study 3, easy to read and understand as the interface has a clear and consistent layout together with visualisations and a logical order for taking the anamnesis. Doctors have many strategic habits and the digital Information tool is hoped to encourage the doctors to develop new habits when supported digitally, as long as they trust the system. The users' trust in the information is crucial to ensure utility, this was especially evident when developing the structure of the presentation of the Digital assessment and the underlying calculations. The function of letting the patient approve her/his own Patient overview before passing the information to the HP, increased the trust to the information among the HPs in the study. The involvement of the patient in the process is an opportunity to relieve the healthcare systems part of the administration tasks.

Integration with other healthcare systems, mainly the medical records, was something highly desired among the HPs and needs to be investigated further. Due to technological and organisational limitations, the Information Tool only has some features that facilitate the usage of the medical records and that contributes to more efficient medical history searches, dictating and writing. To be able to support the HP during a consultation, the information needs to be trustworthy, relevant, structured and consistent, otherwise it will most likely not be considered by the user.



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# APPENDICES

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# APPENDIX 1

## Participants in user studies

User study 1						
Interviewee	Gender	Age	Age (span)	Years of experience	Digital experience	Titel
1	Man	38	30-39	8	No	General Practitioner
2	Woman	38	30-39	5	Yes	General Practitioner
3	Man	74	50+	50	No	Owner of health centre
4	Man	29	20-29	2	No	Intern Physician
5	Woman	26	20-29	2	No	Intern Physician
6	Man	50	50+	18	Yes	Primary care digitaly 50%
7	Man	48	40-49	6	Yes	General Practitioner
8	Woman	27	20-29	3	No	Primary care
9	Woman	27	20-29	3	Yes	Residential Physicians

User study 2						
Interviewee	Gender	Age	Age (span)	Years of experience	Digital experience	Titel
1	Man	29	20-29	2	No	Intern Physician
2	Woman	26	20-29	2	No	Intern Physician
3	Man	44	40-49	20	Yes	General Practitioner
4	Woman	27	20-29	3	Yes	Residential Physicians
5	Man	28	20-29	2	Yes	Intern Physician
6	Woman	32	30-39	2	No	Residential Physicians

Survey				
Respondent	Gender	Age (span)	Years of experience	Title
1	Women	40-49	11+	Midwife
2	Man	60-69	10+	Consultant
3	Women	40-49	13	Doctor
4	Women	20-29	1-5	Doctor
5	Man	20-29	1-5	Doctor
6	Women	30-39	1-5	Doctor
7	Women	30-39	1-5	Doctor
8	Women	30-39	1-5	Doctor
9	Women	30-39	1-5	Doctor
10	Man	30-39	11+	Doctor
11	Man	30-39	1-5	Doctor
12	Women	40-49	1-5	Doctor
13	Man	40-49	6-10	Doctor
14	Women	20-29	-1	Medical student
15	Women	20-29	1-5	Medical student
16	Man	20-29	-1	Medical student
17	Women	40-49	-1	Eye doctor
18	Women	30-39	-1	Nurse

19	Women	50-59	1-5	Nurse
20	Women	20-29	-1	Nurse
21	Man	30-39	6-10	General Practitioner
22	Man	30-39	6-10	General Practitioner
23	Man	30-39	6-10	General Practitioner
24	Man	30-39	1-5	General Practitioner
25	Women	40-49	11+	General Practitioner
26	Man	40-49	6-10	General Practitioner
27	Women	50-59	11+	General Practitioner
28	Women	50-59	11+	General Practitioner
29	Women	50-59	11+	General Practitioner
30	Women	50-59	11+	General Practitioner
31	Women	70+	11+	General Practitioner
32	Women	20-29	-1	Residential Physicians
33	Women	30-39	1-5	Residential Physicians
34	Women	30-39	1-5	Residential Physicians
35	Man	40-49	1-5	Residential Physicians

User study 3						
Interviewee	Pilot	Gender	Age (span)	Experience in years	Digital experience	Title
1		Man	20-29	1-5	6 months	Residential Physicians
2		Man	30-39	1-5	15 h	Residential Physicians
Study						
Interviewee		Gender	Age (span)	Experience in years	Digital experience	Title
1		Man	40-49	6-10	1 call	Residential Physicians
2		Woman	50-59	6-10	1 year	General Practitioner
3		Man	20-29	2	1 year	Intern Physician
4		Man	40-49	11+	4 years	General Practitioner

Recurrent user

## APPENDIX 2A

### Interview guide 1, Participants with digital experience

#### **Bakgrund**

Vi är två studenter från Chalmers Tekniska högskola som skriver vårt examensarbete hos Visiba Care. Vi vill undersöka vilken patientinformation som är mest användbar för er vårdgivare samt hur och när den bör presenteras för att ge bästa stöd vid konsultation med patienter. Projektets förhoppning är att ta fram en lösning som ska underlätta för vårdgivaren att ta till sig rätt information och på så sätt effektivisera konsultationsprocessen. Vi hoppas på så sätt bland annat kunna minska antalet gånger som patienter behöver upprepa sin sjukdomshistoria.

Vi är just nu i uppstarten av vårt projekt så vi är nya på området och vill skapa oss en bild av hur ni arbetar och vilka utmaningar ni stöter på.

#### **Allmänt intervju**

En kartläggning av kognitiva processer i viktiga delsteg

- Frågor kring dessa
- Scenario

Förberedelse

Är det okej att vi spelar in?

Inspelningen kommer endast användas i syfte att analysera data och kommer inte spelas upp för någon annan än oss. All data kommer anonymiseras.

#### **Om personen**

Yrke:

Kön:

Erfarenhet i år:

Ålder:

#### **Generellt**

Hur stor del av ditt arbete gör du digitalt? Användning av digital plattform: %

Vilka delar i plattformen använder du?

Bara för att få en bild vilken utrustning har du tillgång till när du arbetar digitalt? (Skärmar, surfplatta?) Hur sitter du?

Vilken typ av fall tycker du lämpar sig bra att ta online? Varför?

Vilka fall passar mindre bra? Varför?

Tänk tillbaka på ett patientmöte du har haft där patienten har för ett fall du anser lämpligt för online.

Berätta gärna lite kortfattat om processen, hur fungerar det före, under, efter?

## **Innan**

Hur såg informationen du fick tillgång till ut?

Var visas den?

Om sköterska rekommenderat att boka onlinekonsultation, finns det anteckning på det?

Hur går du tillväga för att få en bra överblick av patientens problem innan besöket?

Vad är målet med att skapa en bild innan?

Diagnos? Planering?

Vilken information om patienten var viktigast vid det första mötet?

Är det någon typ av information du upplever att du saknar innan du träffar patienten?

Ser du några fördelar eller nackdelar med hur den är presenterad?

Är det något du upplever irriterande eller frustrerande? Tidskrävande?

## **Under mötet**

Om du hade fått tillgång till patientens aktuella sjukdomsberättelse innan mötet, via sjuksköterska eller 1177, hade det hjälpt dig vid första mötet? Varför?

Hade du fortfarande ställt samma frågor? Varför?

Annan läkare nämnde att det varit så tidigare, hur fungerade det? När var det? Varför har man inte så längre?

Om du hade haft informationen om patienten synlig på skärmen under mötet, hade det underlättat ditt arbete?

## **Efter möte**

Om du tvingats överlämna caset, hur hade du återberättat för att ge bästa förutsättning?

Hur hade du velat återberätta denna sjukdomshistoria för en kollega?

Hjälpmedel?

Stöd?

Testa att lämna över fallet till mig så jag kan se hur du gjort i praktiken.

Var gör du efter mötet?

Journal? Vad? Vad gör du mer?

Dokumenterar du något i plattformen? Hade det varit användbart

## **Scenario**

Jag kommer nu ge dig ett scenario och efteråt kommer du få svara på ett antal frågor. Om du upplever att scenariot inte stämmer överens med en verklig situation tar vi gärna feedback på detta efteråt, men först utgår vi från detta och du besvarar hur du skulle agera om det var såhär det var upplagt.

Du ska ringa upp en patient via den digitala plattformen. Du har kort om tid på dig och du har denna information tillgänglig för att bilda dig en uppfattning om patienten innan mötet.



Tänk tillbaka på scenariot. Vilka steg anser du som viktigast? Dessa kan innefatta bedömning eller beslutsfattande.

Steg	Vad gör du i detta steg?	Vad är din bedömning av situationen?	Vilken typ av information gjorde att du bedömde situationen på det sättet?	Vilka fel skulle en oerfaren vårdgivare kunna göra i den här situationen?
Ex 1:				

### Kalendern i digitala plattformen

The screenshot shows a web-based calendar application. The browser address bar displays 'https://se.visibacare.com/o/ugglan/'. The user is logged in as 'Master Thesis'. The calendar view is for January 2019, with the date 'Ons 30' (Wednesday, January 30th) selected. The calendar grid shows a meeting at 15:05 with 'Malin Wiström' as the participant. A modal window titled 'Videobesök' (Video visit) is open, showing the meeting details: Date '2019-01-30', Time '15:05', and Duration '30'. The agenda for the meeting is 'Väldigt stressad, kan inte sova och tappar lätt koncentrationen. Orkeslös.' (Very stressed, can't sleep and loses concentration easily. Exhausted). The participant's name and ID 'Malin Wiström 199205070000' are listed. A 'Ring' (Call) button is visible. At the bottom, a notification states 'Du har ett videomöte nu' (You have a video meeting now) for 'Malin Wiström - 15:05'. The interface also includes a sidebar with navigation icons and a 'Drop-in' section at the bottom.

## Frågeformulär besvarat av patient

Master Thesis

SV ?

### Formulärsvar

Personnummer 199205070000
 

Tid i kö 30 min

Formulär Stress

Frågenummer	Fråga	Svar	Frågetyp
1	Hur länge har du haft besvären?	Mer än 8 veckor	Enkelval
2	Upplever du balans mellan Arbete, fritid och återhämtning?	Nej, jag upplever att jag inte hinner med någonting som jag borde göra. Det går åt mycket tid på jobbet och det kommer ofta in oplanerade möten och event på kvällar. Här ingen energi att göra något på min fritid.	Fritext
3	Hur ofta har du problem med stress?	Mycket ofta/Dagligen	Flerval
4	Påverkas ditt minne och/eller din koncentration?	Ja	Ja/Nej
5	Påverkas ditt humör? (Ilska/irritation)	Nej	Ja/Nej
6	Påverkas din sömn?	Ja	Ja/Nej

Du har ett videomöte nu  
 Malin Wiström - 15:05

## Journalssystem

Take Care

H - Hematologimott R51

KUS

920507-0000 Malin Wiström

Varning

Spärr

Journalinnehåll

Nytt

Stäng

Journalinnehåll

Att göra

Externa system och tjänster

Läkemedelsjournal

Mätvärden/Laboratoriellista

Senaste journaltext per sökord

Arbete

Översikter

Dokument i tidsordning

Samtliga dokument

Aktivitetsplaner

Akutuppgifter

Ambulansjournal

Bokningar

Brev

Diagnoser

Inskrivningsplaneringar

Journaltext

Konsultationsärenden

Mätvärden

Operationsplaneringar

Patientuppgifter

Påbörjade journaltexter (paus)

Recept

Samordnad vårdplanering

Vårdkontakter

Vårdplaneringar

Multimedia

Bilder

Picsara

Dikterade ljudfiler

Skannade dokument

Aktiviteter

Svar

Mikrobiologi svar

Multidisciplinärt svar

Farmakologi svar

Dokument i tidsordning - 19 920507-0000 Malin Wiström

Sidan 16 / 16

Filter

Välj tidsperiod: 1900-06-01 2101-00-60

Alla dokument visas inte - endast dokument från den egna vårdenhetsgruppen

2019-01-06 14:25 Öppen vårdkontakt H - Vårdcentral

Kommentar: Smärta i brösttrygg
 

Diagnoser/DRG >> Till Vårdkontakter >>

2018-11-26 11:15 Öppen vårdkontakt

Kommentar: Magsmärta
 Status: Skickad
 Önskad undersökning: Gastroskopi
 Frågeställning: AS
 

Hela dokumentet >> Till Vårdkontakter >>

2017-04-11 13:40 Öppen vårdkontakt H - Vårdcentral

Kommentar: Sinuit, bakteriell
 

Diagnoser/DRG >> Till Vårdkontakter >>

2010-06-10 10:54 Öppen vårdkontakt H - Hematologimott R51

H - Hematologimott R51 Den 10 juni 2010 kl 10:54
 

Diagnoser/DRG >> Till Vårdkontakter >>

2010-06-10 10:52 Öppen vårdkontakt H - Hematologimott R51

H - Hematologimott R51 Den 10 juni 2010 kl 10:52
 

Diagnoser/DRG >> Till Vårdkontakter >>

2010-06-10 10:51 Öppen vårdkontakt H - Hematologimott R51

H - Hematologimott R51 Den 10 juni 2010 kl 10:51
 

Diagnoser/DRG >> Till Vårdkontakter >>

2010-06-10 10:51 Öppen vårdkontakt H - Hematologimott R51

H - Hematologimott R51 Den 10 juni 2010 kl 10:51

## APPENDIX 2B

### Interview guide 1, Participants no Digital Experience

#### **Bakgrund**

Vi är två studenter från Chalmers Tekniska högskola som skriver vårt examensarbete hos Visiba Care. Vi vill undersöka vilken patientinformation som är mest användbar för er vårdgivare samt hur och när den bör presenteras för att ge bästa stöd vid konsultation med patienter. Projektets förhoppning är att ta fram en lösning som ska underlätta för vårdgivaren att ta till sig rätt information och på så sätt effektivisera konsultationsprocessen. Vi hoppas på så sätt bland annat kunna minska antalet gånger som patienter behöver upprepa sin sjukdomshistoria.

Vi är just nu i uppstarten av vårt projekt så vi är nya på området och vill skapa oss en bild av hur ni arbetar och vilka utmaningar ni stöter på.

#### **Förberedelse**

Är det okej att vi spelar in?

Inspelningen kommer endast användas i syfte att analysera data och kommer inte spelas upp för någon annan än oss. All data kommer anonymiseras.

#### **Om personen**

Yrke: AT

Kön:

Erfarenhet i år:

Ålder:

#### **Generellt**

Tänk tillbaka på ett patientmöte du har haft där patienten har sökt för hudproblem. Berätta gärna lite kortfattat om processen, hur fungerar det före, under, efter? (HTA)

(Var i processen samlades information in?

Hur (formulär/frågor/journal/etc)?

Hur upplever du att det fungerar?)

Vad är målet med att skapa en bild innan?

Diagnos?

Planering?

Varför?

Följa upp

Hur såg informationen du fick tillgång till ut?

Vilken information om patienten var viktigast vid det första mötet?

Är det någon typ av information du upplever att du saknar innan du träffar patienten?

Ser du några fördelar eller nackdelar med hur den är presenterad?

### **Under mötet**

Om du tvingats överlämna caset, hur hade du återberättat för att ge bästa förutsättning?

Hur hade du velat återberätta denna sjukdomshistoria för en kollega?

Hjälpmedel?

Stöd?

Hur hade detta kunnat vara svårt för en mindre erfaren läkare?

Testa att lämna över fallet till mig så jag kan se hur du gjort i praktiken.

Om du hade fått tillgång till patientens aktuella sjukdomsberättelse innan mötet, via sjuksköterska eller 1177, hade det hjälpt dig vid första mötet? Varför?

Hade du fortfarande ställt samma frågor? Varför?

Hur går du tillväga för att få en bra överblick av patientens problem innan besöket? Varför?

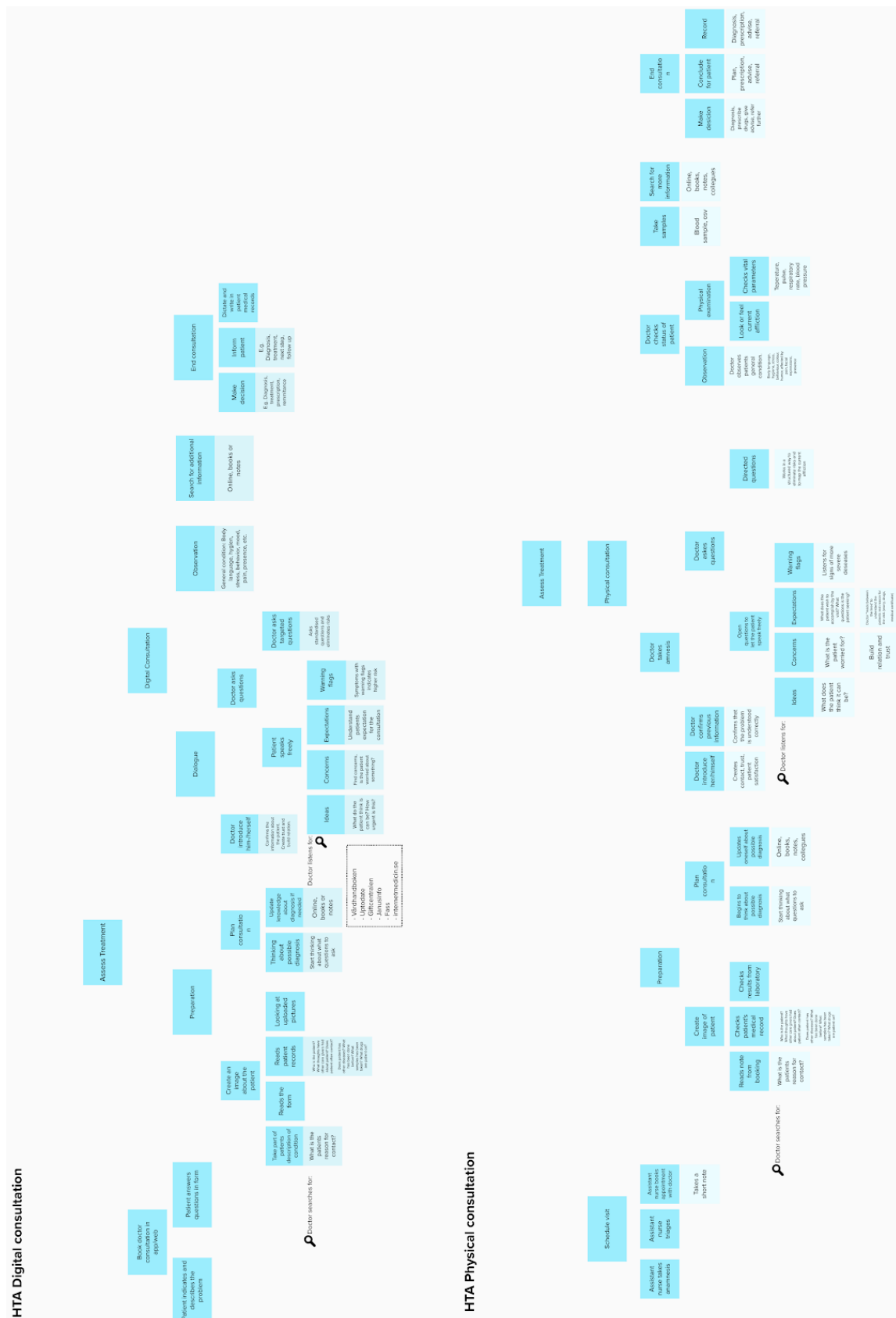
Söker du info innan? Var?

Söker du upp någon ytterligare information innan eller under mötet? Vad? Vart?

När du hade fått en uppfattning om patientens sjukdomstillstånd, hur väl stämmer din bild överens med patientens egen bild av sitt tillstånd? Varför?

Var gör du efter mötet? Journal? Vad? Vad gör du mer? Vilken infor får patient? Vem fixar läkarintyg?

## HTA of physical and digital consultation process



## APPENDIX 4

### Interview guide 2

Vi studerar på Chalmers Tekniska högskola och just nu skriver vårt examensarbete hos Visiba Care. Projektets förhoppning är att ta fram en lösning som ska underlätta för vårdgivaren att ta till sig rätt information och på så sätt effektivisera konsultationsprocessen. Vi hoppas på så sätt bland annat kunna minska antalet gånger som patienter behöver upprepa sin sjukdomshistoria.

Vi arbetar med scenariot att patienten bokar en videokonsultation med en läkare via en chatbot och har i uppdrag att ta reda på vilken information som är mest användbar och hur den bör vara presenterad för att ge bästa stöd för vårdgivaren före och under konsultation.

Vi har hållit intervjuer med 10 doktorer angående vilken patientinformation de anser mest användbar före och under en konsultation.

Studien gav oss uppfattningen om att de viktiga med att skapa en bra bild av patienten och dess åkomma var att

- ge god förutsättning för att kunna genomföra ett effektivt möte då det ofta är ont om tid, tex förbereda frågor för att förkorta anamnestid och
- förbereda sig på hur man bör bemöta patienten om den t.ex. är orolig,
- Öka patientnöjdheten genom att skapa en god relation

Utifrån det tagit fram tre olika förslag på presentation av informationen från chatboten som vi skulle vilja diskutera med dig idag. I de förslag vi kommer att presentera gör vi antagandet att du arbetar med en skärm där du har både journalsystemet och den digitala vårdcentralen där du tar emot patienter via video. Du har även möjlighet till att ha andra flikar samtidigt.

#### **Förberedelse**

Är det okej att vi spelar in?

Inspelningen kommer endast användas i syfte att analysera data och kommer inte spelas upp för någon annan än oss. All data kommer anonymiseras.

#### **Om personen**

Yrke:

Kön:

Erfarenhet i år:

Ålder:

Digital erfarenhet:

#### **Förslag 1**

Du ska ringa upp en patient via den digitala plattformen. Du har kort om tid på dig och du har denna information samt journalsystemet tillgängligt för att bilda dig en uppfattning om

patienten innan mötet. Det är alla ställda frågorna från chatten och patientens svar presenterade i en tabell.

- Hur hade du utifrån detta underlag förberett ditt möte och vad vill du fråga patienten?  
Tänk gärna högt, vilken information använder du till vad? Om du vill söka någon extra information i journalen, i så fall vad?
- Så här ser det ut under konsultationen. Ni ser varandra och kan använda chatten för att till exempel skicka bilder. Och informationen finns i annan flik. Är det någon ytterligare information du skulle vilja ha tillgänglig här?
- Feedback på presentation. Hur upplever du presentationen? Finns det något som är bra/frustrerande med den? Är det någon information du saknar? Hade du velat ha alternativen på flerval?
- Hade du gjort något annorlunda utifrån hur det ser ut här jämfört med hur du gör annars? vad och varför? vill du ställa samma frågor?

## Förslag 2

Här ser du en patientprofil, där patienten själv fått fylla i information om sig själv. Under ärende ser du en sammanfattning av informationen som patienten lämnat i chatbotten. Under information kan du nå länkar som flera läkare nämnt de ofta använder. Under symptom listas de symptom patienten angett i chatten. Under bilder finns de bilder patienten bifogat på sina besvär och slutligen finns en ruta som visar feedback som patienten lämnat efter att varit i kontakt med chatten och du kan även komma till chatthistoriken där du kan se hela konversationen genom att klicka på chatsymbolen.

- Hur hade du utifrån detta underlag förberett ditt möte och vad vill du fråga patienten? Tänk gärna högt, vilken information använder du till vad? Om du vill söka någon extra information i journal, i så fall vad?

- Så här ser det ut under konsultationen.

Skulle denna information hjälpa dig att ha tillgänglig under mötet? På vilket sätt?

Är det någon ytterligare information du skulle vilja ha tillgänglig här? Vad och varför?

- Feedback på presentation. Hur upplever du presentationen? Finns det något som är bra/frustrerande med den? Är det någon information du saknar? Något som är överflödigt?
- Är informationen lätt/svår att ta till sig? Varför?

- Känner du att du får en bra överblick över patienten?
- Är informationen trovärdig? vad är det som gör att den inte/är det? Varför?
- Hade du gjort något annorlunda utifrån hur det ser ut här jämfört med hur du gör annars? vad och varför? Ställer du samma frågor? vill du ställa samma frågor?

### **Förslag 3**

I förslag 3 presenteras informationen från chatten under rubrikerna kontaktorsak, bakgrund, föreställningar, förväntningar och farhågor. Symptomen presenteras i en checklista med de havda symptomen ikryssade, det rödmarkerade symptomet indikerar att det är en varningsflagga som kan vara förknippad med en allvarligare åkomma och bör uppmärksammas. I kroppen nedan har patienten markerat var besvären är lokaliserade. Till höger finner du bilder på åkommorna och på redigera knappen kan du gå in i bilderna och markera/redigera om det är något du vill visa patienten. Längst ner ser du föreslagna diagnoser.

- Hur hade du utifrån detta underlag förberett ditt möte och vad vill du fråga patienten? Tänk gärna högt, vilken information använder du till vad? Om du vill söka någon extra information i journal, i så fall vad?

- Så här ser det ut under konsultationen.

Skulle denna information hjälpa dig att ha tillgänglig under mötet? På vilket sätt?

Är det någon ytterligare information du skulle vilja ha tillgänglig här? Vad och varför?

- Feedback på presentation. Hur upplever du presentationen? Finns det något som är bra/frustrerande med den? Är det någon information du saknar? Något som är överflödigt?
- Är informationen lätt/svår att ta till sig? varför?
- Känner du att du får en bra överblick över patienten? Varför?
- Är informationen trovärdig? vad är det som gör att den inte/är det? Varför?
- Hur ställer du dig till föreslagna diagnoser?
- Hade du gjort något annorlunda utifrån hur det ser ut här jämfört med hur du gör annars? vad och varför? Ställer du samma frågor? vill du ställa samma frågor?



## Jämförelse

- Hur upplever du presentationerna jämfört med varandra? Vad är bättre/sämre?
- Är det något av förslagen du föredrar? Varför?
- Hade det förändrat något i stegen efter mötet? Hade du använt någon information till journalen?
- Tror du den här typen/mängden av information påverkar patientens upplevelse?
- Om du skulle få välja helt själv vilken presentation av informationen du ville ha, hur skulle den se ut? Du kan plocka moduler från förslagen eller komma med helt egna idéer. Börja med före besök.

## APPENDIX 5

### Parts from survey

# Enkät - Patientinformation innan videokonsultation, vad föredrar du?

## Instruktion

Du kommer nu att få två presentationsförslag i varje fråga och du ska avgöra vilket du föredrar. Om du har någon tanke eller åsikt som du vill förklara eller motivera finns det även möjlighet till att lämna en kommentar.

Informationen som presenteras är insamlad av en chatbot som har triagerat patienten till en videokonsultation. Patienten har själv fyllt i personlig information som t.ex. tidigare diagnoser, mediciner och allergier. All övrig information är en sammanställning av patientens svar i chatten.

De grönmarkerade informationsmodulerna kommer att presenteras i olika kombinationer och skillnaderna kan vara små. Det kan röra sig om sättet som ärendet är skrivet på, hur patientens personinformation presenteras, hur placeringen av besvär beskrivs eller hur symptom presenteras. I vissa förslag är ett symptom rödmarkerat vilket indikerar att detta symptom identifierats som en varningsflagga och kan vara förknippat med en allvarligare åkomma.

## Exempel

Master Thesis

SV ?

Patientöversikt

Patient Ida Kvarnström

Personnummer 92 07 48 4824

Besvär Utslag

Tid i ko 30 min

Namn Ida Kvarnström

Längd 174 cm

Vikt 70 kg

Växa Bagare

Familjesituation Ensamstående, 2 barn


Diagnoser Hypotyreos

Mediciner Levaadin, P-piller, Yas

Tobak/Alkohol Röker 3-4 Enheter/vecka

Allergi Augmentin

Fysisk aktivitet 2-3 Gånger/vecka



Ärende


Jag har svår klåda och små vätskande utslag runt ögonen som kvarstår i 1 vecka och uppskattar att jag har feber.

Patienten har inte försökt hantera besvären på egen hand. Besvären är konstanta och det finns inget som lindrar eller förvärrar besvären. Jag är orolig för att det ska bli värre


Symptom

Ja	Nej
Svær klåda	Utslag utbredda över hela kroppen
Klåda som kvarstår 1 vecka	Utslag runt mun och haka
Feber	Hosta
Besväret är konstant	Kräkning

Bilder



Placering: Utslag



\*Obligatorisk

☐ NejDitt svar

## Fråga 4/15

Här beskrivs patientens ärende på två olika sätt.

### Ärende beskrivet i första person

Master Thesis

Patientöversikt

Patient: Anna Andersson, Personnummer: 197612024475, Besvär: Utslag, Tid i kö: 10 min

**Ärende**


Jag har svår klåda och små vätskande utslag runt ögonen som kvarstår i 1 vecka och uppskattar att jag har feber. Jag har svår smärta.

Jag har inte försökt hantera besvären på egen hand. Besvären är konstanta och det finns inget som lindrar eller förvärrar besvären. Jag är orolig för att det ska bli värre.

**Symptom**

Svår klåda ☒  
Klåda som kvarstår 1 vecka ☒  
Feber ☒  
Svår smärta ☒  
Kräkning ☐

**Bilder**



**Diagnoser**

Hypotyreos

**Mediciner**

Levaxin  
P-pillar, Yas

**Tobak/Alkohol**

Röker  
3-4 Enheter/vecka

**Allergi**

Augmentin

**Fysisk aktivitet**

2-3 Gånger/vecka

### Ärende beskrivet i tredje person

Master Thesis

Patientöversikt

Patient: Anna Andersson, Personnummer: 197612024475, Besvär: Utslag, Tid i kö: 10 min

**Ärende**


Patienten har svår klåda och små vätskande utslag runt ögonen som kvarstår i 1 vecka och uppskattar att hon har feber. Hon har svår smärta.

Patienten har inte försökt hantera besvären på egen hand. Besvären är konstanta och det finns inget som lindrar eller förvärrar besvären. Patienten är orolig för att det ska bli värre.

**Symptom**

Svår klåda ☒  
Klåda som kvarstår 1 vecka ☒  
Feber ☒  
Svår smärta ☒  
Kräkning ☐

**Bilder**



**Diagnoser**

Hypotyreos

**Mediciner**

Levaxin  
P-pillar, Yas

**Tobak/Alkohol**

Röker  
3-4 Enheter/vecka

**Allergi**

Augmentin

**Fysisk aktivitet**

2-3 Gånger/vecka

Vilken föredrar du? \*

- ☐ Ärende beskrivet i första person
- ☐ Ärende beskrivet i tredje person

## APPENDIX 6

### Interview guide 3

Vi studerar på Chalmers Tekniska Högskola och just nu skriver vi vårt examensarbete hos Visiba Care. Projektets förhoppning är att ta fram en lösning som ska underlätta för vårdgivaren att ta till sig rätt information om en patient innan ett möte och på så sätt effektivisera konsultationsprocessen. Vi hoppas på så sätt bland annat kunna minska antalet gånger som patienter behöver upprepa sin sjukdomshistoria.

Det här projektet pågår parallellt med ett projekt där man tar fram en chatbot som ska triagera patienter digitalt till rätt vårdnivå. Den triagerar med hjälp av att ställa frågor till patienten och med hjälp av svaren och sannolikheter beräknar den vad som är en lämplig vårdnivå. Chatboten använder sig av AI-teknik som är uppbyggt av diagnoser, symtom och riskfaktorer och triagerar patienten med hjälp av dessa sannolikheter för olika symtom och kopplade diagnoser vilken gör att den vet vilka följdfrågor som är relevanta.

Sannolikheterna och kopplingarna är framtagna av ett läkarteam och nätverket valideras och utvecklas kontinuerligt för att hålla sig uppdaterat.

Övriga påverkande faktorer är också framtagna av chatbot i samband med triage då det är faktorer som påverkat triageringen och kan stötta läkaren i inläsningen. Detta kan vara riskfaktorer för olika diagnoser och i så fall syns de under respektive diagnos de är kopplade till.

Vi kommer att använda oss av ett scenario där vi gör antagandet att du arbetar med en skärm där du har både journalsystemet och den digitala vårdcentralen tillgängliga. Du har även möjlighet till att ha andra flikar uppe samtidigt.

#### **Förberedelse**

Är det okej att vi spelar in?

Inspelningen kommer endast användas i syfte att analysera data och kommer inte spelas upp för någon annan än oss. All data kommer anonymiseras.

#### **Om personen**

Yrke:

Kön:

Erfarenhet i år:

Ålder:

Digital erfarenhet:

#### **Scenariot**

Du ska ta emot en patient i den digitala vårdcentralen och scenariot börjar med att du kollar i kalendern och ser att det är snart dags för din konsultation med nästa patient, Erik Ekdal. Din uppgift är att förbereda dig inför mötet med den information som finns tillgänglig, ringa upp patienten och berätta hur du hade bemött patienten vid själva samtalet. Berätta

högt vad du gör i varje steg, vilken information du använder eller eventuellt saknar och om du hade använt dig av t.ex. journalen eller externa informationskällor och i så fall varför.

Fråga om det är någonting du inte förstår eller undrar över, tanken är att läkare ska arbeta i det här systemet varje dag och på så sätt bli vana vid hur det fungerar.

Chatboten kan som det ser ut idag bara samla in medicinsk data, så all övrig data kommer att behöva samlas in med hjälp av ett formulär.

Diagnoserna visas under Digital bedömning och är endast förslag på möjliga diagnoser, det är inte till för att ställa diagnos utan det bör göras av läkaren. Diagnoserna visas för patienten vid avslutad chat med chatbot och läkaren får se den informationen.

### **Innan konsultation**

- Hade du gjort något annorlunda utifrån hur det ser ut här jämfört med hur du gör annars? Vad och varför? Ställer du samma frågor?

### **Skala**

- Gradera i skalan hur hindrande eller stödjande du upplever patientöversikten.  
Varför upplevs den på det viset?

- Gradera i skalan hur komplicerad eller enkel du upplever patientöversikten.  
Varför upplevs den på det viset?

- Gradera i skalan hur trovärdig eller inte trovärdig du upplever patientöversikten.  
Varför upplevs den på det viset?

- Gradera i skalan hur strukturerad eller rörig du upplever patientöversikten.  
Varför upplevs den på det viset?

### **Övrigt**

- Är det någon information du saknar/överflödigt?

Under konsultation

### **Skala**

- Gradera i skalan hur hindrande eller stödjande du upplever informationen under konsultationen.

Varför upplevs den på det viset?

Vilken information är användbar under?

- Gradera i skalan hur komplicerad eller enkel du upplever informationen under konsultationen.

Varför upplevs den på det viset?

- Gradera i skalan hur strukturerad eller rörig du upplever informationen under konsultationen.

Varför upplevs den på det viset?

**Övrigt**

- Hur tror du den här typen/mängden av information påverkar patientens upplevelse?
- Hade det förändrat något i stegen efter mötet? Hade du använt någon information till journalen?
- Hade man velat kunna anteckna direkt i verktyget för att behålla fokus mot skärmen eller kunna flytta över i journal?
- Övriga frågor kommentarer? frågor?