Enhancing the person-centered care system through digital communication tools by applying a user-centered approach to a hospital environment

Daniel Selleby

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Supervisor: Anne-Marie Hansen
Contact information

Author:
Daniel Selleby
E-mail: daniel.selleby@gmail.com

Supervisor:
Anne-Marie Hansen
E-mail: anne-marie.hansen@mau.se
Malmö University, Konst, kultur och samhälle (K3)

Examiner:
Anuradha Venugopal Reddy
E-mail: anuradha.reddy@mau.se
Malmö University, Konst, kultur och samhälle (K3)
Abstract

Digital technologies are becoming increasingly common tools in our daily lives. We use it for finding information, but also to communicate with people all over the world. With a vision to strengthen Swedish healthcare's digital resources, Sweden has made major efforts in this area. Improved living conditions have changed the demographic situation as people grow older, which in turn places higher demands on healthcare efficiency. Being able to meet these demands has made digitalization of healthcare increasingly important, but also demonstrating new challenges such as participation, transparency and usability. The purpose of this study has been to investigate if communicative tools can be created to facilitate nurses work with patient-centred care and to enhance patients' positive experiences of their own care. The study is based on interviews and observations with nurses working within orthopaedic sections and employees working in facility management as well as administration within the hospital. The results show that digital solutions can be effective tools for enhancing patient-centered care, but with automated solutions the physical encounter between nurses and patients can be reduced. The concepts that have been developed are two mobile applications. They were developed with the intention to make it easier for nurses to document and communicate patients’ activity and care plans.

**Keywords:** User-centered design, Contextual design, Communication theory, Healthcare, Patient-centered care.
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1 Introduction

1.1 Background

Region Skåne – the county council of Scania County in Sweden, responsible for healthcare development and issues in Skåne (Skåne 2018) – decided early in 2017 to invest in three new buildings within the hospital area of Malmö city. They are currently in the process of planning the project, while making changes to the architecture of some of the existing buildings. The project is estimated to be finished in 2024, in which two new hospital areas will have been built which will include new facilities, technological systems, interior architecture and service procedures. The goal is to modernise the hospital area to provide conditions for a high quality and safe care. This will in some cases change the processes and workflow of the hospital. To achieve these goals, the project management team must partly study how the hospital operates in its current state. This is where the field of Interaction Design can provide valuable research and exploration to find currently existing problem areas and introduce new ideas that can aid Region Skåne to achieve these goals when they build for the future.

1.2 Research area

The project aims at helping Region Skåne achieve its goals using methods derived from interaction design. The starting point of this study has been to gather qualitative data through field work to discover current problem areas in the hospital, since then in relation to theoretical frameworks and design methods, give rise to new insights and ideas that can inspire Region Skåne in its project to build for the future hospital. The research methods used in this project are derived from a user-centred and contextual design practice to create a deeper understanding of the user's experiences in the environment they are in and gain a better understanding of the design area. Through meetings and conversations, it has been expressed that there is a need to develop digital resources that makes the hospitals operations more efficient and less time consuming to improve the patient's care and process through hospitalization, which is something that has been addressed in this study.

1.3 Purpose

The purpose of this study is to investigate if communicative tools can be created to facilitate nurses work with patient-centred care and to enhance patients’ positive experiences of their own care. It also aims to explore and highlight how nurses and patients together can create a greater value for each other through digital communication. The gathered insights and design concepts may also serve as research data that can later be used as inspiration for similar projects, as well as for further development and implementation.
1.4 Research questions

1. How can the person-centered care system be enhanced by creating an effective and transparent way to communicate a patients’ healthcare plan and healthcare process to the users through a digital solution?
2. How can a user-centred and contextual design approach be applied to a hospital environment to create more meaning and effective care for nurses and patients?

1.5 Ethics

A hospital is a sensitive field to work with in terms of confidentiality, but also privacy and integrity. Building trust is therefore important and to communicate with all actors involved in the project what the purpose of the project is and what information will be, or should not be, shared. Patients are of course an especially difficult group to work with in concerns of this. However, they are still one of the most important target groups. The result of the project will in the end be influenced or affect them either directly or indirectly. Different sections of the hospital may also have different goals, needs and priorities. From a political viewpoint this might affect the project in different ways, such as complexity and regulations.

The Swedish Research Council has codified ethical principles in relation to research practices, which I have had the intention to follow in this project. The participants have been informed about the purpose of the project and have given their consent to participate by their own choice. They have also been informed about the purpose of documentation and have given consent of its usage.
2 Theory

2.1 Person-centered care

Healthcare in Sweden has in recent years adopted a development process aimed at making the healthcare environment more individual. From a historical perspective, caregivers have been based on medical terms to describe patients, that consist of different parts and procedures that influence each other (Edvardsson 2010). The patient has been subordinated to the caregiver and is treated solely on the basis of his diagnosis, which has created an environment of categorization and has suppressed human individuality. In recent years, this has been considered contributing to a negative culture in health care, of which the continued development attempts to change the traditional perspective. Person-centered care is a concept that has become increasingly more valued and is now considered important in order to create a more humanistic perspective in health care. Region Skåne is a user of the person-centered care perspective, as they themselves mention via their web platform (Region Skåne 2018).

*Person-centered care can be described as a care that aims to visualize the entire person. This is an attitude that the Quality Development Unit always brings with them in any form of improvement work.*

According to the Gothenburg University Centre for Person-centred Care (GPCC) – A government-supported research centre in Sweden, aimed at supporting and conducting research in person-centred care (GPCC, 2016) – The notion of person-centred care is to aggrandize a patients experience and seize the individual’s needs and abilities during hospitalization. Through this notion the GPCC further expresses three key concepts that they consider to be essential in person-centred care and what conditions they enable.

2.1.1 Patient story

By actively listening to the patient’s story, one can gain a deeper understanding of the resources the patient has. A patient’s resources can be described as human assets that the patient possesses, such as the ability for social interaction, motivation and willpower. Resources like these can be used to develop different goals according to the patient’s own abilities, which helps the patient to actively contribute to his or hers own healing process.

2.1.2 Documentation

By understanding a patient’s resources the healthcare professionals can in collaboration with the patient create the documentation needed to provide effective care. This enables both caregivers and patients to get a similar and comprehensive picture of the patient’s care plan, while also creating greater equality and trust between both parties.
2.1.3 Partnership

By taking care of the patient’s resources and the co-creation of the individual’s care plan, the most important purpose is to establish a sense of partnership. The patient no longer feels subordinate to the healthcare staffs; instead mutual respect is created where both parties are in need of each other’s knowledge. The patient is considered an expert of his or her own situation in terms of well-being and how the disease is experienced, while the healthcare staffs possesses the knowledge required to provide efficient care and treatment of the disease.

Several studies show that patients with different diagnoses receives a stronger positive experience of their care by being treated through a person-centered approach and some symptoms that characterize their diagnosis become less serious (Svenska sjuksköterskeförening, 2016). They also show that it has a positive impact on the working environment of healthcare staff, which experiences reduced stress and increased satisfaction of their work.

2.2 Communication theory

Based on the patient-centered perspective, such as Edvardsson (2010), communication expresses an important part in providing a good and effective care. It is based on the interaction between the information that the healthcare provider possesses and the patient’s knowledge about himself. Therefore, it is also important to consider how information can be conveyed efficiently to highlight the individual and create a partnership between the healthcare provider and the healthcare provider. Griffin (2011) argues that it is complicated to define what communication is, as it includes all forms of interaction and thus becomes very complex. However, Griffin (2011) emphasizes that there are important points in communication theory and chooses to define it based on the following:

*Communication is the relational process of creating and interpreting messages that elicit a response.*

Communication has a great variety of theories for approaching the concept (Griffin 2011). Because of this, it has become apparent to address the theories that are relevant in the context of which you work from outside. The person-centered care center aims to remove hierarchic structures between patients and healthcare professionals, as it creates an experience of insecurity (Svenska sjuksköterskeförening 2016). To counter this type of experiences one must therefore take into account how communication can be provided in a hospital. Berger (1987) presents a theory called “uncertainty reduction theory”, which aims to explain the contradictions between uncertainty and effective communication.
2.2.1 Uncertainty reduction theory

Berger (1987) presents the idea that when people who does not know each other well meet, it evokes uncertainty. He regards this as a natural reaction to our behavior and suggests that is because we do not have sufficient understanding of the person we communicate with. One aspect of uncertainty derives from a behavioral perspective, in which we question ourselves on how to act. The other aspect derives from a cognitive perspective where we attempt to perceive the other person as an individual (Berger 1987). With this theory in mind, it can be argued that the encounter between nurses and patients evoke uncertainty if they do not know each other from before. Furthermore, as the patients are seeking professional aid and becomes very reliant on the caretaker’s expertise and knowledge, it can be argued that an initial hierarchy is established during the first encounter.

Berger (1987) further argues that in order to reduce uncertainty, we strive to find predictability. By observing the person’s body language and talking to one another we gain more knowledge of the other person and thus increasing predictability (Griffin 2011). It is also important to understand differences and similarities in values, goals and motivations in order to establish a closer relationship. Attempting to reduce uncertainty and increase predictability is according to Berger (1987) primarily a cognitive process that occurs either consciously or unconsciously through communication.

Gudykunst (2005) provides a different perspective of the uncertainty reduction theory, claiming that communication with other individuals is an emotional process. Because of this he emphasizes the distinction between “uncertainty” and “anxiety”, while maintaining Berger’s (1987) theory to be equally relevant. Through this notion, Gudykunst (2005) provides an alternative theory, called “anxiety/uncertainty management (AUM) theory”.

2.2.2 Anxiety/uncertainty management theory

The AUM theory combines the “uncertainty reduction theory” with the concept of anxiety, emphasizing that both perspectives must be combined in order to achieve meaningful and effective communication (Gudykunst 2005). The AUM theory aims to limit misinterpretations of verbal and nonverbal messages so that the message is perceived the way it was intended to and can provide purpose to the receiver (Gudykunst 2005). Through Griffin (2011) it is further expressed that perceived understandings of different qualities such as context, motivations and individuality are key factors that reduces both anxiety and uncertainty in AUM theory.

One of the focus points in AUM theory is the concept of “mindfulness”. Griffin (2011) interprets the term based on the theory as follows:

*The process of thinking in new categories, being open to new information, and recognizing multiple perspectives.*
“Mindfulness” is achieved when we are aware of the way we communicate and actively try to alter the way we act, with the goal to communicate more efficiently (Griffin 2011). It also draws from the notion to be open-minded in order to understand other people’s perspectives (Griffin 2011).

In relation to person-centered care (Edvardsson 2010; GPCC 2016), The uncertainty reduction theory Berger (1987) and AUM theory (Gudykunst 2005) supports the fact that active communication between people with different values, goals, attitudes, motivations and knowledge can form a sense of relation to each other (Gudykunst 2005; Berger 1987). Furthermore, the principle to reduce misinterpretation and apply effective communication can be implemented in both verbal and non-verbal communication. This makes the theory relevant for the approach of digital work environments, and in a hospital context this theory can be applied by creating solutions where both patients and nurses are given the capacity to express their own perspectives towards each other.

2.3 Social information processing theory

In 1992, Joseph B. Walter published a theory labeled “social information processing (SIP)”. In this theory, it was suggested that it is possible for users to develop relations to one another through “computer-mediated communication (CMC)”. Inspired by Joseph B. Walters work, the following explanation of the theory is described by Em Griffin in his book “A first look at communication theory (2011)”.

Social information processing theory emphasizes that CMC users have the possibility to receive the same information and knowledge as it is through direct verbal communication (Griffin 2011). Although it is pointed out that CMC distances the qualities of visual and audible feedback from the user, Griffin (2011) stresses that adaption to digital systems is possible to the very degree that users are fully satisfied with the information they receive. The human need for closeness does not necessarily diminish through CMC, but it does limit the possibilities to express information. This results in communication becoming more time consuming in order to achieve a strong enough impression of the information (Griffin 2011). Furthermore, it is empathized that time has a more crucial impact of the experience rather than the quantity of information that is being produced, meaning that the time it takes to express the necessary information is more important (Griffin 2011). In relation to the social information processing theory and hospital environments, it can be argued that digital systems can be used to send and receive information between nurses and patients and that it is possible for both parties to perceive the information just as well as through verbal communication.

It can be possible for CMC to be more intimate than it would be through a psychical connection; Based on the way information is shared online. It is argued that identities can be portrayed in a favorable manner by the users, by
expressing selective qualities of themselves. This approach enables to maintain integrity and without worrying about negative impression such as prejudices or norms (Griffin 2011). It is also expressed by Griffin (2011) that without physical visual feedback, the interpretation of other users is limited to the linguistic qualities of the communication. This perspective shows two extremes (Griffin 2011). If the communication shows a language of low quality, it can adversely affect how users reflect on each other. However, if the language is of high quality, it may provide a glorified image between users. In a hospital environment, an example of low quality communication would be if a nurse expresses him or herself towards a patient in terms that is general are only understood only by those with experience or education within healthcare. In comparison, high quality communication occurs when both parties have the same level of understanding of the same information. Furthermore, SIP describes an advantage in non-physical interaction via the notion that users can act within different time spans (Griffin 2011). Communication through online platforms does not require the users to respond immediately but can rather formulate a profound answer with a relaxed patience. Finally, Griffin (2011) suggests that the positive impacts CMC can produce a “self-fulfilling prophecy”. He describes the term as follows:

*Self-fulfilling prophecy is the tendency for a person’s expectation of others to evoke a response from them that confirms what he or she anticipated.*

If all other key points are fulfilled; the expression of specific qualities, a glorified image of one another and the ability to communicate within different time spans; self-fulfilling prophecy can be achieved (Griffin 2011). The connection between users who has reached this stage can be very strong and it is further argued that it has the ability to improve connections which has had conflicts or oppositions in the past (Griffin 2011). Through this notion, the social information processing theory supports the idea that communication via non-physical and non-verbal platforms can still create and maintain strong relationships, which are based on respect and understanding between one another.
3 Method

3.1 User-centered design

User-centered design (UCD) is a method that places a strong focus on involving the user in the design process. Abras et al (2004) provides one description about the concept of user-centered design:

‘User-centered design’ (UCD) is a broad term to describe design processes in which end-users influence how a design takes shape.

One of the purposes that UCD enables is to gain a deeper understanding of the users and their environment, in which the design concept is developed (Abras et al 2004). Furthermore, Abras et. al (2004) argues that it is important to consider who is influenced by one’s design to identify all potential users. On this basis it becomes possible to categorize different types of users from the extent to which they are influenced by the produced artefact; “primary”-, “secondary”- and “tertiary users” (Abras et.al 2004). It is further clarified that the “primary user” are considered to be those who utilizes the artefact to the highest extent and thus become influenced by it the most. “Secondary users” are defined by those who utilize the artefact to a more limited extent, while “tertiary users” are only influenced by the artefact through the utilization by the other two user types (Abras et. al 2004). For this study, nurses working within orthopedics are considered as primary users, while patients who are hospitalized at the orthopedic sections are defined as secondary users. Finally, the patient’s relatives has emerged as tertiary users during the design process.

Abras et. al (2004) also points out that the user centered design approach does have disadvantages in some scenarios. The most prominent one being that it is time consuming to gather data with this approach to obtain an arbitrary understanding of the users’ environment. In relation to this, Still and Crane (2017) emphasize that the level of involvement with users can vary widely in different projects. The authors argue that the strongest form of participation makes the user a co-creator in the design process, while the other side of the spectrum makes the user involved in specific parts of the process at most. Still and Crane (2017) further emphasize that no approach is necessarily more effective than the other, if the users have some form influence in the process and can fulfill the desired results.

In this study, nurses have been involved as a primary user in the design process by being able to describe their working environment and express their needs, goals and motivation for potential design solutions during several occasions. During this time, they have also had the opportunity to express the patients and patient relative’s perspective in the way that they see it, which has been considered. This form of participation has continuously
been of great influence during the design process and has thus shaped the design of the developed concepts.

3.2 Contextual design

Holtzblatt and Beyer (2014) define contextual design (CD) as follows:

*Contextual Design is a user-centered design process built upon in-depth field research to drive innovative design.*

The approach to this method is to utilize different techniques in order to efficiently collect qualitative data, which can then be organized and analyzed. This allows for an enhanced ideation process, while also allowing a more structured way of working in the design process. Contextual design is driven by the notion that in order to enhance or redesign something in the user’s life, it is important to realize the context of the environment that the user operates in (Holtzblatt and Beyer 2014).

Holtzblatt, Wendell and Wood (2005) emphasize how a contextual design methodology can be utilized in a more limited form. The authors further describe that this approach is still based on the same conception as contextual design, to be able to immerse oneself in the user's environment so that qualitative data can be gathered for the design process. But it is also stressed that in some projects there is room to make priority choices, based on the scope of the project and where the project has its starting point. From the perspective of this project, it is possible to see a relation to what Holtzblatt, Wendell and Wood (2005) expresses. A hospital area is a large complex, with many different sections. Although there are differences in the sections' tasks and performances, there are similarities in the working methods and frameworks used. This gives the opportunity to have a broad and flat starting point in the project to identify key roles that support the operations of the hospital area, then gradually narrowing down to a more detailed level (Holtzblatt, Wendell and Wood 2005). This can also be placed in relation to (Abras et. al, 2004), which emphasizes the importance of identifying which actors are primary, secondary and tertiary users in the design process.

3.2.1 Contextual inquiry

As a part of the contextual design methodology, contextual inquiry is an effective way to gather qualitative data about the user. The idea is that to better understand the context of a person’s work, the research studies are carried out where the work takes place (Holtzblatt, Wendell and Wood 2005). By observing the user while working, one can detect actions that may be difficult to communicate, such as body language, facial expressions, and other less noticeable behaviours. One can also receive a better picture of the environment in which the actions are performed and how it affects behaviour. These observations provide material that can be raised together with the user as it happens through interview questions and discussion. By asking the user
to explain the mindset and the reasoning behind his or her actions, one can better understand the person's motivation, goals and underlying structures in the work environment. Since I am not familiar with the healthcare workplace environment from before, this has been an important method to receive valuable insights and information that could then be applied in purpose of my project.

3.3 Storyboards

Storyboards can be described as a form of prototype with the intention of providing a narrative or interpretation to the user of how a design can be used. Through various frames and sketches like that of cartoons it is possible to highlight relevant aspects of ideas and concepts that has been reached during a project. Storyboards can be a powerful tool to communicate these concepts which provides the opportunity for discussion and feedback (Wahid et al., 2011).

3.4 Affinity diagram

Affinity diagramming is a process used to externalize and meaningfully cluster observations and insights from research, keeping design teams grounded in data as they design. (Hanington and Martin 2012)

Hanington and Martin (2012) expresses affinity diagramming as an efficient approach to utilize gathered research data from the design process. It draws from the notion that implicit knowledge that has been gathered through qualitative research methods becomes more difficult to combine or place in relation to each other when being in large quantity. An affinity diagram enables a way to seize this knowledge to produce and formulate experiences, resources, user needs and distinguish and examine issues. The method utilizes sticky notes, on which each new elevated piece of information is written down. It is then attempted to categorize all notes into specific themes represented by a cluster of information. Through this approach, the gathered research data can be observed and contemplated both from an individual and a holistic perspective (Hanington and Martin 2012).

The process of affinity mapping is supported by Holtzblatt and Beyer (2014), emphasizing that the method has positive advantages from a contextual design perspective. Visualizing data through this approach provides a deeper understanding of the user's experiences and complications in their life's. Holtzblatt and Beyer (2014) further argue that affinity diagrams may provide an experience of narrative from the users. When the data is collected and categorized into themes, they complement each other and create stories. The narrative can provide further knowledge about motivation, needs and goals of the users.

There are a few varieties of the method (Hanington and Martin 2012). In this project it has been utilized as an inquiry from a contextual and user-centered
perspective, which has helped to identify issues, target groups, communication flows and more.

4 Design process

4.1 Field research

4.1.1 Specialty meetings

The collaboration with Region Skåne gave me the opportunity to participate in meetings that discussed different subjects regarding the planned construction work in the hospital area. At these meetings there were many different representations from different sections in the hospital, of which one agreed on current issues and collaborations. There were also discussions about how sections would develop on an individual plan and at the same time could have a good interaction for when the new building project was clear. The aim of attending these meetings was to try to get a better overall perspective regarding hospital operations and to identify potential problem areas that might be relevant to the project.

Participation in these meetings consisted of active listening and observations. Hanington and Martin (2012) names this approach for "fly-on-wall observation". They explain that observation methodology can be of practical use when striving to collect qualitative data without affecting behavior or the way people formulate themselves. Hanington och Martin (2012) also distinguishes two different types of observations in relation to the "fly-on-wall"; "Secret outsider" and "recognized outsider". "Secret outsider" is defined by the observer being in a range that reduces the risk of influencing participants' behavior to a minimal level. "recognized outsider" means that observers are present at the participants, but try not to interfere with what is observed.

When participants at the meeting were aware of my present, these observations are placed within the term "recognized outsider". This may have a negative effect on the data obtained as it is intrusive to a greater extent and may affect the behavior of participants (Hanington and Martin 2012), but for these specific observations performed, there was no possibility of adopting a position to be a "Secret outsider."

Each meeting lasted between one and four hours and each participant was more or less recurring, depending on the topics raised. The observations made were noted in writing to be as unobtrusive as possible. When every meeting was officially over, there was also room for asking relevant questions and concerns to some of the participants based on what had been discussed
during the meeting. This was done with the help of the notes and observations received during the participation.

4.1.2 Presentations and action plans

Region Skåne and employees at Malmö Hospital gave lectures in the course of the project and presented action plans for the development of health care activities and the direction that is being pursued, both nationally but also a local level. One of the goals with this was to provide a comprehensive and integrated image between hospitals and sections for how development should be directed forward, and prioritization was to highlight business and design perspectives.

In addition to providing information to relevant actors, action plans and lectures gave rise to discussions and findings. Different values and opinions can be highlighted by a variety of participants from different fields of work in the field of healthcare, which can be a tool for identifying where there is agreement and contradictions (Preece et al. 2015). My participation gave the opportunity to gain a deeper understanding of the goals and motivations that drive the development of healthcare ahead. It also gave the opportunity to participate in discussions to identify problem areas and design openings.

4.1.3 Interviews

In order to receive a better understanding of how the hospital operates at present, as well as gaining more insight into the employees' perspective on health care, I conducted a number of interviews with people from different sections. At the same time, I wanted to capture the employees' visions for the future and what they see as the biggest challenges for achieving them. The interviews conducted during the project were based on what is called "unstructured interviews" (Preece et al., 2015). "Unstructured interviews" provides the interviewee with a greater scope and ability to control the conversation, by having the interviewer ask open-ended questions that do not necessarily require answers within a specific context or demands how the answers are formulated. This type of interview method has the advantage of being able to provide rich data that goes deeper into subjects, as the interviewee is given the opportunity to develop his answers unaltered. It also provides the opportunity to get into unexpected conversation topics that can provide new directions and ideas for the design process (Preece et al., 2015).

Disadvantages of unstructured interviews are that it can be more complicated to stay within a given time frame and you also reduce the degree of control of the interview (Hanington and Martin 2012). A more structured interview based on predetermined questions usually provides more distinct answers which are easier to analyze. Preece et. al (2015) advocates that when conducting unstructured interviews, one may have predetermined topics that the interview can circle to and create a discussion.
The interviews were conducted together with people from four different sections at the hospital, the orthopedic, hand surgery, facility management and the NSM administration section. They lasted for about an hour each time and if the interview subject gave permission for it, the interview was also recorded. This was used to get a more fluid discussion without distractions, and to more efficiently collect and analyze the data obtained. Otherwise, the interviewer's response to the questions was noted in writing.

4.1.4 Aim for future development of healthcare

During the participation of lectures and presentation of action plans, I was able to gain a deeper understanding of some of the key concept that drives the development of healthcare on a regional level. I was able to identify recurrent themes during my participation and these provided me with a basis for the theoretical framework that has been implemented in the design process as well as a more contextual immersion of the hospital environment (Holtzblatt and Beyer 2014).

It was expressed on various occasions that the patient is at the focus of all activities of the hospital. This is to make sure that the patient receives a good care, can feel secure and gain a sense of trust. During an action plan presentation held by Region Skåne it was emphasized that a person-centered care is a crucial approach when developing future health care practices. It is further expressed that healthcare environments must be flexible and be able to be at the right place at the right time. Region Skåne also made the connection between person-centered care and two of the four main principles applied in any development decision; the “flow principle” and “sustainability principle”. The “flow principle” advocates optimizing the patients care throughout the whole care process. The “sustainability principle” advocates that a hospital must prove a safe and caring environment. These two principles have a relation to the concept of person-centered care as expressed by GCCP (2016) and it would therefore be important to take them into consideration for the design process.

4.2 Results

Based on the interviews and observations of the meetings that I participated in, I was able to obtain a more holistic view of the hospital operations and to identify potential design openings. Many sections of the hospital have continuous cooperation with each other in order to deliver their healthcare service. For example, the Laboratory Medicine (LM) section provides diagnostics and guidance to the patient care (PC) section and the facility management (FM) assembles and mobilizes resources such as technological equipment to where it is needed within the hospital. It became evident that most, if not all sections of the hospital affect each other in one way or another, which emphasizes the importance of consideration from a user-perspective when developing the design concept (Abras et. al 2004). The way sections
communicate is different depending on the tasks and services that each section provides. The Patient Care section has a much more involved and direct communication with other sections in order to make the care process more flexible, while Facility Management and the Laboratory Medicine section does not necessarily engage in direct communication to provide their services, performing their tasks in a manner that does not interfere with other healthcare activities.

An important finding obtained during the interviews and observations is that various sections within the hospital area utilize analog solutions for their daily work. The most preeminent and recurring solution being something called “pulse boards” (see figure 1). As they appear within the hospital visited for this project, pulse boards consist of structured text information written on a whiteboard to visualize the patient’s process through hospitalization. Descriptions of the patient’s location displayed on the pulse board consists of descriptions of the patient’s location, planned procedures and estimated time for when the patient may leave the hospital. Another variant of the pulse board than the one just described, visualizes the managing of the caregivers, explaining to which patients the caregivers are stationed and whether they are on duty. Magnets are utilized to make adjustments as part of the visualization. It was expressed during the field work investigation that these analog solutions are important tools in order to structure and manage the working process. However, it was also stressed that there are certain limitations. Since the board is stationary it can sometimes become difficult to keep track of a patient’s progress while being on the run within the hospital area. Another expressed disadvantage was that since the boards are adjusted manually during irregular time-intervals, it becomes difficult to share new information to other coworkers. This finding provided ideas of potential design openings for the project, in relation to Griffins (2011) description of the social information processing theory, which claims that CMC creates opportunity for communication within different time-intervals. Furthermore, it can be related to the theory of person-centered care as explained by GGCP (2016) and Edvardsson (2010), who stresses the importance of participation and knowledge sharing.
Another important finding regarding the way in which the various operations were performed was that there was a desire to improve or develop new digital resource systems in healthcare. This desire is in accordance with the Swedish Government’s vision of future health care. This is to be able to streamline employee collaboration, but also to provide good care to patients through increased participation and a better overview of the patient’s care process. In its current state, Sweden’s healthcare utilizes various digital resources to carry out its work. For the caregivers work activities these are used to organize the necessary information about a patient so that healthcare professionals can gain an overview of the patient’s course during hospitalization. They are used both at a local level where many routine procedures are performed daily, but also at a central level. The digital resources aim to support the cooperation between sections in order to share information and to communicate the performed and planned efforts for the patient’s healing process. Facility Management is currently in the process of developing a new digital solution for its services, focusing on providing better access to their services in a faster and more efficient way.

In relation to the findings of the hospital’s digital resources, another finding obtained during the interviews was that although the digital work environment is important for current and future operations in the hospital, it is not perceived as sufficiently effective. There are many different systems that the caregivers use daily, but they are incompatible with each other. It is also difficult to navigate the systems and to share information, which in turn makes it difficult to communicate the information to all interested parties. The fact that the digital resources are not user friendly makes the work of the healthcare staff more time consuming and degrades the quality of the patient’s care. This can be related to Abras et. Al (2004) arguing that when interactions in our everyday lives are not manageable enough, they can evoke negative emotions such as frustration.
4.3 Summary of conducted interviews and observations

It was expressed several times that the digital resources used at the patient care sections were very time consuming to use, which meant that the nurses had less time to communicate with the patients. Many nurses are stressed and experience that they cannot perform their work in the context of patient-centred care. Instead of visualising the individual, every patient simply becomes one of many. There seems to be an aspiration to make the healthcare more personal.

Furthermore, the physical meeting between nurses and patients was considered important for the patient, to make them feel that they receive the care needed to recover. However, much of the information that nurses have on a patient care and activity plan does not reach the patient as it exists in computer systems that are only available through office computers. There is a desire for greater transparency and more effective tools to communicate this information to the patient. Nurses at the orthopaedic section and other care sections have developed their own analogue solutions that help them keep an overview of a patient’s care process.

4.4 Design guidelines

Based on my new knowledge received from the field research and from the development principles designed by Region Skåne I choose to formulate and adopt the following design guidelines for the continuation of the design project.

- The design should create conditions for the patient to understand his or hers care plan.
- Digital solutions should be flexible to make the hospital operations less administratively time consuming.
- The design should create the conditions for the patient to be a co-creator of his or her own care.

4.5 Affinity diagram

With the amount of data collected from the field research, an affinity map was created to structure the data, enabling reflection over the user’s work environment and their needs (Holtzblatt and Beyer 2014). It was also utilized to better understand the stakeholder’s relationship to each other and to find new touchpoints which can help giving notice to design problems. Except for myself, my two classmates who were also a part of the collaboration project with NSM participated during the creation of the affinity diagram as it is argued to be beneficial to include several participants in this process (Holtzblatt, Wendell and Wood 2005). The purpose of this is to prompt discussion and receive multiple perspectives of the data that is being presented.

4.5.1 Implementation

The first step of the process to map out the affinity diagram was to let all participants write down findings and observations from the field research on sticky notes (Holtzblatt, Wendell and Wood 2005), which were then placed on a whiteboard in order to make the notes more manageable.

![Figure 3. An overview of the initial diagram.](image)

This process was done without discussion, as it is argued by Holtzblatt and Beyer (2014) that the initial notes should be put up without opposition, for which it can produce an environment of uncertainty and limit the innovative process. Once a note was placed on the whiteboard, the other participants could place their own observations in relation to the others. This placement does however not need to be argued at the initial stage. The purpose is to form a fundamental image of how the data can be grouped (Holtzblatt and Beyer 2014).

When all generated observations and findings had been produced and placed on the whiteboard, the next step in the process was to try and cluster them. The idea is to try and identify which notes are more closely related to each
other in order to characterize different themes according to the information presented.

This step can be done in discussion with the other participants, as it is during this step that the information starts to produce meaning (Holtzblatt and Beyer 2014). By changing the structure of the cluster enables to view the data from different perspectives. Eventually, when all notes had been grouped togheter or placed in an arbitrary order, the groups were circled and were given a name accordingly to what data each consisted of. This produced a complete affinity diagram (Holtzblatt and Beyer 2014) that provided a holistic view of the data, while also enabling to observe and ponder about specific groups and notes.

![Figure 4. An overview of the complete affinity diagram.](image)

The final groups that were created were “art”, “administration”, “Facility Management”, “lab analysis” and “departments”. The “departments” groups were divided into two subgroups: “Digital resources” and “Utopia”. There were also a number of notes that was not grouped. This is because during the process of forming the affinity diagram, they were considered to be relevant to all groups, affecting the hospital environment at the top of a hierarchy level. Each of these groups affect the patient care in different way, from the logistical solutions that must work to the art used at the hospital to create a healing environment for the patient.

After the diagram was complete, an attempt was made to discuss the different groups to see if there were any recurring themes, such as issues, statements, working methods or needs. A couple of such themes were identified. First, it became clear that digital resources influence many of the groups. The diagram expresses that the digital resources try to complement each other, but does not necessarily work in a uniform way. These groups, especially the “departments” and “utopia” groups also stress the needs to gather a more holistic perspective on patient’s health progress. The amount of digital resources used creates a confused impression that removes time and focus from performing close care.
4.6 Generating ideas

Following the research studies and the affinity mapping, the questions formulated below was considered appropriate to be assumed in the continued design process.

1. How can information that nurses possess become clearer and more transparent to hospitalized patients at the orthopedic sections of the hospital?
2. How can the communication between nurses and hospitalized patients at the orthopedic sections become more collaborative and continuous?
3. How can a patient hospitalized at the orthopedic sections receive extended abilities to contribute to his or her own health care process?

The ideas presented in this section have partly arisen in discussion with nurses working at the orthopaedist and hand surgery section, employees at the NSM administration, facility management and with designers. This has been of help me to concretise my thoughts and has provided a prerequisite for developing new ideas.

4.6.1 Care plan

The pulse board solution utilized by the orthopaedist and other patient care sections are an important tool to manage a patient’s process through hospitalization. They do however have the disadvantage of being tangible artefacts, only located at specific locations. They also hold information that can be shared with the patients. This is something that could be transferred into a digital solution, enabling employees to connect to the same information where ever they are. I also believe this solution would be beneficial for communicating a patient care plan to the actual patient. By making this information more transparent, the patient would be able to better understand where he or she is heading during the hospitalization and receive more knowledge on how and why certain procedures are being done. This would also encourage more communication between the patients and nurses, as the patient may express concerns, questions and thoughts while the nurses are able to share their knowledge and gain a deeper understanding about the specific patient’s feelings and perception of his or her situation.

4.6.2 Voice-to-text

During a patient’s medical care course nurses perform many daily routines inside the patient room, such as removing catheters or initiating infusions. However, since they are forced to register and administrate these routines at an office computer they miss valuable time that can provide security to the patient by being present and speaking with them. A possible solution to this would be to develop a system that allows nurses to document their routines in the patient room. Voice-to-text technology can be utilized to allow the nurses to register specific actions to the computer system while they are doing
it which would reduce the need to manually register them. It could also make information more transparent to the patient, as he or she receives knowledge on specific procedures being done to make the patient healthy again.

4.6.3 Routine checklist

The checklist for the daily routines that the nurses performs could also be transferred to a digital solution, since it was observed that they currently exist on physical paper in the patient rooms. An alternative could be a digital checklist that the nurses can use via their mobile phone. This way, it would also become possible to receive notifications and reminders for these routine procedures. This could also be shared with the patient and provide the prerequisites for a more safe, present and effective care.

4.6.4 Activity goals

Many of the interviewed people at the hospital expressed that the assigned activity goals and the assessed nutritional needs were not communicated in an arbitrary way to the patients. Therefore, I believe it would be appropriate to develop a solution were these goals and needs are developed in collaboration between the nurses and patients, which would make this information clearer and provide both the nurses and the patients with an easier way to send and receive it. This could give the patient greater opportunity and motivation to contribute to their own health improvement in the care process but also provide a stronger sense of partnership with the nurses.

4.6.5 Shared knowledge platform

It would also be possible to create a platform where nurses, patients and patient relatives can share knowledge and information with each other. During my research studies I found that many experienced nurses can develop what they call “the clinical eye”, which can basically be described as detailed knowledge about different patient groups that they learn from work experience. If nurses were able to share and teach this knowledge on a shared platform, it would enable to educate junior nurses on what to look for and be aware of when it comes to a patient’s health. At the same time, it would also enable the patient and the relatives to better understand the diagnosis as a support for the health process. Patients and relatives could also share knowledge on this platform, for example, by telling how feelings and the approach to healthcare differentiates if one belongs to a religion. By communicating experience and information at a certain space, it can build conditions for strengthening the relationship and increased understanding between nurses and patients as well as relatives.
4.7 Design orientation and concept development

The activity goals and care plan are necessary parts of the healthcare operations and has a close connection between both the nurses and patients at the orthopaedist section. If the information from these could be communicated more efficiently, I believe that it would be very relevant and create a greater value for both parties, based on the guidelines I have formulated and the questions I strive to answer. Furthermore, they received the Therefore, I decided to prioritise these two ideas for concept development. The pulse board can be digitalized, and the activity goals can be transferred to a more efficient platform. They can also potentially be combined with the other ideas.

4.7.1 Tools

The tools that have been considered for further concept development have been inspired, among other things, from tools currently used by the hospital to communicate information between employees and patients. This does not mean, of course, that the tools need to be optimal for the purpose, but they have properties that were considered appropriate in this project. In addition, it was considered beneficial to use tools that people at the hospital are already familiar with.

4.7.1.1 Smartphone

Smartphones are something that most people own, and they have the advantage that you can bring and use them almost anywhere. This also means that you can more easily transfer and receive information very quickly. In relation to the hospital, it is an appropriate means of use as it creates the conditions for keeping both caregivers and patients constantly updated during the care process. In addition, with all the features that mobile phones possess such as GPS and accelerometers, there is potential to develop and add new features in the design.

4.7.1.2 TV-screen

There are TV screens located in various places at the hospital. In relation to mobile phones, TV screens are not as easy to move and without additional controls it is often not possible to change what information is displayed. However, they do have more screen space to utilize, which makes them effective when you want to display the same information to a larger group of people at the same time. Many decisions taken by the nurses at the operations section are taken in groups and not individually. I therefore believe that a screen that people can gather around creates conditions for discussion and more informed decisions.
4.7.2 Mobile activity goals

Through the activity goal application, the nurse and the patient jointly create goals for activities and nutritional intakes that provide the opportunity to improve the patient's healing process. The patient is given the opportunity to express his or her own needs and personal resources for carrying out activities, while the nurse can share his or her expertise as a basis for proposing the goals. In this way, customized goals can be developed for the patient which are realistic to fulfil, and both parties receive a comprehensive overall picture and documentation of what has been decided. With agreed goals decided by unanimity, it also enhances the sense of equality and partnership between the patient and the nurse. They receive an increased understanding of each other, which provides further prerequisite for good care.

The application itself becomes a tool for communicating the patient's path to improvement and with clear, easily readable information, it reduces the risk of misinterpretation. Finally, it also creates greater opportunity for the patient's relatives to help, as they may also take part of the set goals to support and motivate the patient to fulfil them.

*Figure 5. Storyboard of the mobile activity goals application concept.*
4.7.3 The digital care plan

The digital care plan is an effective way of syncing information between nurses and other relevant staff at the hospital. It also creates conditions for the patients to more easily understand their own care plan. Changes to the plan can take place at any time during a patient's hospital stay and through a mobile application, everyone can share the new information wherever they are and stay up to date. An additional means for this concept is a form of chat function. Through the application, the patients can receive detailed information about the operations, samples or treatments that are scheduled to be performed. If there are any thoughts or questions, they may comment them within in the application. These can then be answered through the same function by a nurse, or they may be used as a basis for dialogue in the patient's room.

The screen located in the operation department serves as a meeting point for nurses and other healthcare professionals. Through that, they can be gathered to discuss in groups, make decisions and make changes in patient care plans deemed necessary. If a specific patient needs help understanding his care plan, this will also be highlighted through the screen. One of the major advantages of using a digital screen as a pulse board is that it can be controlled via the mobile application. When something in a patient's care plan changes through the application, the information is synced to appear on the screen as well. This makes communication more effective and reduces the risk of misunderstandings. Potentially, it would also be possible to use a touch screen, which would make changes and communication possible via the screen as well.

*Figure 6. oryboard of the digital care plan application concept.*
4.8 Feedback from proposed concept ideas

It was expressed that the activity goal application would make it easier and more effective to create documentation as it could be used in the patient rooms. Furthermore, it would also help the nurses to see and understand the patients better as individuals, which would help them to provide better care from a wider perspective, beyond the patient’s activity plan.

To make information about the patients care plan more transparent was considered positive as it makes the patient more aware of what will be or needs to be done, which creates better adherence through the whole care process.

For both the activity goal and care plan application it was expressed that although digital information and communication tools would make the caregivers more accessible for the patients, there is a risk that it would reduce the physical meetings where direct dialogs take place – *When discussion takes place in the patient room, the patient feels noticed, safe and secure*. 

5 Discussion

Based on user-centred design methodology, it has been difficult to gain influence from patients during the design process. This is largely due to confidentiality and permission to conduct studies with this target group. Abras et. al (2004) believes that the considered users of one’s concept should have some form of influence in the design process. Based on this, the patients have been considered during the design process, but their level of influence has been limited. Therefore, I have used different sources to make patients more representative. Literature studies have been useful for this purpose. In addition, discussions with healthcare professionals and previous patients has been of help. I would have liked to involve the stakeholders of my project on a deeper level, as a co-design or participatory design project. However, this is a more time-consuming process, which in part requires initiating discussions between stakeholders (Abras et. al 2004), which also proved difficult to perform.

The observations and interviews conducted during the study have proven to be valuable in gathering qualitative data during the design process and for concretising ideas and concept development (Holtzblatt, Wendell and Wood 2005). Since sections at the hospital are linked to each other in several ways, it has also been used to try to get a holistic perspective of how the organization is structured. Through this, it has then been explained how one’s designs affect the entire structure to detect shortcomings and, in this study, observations and interviews have been conducted on different sections for
this purpose. However, within the time frame for this study, the number of places that have been visited may be limited. Sections at the hospital where patients and nurses are located has therefore been a priority.

Smartphones today are a common technology in society and are owned by a large part of Sweden's population. However, some people do not have access to technology due to various reasons, such as lack of interest or knowledge. If a person is unable to access and utilize the technology and solutions available in healthcare, this can in turn lead to poorer care. Through further development of the concepts to other platforms, using studies similar to those performed in this project as well as user tests, this target group could also have taken part in the solutions. But after all, I would say that smartphones are one of the tools that have the greatest potential for reaching out to a big part of the population. In addition, healthcare professionals, in this case the nurses specifically, are very familiar with smartphones through their work. The digital solutions make their work easier and more efficient, which in turn can provide better care to a larger group of people, even those who are not familiar with the technology.

As humans are social beings, communication is an extremely important part of our lives. Communicating using digital solutions is something that is becoming more common, especially in the younger generations. Although digital communication can be used to build relationships (Griffin 2011), I do not think you can overlook the physical contact. It became clear during my studies that physical contact is important for establishing relationships based on trust and knowledge. It is also something that is highly valued by nurses and other healthcare professionals. I would therefore argue that digital communication solutions should not serve as a replacement in health care. Instead, digital communication should serve as an extension of the physical meeting and enhance it. However, finding a balance between digital and physical communication in the design is something I believe must be developed over a longer period of time, where it is possible to develop multiple iterations of the design through user testing.

Information exchange between the patient and nurse has shown to be an important part of creating a more patient-centred care. It is through this that mutual respect is built and the partnership is formed. At the same time, I see a need to be critical of what information is given and to reflect on the situation. Some patients undergo surgery that in the long run is meant to save their lives, but these are not always successful. When this happens, the patient often has a need for support from relatives or caregivers when the information is to be received. If the patient would instead receive the information through a digital platform, it could have negative consequences. Some people also have a lot of anxiety about their health and do not want to know too much about their symptoms or diagnosis. To make information more transparent and to let the patient take part of his or her care plan is something that I in general consider beneficial, but I would also argue to
allow caregivers to remove parts of the information in the digital communication tools if deemed necessary. I would also say that the patient should have the choice of whether they want information or not.

6 Conclusion and further research

By applying a user-centered and contextual design methodology, it is possible to identify problem areas and the gaps that exist in the solutions that are currently implemented in the healthcare environments. By making use of the knowledge and expertise that the healthcare possesses is an effective way of developing new or to redesign solutions. This enables interaction design to create more meaning and effective care for nurses and patients.

Digital solutions can be effective tools for strengthening patient-centered care, but with automated solutions, the physical encounter between nurses and patients can be reduced. How to create the digital tools to build relationships between patients and care requires further research to develop a basis for how to shape them.
References


