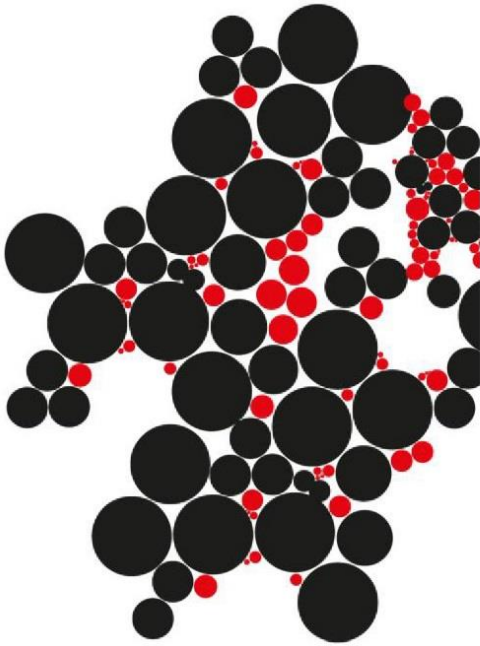




A PARTICIPATORY DESIGN APPROACH TO IMPROVE THE COMMUNICATION BETWEEN CARE PROVIDERS THROUGH AN ELECTRONIC HEALTH RECORD

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Abstract

This report describes the execution and results of a participatory design approach to improve the communication between care providers through an Electronic Health Record (EHR) suited for the Dutch home and nursing care. The goal is to create a design that supports the communication between the care providers, to eventually improve the Quality of Care. The research has been executed on behalf of the University of Twente (Enschede, the Netherlands) and Nedap (Gronlo, the Netherlands). Nedap is the owner of an EHR system called 'Ons' which is suited for the Dutch home and nursing care. The recommendations of this project are meant for this system, but during the user meetings users of different kinds of EHRs have participated. These participants were care providers working in nursing homes or the home care: elderly care physicians and nurses. They have provided a lot of input concerning what they want and need in their communication processes to provide a high quality of care. The input of the participants is complemented with theory from literature about how to improve Quality of Care in general. A high Quality of Care is defined as effective, efficient and safe care with a high level of client satisfaction.

Currently communication about the client is conducted through a variety of verbal and written channels. Communication through only one system, like the EHR, can support more effective working because it provides a better overview and might even save time. Efficiency is one of the aspects to improve the Quality of Care. However, risks like information overload exist.

In the first user meetings of this research the participants (elderly care physicians and nurses) made collages individually or in pairs with the goal to explain their needs and ideas. Together with supportive literature, the requirements to the EHR were set. Improvements in communication could be made concerning the writing and reading of reports about a client. To improve the Quality of Care supported by this functionality, focus should be on improving the quality of the documentation of information about a client and on improving the cooperation between the care providers.

Current EHRs only provide the opportunity for the user to report after a visit and read the reports of other colleagues about the situation of a client. It is proposed by the author of this paper that the Quality of Care can be improved if the user is stimulated to do more with a report when he writes it. Sending messages to others, creating tasks from the reports and labelling reports for later use are three aspects that were often mentioned by the participants and therefore integrated in the design.

Together with the participants, a design has been created and refined to eventually create a wireframe of a part of the EHR. A wireframe is a visual user interface which shows the functionalities of a system, but in which no attention has been paid to the graphical appearance of this interface. Most requirements (set after the first user interviews) have been met or are expected to be met when the system is used in practice. The participants were all very enthusiastic about the functionalities that were provided in the wireframe. The more the user will use the EHR to communicate about a client instead of using other communication systems, the less information about a client will be shared through these other devices and communication flows. When information about a certain client is shared through different communication flows, there might be a greater chance of information leaks, or no complete overview when this is needed. Therefore this wireframe can be the foundation for a system in which information about a client is saved at a single place. This makes the communication more efficient, which in turn makes the care more efficient (and therefore provides a higher Quality of Care). Furthermore the interface supports the workflow of the user. Therefore the user can spend less time at the EHR and more at the patient, which also supports the Quality of Care.

I Introduction

This report shows the execution and results of a Participatory Design (PD) approach to create a prototype of a part of an Electronic Health Record (EHR) to support the communication about a client between care providers within one healthcare organisation. The research question of this research is:

In what way can the Electronic Health Record contribute to the communication between the care providers within the care process of the client to eventually optimize the quality of care?

The research question consists many terms, like ‘Electronic Health Record’ and ‘care providers’ that might not be clear to the reader. A short explanation of these terms will therefore be provided in this introduction. More in-depth information about these terms can be found in chapter 2.

Due to limited time, Nedap has agreed upon a scope to focus on during this research. The environment in which the EHR will be used is limited to the nursing and home care and will only be used in one healthcare organization. The care providers are therefore care providers of one organization, both from the care and the medical sector: nurses, elderly care physicians and paramedical staff.

Care providers are the employees of the nursing or home care sector and care for the clients. The clients are mainly elderly people who are in need of care because of mental or physical illnesses and limitations. Care providers all have their own discipline and knowledge. Nurses for example help the client with their daily activities and an Elderly Care Physician (ECP) can be compared to a general practitioner, who prescribes drugs and takes care of diseases. More about the care providers and their responsibilities can be found in chapter 2.3.

This research focuses on the communication between the different care providers. Proper communication is one of the aspects to provide a high quality of care (see chapter 2.2).

As a contribution to better readability, this report makes use of the male gender when talking about ‘the user’, ‘the participant’, et cetera. In all cases ‘he’ can be replaced by ‘she’.

1.1 Participatory Design

A participatory design approach has been used to find out how the communication can be improved by use of an EHR. Participatory design is based on designing with the user instead of for the user. This approach pioneered in Scandinavia and was based on a democratic ideal, the right to participate equally in decisions concerning his or her life (Kyng, 1994). The users are the people who have most knowledge about what they want and need and therefore they have the right to participate. Even though in this research the approach is not applied because of the democratic ideal, the participatory design approach assumes that because of the users’ knowledge about their own needs and wishes, they can make the best products for themselves.

The right side of the table in figure 1.1 is occupied by participatory design as is indicated by the blue shading. At the methods at the right side of the figure, the users are seen as ‘partners’, at the left methods the users are seen as ‘subjects’. This explains the difference between User Centred Design and Participatory Design. Both methods rely on the users’ behaviour and opinion, but the extent to which these users are involved in the process differs. Since the author of this paper has no experience in the field of nursing and the elderly care, it seems very useful to let the experts in the field decide what is necessary and important for them as users. Three times in this research therefore the users (participants) have been asked to provide input in the project. A key characteristic of the participatory approach is the use of physical artefacts as thinking tools. Tools were provided to stimulate creative thinking and structuring of ideas. The researcher summarized the input of the different participants and created (with input from literature and experience) an interface which she presented to the participants again.

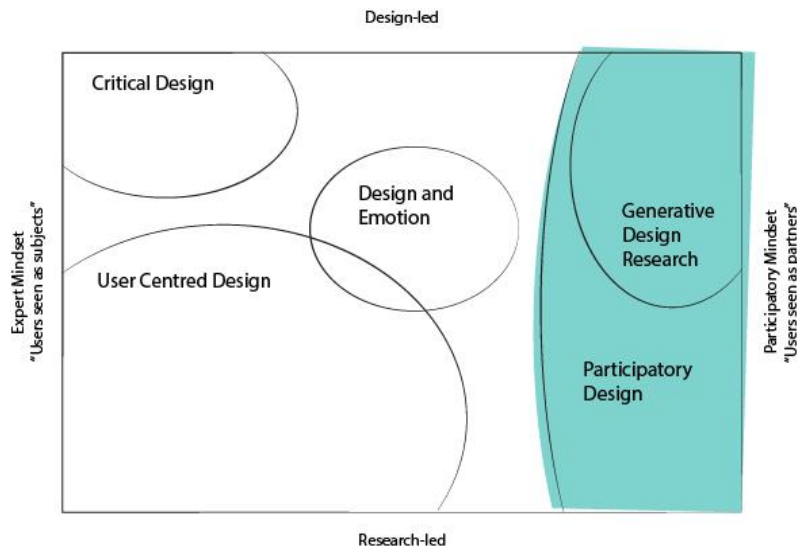


Figure 1.1: Fields within the Design Research (Sanders & Stappers, 2012). The figure indicates that in the participatory design approaches the participants are seen as ‘partners’ instead of ‘subjects’ (the left part of the figure).

1.2 Related Work

Preceding this research a requirement analysis has been executed to find out how the Quality of Care can be supported and improved by use of an Electronic Health Record (EHR). The terms ‘Electronic Health Record’ and ‘Quality of Care’ have been researched to understand how the EHR can improve the Quality of Care. To understand the scope of the EHR better, interviews have been held with the current users of an EHR within the elderly care. The important information gathered through this research can be found in chapter 2.

Other researches have already combined a participatory design approach to design (parts of) an EHR.

Sjöberg & Timpka (1998) describe how they used a participatory design approach to design information systems in health care. Their goal was, however, to develop a model that makes it possible for system developers to decide whether or not to use a participatory design approach. They mainly focused on viewpoints of the different participants and found that non-designers need more instructions before joining the design approach. No results have been found in this paper about how the information system could be improved.

Faber (2003) describes a participatory design of an Electronic Health Record. He researches two forms of participatory design: bottom-up (end-users focused) and top-down (management-dominated). Both approaches show disadvantages and Faber suggests that a more appropriate balance should be found between these two forms. A great disadvantage of the bottom-up method (like the one that has been used in this research), is the explosion of variety in solutions to a problem that can arise.

The research of Scandurra (2007) is closely related to this research. Scandurra (2007) did research on the home care sector and how the care providers can be supported in this sector. She therefore used a participatory design approach. She found that the needs of the have a lot to do with communication. The functions she describes are, among others, sharing of information, avoiding information overload, supporting documentation, notification of new information and high priority messaging. As will be shown, these functionalities correspond to the users’ needs found in this research. A big difference between the research of Scandurra (2007) and this research, is the scope. The design is general and broad (the whole Electronic Health Record), while this research focuses more on improving the communication and the Quality of Care.

1.3 Structure of this paper

Chapter 2 and 3 provide information to understand the research scope, as was already explained in the previous section. Consecutively the terms 'EHR', 'Quality of Care', 'care providers' and 'communication' are discussed. After understanding the theory the first user meetings were organized. Chapter 4-12 discuss the execution and results of the design approach.

Three times a user meeting has been organized. To preserve overview and structure, the research is therefore divided into three phases. This is not necessarily an aspect of the participatory design approach, but it is common to iterate. With regard to the time set for this project (6 months) and the goal (understanding how communication can be improved with the EHR), three iterations seemed appropriate for this research. Each phase starts with a user meeting and ends with the design of a part of the EHR. Figure 1.2 shows the iterations in the research. Every circle represents one phase. Chapter 4, 5 and 6 represent phase 1: establishing the requirements. In this phase the requirements concerning the design of an EHR to improve the communication between the care providers are defined, inspired on the first user meetings. The requirements led to a design of a part of the EHR, which is reviewed by the participants in a second user meeting. This user meeting is the start of phase 2 (chapter 7), in which the assumptions from the first phase are verified and improved by the participants. At the end of phase 2 a new design of the EHR was created (chapter 9). This design of the EHR was again showed to the participants (phase 3, testing the usability, chapter 10). In this last iteration the goal was to test the usability of the design to improve the design of the EHR. Figure 1.2 can be found at the start of every phase and chapter to indicate what part of the iteration will be handled in the concerning chapter and phase.

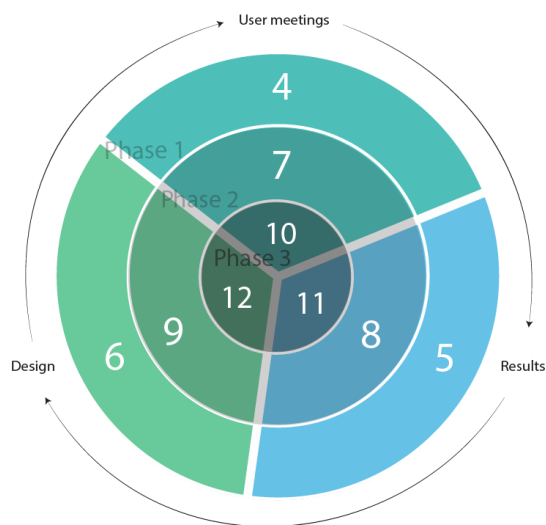
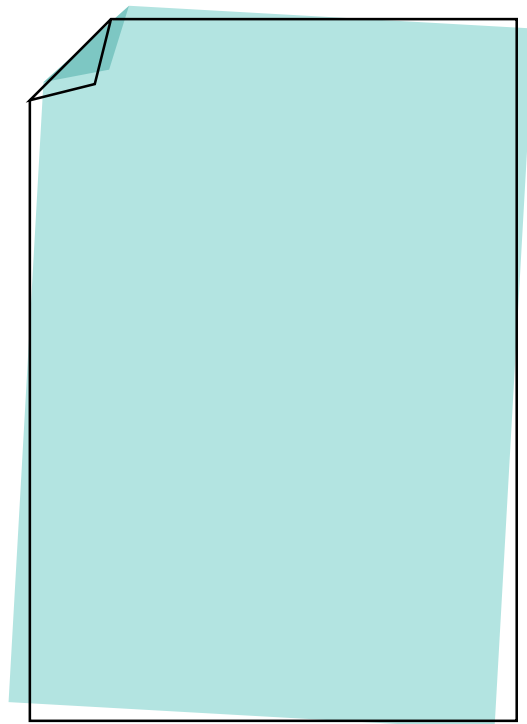


Figure 1.2: Schematic overview of the research approach. The three circles show the three phases of the research. Every circle segment represents a chapter, from chapter 4 to chapter 12. Every phase consists of three parts: user meetings, the processing of these meetings and a design proposal.



THEORY:

“Creating a fundament”

2 Preliminary Research

2.1 The Electronic Health Record

This research focuses on the Dutch Electronic Health Record (Dutch: 'Elektronisch Cliënten Dossier') meant for the elderly care. However, it was difficult finding a Dutch definition describing the term. When searching for international definitions of the Electronic Health Record, one can find many discussions about its nomenclature and definitions. Most found nomenclatures are the Electronic Health Record (EHR) and the Electronic Medical Record (EMR). To avoid confusion the different definitions of these nomenclatures will not be outlined here. In general it seems that the definitions of the EHR correspond better to the Dutch record, so therefore the term Electronic Health record will be kept as the standard in this research. Researches that use other nomenclature are translated to EHR for the clarity of this report. The definition adapted from Gartner (2014) will be used, because this definition fits best to the scope of this project:

“An electronic health record (EHR) system contains patient-centric, electronically maintained information about an individual’s health status and care, focuses on tasks and events directly related to patient care, and is optimized for use by clinicians. The EHR provides support for all activities and processes involved in the delivery of clinical care. The definition of an EHR system limits its scope to the continuum of care in one HDO [Healthcare Delivery Organization]” (Gartner, 2014)

An EHR is a complex system with many benefits and drawbacks. Because of the many information components the system contains, the design can be created in many different ways. From the requirement analysis on how to create an EHR that supports the Quality of Care (Wolbers, 2014) some requirements to a good EHR were found. This requirement analysis consisted of literature research and interviews with nurses and physicians.

The EHR should fit the practices in the different environments (home care and nursing homes). Although the home and nursing care sector have much in common, a big difference is the way clients can be treated. In the home care the nurse is the guest, while in the nursing homes the client is guest. This changes the way people communicate. Furthermore, the multidisciplinary team is more extensive in the nursing homes and therefore more challenging.

The purpose of a health record is ‘to recall observations, to inform others, to instruct students, to gain knowledge, to monitor performance and to justify interventions’ (Reiser, 1991). It is important to keep in mind the different functions that an EHR can have and which user makes use of certain functions. For example, a nurse would like to inform others at the end of his shift and gain knowledge/recall observations at the start of it. The biggest advantages of an EHR are the increased legibility and the accessibility of data anywhere, anytime (Car et al., 2008; Menachemi & Collum, 2011; Michel-Verkerke & Hoozeboom, 2012). Furthermore, an EHR could be an assist in making decisions and it is easier to locate cases and clients in this electronic record (Car et al., 2008).

Pitfalls of an EHR are also mentioned: Changes in patient-care provider interaction may occur (Car et al., 2008; Michel-Verkerke & Hoozeboom, 2012) and there could be too much trust in the system and inappropriate system use that causes chances on wrong information (Car et al., 2008; Menachemi & Collum, 2011). Also technical problems could occur (Michel-Verkerke & Hoozeboom, 2012) and people are worried about the patient’s privacy (Menachemi & Collum, 2011).

Finally, interviewees indicate that a good EHR is defined by its interface: a simple interface that delivers information connected to the needs of the user. To create such an interface, the needs of a user should be understood thoroughly. See more about the needs of the user (based on interviews with them) in section 2.3.

2.2 Improving Quality of Care

2.2.1 Definition

The Quality of Care (QoC) is defined by several variables, of which efficiency, effectiveness and patient orientation are used by the Dutch Care Institutions Quality Act (Zuidgeest, 2011) and implemented into this research. Patient-orientation is subdivided into client satisfaction and Quality of Life, although overlap exists. Campbell, Roland, & Buetow (2000) found two main aspects which define the quality of healthcare; accessibility and effectiveness. The IOM (2001) defined six components of quality of care: safety, effectiveness, patient-centeredness, timeliness, efficiency and equity. Most EHR research focuses also on effectiveness and efficiency, combined with patient safety (Menachemi & Collum, 2011). To avoid confusion, one definition should be used. Quality of Care will therefore be defined in this research as:

Whether individuals can access the best possible care they need and want, and whether this care received is effective, efficient and safe.

This definition is based on the definition of the Dutch Care Institutions Quality Act (since the project is aimed at the Dutch EHR), complemented with 'safety', since this is mentioned in many other definitions. The variables which are worked with are therefore 'effectiveness, efficiency, safety and client satisfaction'.

2.2.2 Improving Quality of Care

A widely accepted framework of Donabedian (1988) shows how quality of health care can be improved in the three following aspects: **Structure** (the stable elements of the care system), the **process** (the interaction between the client and a provider) and the **outcomes** (results of the care). First the structure should be established; the preconditional factors of the healthcare (Harteloh, 2000). The **structure** influences the likelihood on a properly functioning care process. Kazley & Ozcan (2008) suggest that because of their automated nature it is likely that EHRs would function as a structure and therefore can influence the process of care. The **process** of care is the interaction between the client and the care provider. The process is what eventually influences the **outcomes**: the changes in the state caused by a (medical) intervention (Harteloh, 2001). In the Netherlands these changes are measured by qualitative and quantitative indicators.

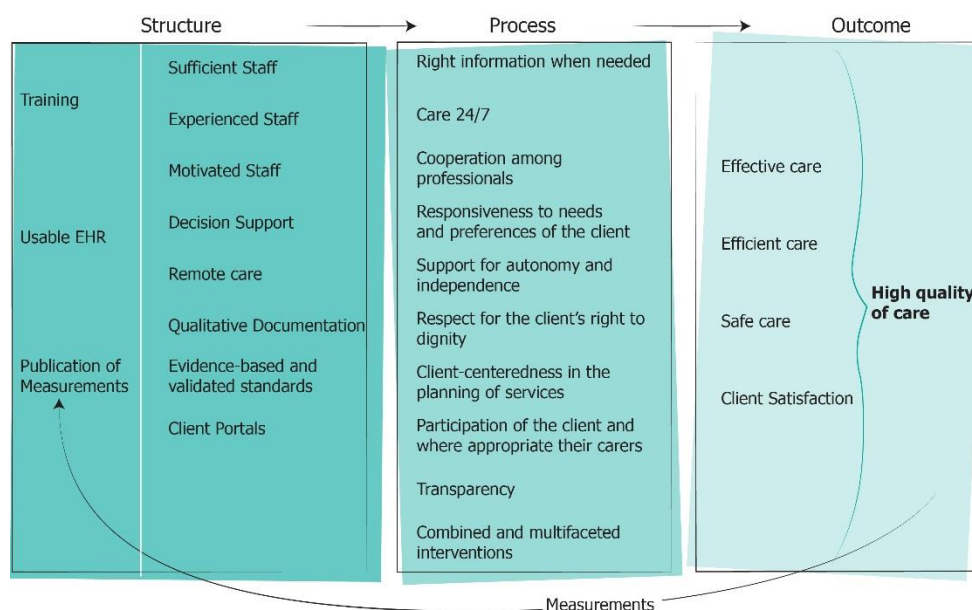


Table 2.1: Structures, processes and outcomes in one scheme. The structures and outcomes are split in two parts. For the structure the resources and the following parts of the structure are split. The outcomes are split into the dimensions of quality of care (Wolbers, 2014)

Several solutions are offered by the literature to improve the Quality of Care. These solutions can be found in table 2.1 in the structure part of the table. Especially decision support systems are recommended (Scott, 2009), because they prevent the user from making mistakes. These systems warn for example the user about drugs interference when he prescribes a new drug. Experienced and motivated staff are at the base of improving quality of care. Training and publication of quality of care measurements and a usable EHR might influence their mind set and should therefore be at the start of quality improvement.

Furthermore, listening to the client is the basis of good care and technology should not counteract this. It is one of the processes mentioned in table 2.1. Another important process is good cooperation between the disciplines (Boorsma et al., 2011; IOM, 2001). Currently the EHR is often only used to inform others. Communication can have other goals, like triggering someone to take action, asking for help or to think along. These types of communication could be better supported by an EHR, to eventually improve the QoC. The goal of the EHR would be to support the users in better cooperation in the delivery of care. An example mentioned by an interviewee would be that he could easily tag a report he just made and send it with a request to think along to one of his colleagues. An EHR would be a useful method to support the communication over distance and/or over time. A care provider can easily drop by his colleague in a small institution to communicate about a problem, especially when it is relevant now. Information sharing over a longer time span or over long distances is more problematic and therefore interesting. One might think about a problem that is solved now, but can return next year. Or information that should be shared in a transfer between the nursing home and the hospital. More information about communication and its aspects can be found in the next chapter.

2.3 The users and their needs

This project makes use of a participatory design approach, which means that the users are actively involved. But it has not been clearly explained who these users are, what they are doing and what they need from the EHR. Therefore, below a presentation of the different users is given. Elderly Care Physicians, a practice nurse, nurses and nurse aides have been interviewed. Some care providers were acquired by Nedap. The author of this paper has contacted nearby healthcare organisations to acquire more care providers. The focus in the interviews was to understand their daily

activities and workflows. Beside these interviews information has been gathered from the research of Bloemendaal, Albers, de Kroon, & Dekker (2009).

2.3.1 *The Elderly Care Physician*

An Elderly Care Physician (ECP) can be seen as a combination of a primary care expert in geriatric medicine and a basic specialist with expertise in geriatric medicine (Koopmans, 2013). He is the main practitioner in a nursing home and provides guidance to a multidisciplinary team of nurses and paramedical specialists.

Although it is assumed that the ECP works in a nursing home, it is also possible to work as an ECP in the hospital, mental health care, the hospice or as advisor/co-practitioner of the general practitioner (Faas, Heidstra, & Doornbos, 2012). Because of the attempts to keep clients live longer in their own homes, the ECP will get an increasing role outside the nursing homes.

The ECP has the final responsibility of the care plan of a client. Frequent processes of the ECP are visiting the client, having multidisciplinary meetings (MDMs), family meetings, acute cases and intakes.

Visiting a client is done frequently (often on a weekly basis) to make sure the client is doing as planned. It is a set route and the client and nurses are aware of this planning. The nurses are able to prepare questions about the client beforehand, so the questions are clustered. On the other hand, acute cases are not planned and often unprepared. In those cases, an ECP needs to be able to quickly assess the situation and define a plan.

For all disciplines it is most important that the user receives the right information at the right moment. This would be when visiting the client, when having multidisciplinary or family meetings, in acute cases and intakes.

The ECP has contact with many different disciplines and, as mentioned before, communication in a multidisciplinary team is essential to achieve good outcomes. Therefore, an ECP should be supported in sending the right information to the right person, but also receiving the right information and being able to handle this information.

2.3.2 *Nurse practitioners*

Nurse practitioners (NPs) can be found at the border area of the medical and nursing field. They are mainly deployed as co-therapist, expert and director. The most important reason for deploying a nurse practitioner is because of the decrease in formation of the ECPs (Bloemendaal et al., 2009). Furthermore, a nurse practitioner can be a perfect link between the nurses and the physicians. There are some variations to the deployment of the nurse practitioner; he could run a number of departments with the ECP as rear-guard or he could run several specific tasks in support of the ECP. Globally the ECP and the NP conduct the same tasks. However in all organizations there are also tasks which are reserved for the job of doctors, like the diagnostics, the implementation of a treatment and the prescription of (new) medication. A NP often proposes medication, which he then reviews with the ECP.

In general, ECPs are positive about the deployment of the nurse practitioner (Bloemendaal et al., 2009). The NPs know their own limits and ECPs are called in cases of acute problems or doubt. Another important task of most NPs is the coaching and training of nurses.

It might happen that the nurse practitioner is the highest discipline within a healthcare organization, for example in a care home.

Since the nurse practitioner has a job of which the activities are close to those of the ECP, the way of supporting is also quite similar. Important for the nurse practitioner is close contact with the ECP. The ECP should check for example proposed medication, this should be asked and confirmed through the EHR.

Besides nurse practitioners, also 'practice nurses' and 'specialized nurses' exist. They have more responsibilities than nurses have, but are more directed towards the medical sector. A practice nurse is able to take over a medical treatment of specific groups of clients, like clients with diabetes or decubitus. Often they also perform triage: they are the first contact for the care and decide whether or not a practitioner should be called. Specialized nurses have also a specialization in a specific group, like wound care, diabetics or strokes, but they lack authorization over practice nurses.

2.3.3 Nurses

There are several levels of nurses in the Netherlands. In this study, a distinction will be made between extramural versus intramural nurses, and between nurses with a lower educational level (called nurse aides) versus the higher educated nurses (called nurses).

A team of extramural nurses consists of a home nurse and many aides. The home nurse has the final responsibility, the nurse aides execute the basic skills and visit the client most of the time. At the intramural care a team of nurses and nurse aides is also available, although there are more nurses because the intensity of care in nursing homes is higher. Therefore, there is more frequently a need for skills that only the higher educated nurses possess. The activities of the nurses are outlined below.

A home nurse is responsible for the clients in his ward and their nurse aides. He regularly visits the clients that are helped by the nurse aides to preserve the quality of care. He checks the health record and sees how the patient is doing and feeling. Furthermore there are some clients that need nursing care (like wound care) who he visits frequently.

In many nursing homes, the general nurse is often replaced by nurse aides. Instead many are operating at the departmental level as team leaders. Nurses who work at the department level are often first-responsible nurses (EVV) and the first contact for the client. They are responsible for the continuity of care of the client.

Both in the intra- and extramural care the nurses have a key function in the communication between the medical and the care team. Nurse aides often have questions concerning care activities for the nurses. Communication support and overview is needed. Nurses often care for a higher number of clients than nurse aides do (according to interviews with extra- and intramural nurses) and they therefore need to quickly receive an overview of the current status of a client.

As a coordinator or team leader, the nurse is mainly gathering information about the tasks done by the team. Therefore, for him it is important to see the progress of all clients, also when he has been away for a few days.

2.3.4 Nurse aides

Of all disciplines, nurse aides interact with the clients most often. This is true for both extramural and intramural nurse aides. In extramural care, they help the clients with daily activities like showering, eating and taking medicine. For every client one of the nurse aides has the first responsibility. He maintains the communication with the relatives and the team leader. The nurse aides work in shifts and are therefore confronted with a lot of information transfers. To avoid an overload, they rather only be notified when something is aberrant from the care plan. Within the extramural care, the basic principle is that the client can do everything on his own. The nurse aides only help the client with the agreed tasks. Making an appointment with the physiotherapist or the general practitioner belong to the responsibility of the client, unless otherwise agreed upon.

Intramural nurse aides have the same tasks, but they do not have to travel from client to client; all clients are in the same institution. They work in shifts to preserve care 24 hours per day/7 days a week and can check how the client is doing whenever the nurse aides feel like they have to. When something is wrong or questionable, they can ask nurses or other higher professionals for help.

Extramural nurse aides can also call their team leader (often a nurse) or, in cases of emergency, the general practitioner of the client for help.

Transfers should be supported; when a nurse aide opens the record he should immediately understand what happened and what he needs to do today. Furthermore, contact information about the relatives and higher disciplines should be easily found. The nurse aides communicate a lot with the other nurse aides in their team to help each other to deliver the best care to all the clients. This communication could also be supported by the EHR. The information they gain, should be clearly documented, in such a way that the ECP or nurse can easily understand the status of a client.

2.3.5 The client

The client is theoretically the owner of his Electronic Health Record and should be asked for permission before others can look in to his record. In practice most institutions have created their own authorization systems and the client only agrees once. At all times, the client is allowed to look into his record. The need of the client is to get better or remain in the current health condition. An important aspect for the client is his quality of life. To improve the quality of life, it is important to understand what a client likes or dislikes. In the elderly care there are clients who lack the mental competence to make decisions about their own lives. It would be interesting to find out how one could understand the needs of these clients. Nowadays, the first responsible relative (or friend, neighbour...) is asked to make the decisions. One can only assume that this is what the client wants.

2.3.6 The relatives of the client

For every client there is a primary contact of the relatives. Via this person information is shared among the care providers and the family/friends of the client. More and more is asked of the relatives of a client. Because of the changes in the Dutch health care, solutions within the family will be researched first before one will receive home or nursing care. This is called the Social Support Act. Since the relatives are playing a bigger role in the care of a client, they will also have a higher need to be informed about him. The care providers need information from the relatives about the client. When a client is mentally incompetent to make decisions about his life, the primary relative is the one to decide. Furthermore, the family is the one who knows what a client has been like before he got ill. Memories of the past, hobbies et cetera can improve the quality of life of the client during his stay in a nursing home. Involvement of family in the care process is therefore important.

2.3.7 Paramedical staff and psychologists

The paramedical staff can include (depending on the focus and size of the nursing home) occupational therapists, dieticians, physiotherapists and speech therapists. In general, all medical professionals that are not physicians can be classified as paramedical staff. Paramedical staff belongs to the medical team of an intramural care organization. They are involved in the treatment of a client on request of the ECP. For example, an occupational therapist can be asked to watch the sitting posture of a client or a physiotherapist can be asked to help in the client's revalidation process.

2.4 Hierarchy

There is a certain hierarchy within the elderly care, both in the extramural and in the intramural care. This is reflected by the order of the previous subsections, except for the client and the paramedical staff. Although there are differences in each organization, there are several attributes that are true in most cases. In the intramural care, the ECP is often the communication point between the care sector and the medical sector (other ECPs and the paramedical staff). For example, if a nurse thinks that the client needs to see a physiotherapist, he will ask the ECP to decide and call in a physiotherapist. The ECP is authorized to see all the information about a client, because of his central role which is highest in the hierarchy. The ECP receives information from the other

therapists one to one. In the care sector however, often not all nurse aides are supposed to call the ECP. In most cases a nurse or a team leader is the contact person of the nurse aides, he communicates with the ECP. Figure 2.1 shows a schematic overview of the hierarchy. Again, this is just an example: the exact implementation differs per institution.

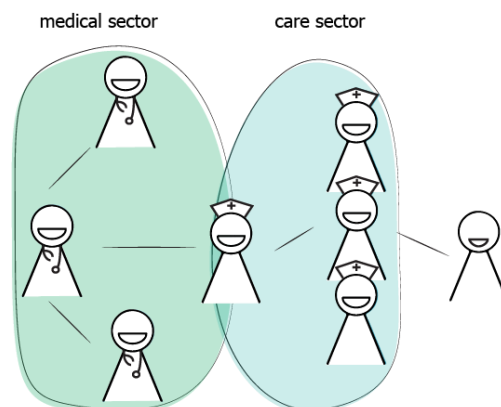


Figure 2.1: A schematic overview of the hierarchy. From left to right the ECP, the paramedical staff, the nurse, the nurse aides and the client are represented.

Within the extramural care, a lot of the communication is done via the client when he is able to call other disciplines by himself. Just like the ECP in the intramural care, the general practitioner can be seen as the central figure. Communication from the care sector goes via the first responsible nurse.

The client actually tops the hierarchy, but the information he shares often is passed on by the nurse aides and nurses, because these are the care providers they see the most. Paramedical staff can be seen as a branch of this hierarchy.

Everyone passes information to everyone about their findings during their visit/ward round. Top down tasks are assigned. The other way around questions about the treatment are asked. This is not strict. For example, an ECP could ask a nurse to check how the treatment is going and whether he thinks something should be changed or not. In this case the roles are reversed. However, when a treatment should be changed, deployed or closed, it will be always the responsibility of the ECP, together with the client.

2.5 Summary

This chapter has discussed the EHR, the Quality of Care, and the users of the EHR and their needs. The EHR is a complex system with many benefits and drawbacks. Table 2.1 showed that the EHR could improve the Quality of Care by supporting qualitative documentation, decision support, client portals, evidence-based and validated standards, and cooperation among professionals. The professionals have different needs according to the EHR. They all need the right information at the right moment. ECPs are allowed to see a lot of information about the clients they care for, which makes that they have a specific need to see the most important information for them. They also communicate with many different disciplines. The nurse aides on the other hand, mainly need the EHR to know what they need to do today. Especially changes in the plan and the current situation of a client are important information aspects for them. Nurses have to communicate a lot, just like the ECPs. Furthermore they need to easily understand the progress of the situation of a client to indicate whether action or change is needed.

3 Communication

Communication means the sharing of information, but this is too general and too non-informative for this study. The term has therefore been unravelled in figure 3.1 based on the five W's and one H (who, what, where, when, why and how). In the next sections the questions will be outlined separately. Because of the scope of this research, only communication between care providers *concerning information about the client* is taken into account. Although this might seem very limiting, in a healthcare organization a lot of communication is about a client (or a group of clients), especially when talking about multidisciplinary treatments. To cooperate, one will inform one another about the current status, discuss treatments, arrange shifts, and many more.

Based on the first user meetings with the participants (see more about these meetings in chapter 4) and some additional literature research, this chapter provides an overview of the term 'communication' to understand all aspects one should take into account in order to design for communication.

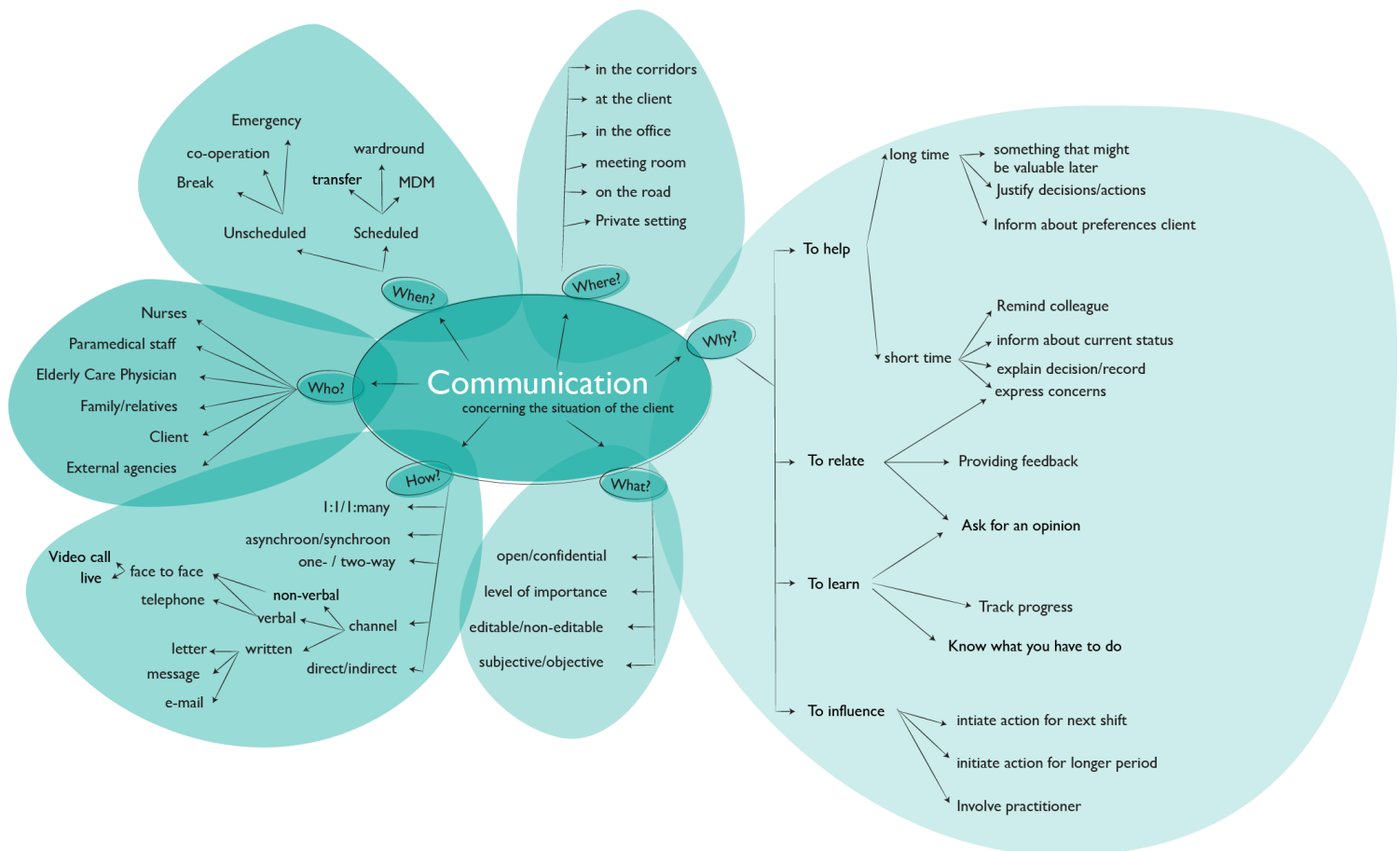


Figure 3.1: A scheme of the all kinds of communication about the situation of a client.

A scenario has been written to show a bit of communication of the situation of a client, Mrs Adams. She has pain in her back, but it is not clear what causes this pain. Therefore several care providers are asked to think along about this problem. The scenario was made up by the author of this thesis, based on the meetings with several care providers during the research. Below the scenario the questions from figure 3.1 are elaborated. In this elaboration references are made to the scenario. The scenario is therefore an example to explain how extensive communication in the elderly care is.

Mrs Adams is an 87 year old woman who lives, just like her husband, in a nursing home called 'The Sunshine'. She has been living here for over a year now and she notices more and more signs of decline of her body. Since two days she experiences a nasty pain in her lower back and she decides to ask the nurse aide for advice. During the 15 minutes transfer of the nurse aide, the nurse aide tells her colleague face to face about Mrs Adams' problem. Later in the day, the colleague asks Mrs Adams later today if she experiences some improvements. However, this is not the case. Therefore the nurse aide decides to request advice of the care coordinator. She calls the care coordinator at the end of her shift, but the connection is poor. The nurse aide asks for advice, but the response of the care coordinator seems not to accord to her question. She therefore decides to stop this conversation and send an SMS text message to make an appointment for tomorrow. The care coordinator responds immediately, he is currently in a noisy environment, but will be there tomorrow.

The next day, the care coordinator arrives. He does some tests, but cannot find a cause of the pain of Mrs Adams.. He decides that the pain is not that severe that immediate action is required,, but it can wait until the next ward round of the ECP. He writes his concerns in the notebook designed for the ECP visits and the results of his tests as a report in the EHR.

Two days later the ECP arrives. She does some checks and tells the care coordinator (who joins the ward round of the ECP) that he has done a good diagnosis. It is indeed not severe, but it is important to get a closer look at it. The ECP prescribes a painkiller, which she also notes down in the care plan of the EHR. The nurses have to dispense this drug the next days and track the progress of Mrs Adams' conditions.

Back at her workplace the ECP writes an e-mail to the occupational therapist. The ECP thinks that the problem is related to Mrs Adams' lying position. Therefore she asks the occupational therapist if he want to think along about this problem. That afternoon the occupational therapist visits Mrs Adams at her room and does some tests too. He decides that it is indeed related to her lying position and prescribes a new tool.

The next week the multidisciplinary meeting (MDM) is planned. Among others, the ECP and the occupational therapist prepare their part by reading their reports about Mrs Adams of the past months. During the MDM each domain is discussed and everyone can say what he wants to say about the specific domain. Together they create a new plan. Due to the persistent back pain, it is decided that the physiotherapist will do further exercises with Mrs Adams. The focus will be on pain relief rather than being able to move more. Of course, this must still be discussed with the client. Therefore, the responsible nurse walks straight back to Mrs Adams after the MDM to ask if she agrees with the plan. Mrs Adams is very happy with the plan and agrees. The responsible nurse writes this in the record as a new report. The ECP changes the treatment plan and sends an e-mail to everyone to notify that she has changed and finished it.

3.1 Who?

Communication starts with a sender, the source of the information. The relationship with the sender is partly determining for the receiver to accept or decline certain information (Thomas, 2006). Thomas (2006) defines three groups of communication sources: informal, formal and impersonal sources and discusses them from the client perspective. Informal sources are sources like family, friends and social groups. Especially for the client these are important credible sources.

Formal sources include the persons who communicate as part of their job (Thomas, 2006). In the case of this study, most communication will be received from formal sources. However, one might imagine colleagues communicate in an informal way too when talking about their personal life, or thoughts about other colleagues or clients.

The last source is the impersonal source. Thomas (2006) describes this source as a third source, but in fact both formal and informal sources can be impersonal or personal (Kaye, 1995). In most cases however, formal sources are impersonal and informal sources are personal. The mass media, like the internet, is a popular example of an impersonal source.

The sources of information are the persons who are involved in the communication about a client. This is of course the client and his family. Furthermore, the nurses, the paramedical staff, the Elderly Care Physician and external agencies (like a hospital or specialist) will be senders and receivers.

The scenario example shows different sources of information. The first is Mrs Adams, an informal source who informs the nurse aide about her feelings. All care providers are named formal sources when they talk about the situation of the client, since this is part of their jobs. The formal sources are therefore in this scenario the nurse aides, the care coordinator, the ECP and the occupational therapist. All sources are personal.

Since two days she [Mrs Adams] experiences a nasty pain in her lower back and **she** decides to ask the nurse aide for advice. During the 15 minutes transfer of the nurse aide, the **nurse aide** tells her colleague face to face about Mrs Adams' problem. Later in the day, **the colleague** asks Mrs Adams later today if she experiences some improvements. However, this is not the case. Therefore **this nurse aide** decides to request advice of the care coordinator. She calls the care coordinator, but the connection is poor

3.2 What?

Several information types are saved into an EHR. Examples of these types are contact information, results of investigations, a care plan and personal notes (Actiz, 2013; Car et al., 2008). Except for maybe the personal notes, these types of information are also the things that are communicated between the care providers. Besides there might also be some information that is shared, but will not be written into the EHR. Think for example of a working schedule of a nurse. It is hard to create a full list of subjects a care provider or client is communicating about. However, one can state something about the properties of the information types. Information that is shared can be open or confidential, have a certain level of importance, can be editable or non-editable, and objective/factual or subjective.

In the scenario most information that is shared is confidential, it is personal information about Mrs Adams, but visible for all involved care providers. Some information is objective (the tests and the painkiller information), some information is subjective (advice and the expression of concerns, the pain description of Mrs Adams). Also the level of importance differs for the information chunks described in the scenario. The responsible nurse goes immediately to Mrs Adams to get her consent, because this is important information before the treatment plan can be generated. The care coordinator thought that the information about the status of Mrs Adams was not of high importance and therefore decides to write it down instead of calling the ECP. This shows the influence of the type of information on the 'how' and 'when' aspects of communication.

The next day, the care coordinator arrives. He does some tests, but cannot find a cause of the pain of Mrs Adams.. He decides that the pain is not that severe that immediate action is required,, but it can wait until the next ward round of the ECP. He writes **his concerns** in the notebook designed for the ECP visits. Two days later the ECP arrives. She does some checks and tells the care coordinator (who joins the ward round of the ECP) that he has **done a good diagnosis**. It is indeed not severe, but it is important to get a closer look at it. The ECP prescribes **a painkiller**, which she also notes down in the care plan.

3.3 Where?

Communication can take place in very different situations. The sender and receiver might be in the same room or communicating over a distance. Figure 3.1 shows examples of environments where communication can take place. The environment and distance often the 'how' of communication (see section 3.6).

The scenario shows three different environments in which communication takes place: at the client, in the office and in a meeting room.

Back **at her workplace** the ECP writes an e-mail to the occupational therapist. The ECP thinks that the problem is related to Mrs Adams' lying position. Therefore she asks the occupational therapist if he want to think along about this problem. That afternoon the occupational therapist visits Mrs Adams **at her room** and does some tests too. He decides that it is indeed related to her lying position and prescribes a new tool.

3.4 When?

Time is an important factor within communication. Timing can determine whether a message reaches its goal or not. For example, if one needs certain information, he will pay more attention to the message than when it is not relevant at the moment. Furthermore, time can influence the choice of the channel (see section 3.6.1). If response or action is needed right now, one would use other channels than if response is needed within a week, or if no response at all is required.

Besides time, also the situation might influence communication. Certain situations lead to certain types of information. If a person is in a closed room, more confidential information can be shared than in a public room.

A lot of communication is going on during the change of shifts. The care providers want to transfer information to share their experiences (see the next section 'why'). The current status of a client is transferred, but also concerns can be expressed, or one might need or want to explain something. Furthermore, one will use this time to ask the other care provider to think along about a diagnosis or a treatment. Questions are asked and decisions or actions might follow from these conversations.

Time is involved a lot in the scenario. Communication takes for example place at the change of shifts or when the ECP is doing her ward round. Some information sources communicate within a short time span after retrieving the information (the nurse aide calls the care coordinator, the therapist comes to take a look the same day). On the contrary the client decides to wait two days before she communicates her concern and the care coordinator also waits before he transfers the information.

Since two days she experiences a nasty pain in her lower back and she decides to ask the nurse aide for advice. **During the 15 minutes transfer** of the nurse aide, the nurse aide tells her colleague face to face about Mrs Adams' problem. **Later in the day**, the colleague asks Mrs Adams later today if she experiences some improvements. However, this is not the case. Therefore the nurse aide decides to request advice of the care coordinator. She calls the care coordinator **at the end of her shift**, but the connection is poor.

3.5 Why?

As the example in the previous section described, there are many reasons why one would communicate. Figure 3.1 shows an overview. DeVito (2008) mentions five purposes why people communicate: to learn, to relate, to influence, to help and to play. Since this thesis is only about the communication concerning the situation of a client, the reason 'to play' is left out of this research, because the purpose playing is to 'pass time'. The other purposes are shown in figure 3.1.

3.5.1 To help

A first reason for a care provider to communicate about a client is because he wants to inform one or more persons. This is often about the current situation of the client. Information about the current status of a client is called communication over a short time, because it is (in general) only relevant over a short period. Over this short period, one might also want to inform the receiver to express his concerns or to explain something. Finally, one might want to communicate because he wants to remind the receiver about an action or event.

In figure 3.1 one can also find transfers of information over a longer period of time. The sender wants to transfer information, because he thinks that it might be valuable for later or for a longer period. Certain information might explain symptoms in the future and the preferences of a client are valuable information chunks for now and later. The sender also could want to communicate because he wants to justify earlier actions or decisions.

In the scenario a lot of information is shared to help: to inform each other about the current situation. However, in most cases this is combined with the purpose to influence, because action of the receiver is needed.

The next day, the care coordinator arrives. He does some tests, but cannot find a cause of the pain of Mrs Adams. He decides that the pain is not that severe that immediate action is required, but it can wait until the next ward round of the ECP. He writes his concerns in the notebook designed for the ECP visits and **the results of his tests as a report in the EHR.**

Two days later the ECP arrives. She does some checks and tells the care coordinator (who joins the ward round of the ECP) that he has done a good diagnosis. It is indeed not severe, but it is important to get a closer look at it. The ECP **prescribes a painkiller, which she also notes down in the care plan of the EHR.** The nurses have to dispense this drug the next days and track the progress of Mrs Adams' conditions.

3.5.2 To influence

The next day, the care coordinator arrives. He does some tests, but cannot find a cause of the pain of Mrs Adams. He decides that the pain is not that severe that immediate action is required, but it can wait until the next ward round of the ECP. He writes his **concerns in the notebook designed for the ECP visits** and the results of his tests as a report in the EHR.

Two days later the ECP arrives. She does some checks and tells the care coordinator (who joins the ward round of the ECP) that he has done a good diagnosis. It is indeed not severe, but it is important to get a closer look at it. The ECP **prescribes a painkiller, which she also notes down in the care plan of the EHR**. The nurses have to dispense this drug the next days and track the progress of Mrs Adams' conditions.

Messages do not need to only inform the receiver, they might also initiate an action. Actions can be set for once or for a certain period. The moment of the action can be specified, but it is not needed. The ECP in the scenario for example wants to involve the occupational therapist in the treatment of the client, and influences the nurses to dispense a pain killer for the next days.

3.5.3 To learn

The sender might also want to communicate because he wants to ask a question. An action of the receiver is required, in this case he needs to give an answer. The sender might ask the receiver to think along, because he is in need of advice about for example a diagnosis he made. He might also have a question about something he read or heard. At last, one can also ask a question purely out of interest. These kind of questions will often be asked in the corridors (section 3.3).

The sender might also want to know more about the current situation, or the tasks he needs to do. He can ask a colleague, or search for it in the health record of the client.

Examples can be found in the scenario. The responsible nurse asks Mrs Adams about her preferences to learn about her preferences. The nurse aide at the start of the scenario wants to learn from the expertise of her care coordinator. The ECP communicates during her ward round to learn about the current situation.

During the 15 minutes transfer of the nurse aide, the nurse aide tells her colleague face to face about Mrs Adams' problem. Later in the day, the colleague **asks Mrs Adams later today if she experiences some improvements**. However, this is not the case. Therefore the nurse aide decides to **request advice of the care coordinator**.

3.5.4 To relate

Especially when talking about communication in general, people often communicate to relate. If one asks for example how one is doing, this is not merely because this person wants to learn something, it is also a form of building relationships. Also in the scope of this research the care providers communicate to relate, because this is an important step in cooperation. Building relationships has a lot to do with subjective information. Asking about an opinion, providing feedback on someone's behaviour and expressing concerns are therefore all connected to the purpose 'to relate'.

In the scenario the ECP says to the care coordinator that he has done a good job. This is typically communication with the purpose to relate. A less obvious situation is the change of shifts in which the nurse aides share concerns and advice each other. This is also a form of building a relationship,

but it has also the purpose to help, learn or even influence. It is shown that in practice the purposes to communicate often overlay; the lines are not clear.

The next day, the care coordinator arrives. He does some tests, but cannot find a cause of the pain of Mrs Adams. He decides that the pain is not that severe that immediate action is required, but it can wait until the next ward round of the ECP. He writes his **concerns in the notebook designed for the ECP visits** and the results of his tests as a report in the EHR.

Two days later the ECP arrives. She does some checks and **tells the care coordinator** (who joins the ward round of the ECP) **that he has done a good diagnosis**. It is indeed not severe, but it is important to get a closer look at it. The ECP prescribes a painkiller, which she also notes down in the care plan of the EHR. The nurses have to dispense this drug the next days and track the progress of Mrs Adams' conditions.

3.6 How?

3.6.1 The channel

DeVito (2008) distinguishes two forms of communication; face-to-face (verbal and non-verbal) and computer-mediated communication (written). He describes the differences of some communication elements between these two. For example, written messages can be retrieved by others or forwarded verbatim to anyone. Verbal communication, on the other hand, can only be repeated without complete accuracy. Furthermore, the number of receivers (see section 3.6.3), the context (section 3.3) and the permanence of the message are dependent on the channel.

Verbal communication through the telephone is often executed if the message is urgent and action is needed quickly. In the home care sector the phone is more often used than in the nursing home sector, also for example to order drugs. In nursing homes, this is often done by written communication.

Verbal communication also takes place in less urgent cases, for example when care providers run into each other on the hall way. These conversations might be just about how someone is doing, but sometimes also decisions about a treatment of a client might be discussed and decided in the hallway.

A third manner of verbal communication can be found in the change of shifts. The care providers share the events of the last shift. Although the events are also described in the record, many interviewees indicate that they like to communicate this also orally to share their thoughts about the problems and provide nuances to the records they entered.

Many interviewees indicate that they write e-mails to their colleagues to inform or require information from them. E-mails are mostly used to communicate with other disciplines and within the medical sector. The nurses themselves often communicate orally or by chat messages. These are shorter messages, often meant for one colleague or a team. According to the interviews, it seems that messages are more used in the home care sector than in the nursing homes. They use it to inform the colleague who will do the next shift about something important that happened at the client. In the nursing homes, there is often a face to face transfer of 15 minutes available to discuss matters about a client, the home care sector only has the (electronic) health record to communicate. This might be a reason why send messages to each other more often.

A letter (analogue or digital) is often used when a client is transferred from, for example, the hospital to a nursing home. Letters can also be referrals. In short, one can say that letters are used access to the record of the client is denied.

In the scenario different channels are used for different purposes. Face to face communication, communication through the telephone, a notebook and an e-mail message. Which medium is used is mostly defined by the importance and therefore the time. When possible face to face communication is preferred by most care providers in the scenario, because one receives immediate feedback. Verbally, but also non-verbally.

3.6.2 *Asynchronous/synchronous*

This aspect has a lot in common with the channel used. Synchronous communication is 'live' communication: one receives response immediately. The receiver and sender should both be available at the same time in synchronous communication. The telephone calls and live conversations in the scenario are examples of typical synchronous communication types. If the sender and receiver are not available at the same time, one talks about asynchronous communication. An example of asynchronous communication is leaving a note for the receiver (just like the notebook in the scenario, or the e-mail message). If communication is asynchronous, the communication might not be directed to a specific person or group.

3.6.3 *I to I, I to many*

Communication can be one to one (for example between a nurse and an ECP), one to many (an ECP to a team of nurses) and one to a specific set of people (for example the ECP to the involved care providers in the multidisciplinary meeting (MDM) in the scenario).

3.6.4 *Direct and indirect communication*

Communication can be direct (from the sender to the receiver), but the information might also first pass a third party. In the case of this study, communication between the nurse aides and the ECP is often executed via a nurse or nurse practitioner. Indirect communication has a drawback that the message is more likely to be misinterpreted (see section 3.7, below). However, care organizations like to make use of this system to avoid *information overload* for their care providers. The nurse acts as a 'filter'. Not all information that is shared by a nurse aide is important for an ECP to know, so the nurse makes sure only the messages related to the ECP are communicated to him. In the scenario the communication is often partly direct and indirect. The information that Mrs Adams shares is passed to the occupational therapist by many persons, but every person adds new information to the message.

3.6.5 *One or two-way communication*

If a sender sends a message, response might be required or not. When looking at the 'why' of figure 3.1, one does not specifically need a response when he informs the receiver about the preferences of a client. However, if one asks a question, he certainly needs a response.

If response is required, the communication is called two-way: the receiver responds to a message and thereby he becomes the new sender. The sender becomes the receiver. Communication often takes place over a short time (section 3.4). An action or answer is needed, or the message should at least be confirmed.

In the scenario most communication is two-way. At the end the ECP uses a one-way communication method through sending an e-mail to notify the care providers about the changed plan, because no response is needed.

3.7 **Noise**

An often used communication model is the model of Shannon and Weaver (Shannon & Weaver, 1971). The sender and the receiver are shown in this model (figure 3.2), both with their channel. In the middle of the picture, noise is drawn. Noise is all that interferes with the communication process and therefore changes the message. DeVito (2008) describes four types of noise: physical

noise, physiological noise, psychological noise and semantic noise. Physical noise is external interference, like illegible handwriting, poor grammar or loud background sounds. Physiological noise includes impairments of the sender or receiver, like hearing or memory loss. Psychological is about mental interference in the speaker or listener. One can think of biases, closed-mindedness or a lack of interest. At last, semantic noise appears when the sender and the receiver have different meaning systems. The use of ambiguous words or abstract terms can cause semantic noise.

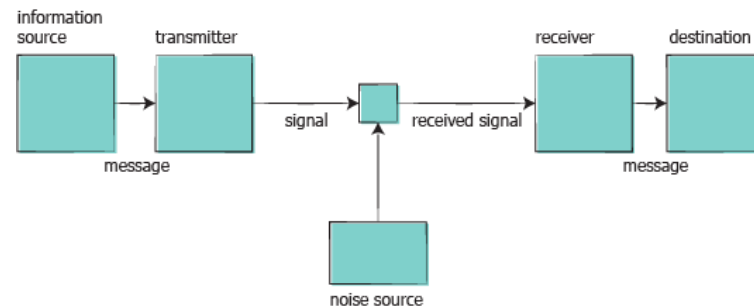


Figure 3.2: A schematic overview of the communication model of Shannon and Weaver (Shannon & Weaver, 1971, p. 34).

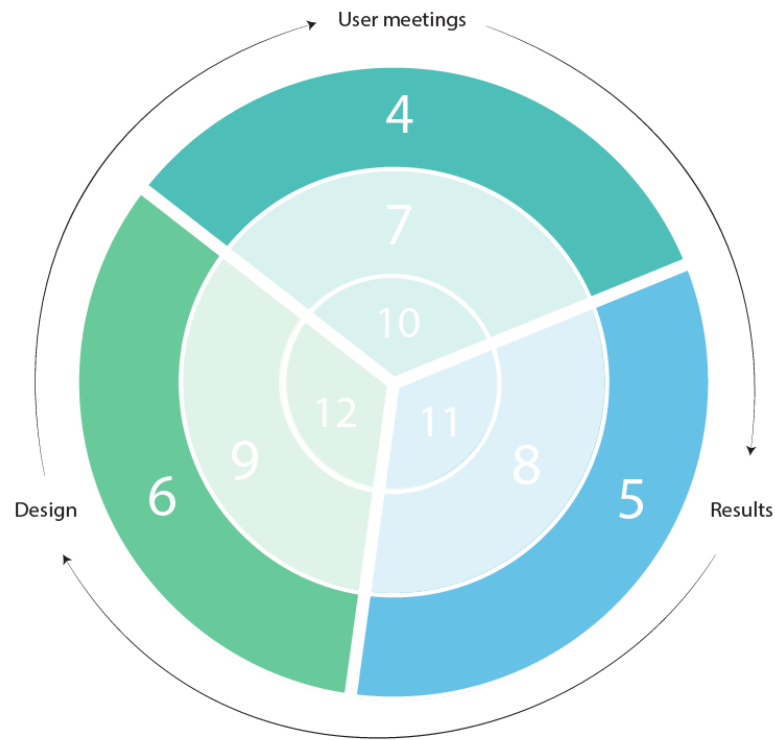
Shannon & Weaver (Shannon & Weaver, 1971) also refer to the semantic problem as one of the levels of communication problems. The other levels are called ‘the technical problem’ and the effectiveness problem’. The technical problem is closely related to the ‘physical noise’ of DeVito, the effectiveness problem is comparable to the psychological noise. Shannon & Weaver state that all three levels are overlapping and interrelated.

Furthermore, information overload can cause the receiver to not fully understand the message. People seek out information automatically, so if the information is coming too fast, people tend to put up barriers (Thomas, 2006). If a user is overloaded, he is more likely to respond to simpler messages and generate simpler messages, although not intended.

In the scenario there is only one sign of noise: the poor telephone connection. Luckily the nurse aide recognizes the noise and sends an SMS for confirmation. More noise might have occurred in the scenario. It might have happened that the care coordinator interpreted the complaints of Mrs Adams wrongly and just told the nurse aides to continue their current treatment, because he has experienced that Mrs Adams complains quickly.

3.8 Summary

Communication is more than talking or transferring information. In this chapter the term was unravelled based on six questions (who, what, where, when, why and how). Many aspects that were found are dependent on other aspects. How a person communicates depends on the goal of his message and the current situation (environment, timing, person). Many communications takes or could take place through the EHR. It is therefore important to keep in mind which aspects of communication change when a certain design decision is made.



PHASE I:

“Establishment of requirements”

4 Phase I: User Meetings

As mentioned in the introduction, a participatory approach is used in this research. The figure at the right shows that this is the first part of the first phase. At the start of every next chapter (until the conclusion) this figure will indicate the progress of the research. The theory and approach of the first user meeting will be explained in this chapter. Information gathered during these first user meetings was also used in the previous chapter about communication.



4.1 Theory

Typical for participatory design is the use of physical artefacts as thinking tools throughout the process (Sanders, 2006). In this first part of the research 'generative tools' were used, which are tools of a more design-led method to understand the needs of a user. The name refers to the creation of a common language between the users and the designers/researchers (Sanders, 2006). Generative tools are generative in such a way that the participants can express their ideas through the items and therefore they are more able to explain to the designers what they want. Generative tools are often used in the front end of the design process and will also be used in this research in the first phase to determine the needs of the users.

To reveal the user's needs, one could look at what people say, do and/or make (see figure 4.1). 'Say' techniques are for example interviews. Saying reveals the explicit knowledge level of a person. When looking at what people do, more knowledge is revealed. This is knowledge that cannot be stated in words. Observable knowledge can be achieved by observation. Participants are often not aware of their behaviour and are therefore not able to articulate this knowledge in an interview. An example might be that someone is always making faces while he/she is on the phone (Sanders & Stappers, 2012).

'Make' techniques are generative sessions. When people make artefacts, their tacit knowledge is being addressed. Tacit knowledge was first introduced by Polanyi (1964) (as cited in Visser, Stappers, van der Lugt, & Sanders, 2005). The theory is based on 'we know more than we can tell'. Tacit knowledge refers to knowledge which one cannot explain in words. For example, one can provide another a list of all things he should know before he is able to ride a bike. However, after memorizing the list he will still not be able to ride it. He will have to practice and suddenly there is this moment where he has the knowledge of how to ride a bike, which he cannot describe to others. To reach this knowledge level, people should be able to make and create, just like riding the bike is creating the movements of riding. This level is harder to reach and therefore drawn 'below the water level' in figure 4.1. Figure 4.1 shows the levels of what people, say, do and make, the methods that belong to these levels and the corresponding knowledge levels.

The 'make' level explores experience at this deeper level. Although one will reach this level with generative tools, the 'make' level should not be used on its own (Sanders & Stappers, 2012). Therefore, the participatory design methods contain elements of make, say and do techniques.

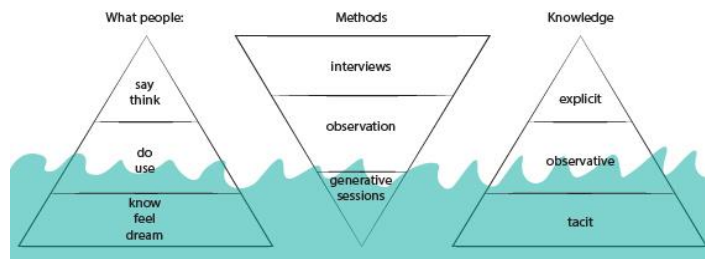


Figure 4.1: Methods of research and the layers of knowledge (Sanders & Stappers, 2012). Generative sessions can reach a deeper level of knowledge and should reveal what people know, feel and dream.

The generative tools method is closely connected to the grounded theory approach. The basis of grounded theory approach is to generate theories, instead of testing theories. In this approach empirical fieldwork and links to 'the real world' are important. The grounded theory originates in the work of Barney Glaser and Anselm Strauss. Their book was published in 1967. In the course of time the approach has been changed by many researchers to fit it for their own purposes, but the basic ideas remain constant (Denscombe, 2007). When executing grounded theory, the researchers start with an 'open mind'. This matches well with the generative tools that were explained earlier on. When using generative tools there are no theories created beforehand, but they are created by the participants during the sessions.

Toolkits for generative sessions often consist of trigger items. These trigger sets are not generic, but should be custom-made for the purpose of a certain study (Sanders & Stappers, 2012). A trigger can consist of all kinds of tools, 2D or 3D. Examples are photos, words, puppets, scrap materials or construction kits. The form suggests a way of using it, but it is still open to the user to decide which items of the trigger set he wants to use and how he want to use them. It is important to decide which tools to include in the set and which should be left out. For example, photos tend to elicit emotions and memories, puppets are useful for storytelling, and 3D shapes can quickly be assembled to product prototypes. According to Sanders & Stappers (2012) the trigger set should vary in content, abstraction, level of ambiguity and openness, aesthetics and form. Typically, a word-and-photo set to create a collage in 10-15 minutes consists of about 100 words and 100 images (Sanders & Stappers, 2012; Sanders & William, 2001).

A big threat in using a toolkit as an aid for getting information from the user, is the chance of influencing and steering the participant. The choice of the tools triggers the user, but other tools might have triggered other ideas or feelings. This is unavoidable and therefore important to take into account. Sometimes it is even useful to know that you are steering. In an example from Sanders & Stappers (2012) it was shown that they choose round tools to work with on purpose. The assignment was to create a vision for a new workflow and round tools ensure the participants did think about zones and activities instead of rooms.

The raw, 'messy' data after the generative sessions should be analysed to find patterns and directions to explore further. Chunks of data can be compared to find similarities in relation to a specific topic. The chunks of data should be coded and then categorized (Denscombe, 2007). Unlike quantitative research, the categories are not set beforehand, but are created throughout the process. To create the categories, 'statement cards' can be used (Sanders & Stappers, 2012). To create a statement card, one selects a quote from the transcription and writes it down on a card. Then the designer writes on top of the card a statement about how he interprets the quote, like a function a system should contain. More designers execute this same task. Then the statement cards are merged, discussed and categorized to find structure in all the gathered information. This way of analysis is used for inspiration and little analysis.

4.2 Implementation of the method



Figure 4.2: Picture of the tools and the background used in the first session. The background shows three circles, ranging from 'required' to 'desired'. The toolbox consists words, photos and more abstract pictures. Besides, sticky notes were provided. See appendix II for an overview of all words and pictures.

The trigger set used (figure 4.2, see for all words and pictures appendix II) is very open and interpretable in several ways. A small brainstorm was executed to gather all kinds of words and pictures. The background was designed to guide the participants to think about what is really important (the middle of the circle) and desirable, but not necessary (outer circles). The more the words and pictures are placed to the outside of the background, the less important they are for the participant. This approach is based on the research of Garde (2013), which was also used in a medical and care setting. In her research care providers of different disciplines were involved in the same session. In this research this was avoided, because it is about the needs per discipline. Involving more disciplines in one session could cause one discipline to be overshadowed by others.

Four ECPs, five nurses (two extramural, three intramural) and ten nurse aides (six intramural and four extramural) have participated in the sessions. The generative sessions have been held with one or two participants per session. Preferably the sessions were held with two participants per session. However, due to time constraints and lack of availability of participants in the holiday period, this was not always possible to accomplish. The sessions were recorded and transcribed afterwards.

After transcription the transcripts were interpreted by the author of this report and two User Experience designers from Nedap. They all read the transcriptions and created the statement cards (Sanders & Stappers, 2012: 'analysis on the wall'). These statement cards have been structured into twelve categories, which will be described in the next section (section 5.1).

5 Phase I: Results

The figure to the right shows the second part of the first phase. In this chapter the results of the user meetings will be explained. The goal of this chapter is to create requirements of the EHR, with the purpose to improve the communication between the care providers.



The participants were all provided the tool set of figure 4.2. Figure 5.1, 5.2 and 5.3 show three examples of collages that were created by the participants. The collages were mainly meant to stimulate the participant to tell stories and to decide what they think is important and what is less. The collages have therefore been very useful for storytelling, but they are not further figured out in the processing of the sessions. This has been done with the transcriptions of the sessions as can be read in section 5.1.



Figure 5.1: a collage made by a nurse. Artefacts placed in the middle of the circle are most important, the aspects at the outer circle are still important, but not necessary to implement.

5.1 Findings

5.1.1 *The participatory approach*

The generative sessions have been held with one or two participants per session. Caused by the tools, the participant(s) had the lead in the session instead of the facilitator. The facilitator only had to return the focus to the research question several times, because some participants had a tendency to stray from the topic. However, a lot of different aspects were discussed thanks to the tools. They inspired the participants to think of other stories and problems. It was expected that this would work better than interviewing, because it involved less guidance from the interviewer. The pictures were of course also influencing, but the participant is able to interpret the picture in his own manner, which is not possible with interview questions. Especially the photos had a great impact and elicited most of the ideas the participants created.

It was sometimes hard to get people out of their comfort zone. The photos had a great impact on the variety of subjects people talked about, but they were inclined to tell about current or past events, instead of thinking about the future. For example, two nurse aides work in a region where the wireless network is not working properly. Although they knew that they were asked to dream without restrictions, they constantly referred to the network problems. They stated that they could not think of a solution, because the connection was too slow.

5.1.2 *The categories*

The statement cards have been ordered into twelve categories. Below these categories are elaborated, numbered from 1 to 12. Every category is named after a 'wish', a vision of the ideal record:

1. The EHR would run on a device that provides up to date information at any time

There are differences between the devices that the interviewees use. As a result, there is also a spread in the level of mobility. In general, most interviewees indicate that 'it would be better if they could use a tablet'. They indicate that if they had a tablet, they would be able to have a more up to date overview and that they would be able to enter data even faster. This would, for example, lead to more, and more detailed reports. They were annoyed by the fact that they have to walk back and forth to the computer to enter and read information. Furthermore, the computer is in some cases located at an inconvenient location, which causes annoyance.

Another technical issue has to do with the network connectivity. Two home care nurses used tablets, but often worked in the border area between Germany and the Netherlands, which caused difficulties with the network connection. They also mentioned another drawback of their use of tablets: Distrust is created at the clients caused by the tablets. The clients are not well aware of the functionalities of such a tablet: They only see the nurse aide enter information into a device, which is then taken outside their house. This is different from the paper-based record, which was in their own homes and could be looked into by the client or family at all times.

2. The EHR would have an understandable interface, which I can operate in a few clicks

Many interviewees indicated that they were in need of training, or at least refresh courses. All interviewees had some kind of a course before they start using the EHR. However, especially the nurse aides had the feeling that they had forgotten how to work with some features in the EHR and that this might cause some mistakes. Furthermore, new features were added to their record in the course of time, of which they did not know how they work and therefore they did not use them.

Although training might indeed be a solution, it also suggests a lack of usability of current EHRs. If one can understand an interface without training, this would be more time and cost efficient. During the interviews the participants mentioned more usability features, which will be listed next.

The user would like to..

- be able to sort and gather information from a care and treatment plan;
- reuse information without having to 'copy and paste';
- have some support in qualitative reporting;
- use a system that would learn patterns from the user's behaviour;
- see relationships and links in a record;
- spend as little effort as possible to find the information he is searching for;
- execute his actions in a workflow, without disruptions like switching screens.

It is interesting to see how the interviewees describe their vision of a usable interface. One ECP compared the EHR to Prezi: the user can see all links, can zoom into parts to see the details, et cetera. A nurse described a big screen that would hang in every client's room. She would only have to say what she needed and the information would appear on the screen. Not only information of the record, but also activities like dimming the lights would be done by use of this screen.

3. The EHR would contain a message service to communicate with colleagues

It is clear that there is a need for care providers (mainly nurse aides) to communicate about clients, but also about the side activities. Some interviewees indicate that they use multiple devices or applications to communicate with their colleagues. They use for example the mail and SMS text messages to talk about clients, and a mobile chat application to mutually change shifts. Furthermore, clients are discussed orally in the corridors or during the breaks. More about communication channels was written in the section 3.6. To make sure the shared information is safe and easy to retrieve, the interviewees mention that they would like to use one message service coupled to the EHR.

Two nurse aides indicated that they would like to use something like a forum, in which they can pose health-related questions. Colleagues could then help each other through this forum.

4. Relatives would be able to easily provide input about the client's needs

What I have often noticed, is that when you attend a cremation and someone is describing what the resident has been like in the past, that I think: 'Eh? That's interesting, I wish I had known that before!' (Quote nurse aide)

This quote shows, though not literally, a problem many interviewees faced. Many said that they would like to receive more input of the family. They mainly need input about the past of a client, because the care providers can then respond to these hobbies and activities to promote the quality of life of the client. Furthermore, they can use the history to initiate a conversation and thereby create trust.

Family often has the tendency to pull their hands off the client once they brought him to the nursing home. They often have provided a lot of care before they reached the level at which they decide it is better for the client to live in a nursing home. They are relieved of the care, although this is often the time where input of the family is most needed to comfort the client (interview ECP).

It would be interesting to create a system in which family can easily provide input about the client, for example in the appearance of a book of life, or questionnaires.

5. The EHR would provide validated standards and support me in doing research

Some ECPs are interested in doing some research to, for example, find out how many patients they have had with a certain disease et cetera. Furthermore, an ECP expects the EHR to support him in making decisions. ECPs, but also nurse aides spoke about the opportunity to include protocols in the record.

6. The EHR would encourage personal attention to and well-being of both the client and me

What does the client want? [...] Most of the time the answer is: I would like to go home [...] Well, that is not possible, so how do you make sure that he will experience this residence like his home? So you have to create a sense of home. Beautiful expression, sense of home. People don't feel at home. We think so, we all deliver good care. But then we tell them and our colleagues 'we are leaving, we are going home'. That is for the client who is not able to go home the moment to tell you he also wants to go home. He wants to leave with you. (Quote ECP)

Humanness in the elderly care is important, both for the clients and the care providers themselves. This might cause conflicts as stated in the quote above. Nurse aides have a need for collegiality. One nurse aide for example also mentioned the importance of meeting her colleagues at the start of their shift, because her colleagues are willing to help each other more because they know their backgrounds. Also saying goodbye is part of collegiality. On the other hand, care providers put all their effort in supporting the Quality of Life of the client. Feeling at home is one of the aspects of the Quality of Life. A nurse aide mentions that she thinks paying attention to the wellbeing of the client is the most important part of her job, more than providing care and especially more than completing the EHR. That goes with not always following the rules, something on which many interviewees agree upon. Rules are important, but with your own expertise it should be possible to do something else in the interest of the wellbeing of the client.

Personal attention also means that the client is involved in the process. An ECP said that they first discuss a new procedure with the care providers, before submitting it to the client, while it should be the other way around. The EHR should encourage this.

Finally, many nurse aides appreciate the moment they transfer information to the nurse of the next shift. They mentioned that their organizations are trying to shorten this time of transfer, because all information is also written in the EHR. The interviewees (nurse aides) said that they liked the oral transfer of the information, because they are then able to think along or exchange thoughts.

7. The EHR would provide me with just the information I need

If one asks a care provider what his vision is of an ideal Electronic Health Record, one can expect that the answer will be: 'I would like an easy and clear record'. This was also the case in these interviews. What 'clear' means is different per user, but the bottom line is that everyone prefers an overview in which he sees the information that he thinks is valuable. A record should be adaptable and learn from the 'habits' of a user. This adaptability should also provide the user the freedom to enter information the way they like to work. Especially the ECPs indicate that they would like to work multidisciplinary, but they are in need of their own treatment plan, coupled to the plans of the others. They would like to work 'episode-oriented' (Dutch: 'episodegericht werken'). See the glossary (appendix I) for more information about episodes.

Nurses have to communicate with many different people; they are often the link between other disciplines. One home nurse who participated in the research, showed two mobile phones and one tablet which he carried around all day to communicate and make notes. He used these different devices, because he felt that none of the devices was ideal for accomplishing all his goals. He would benefit from a system that would support him in creating an overview in all communication and events. Nurse aides on the other hand, are more interested in the tasks they need to carry out today, and especially in the tasks that are different than usual.

Beside the different needs of the users, the information one needs to view is also dependent on the situation of the client. Clients who need to revalidate have other goals and therefore the care provider needs to keep an eye on other aspects than for the clients who suffer from chronic diseases.

8. The EHR would support feedback giving to other care providers

Although this research is focused on communication between care providers concerning the client, other communication problems have been mentioned too. An example mentioned more than once is that care providers should have the opportunity to give feedback to each other. They should be able point out the mistakes of their colleagues.

9. The EHR would show only information to the ones that are authorized to see it

Authorization is a big issue concerning the Electronic Health Record. To preserve privacy, not every care provider is allowed to see all the available information. Basically, the client should be able to decide which information is shared with who(m). However, the borderlines are blurry. An interviewed ECP tells an example in which the secretary reads the wishes concerning reanimation et cetera to the ECP, while the ECP rushes to the client for an emergency. In this case, it is useful that the secretary knows this information, while in general this information is none of the secretary's business.

10. The EHR would support multidisciplinary working, even with external care providers

Everyone has his own specialism, but the essence lies in the integrated care provision. That is precisely our strength, that's why we are, in the elderly care, a party to take seriously. (interview ECP)

Often when the interviewees were asked about communication, they started to talk about the need to communicate with other disciplines. Often within an organization, but they also expressed their needs to have better communication with external disciplines. For example an ECP and a nurse aide (intramural) both described how a 'cut' is being created in the care provision when a client is transferred from or to a hospital. Because of the lack of possibilities to transfer the record, much information has to be gathered again or the transmission of the information is delayed. Therefore one is not informed about the history of a client the moment the client is admitted to the hospital or nursing home.

Furthermore, many interviewees indicated how important it is that one is informed about the activities of the other disciplines. According to the quote of the ECP above, the strength of the elderly care is the multidisciplinary care. To support this multidisciplinary care, various ideas have been mentioned. One would like to have more insight into the records of the other disciplines and involve each other into the care process. By having more insight in the 'total plan' and the 'total agenda', mistakes can be avoided. A nurse explained how she improved the care by reading the records written by the nurse aides. The nurse aides do not always recognize the need to action or did not read the previous records. These 'errors' are removed by the double-check of the nurse.

One would like to perform more actions within the EHR, like sending messages (e-mails) and the handling of appointments, so that one would be able to faster and safer communicate with the other disciplines. Everyone should be kept up to date, including the ones who have no access into the record.

During the ward round of the ECP, the nurse aide takes notes. Afterwards the nurse aide writes down a report per client about this visit into the care plan. The ECP does the same, but writes his findings in his own treatment plan. The interviewees feel that this is redundant and suggest that the ECP should be able to write his own part, which should then be coupled to the care plan.

11. The EHR would help me in organizing and sharing of information

Well, something I notice [...], we are working with a 'zorgleefplan', that is where you report. [...] Save, exit, and then go to my mailbox to ask 'Hey physiotherapist, please remember to check this or that'. Or I need to write it down, those kinds of things. If you could do that at one point of the record, if you could open a dialog window everywhere [...] It should not be that hard. A kind of link which you can send: 'Hey Peter, I have reported this, think along with me'. Peter then receives a link and is guided immediately to the related report. (Quote interview ECP)

This quote describes the ECP's vision on his ultimate record; a record which allows you to communicate with other disciplines wherever you think it is useful. In fact, one could describe it as tagging or selecting a part of information and share it with others. Other interviewees indicated that they would like to be able to 'tag' information so they could find it back easily, or to indicate that a certain report is important for others to read. These wishes are all collected under the title 'organizing and sharing of information'.

More interviewees (mostly ECPs and nurses) described how they use their e-mail system to ask somebody to have a look at their report. It would be safer and more efficient if this could be combined. Something a care provider reports can be important for another discipline. This does not mean that the colleague should immediately take action, raising awareness might be enough. Especially during the day the care providers would like to receive notifications, because they read reports of their clients at the start of their shift.

Some nurse aides described that they would like to see only the important reports of their clients when they have not been working for a couple of days.

In the previous chapter it was already described that 'information' is a broad term, which also emerged during the interviews. Factual observations should be shared in a report, but the interviewees would also like to have the opportunity to exchange their thoughts about something they find in the record, which might be more subjective information. For example, one might have a question about a diagnosis made by a colleague.

In short, the participants would like to link information of the record (especially reports) to other goals. A goal can be communication with another discipline or with a colleague (subjective or objective), save information for a later goal, or to indicate the importance of certain information.

12. The EHR would help me in reminding activities and attract my attention when necessary

We have a lot of appointments, so that is something I miss. We have got a calendar, a residents calendar, in which we write down when somebody has to take a blood sample for the thrombosis service. Well, it would be very useful if you add the date to their record in the computer and it will appear in the morning as a report. [...] And other appointments you can remind people of. That it appears..

A yellow memo appears: "there is an appointment for the hairdresser" A couple of times in the morning. That seems very useful to me. (Quote interview two nurse aides)

It was already mentioned that care providers are in need of notifications of important information. Also notifications of tasks and to-do lists were mentioned. Care providers have to execute many tasks during a normal day. Especially the nurse aides explained that they have several standard tasks to execute when visiting a client. They would like to receive reminders if they have to do an (incidental) 'unusual' task. Also in the care sector, it might happen that an ECP initiates a task that should be done by someone from the care sector. Four interviewees said that it would be useful that when someone will do the task, he can indicate that. Until that moment, the task should appear in everyone's view.

Interviewees indicated that they would like to see what is important to do and to read today. This is about tasks and appointments, but also about important reports. It would be useful if the user would be actively notified. Nowadays many care providers said that they had to search by themselves for important reports or tasks, which makes them forget or miss things. However, there should be 'not too many beeps', as one ECP said.

Some nurse aides described how they send each other messages to inform each other about little things they do not write in the record. This might be because it is subjective information, or to tell someone he has to take the backdoor to get in.

Finally, more care providers (mostly ECPs and nurses) said that they would like to have more certainty about whether one read his report or task. They would like to have some kind of read receipt. Two nurse aides told how they had created rules within their team. One team had arranged that they had to answer every message, it might be only a 'yes' or an 'OK'. The other team agreed otherwise: if you send a message for tomorrow and you send it before 5 o'clock today, you can be sure that your colleague has read it. If you want to send a message later, you will have to call to make sure one reads it.

5.2 Focus points

A lot of information was gathered and narrowed down to twelve categories. Not everything can be solved in this research and therefore choices need to be made. Below it will be explained why certain categories have or have not been chosen to be part of the design. In this search for focus, choices have been mainly made based on the design possibilities of a certain category.

The first two mentioned categories concern technical and general usability issues. Although they affect the ease of communication, there is no concrete part of the EHR found in these categories to focus on. The same goes for categories 6, 7 and 8. Although all are considered to be important and interesting, more delimited issues with many design possibilities are searched for in this paper.

Category 3 describes a message service for care providers (especially nurse aides). Currently Nedap already provides such a message service (Ons Messages, see glossary), which keeps improving. It seems therefore meaningless to focus on designing such a system. Also the option to support the input of relatives (category 4) is beyond the scope of an EHR. Nedap provides an informal care portal (called 'Caren'), in which carers and family can log in, track the progress of a client and together manage an agenda. Family input could be supported through this portal instead of directly through the EHR. Although the subject is interesting, duplication of work will emerge if this subject will be treated in this research. The quotes in this category will be transferred to the team of 'Caren' to further investigate and design this issue.

As mentioned before the EHR should be multidisciplinary (category 10). Although multidisciplinary collaboration implies a certain level of openness, authorization is also an important issue. Nedap is therefore searching for solutions to create a usable multidisciplinary record. Combined with requirements from categories 11 and 12, there has been chosen to focus the design research on writing and reading reports. The interviewees indicated that they would like to do more with reports. Currently they can write a report and read all reports in a list. Some EHRs provide the opportunity to link disciplines, so a user can filter on his discipline to only read the reports addressed to his discipline. Most EHRs also support the user in reporting on a certain goal (from the 'zorgleefplan') This way, reports can be shown per goal instead of in one list.

From the generative session it turns out that care providers are in need of more overview and communication options surrounding the reports. When writing a report they would like to notify someone or even set actions for other disciplines. Furthermore, they would like to gather more overview when reading the reports.

5.2.1 Requirements

The goal of this research is to improve the communication between the care providers through use of the EHR, to eventually improve the Quality of Care. Based on the first participatory meetings, it is decided to only focus on reading and writing reports. If one looks at the aspects to improve the Quality of Care, quality of documentation and cooperation between the care providers are logically to improve when creating a good report system. Therefore the focus will lay on these two aspects in the list of requirements. Requirement 1 up to requirement 5 belong to 'improvement of the quality of documentation'. From requirement 5 the requirements belong to 'cooperation between the care providers'. The requirements themselves are extracted from the theory and the results of the previous session (category 10, 11 and 12). Throughout this paper the requirements will be reviewed and adjusted when deemed necessary.

1. The user must be encouraged to create reports connected to a goal

The participants (nurses and nurse aides) indicated that they wanted and needed to link their reports to a goal from the '*zorgleefplan*', but that it often did not happen. To improve the quality of documentation (one of the aspects to improve the QoC), the EHR should support the user to report on the set goals. It was also requested as one of the usability concerns (category 2) that the user would like to be supported in qualitative reporting.

2. The user must be able to tag the reports

Another way to improve the quality of documentation, is to tag the information that is saved. This is also mentioned by the participants (category 11). It is also connected to three of the usability concerns in category 2: tagging can provide the user more insight in the relationships and links in a record and enables the user to easily find the information he is searching for by sorting the information from the care and treatment plans.

3. The EHR must support work practices from the medical and care sector

There are many methods created to improve the quality of documentation, like the *zorgleefplan*, the episode-orientated method or the OMAHA system. See the glossary (appendix I) for more information on these methods. One that has been mentioned by the ECP's in the participatory sessions is the episode-orientated method. The episode-orientated method is a method that is mostly used in the general practice. When a patient has a certain (new) problem, like a head ache, a new episode is created. Every time the patient visits the general practitioner for a consult for the head ache, the process will be reported under this episode. Since the methods mentioned are already efforts to improve the quality of documentation and also support the current practice of the care provider, the new system should support these.

4. The user could be supported in using codes when writing reports.

In the theory (section 2.2), it is also mentioned that CDS systems would improve the Quality of Care. To make proper use of such systems, information that is written into a record should be coded so a decision support system can read and process this information. Since it does not immediately improve the communication internal, it is not a 'must'- requirement. However, it might very well improve the communication with external organizations, because information could be more easily translated to another EHR system. It would therefore be interesting to see what is possible to support the user in using these codes when writing reports.

5. The user must be able to learn, and to help and influence other care providers

This is actually the core requirement for the communication: supporting the user to learn, help, and influence. These are three of the basic purposes of communication (DeVito, 2008) which could be supported by the EHR. These were also mentioned in chapter 3.5. The other two purposes (relate and play) are not required, since the goal is to create an factual report. As one participant said: 'The EHR should be concise to function well. The people who work with it will provide the emotions and feelings at the clients'. The next four requirements are elaborations of this requirement, but are mentioned in particular because they emerged clearly from the first participatory session.

6. The user must be able to notify other care providers within the organization about a report

From the interviews it emerged that the users nowadays often notify each other through e-mail messages about reports they have written. However participants thought this was cumbersome and some also thought it to be unsafe. Creating a more usable solution in the EHR would encourage the users to involve each other more, but is also better for the patient safety (which serves a higher QoC). There is also a usability concern of category 2 that connects to this requirement: the user would like to execute his actions in a workflow, without disruptions like switching screens.

7. The user must be informed about the 'read' status of a report

This requirement has emerged from category 11. As described in the theory about communication, feedback is important. Although it is not always necessary, it confirms whether the sender's message has reached the receiver. A read receipt is an elegant option to enable the sender to check whether his message is received, while there is no (necessary) extra effort required from the receiver.

8. The EHR must notify the user about important reports

The participants indicated that they would like to know what is important to read and what is not. Especially when they have been away for a while, or when a report is placed during their shift, there is a chance that they will not read it.

9. The EHR must notify the user about tasks

Fulfilling tasks was a hot topic during the participatory sessions and should therefore be taken into account. The EHR must inform the user about tasks that are 'unusual'. This also implies that the EHR should provide the opportunity to add tasks.

10. The EHR must combine the reports from all disciplines about a certain problem (also family)

This is required to improve the multidisciplinary process. The care providers should be aware of the actions of other care providers to make the right decisions. It was also requested by the participants (see category 10).

11. The EHR must have authorization options

Not everybody is allowed to see every documented report or file. It is therefore important to make sure that the EHR contains authorization options to make sure only the persons who have the legal rights are able to see certain documented information. This improves the client satisfaction and patient safety (QoC).

12. Reports must be open or confidential

It should be possible to share reports with one person, many persons or a given set of persons. This is due to the different patient privacy concerns and to avoid information overload for the users. They should only receive information that is of interest for them.

13. Reports must be factual

As stated before in requirement 5, the goal is to create an factual record. This means that only the observed information should be shared, without providing judgments like 'The client is annoying'. The reports shown in the record should be read by the client at any time.

14. The communication must take place direct or indirect and asynchronous.

As described in the theory (section 2.4), there are certain hierarchies in the elderly care sector. It should therefore be possible to ask questions or set task via an intermediary. Reports are not meant for synchronous communication, so the EHR should support the asynchronous communication.

5.2.2 Functionalities

The functionalities are based on the requirements and will be listed below. The design will be created for two work processes: the '*zorgleefplan*' and the episode-orientated process, but eventually it should also be used with other work processes (requirement 4).

- Select goals/episodes after writing a report (requirement 1);
- tag reports (requirement 2);
- add notifications (requirement 6);
- provide a read confirmation (requirement 7);
- show notifications at the start screen (requirement 8);
- show changes in record at client screen (requirement 8);
- add a task for a user (requirement 9);
- show tasks at the start screen (requirement 9);
- show messages underneath the reports (requirement 10);
- provide actions from a received message (To support the communication and the flow, one should also be able to execute actions from the messages one receives).

An extra explanation is needed for the first functionality. During the user meetings it was mentioned that goals were often not selected when writing a report, although the option to do so exists in many EHRs (requirement 1). It is thought that users do not select goals because they have to do it in front and because they might want to say things that are connected to more than one goal. It is therefore thought that it would be more usable if one can first write his story and then select the goals or episodes.

6 Phase I: Design

This chapter describes how the functionalities are translated into a first concept. This is the last part of the first phase as can be seen in the figure to the right. The concept created in this phase is only a sketch: a collection of ideas based on the requirements that were set after the first user meetings.



6.1 Method

Beside the requirements, design principles should be applied to make it more likely that the user operates the system as intended. The thirteen principles of display design (Wickens, Lee, Liu, & Becker, 2004) are mainly used to design the interface of the EHR in this research. Appendix III shows the thirteen principles, including a short explanation of every principle.

6.2 Sketches

The functionalities that were created in section 5.2.2 have been the base for the design. The workflow of a care provider is the base of the design. The starting point is the input field of the EHR interface in which the user has to fill in the report. If one enters a report, he needs link it (if possible) to a goal, so this is placed in the same view. The goals are shown, so the user does not have to memorize them. After one has created a report, he might want to do more with this report: notify a care provider, label the report, or add a task. These options are therefore also shown in the same view, but in a 'next step'. Information access is minimized: the information the user immediately needs is shown and buttons to 'extra steps' are shown. If all options would be shown immediately, a risk of information overload exists.

If one wants to read a report, he first wants to know what is important to read. Then he wants to read the actual (total) text, which means the report plus potential messages. Afterwards, he might want to do something with the information he just gathered. Therefore options to react and to add tasks are added to this view. Since the options are shown close to the report, it is clear to the user that the actions belong to the certain report (proximity compatibility principle, appendix III).

The design focusses on supporting the user in this described workflow. Appendix IV shows the sketches shown to the participants, below one can see already the three most important parts (figures 6.1 t/m 6.3).

Figure 6.1: The report field. The user is able to enter a text and then (at the right side of the screen) select multiple goals. If a goal is selected, one can highlight which part of the report belongs to this goal. Below the field the user can select extra options: 'send a message to a colleague', 'tag the report' and 'add a personal task'.

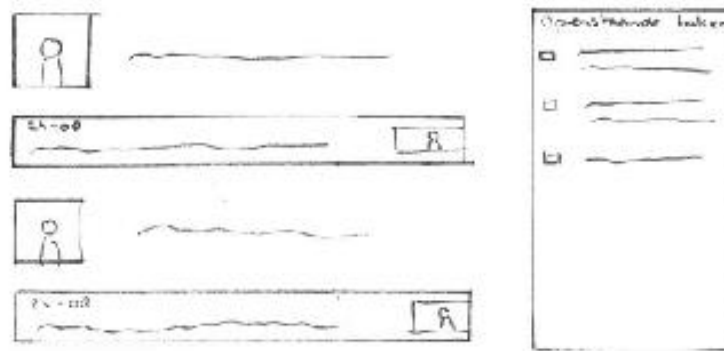


Figure 6.2: The start screen. Before the user selects a client, he is already informed about some reports. These are the reports about which a notification is sent addressed to the user. At the right the user can find a to-do list, with the tasks he needs to do today.

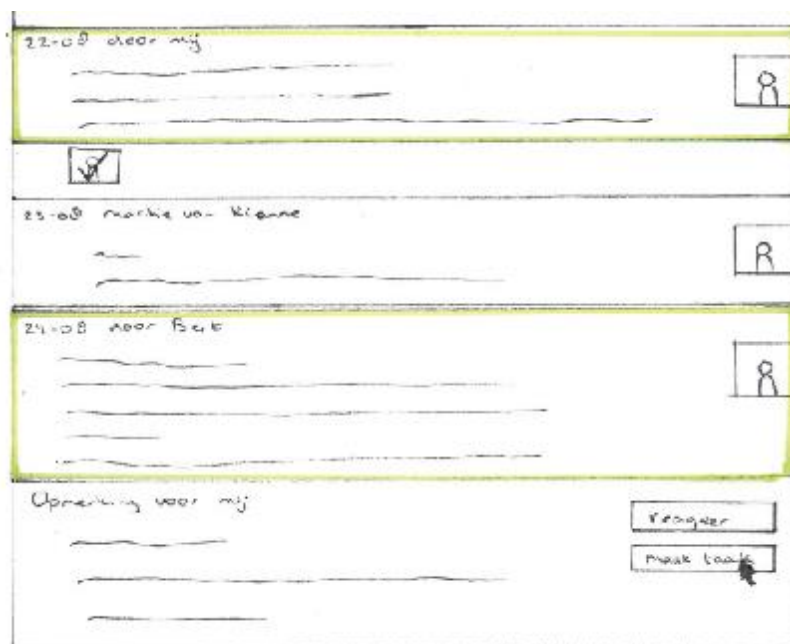
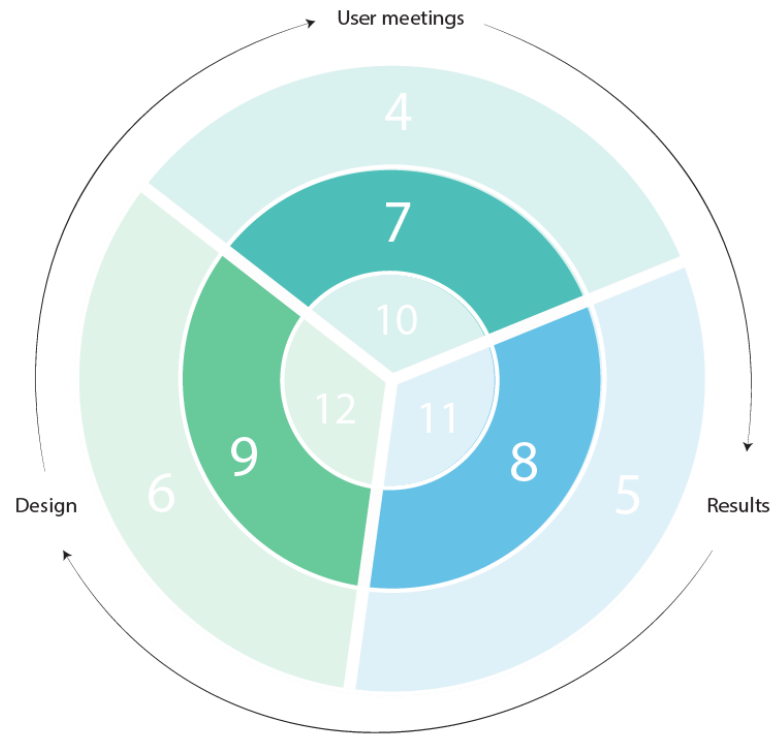


Figure 6.3: The report list. The green outlined boxes represent reports. Below the first report, one can see who has read the reports, and a reaction to a question the user posed is visible. Below the second report, a question to the user is posed and options are shown.

6.3 Summary

The goal of phase I was to establish the requirements of this research. Users of different EHRs and different disciplines were asked to participate in generative sessions to envision their ideal EHR. The results have been analysed and ordered into twelve categories. Not all issues can be handled in one research, so choices had to be made. It has been chosen to focus on the communication that takes place while writing and reading the reports about a client. The concept that has been designed has some added functionalities beside the standards (input field and list of reports), like the option to send a message to a colleague, to tag reports and to add a task. In the next phase this design has been presented to the participants of this research. The goal of this next phase is to verify and improve the concept of this chapter.



PHASE 2:

“Verification and improvement of the functionalities”

7 Phase 2: User Meetings

7.1 Theory

In the participatory design approach it is important to keep involving the participants in the design process. Participants should be asked to help and provide their opinion about the concept of the previous chapter. This chapter describes the first part (the user meetings) of the second phase as shown at the figure at the right. Prototyping can help the participant in understanding the concept. It creates a base on which they can comment and generate new ideas.



Prototypes can be created in many forms. One way to define the characteristics of a prototype is to look at the next four dimensions (Mackay & Beaudouin-Lafon, 2007):

- Representation (the form of the prototype)
- Precision (the level of detail)
- Interactivity (the level of interactivity)
- Evolution (the expected life cycle of the prototype)

The content of these characteristics depends on the goal of a prototype. Prototypes are often used in participatory design to serve as a medium for communication. It helps the user to articulate his needs and he can reflect on the design solutions proposed by the designer (Mackay & Beaudouin-Lafon, 2007). In this early stage of design, the level of detail is low. It does not matter what a button looks like, or what the size of a text field is. It only matters that there is a button and a text field. The precision of the prototype can therefore be low (this is comparable to the 'low-fidelity prototyping'; this term is often used in the literature). The representation of the prototype can be low-fidelity too: paper prototyping is very useful to rapidly create a representation of an idea and test it (Mackay & Beaudouin-Lafon, 2007). Furthermore, paper prototypes increase the participation in a design process and make sure that the designer does not become overly attached to his first solution (Mackay & Beaudouin-Lafon, 2007). The level of interactivity does also not need to be high in this stage. However, the interactions should be made clear to the user, because the interaction can be part of a functionality. The prototypes in this research are iterative; they are developed with the goal to evolve (Mackay & Beaudouin-Lafon, 2007).

In this phase of the project a lot of questions may arise about parts which are not thought about yet (the level of detail is very low). Because of the participatory design approach this is not a problem, it is even useful. Every question that is asked by the participant about the design ('how does this work?'), is bounced back: "How should it work, what would you like?". Because of this approach, new ideas can be generated quickly. The participant is offered a base, a starting point from which he can comment and idealize the design.

7.2 Implementation of the method

The low-fidelity prototypes are created on paper. The sketches created in the first phase are situated on two A2 papers. One paper shows the interfaces that belong to 'writing a report', the other to 'receiving reports' (see Appendix IV). The participants are asked to comment on the sketches by use of sticky notes. A distinction is made between negative and positive comments by using different notes for these categories. This is done to stimulate the participant to also indicate the positive aspects of the design. When people are asked to comment on an idea, they are more likely to mention the negative issues. It is also important to know what the positive points are, because they influence the design too.

During the session, first the page of 'writing a report' was shown and next the functionalities were explained step by step. After each functionality the participant was asked for comments. However,

it was always possible to comment on a functionality later on, which was also stimulated by the researcher at the end of the session.

Fourteen participants participated in this session (three ECPs, four nurses (one intramural, three extramural) and six nurse aides (four intramural, two extramural)). The sessions have been recorded, but not transcribed. The sticky notes were the input for the analysis; the sessions have only be recorded to recall the reason of some remarks on the notes.

8 Phase 2: Results

In this chapter the results of the second user meeting will be discussed. The figure to the right shows this is the second part of the second phase. The comments (sticky notes) are categorized by the functionalities mentioned before. One can find the results per functionality in Appendix V. Below a summary of these findings is provided, based on the requirements list from chapter 5.2. Not all requirements have already been tested in this session, for some only a first impression was gathered. The focus points which are derived from the findings will be discussed in section 8.2.



8.1 Findings

1. The user should be encouraged to create reports connected to a goal

This requirement is partly met, but the participants were not convinced by the implementation of this requirement. In general they would rather not select parts of a report to connect these parts to different goals. Furthermore they would like to select goals or episodes first, because they are afraid of excess and senseless information if they start with writing a report before selecting the goals. They stated that they would write in a more targeted manner if they first select a goal. However, many participants were enthusiastic about the idea that you can see the goals/episodes next to the report field. This makes sure care providers do not need to remember them. Focus point 1 (section 8.2) will explain more about this concern.

2. The user should be able to tag the reports

The second added functionality, tagging reports, received mixed reactions. All nurses liked it, but most nurse aides and physicians did not. The reason to not use it, was because these participants could not imagine a situation in which they would use it. The nurses all could think of a goal and it would save them time when searching through the reports to prepare for example a MDM.

3. The EHR should support work practices from the medical and care sector

Both the participants from the medical and the care sector understood the work flow and appreciated the ability to see the episodes and goals besides the reports.

4. The user could be supported in using codes when writing reports

This requirement was not fulfilled in this design.

5. The user must be able to learn, and to help and influence other care providers

The sketches were designed based on these aspects: first the user learns by getting informed about important reports and the tasks he needs to do. He can write a report and add messages to help and influence others. The participants liked to be able to combine these different aspects of communicating and recognized situations from their daily practices.

6. The user must be able to notify other care providers within the organization about a report

Sending notifications to other care providers was well received, but it might not be that suitable for nurse aides among themselves. They already read the reports anyway, so they don't have to be notified.

7. The user must be informed about the 'read' status of a report

There is some disagreement about the read confirmation. The nurses would like to see it, but the physicians think it is too controlling.

8. The EHR must notify the user about important reports

In contrast to the nurses and nurse aides, the physicians have doubts about the start screen. They wonder of which clients they would see notifications. It might happen that a certain physician is not

available one day and it should not happen that notifications are only shown on the account of that person (see focus point 5, section 8.2).

The welcome screen which is visible when the user opens a client's record is received positively. This way the user cannot ignore new reports.

9. The EHR must notify the user about tasks

The task list is appreciated by all participants, also by the nurse aides who indicated that they did not expect to add tasks for themselves. They would like to see tasks that differ from their routine. Mostly the higher disciplines appreciated the option to add tasks for yourself. A kind of calendar functionality is required, because the participants often would set a reminder for 'tomorrow', or 'next week'.

10. The EHR must combine the reports from all disciplines about a certain problem (even family)

There is some disagreement about the list of reports shown in the drawings. Especially the nurse aides have doubts: they are afraid that the record becomes a chat program, because their colleagues might misuse the notification- and reaction functionalities. The participants all liked the option to respond to messages and create tasks from these messages. It was suggested that one could do these actions for all reports, not only the reports the user is notified about.

11. The EHR must have authorization options

This requirement cannot be met yet, because this is mainly a technical issue. However it is taken into account while designing, because it influences some design choices like share-options of messages and tasks.

12. Reports must be open or confidential

This requirement has not been implemented yet, but should be in the next iteration.

13. Reports must be factual

As already mentioned, some participants were afraid that the report list would become a 'chat program'. This shows that the requirement has not been met. More about this can be found in focus point 3 and 4 (section 8.2).

14. The communication must take place direct or indirect and asynchronous

This requirement has been met. The design is focussed on asynchronous and direct communication. Since one can involve other practitioners after receiving a message, also indirect communication is supported.

8.2 Focus points

Some concerns have emerged from the session. They will be explained below. It will also be explained how these focus points change the list of requirements.

1. Connect a report to a goal/episode if possible

The first session showed that especially nurse aides do not always link their reports to a goal of the 'zorgleefplan', although they could have done so. In the design was therefore searched for a way to support the user in linking a goal by showing the goals next to the report and affording them to select goals after having entered the text. The users appreciated that they could see goals or episodes next to the field in which they has entered the report. However, some users would like to select the goals before they start writing their report (so every report has its own goal), while others would like to select the goals afterwards (a report can contain more than one goal). Finally, it can happen that there is something for which a goal has not yet been created, or will not be created because it is one-time event. Therefore an option should exist to create a report without a goal.

2. Efficiency in text input

In the usability category (category 2, chapter 5.1.2) some wishes were expressed. Two of them were that the user wants to execute his actions in a workflow without disruptions like switching screens and that he wants to reuse information without having to 'copy' and 'paste'. The second wish was not taken into account yet, but it would certainly help the user (especially the ECP), also to support his workflow. It is indicated by research of Nedap that users (especially ECPs) enter text (or parts of a text) more than once. They need for example to write letters, in which parts of reports will be used. Or they have to write a report into the '*zorgleefplan*' and in their own medical record. These texts are not exactly the same (because of the use of words and authorizations), but parts can be used. An example of reuse of text was already shown in the first sketches. The user was able to highlight parts of the text to transfer them to other goals. The participants did not fancy this idea very much, because they first had to write all the text. However, in other forms or in other cases, this might be useful.

3. Sending an overload of messages and notifications to others

In the sketches it has been made easy to send notifications to others when one writes a report. However, it appears there is a fear that this functionality will be misused, because there might be users who will send notifications very frequently. If this happens, the whole concept will not work: when a user receives too many notifications, he will not take them seriously anymore.

4. Discussions or subjective messages in the record of the client

Some of the interviewees got concerned when they watched the record of a client, in which the reports and messages are shown underneath each other (figure 6.3). They explained that they were afraid the record would become more like a 'chat program', instead of a serious record.

5. Messages to not available care providers

Especially the ECPs were worried about the notifications on the start screen. What if there is a specific question posed to them, while they are not available for one or more days? There should therefore be an extra requirement added to the list of requirements:

Requirement 15: The EHR should support prevent the user from sending a message to a non-available care provider.

In the next chapter the focus points will be elaborated.

9 Phase 2: Design

At the end of phase 2, the design of chapter 6 has been improved based on the findings of the previous user meetings. In this chapter the changes are outlined and explained. Furthermore the concept has been developed to a prototype on the computer to be able to test more usability in the next user meetings.



9.1 Design approach

To design the prototype, a mobile first approach (see figure 9.1) has been used. More and more people are using their mobile phones to gather information. In the mobile first approach, one first looks at the small screen of a mobile phone, and later on expands the design towards tablets and desktop screens. The idea is that the designer focusses more on the most important parts of the design if he first designs for the smallest screen.

Of course, mobile users have other needs than desktop users. Based on the vision (chapter 5.1), this project primarily focusses on tablet users, not mobile users. However, it is still decided to use the mobile first approach, but only as a design approach to narrow the space down. The functionalities will be pretended to be the same as needed in the tablet or desktop version.

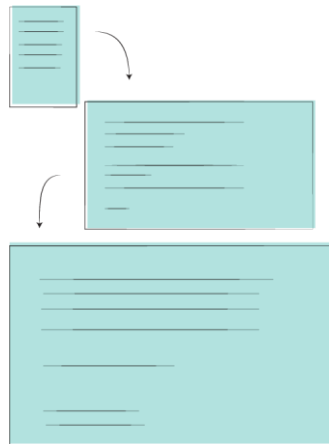


Figure 9.1: Mobile-first approach. First the design for the mobile screen is created, than the design can be expanded for other devices.

First, however, the focus points of the previous chapter will be elaborated to more concrete ideas. A brainstorm session (Appendix VI) was held to create some more ideas, especially on focus point 3.

9.2 Idea generation

1. Connect a report to a goal/episode if possible

The main idea is to show the goals or episodes, but let the users first select a goal before they enter their text. An 'other' option should exist, although this option should only be chosen when no other option is suitable. According to some nurses from the first user meetings, some nurses and nurse aides now decide to select no goal, just because they don't know the goals, or because it is easier to just ignore the goals than to think about it. Figure 9.2 shows an example of how small interface adjustments could nudge the user. The user has to perform an extra click to open the 'other' goal/episode, which is also place a little further from the other buttons. This is an affordance, it makes the user feel like this option is special and therefore the user will rather choose one of the above goals/episodes than select the 'other' option.



Figure 9.2: A list of episodes/goals. One has to perform an extra step to select the 'other'.

2. Efficiency in text input

There are several moments where the system can prevent the user from entering text more than once. Three moments are distinguished: the moment before the first time the text is entered, the moment right after the first time a text is entered, and the moment the user is going to enter the same text again.

Before the user starts writing a report, he could already indicate the goals of this text. He could for example select an episode and a letter, because he wants to create a letter about the same problem as the report he is going to write. A big drawback is that people usually don't know exactly in advance what they will do with certain information they enter in a system. A better time might be during the writing of a text. See figure 9.3 for an example. Right after one enters a text, he could be able to select the text and copy it to another goal.

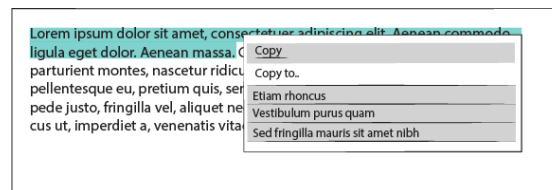


Figure 9.3: Right after the first time a text is entered

Finally, the user could be able to copy text that has been entered a (long) time ago. A nice solution might be to split the screen into two. This was also a request of one of the ECP's. Figure 9.4 shows an example of a split screen, in which the user is able to select a part of a text from the left screen and move it towards his current report on the right. To support this, the cursor would change into a 'move icon' when the user hovers his cursor over the selected text (see figure 9.4).

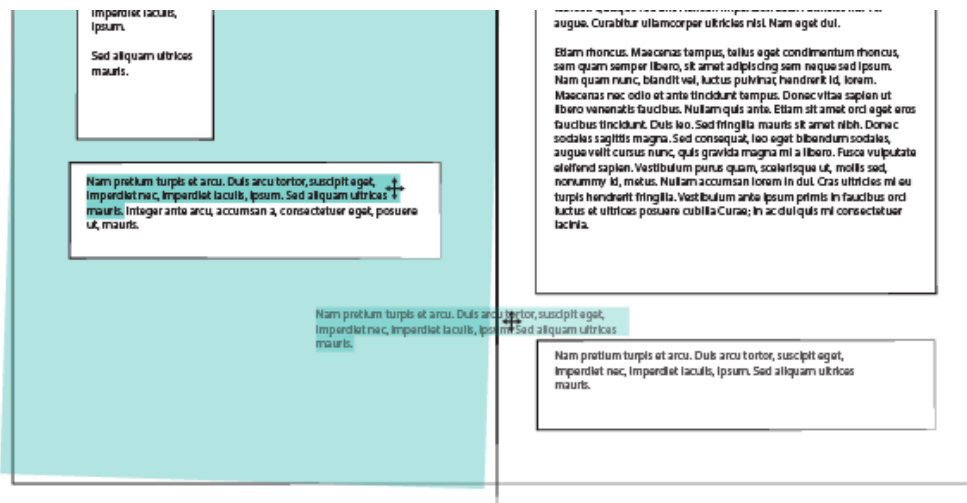


Figure 9.4: At the moment the user is going to enter the same text again

3. Sending an overload of messages and notifications to others

A brainstorm session was held to create solutions to this problem (see Appendix VI). Four Nedap employees joined this session: three software developers (of which one of the application 'Ons Messages', see glossary) and one with expertise in sales support. The solutions below are proposed. They are split into solutions for the sender's side (so when the user writes a message or notification) and the receiver's side. Solutions for the sender's side are mostly focused on creating awareness for the sender.

The Sender's side:

- It should be only possible to send a notification when you also link a task to your message.
- Make the user confirm sending a message (are you sure to send this message?)
- Prioritize your message.
- All messages that are sent by the sender, are also placed in his own inbox to experience the number of messages sent.
- Provide an extra step between creating the report and sending the notification. At the first page, already show which people are permitted to read the report.
- Do not provide the opportunity to send messages, but only to send notifications.

The Receiver's side:

- Up-down voting: Messages that one dislikes (because a notification was not necessary) can be down voted, to provide feedback to the sender. Messages can also be shown lower in the list after they are down voted.
- If there are more messages about the same client, the messages should be placed higher, because it is more likely that it is important.
- The receiver could 'like' messages. Every month there could be a 'communicator of the month', based on the ratings one receives on his reports and the importance of his notifications.

It is thought that it is better to provide a solution on the sender's side, because the problem is then prevented instead of recovered.

4. Discussions or subjective messages in the record of the client

There could be an extra tab in the record which would show the notifications and messages. This way, it will not 'pollute' the record. Another, maybe even better, solution is to make use of the message service that is already owned by Nedap: Ons Messages (Dutch: *Ons Berichten*, see glossary, appendix I). From this service you can receive notifications and you can also discuss things further via this application, without 'polluting' the record. There should be a connection, so the messages can be opened from the record.

Another (maybe additional) solution is to provide the user with a default message. One can edit the message and can add persons. It is thought that the user will therefore be more aware of what the context a message should be. For example, if the predefined message is 'Can you think along with me about the following report (link)?', it is thought that the user will not be very likely to remove all the text and replace it with something like 'I think Mrs Adams is very annoying'.

5. Messages to not available care providers

In general, it should be clear when someone is absent. If it is known that a person is not available today, an automatic reply could be sent, stating that the person is not there at that current time. It might suggest optional other receivers. If the back-up is known, the message could be even forwarded to the back-up. Maybe the message will still be shown to the original receiver, but with a notification that it is forwarded to someone else. Nevertheless, the first issue is to couple the system to the agenda of the users. The users should clearly indicate when they are out of office.

Another option is to send a message by default to everyone of a discipline (or the involved person and his back-up). This might be safe, but it might result in many more notifications and messages. Also a system should be provided to know when a message is undertaken by a colleague.

9.3 Prototype design

Figure 9.5 shows the 'mobile' version of the prototype that has been designed. The focus is first on the care sector (nurses and nurse aides), which can later be extended to the medical sector (the ECPs and paramedical staff). As explained before, the functionalities for both sectors are more or less the same.

In the previous designs (the sketches of chapter 6), a start screen was shown before the user selects a client. On this screen he could see the new messages and the to-do list. Although a start screen should still exist, this is not integrated in the prototype, because nothing new will be shown. Both the messages and the to-do list are namely outsourced to other applications of Nedap: Ons Messages and Ons Tasks. More information about these terms can be found in the glossary. This is done because these are already applications of Nedap that have the functionality that is needed (sending messages and creating a to-do list). By use of these applications, it is possible to read this information not only in the EHR, but also in other applications of Nedap. Buttons will be placed on top of every screen, showing notifications when new messages or tasks for today are set. If the user selects such a button, he will see the information from Ons Messages or Ons Tasks. It is therefore no longer necessary to first look at the start screen. From now on, when the term 'start screen' is used, it will refer to the start screen of a client's record.

If a user opens the record and looks at the reports, he might have three different goals: to see what the newest reports are, to search for something or to write a new report. These three goals have been combined in the screen 1 of figure 9.5. At this start screen, one can read the goals of the 'zorgleefplan'. The two top most goals are unfolded. If a goal is unfolded, this means new reports can be read for this goal. At the right of every goal, a plus sign is shown. This plus sign leads the user directly to enter a new report under this goal. Furthermore, a search icon is shown at the top: The user can search a word or discipline in the reports (regardless of the goal). The whole record (at which the user can enter a report without a goal) is placed separately at the bottom (focus point 1). No plus sign is placed at this button, so the user is not able to immediately enter a report under this goal. It is therefore more difficult to write a report without a goal than a report connected to goal.

Screen 2 in figure 9.5 shows the reports belonging to one specific goal. The user has selected a goal (in this case the first goal) in the start screen to enter this screen. Just like the previous screen, the reason of the user to enter this screen is to read new reports, to find something or to write a new one. Furthermore, the user might like to take action after reading a certain report. Therefore, the search functionality is also applied, complemented with a filter functionality. This way, the user can filter the reports on label or discipline. Messages are no longer part of the report list, but are outsourced to the application 'Ons Messages'. By means of an icon at the right of a report, the user can see that there is a message linked to this report. The same goes for the tasks and the tags. If the user clicks on the icon, he will be lead to a screen which shows all tasks (task icon), or all messages about the client (explanation mark), or to the labels (tag icon).

Screen 3 shows the field in which one can enter a new report. To reach this screen, the user has selected the plus sign in screen 2. The purpose of this screen is to enter a report. The latest reports are still shown underneath, because they might be helpful when entering a new report (also mentioned as an important feature by two nurse aides in the first sessions). As decided at the brainstorm session of focus point 3, the user is not able to select follow-up actions in this screen, he can only indicate for whom the report is visible. After saving the report, the user reaches the fourth screen.

Screen 4 indicates who can read the report. Next opportunities are offered to send a message, add a personal task, or to tag the report. The purpose of this screen is only to give the user the option to add actions to the written report. What the follow-up actions look like has not been elaborated in these sketches, because for two of the screens the actions already exists in the current Ons applications (Ons Messages and Ons Tasks). However, some changes are recommended to the Ons Messages screen, to fit the task flow better.

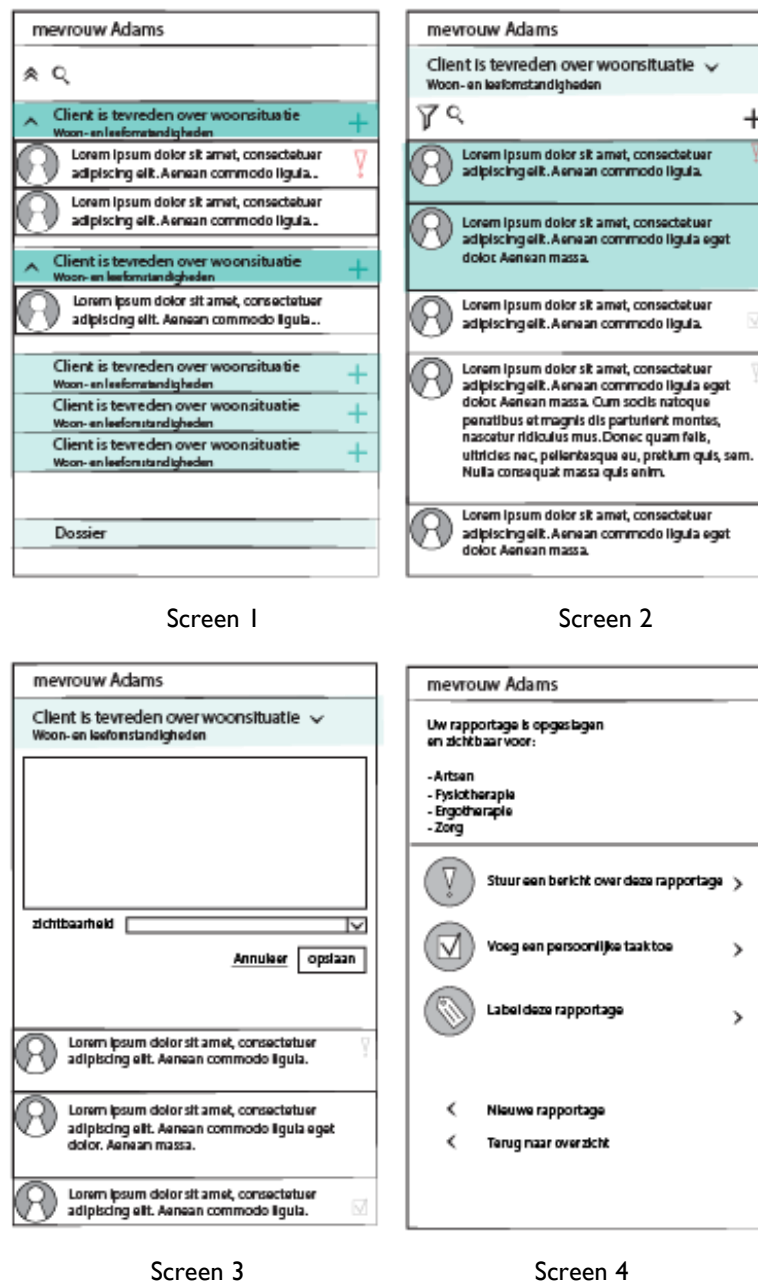
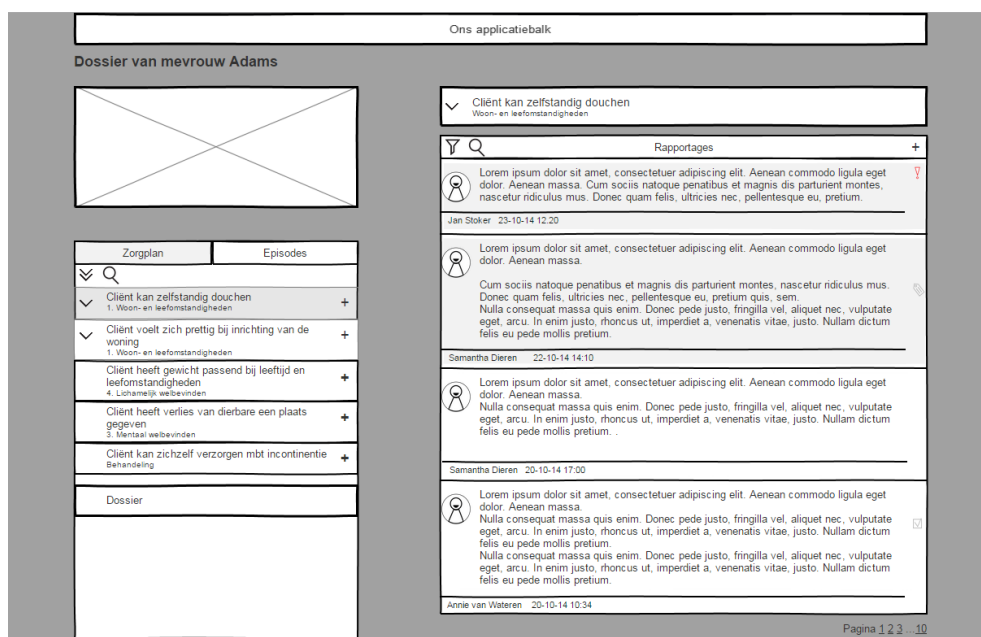
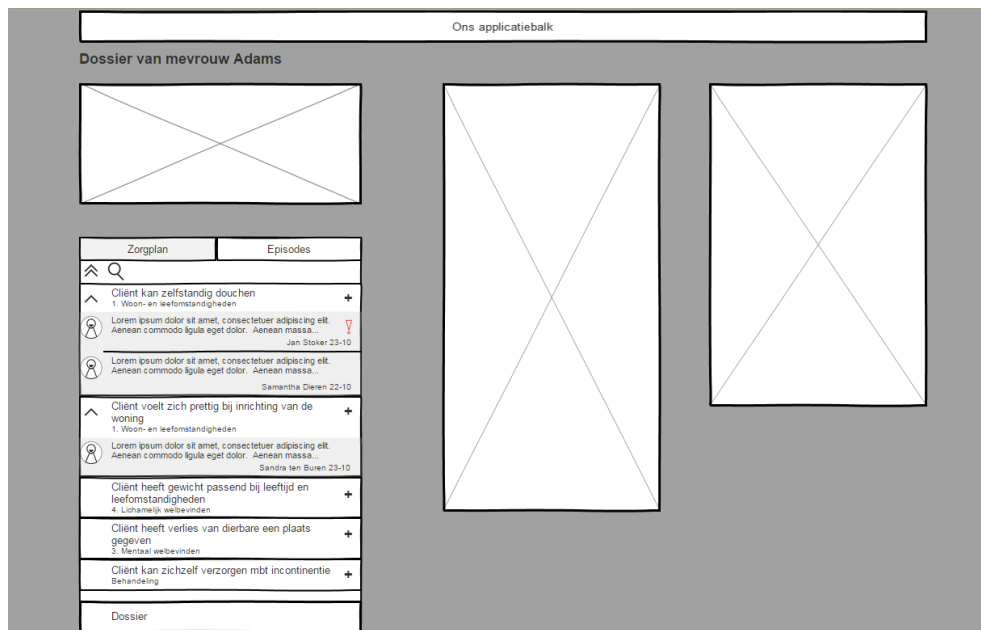


Figure 9.5: Mobile first designs.

Based on these designs, the tablet version has been created. A prototype has been created using Axure RP Pro (<http://www.axure.com>). Figure 9.6 and 9.7 show the first two screens of the prototype. No attention was paid to the appearance of the prototype, because the focus should be on the functionalities. More will be explained in the next chapter. Appendix VII shows an extensive view, explaining all functionalities of every screen.



9.4 Summary



PHASE 3:

“Improvement of the usability”

10 Phase 3: User Meetings

10.1 Theory

The goal of this phase is to test the usability of the design. Again, this has been tested by use of a user meeting as is also indicated in the figure to the right.

Usability testing is defined by five characteristics (Dumas & Redish, 1993):

1. The primary goal is to improve the usability of a product. For each test, you also have more specific goals and concerns that you articulate when planning the test.
2. The participants represent real users
3. The participants do real tasks
4. You observe and record what participants do and say
5. You analyse the data, diagnose the real problems and recommend changes to fix those problems.



Just like the first characteristic, the goal of this phase is to improve the usability of the interface. To set up a good usability test, first this goal should be further specified to specific goals or concerns. The goals and concerns can be the input for the tasks. Task scenario's should be written to create 'real tasks', tasks that are realistic and relevant for the user (Dumas & Redish, 1993). The concerns are described in the next section about the implementation of the method. First more will be explained about the characteristics of the prototype.

In contrast to the previous phase, interaction with the interface is required. When creating a prototype, not all functionalities need to be worked out, as already described in chapter 7.1. In the case of a usability test, often use is made of task-orientated prototypes (Mackay & Beaudouin-Lafon, 2007). Such a prototype only includes the functionalities that are needed to execute a certain, predefined, set of tasks. The precision of the prototype is higher than the previous prototype (chapter 7): the participant should be able to empathize with the situation by use of the interface to properly execute the 'real tasks'. Furthermore, the interactivity should be of course much higher than the prototype of the previous phase.

The reactions to a prototype can explain a lot about how a participant understands the interface. Therefore participants should be asked to 'think-out-loud'. Think-out-loud methods can change the performance of the participant. It is shown by Wright and Converse (1992) (as cited by Dumas & Redish, 1993, p. 279) that it might improve the performance. However, this should not discourage the use of it. "The value of the information you get from participants who think out loud usually outweighs the bias this procedure may cause" (Dumas & Redish, 1993, p. 280).

10.2 Implementation of the method

As described in the theory, first the goals and concerns should be articulated, which then lead to the tasks. These tasks should then be performable with the prototype. The prototype is created with Axure RP Pro (www.axure.com), which has some restrictions in which functionalities are possible to prototype. Therefore, the creation of the prototype and the design of the test have been executed at the same time. Below the concerns and the resulting tasks are described.

10.2.1 Concerns

Are the interface icons clear to the user?

1. Does the user understand how to create a new report?
2. Does the user understand how to filter reports?

3. Does the user understand when a report has a notification?
4. Does the user understand what the icons connected to the possible actions mean?

Does the user understand the structure of the left information box (see figure 9.6)?

5. Does the user understand which reports are new?
6. Does the user know what the button 'Dossier' means?

Is the user able to create a new report and link follow-up actions?

7. Is it clear that the user first needs to save a report before he can create follow-up actions?
8. Is the text for the follow-up actions clear?

9. Is it clear to the user what happens if a care provider is temporarily not available?

10. Does this interface contribute to the communication between him and other care providers?

11. Does the interface have an added value to the user?

10.2.2 Tasks

Below the tasks are defined, including the required steps and the concerns involved. Some tasks are explained with a figure. The red outlined circles in those figures are not shown in the prototype, but only indicate where the participant should look or click.

1. How many new reports have been placed about Mrs Adams since the last time you have seen this record?

Required steps: This task does not require any steps: it is shown right on the start screen.

Concerns: It is the first check to find out whether the user understands the structure of the left information box (concern 5)

2. Look at the reports written at the goal 'Client is able to shower independently'. Respond to the question Jan Stoker posted at the most recent report.

Required steps: Click on the first goal. Click on the exclamation mark at the right of the first report. Click on the message of Jan Stoker. Enter a response and click 'Send'.

Concerns: This checks whether the user understands what the icon of a notification means (concern 3)

3. You are finished. Enter a report under the goal 'Client is able to shower independently', which may be visible to all. Tell in this report that you have the feeling you recognize some decline instead of progress. Send a message to the physiotherapist of Mrs Adams and ask her to think along about this problem. Tag the report for the coming multidisciplinary meeting (MDM).

Required steps: Click on the first goal in the left box. Click on the plus sign (this can also be combined at the first step by selecting the plus sign next to the goal, but this is not built in to the prototype due to some technical restraints). Write a message. Select 'all' in the dropdown menu. Click on the button 'save'. Select the first option in the next screen. Do not select Katy (because she is absent, see figure 10.1), but click on 'observation' and select 'Carmen'. Optionally change the message and click 'Send'. Then select the last option. Click 'MDM' and click on 'save'.

Concerns: This task combines a lot of small actions to check whether the user understands how to create a new report and create some follow-up tasks. Concern 1,7,8 and 9 have been checked with this task.



Figure 10.1: After saving the report, the participant has selected the first option ('send a message about this report'). Katy is absent, see the red outlined part of the figure. The participant can select 'observation' ('waarneming' in Dutch, right under Katy's name) to find out who is the locum of Katy.

4. Read all reports, regardless of the goal, in chronological order. You notice the report of Johannes (on the 22nd of October). You would like to look further at this tomorrow. Therefore, create a personal task linked to this report.

Required steps: Click on the 'Dossier' button in the left box. Click on the third report, written by Johannes. Then select the second option at the right of the report (the box with the check mark, see figure 10.2). Select a date and optionally enter a comment. Click on save.

Concerns: This task checks whether user understands the meaning of the 'Dossier' button and whether the user understands the icons to create an action from an already posted report (concerns 4 and 6).

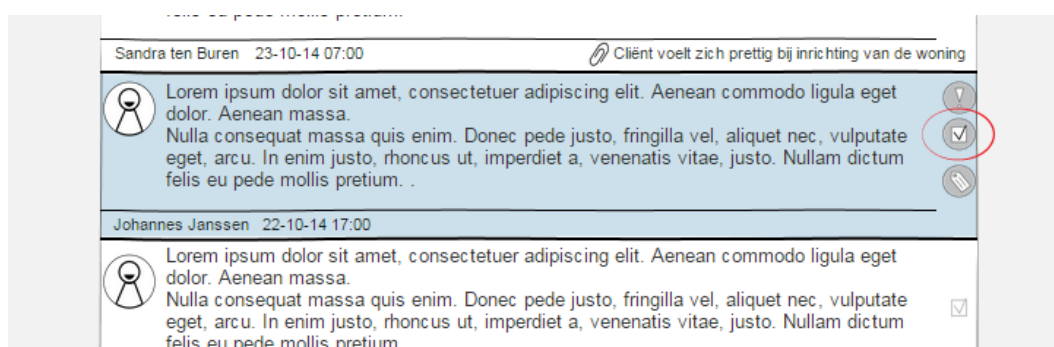


Figure 10.2: If the user clicks on a report, the background colour of the report changes and the three options appear at the right of the report. The participant has to select the second option (red outlined in the figure) to complete task 4.

5. Show only the reports of 'client has a weight appropriate for her age', written by her first responsible nurse and tagged for the MDM.

Required steps: Click on the third goal in the left box. Select the filter icon (the funnel, see figure 10.3). Tick the boxes of 'MDM' and 'First responsible nurse' and click on 'filter'.

Concerns: This task is created to find out whether the user understands how to use the filter option (concern 2)

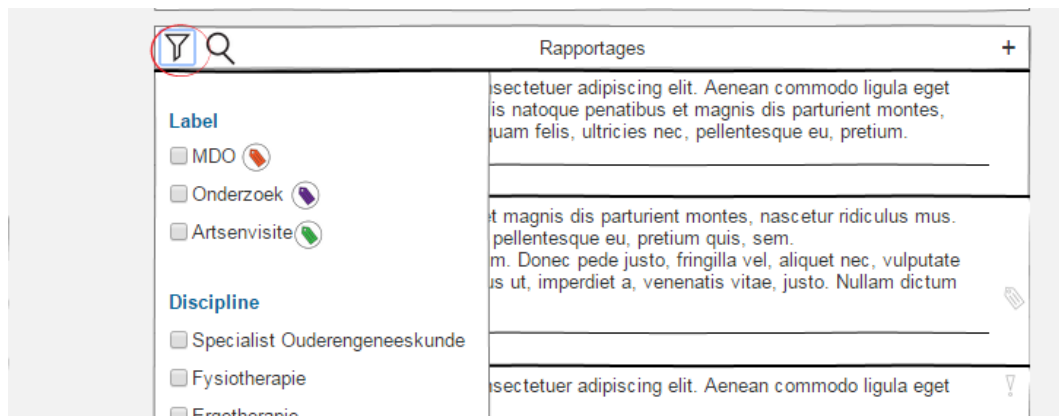


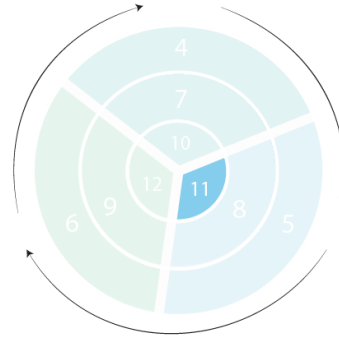
Figure 10.3: To filter the reports, the participant has to select the red outlined filter icon. Then the options as shown in the figure below the icon will appear.

The last two concerns (10 and 11) cannot be tested with tasks. The tasks are created in such a way, that the user is guided through the whole interface if all tasks are fulfilled. Therefore it possible to test these concerns afterwards. A short questionnaire is held, asking the participant what he thinks of the interface, whether he feels like it is valuable for him and what he dislikes or misses in the interface. Because it might be difficult for the participant to indicate what he misses, a last task is added to the test: Create your own task. The participant is asked to create a task, something that he would like to achieve with the interface. Subsequently, the participant is asked to try to fulfil the task. This way, more insight can be gathered to what the participant needs.

Ten participants had participated in this session (3 ECPs, 5 nurse aides and 2 nurses). One ECP and three nurse aides had not seen the sketches before and did therefore not knew about the functionalities that the prototype could have. All participants had received the same instructions and tasks beforehand. The placeholders in the prototype were explained and the user was told that he has to visit Mrs Adams and therefore first takes a look at her record. The participant has clicked on the name of Mrs Adams and now this screen is shown. The test started with the start screen (see figure 9.6).

11 Phase 3: Results

This chapter describes the findings of the usability test and the focus points for the last design. The list of requirements will be reviewed after the last design in chapter 12.



11.1 Findings

For every task the completion time was recorded and it was tracked if the task could be fulfilled without the help of the facilitator of the test. Also comments made by the facilitator were noted for every task. This data can be found in Appendix VIII. The conclusions are outlined below per task. The facilitator offered help when the participant indicated that he was out of ideas to try or when the participant thought he was done with the task, but the task was not yet fulfilled.

The times are measured during the tests from the start of a task until the start of a new task. Afterwards the time in which the question was posed is subtracted from the measured time. The results are compared to the time an expert (someone who knows how the interface operates) needs to fulfil the task. Of course the time the participants needed is a lot higher, because they first have to interpret the interface and the question..

Task 1

Seven participants (one ECP, one practice nurse, four nurse aides, one nurse) were able to understand the first task without difficulty. The average time needed to complete the task without help was approximately 40 seconds. An expert could fulfil the task in 3 seconds. One participant who fulfilled the task without help was not sure of his answer. The participants who were not able to fulfil the task did not understand that the grey shaded boxes were reports. Both ECP's did not understand that the system knew when they last visited this record of Mrs Adams. The nurse aide who did not succeed thought her failure was caused by the fake text which was shown. Therefore she did not recognize the text as being reports. All participants thought it was useful to see under which goal new reports were added. However, one ECP mentioned that he would rather only see reports that are especially meant for him, because he is not interested in most of the reports that are written in the care plan.

Task 2

Four participants (two ECPs, one practice nurse, one nurse) were able to fulfil the task without help. The average time was approximately one minute and 45 seconds. An expert could fulfil the task in 10 seconds. The main problem for the participants who failed in this task was that they did not understand correctly what the exclamation mark (see figure 11.1) meant. Two participants tried to write a new report to answer Jan Stoker, because they did not expect that there could be a message attached to the report at all. They thought that 'the question' they had to respond to was written in the report of Jan Stoker. Both participants had not participated in the second phase of this project.

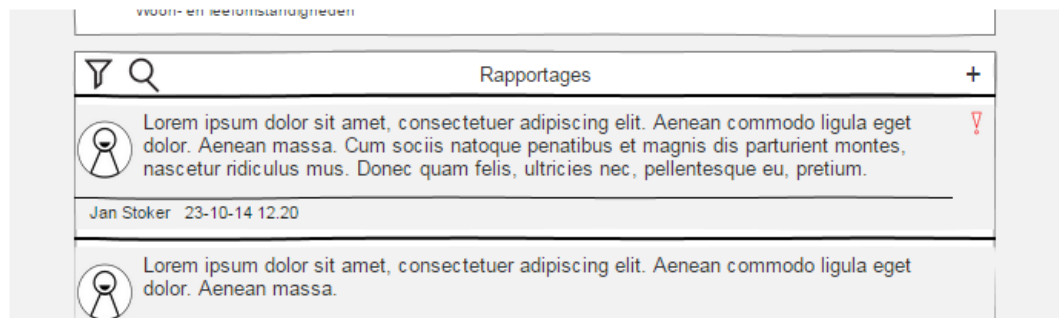


Figure 11.1: At the right of the report of Jan Stoker one can find the exclamation mark. Although the participant saw the sign, they did not all understand what it meant.

Task 3

Six participants (one ECP, one practice nurse, three nurse aides and one nurse) were able to fulfil the task without help. The average time for them to complete the task was approximately 4 minutes and 15 seconds. An expert could fulfil the task in approximately 40 seconds (depending on the amount of text one enters in the report). Two participants who did not succeed in fulfilling the task (one nurse aide, one ECP) tried to create a report by starting with the filter icon (see figure 10.3). Here they selected 'MDO' and 'physiotherapist'. They both expected that they would now send a report to the discipline they labelled, and thus selected the physiotherapist. This caused a lot of confusion, because it was not clear what would happen next. The ECP entered a report and saved it, but then wondered why she had to label the report again. The nurse aide stopped earlier in the process: after she noticed that nothing happened after she selected the disciplines and labels, she gave up. Two other participants (one nurse aide, one ECP) were both not able to understand the plus sign. Interestingly, the ECP had expected that the plus signs beside the goals would lead her to immediately add a new report, but she could not find how to add a report once she was at the page of the goal.

The follow-up tasks went smoothly, although only three participants recognized that the physiotherapist was currently absent and that they had to select another physiotherapist. They did not see it. One nurse aide had recognized that the name was coloured differently, but she thought this was a hint of the prototype to indicate that she needed to select this name.

Many participants however noticed the option to send messages to the relatives of the client directly from the EHR. The appreciated this functionality, because it stimulates communication with these persons. As was described earlier in chapter 5.1, it is important to involve the family of a client. Although the focus of this project was not on this aspect, it is thought to be very useful to include the family members in the message service of Ons. It was therefore included in the design and the participants appeared to appreciate the functionality.

Task 4

None of the participants was able to fulfil this task without help. An expert could fulfil the task in 18 seconds. Two main reasons can be mentioned for this failure. First of all, many participants did not recognize how they could get an overview of all reports (regardless the goal). They searched Johannes (part of the task) in the report list they were looking at from the previous two tasks. So the facilitator had to guide them to the 'dossier' button in 5 cases. The other obstacle that caused the participants to get confused was the fact that they looked at the report below the name of the author, instead of above (see figure 11.2). This was the case for 8 participants.

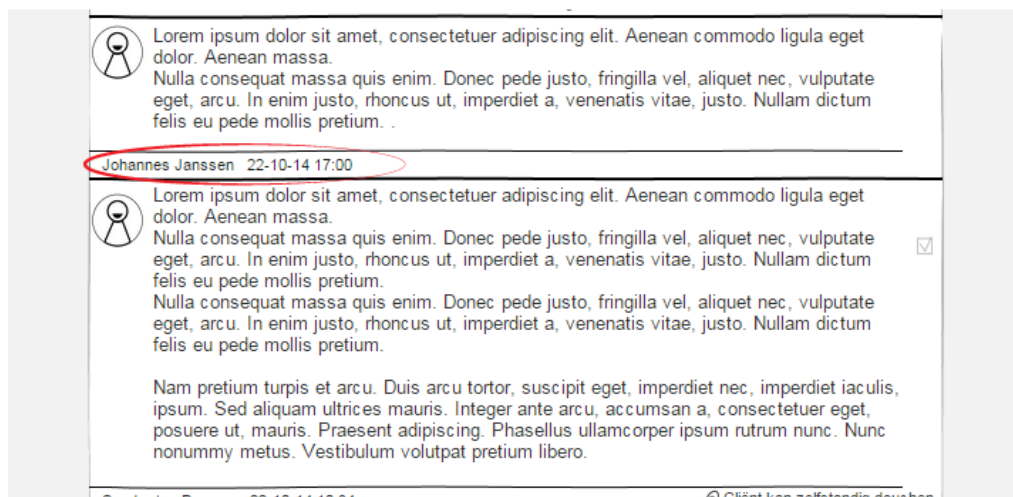


Figure 11.2: The participants had to select the report written by Johannes (red outlined in the figure). Most participants selected the report below the name, instead of the report above the name.

Task 5

Seven participants managed to fulfil the task without help. The average time to complete the task was 1 minute and 50 seconds. An expert could fulfil the task in 10 seconds. Three nurse aides encountered problems with understanding the task. They both searched for one report which could be written by the responsible nurse (as asked). One of these nurse aides found another report that had a label connected to it, the other nurse aide kept trying to add a label to a report that was written by a responsible nurse. The third nurse aide did not recognize the icon of the filter. She had seen it, but did not recognize it to be something useful.

Own task

The tasks differed per person. Some wanted to execute tasks that were possible to do with the current prototype, some did not. One participant wanted to search for all the reports which are not linked to a goal, so she could look if some of these reports should still be linked. Two participants wanted to add a new goal/episode and expected a button in the left information box. Two participants (nurse aides) wondered if they were allowed to indicate how important a certain report is. The last participant wanted to know when the last evaluation had been done. She expected a button beneath the care plan where she could see all evaluations.

The tasks that were successfully executed were to filter reports (3 participants) and to create a new report and connect a task/message to it (3 participants).

Added value

The participants thought in general that the interface had a much clearer overview than the ones they currently use. It is nice to have a split screen, so the care plan is always retrievable. Also they liked the task-functionality, especially the possibility to open it whenever they want to. Two nurse aides also mentioned that this record is much more legible; these nurse aides currently use a paper-based record.

Communication

Not everyone felt that the EHR really adds value to the communication. The participants who thought so, mentioned again that they currently have to check the mail et cetera and that it would be a relief if this functionality is integrated into the EHR. One participant is still worried that information will be placed in the 'Ons Messages' which should have been a report, because conversations will be held in this application. Another participant specifically mentioned the communication with the family. She indicated that it is important to communicate with the family, so it is good if people will be stimulated to do so.

11.2 Focus points

To understand what should be changed in the design, the focus goes back to the concerns to understand to what extent the concerns are issues. To what extent the requirements have been met, will be discussed after the last design iteration in the chapter 12.

1. Does the user understand how to create a new report?

Only one participant did not understand how to create a new report. After showing it to him, no problems occurred. It can therefore be stated that creating a new report is not an issue.

2. Does the user understand how to filter reports?

Although this went also fine in most of the cases (only one participant did not understand what the icon meant), four participants first clicked on the magnifier before they selected the filter icon. This raises the question why there are two filter functionalities (a search button to search for text and a filter button to filter the reports on authors or labels) and whether these should be separated or not. Furthermore, more feedback is needed, because some participants had some doubts about whether they had filtered the reports or not. They needed to click again on the icon to check this.

3. Does the user understand when a report has a notification?

In general this was not clear. Although 8 participants saw the exclamation mark, only 4 of them selected it. The main reason was that people thought it only meant that the report is important, it was not clear that one could click on the icon, or that it could contain a message.

4. Does the user understand what the icons connected to the possible actions mean?

The participants did not mention that they did not understand the icons, but 7 participants first tried all three icons before they knew how to create a task. This indicates that the icons are not very clear in their meaning. This does not automatically mean that the signs themselves are not clear, it might also be caused by the size or colour use of the icons.

5. Does the user understand what reports are new?

Seven participants had no problem with understanding which reports are new,

6. Does the user know what the button 'Dossier' means?

Since 5 participants did not select the button by themselves, it is concluded that this button is not clear. This might not be caused mainly by the text, but also by the placement of the button (see figure 11.3). Two participants tried to click on the word 'care-plan' at the top of the left information box, this might for example also be a solution.

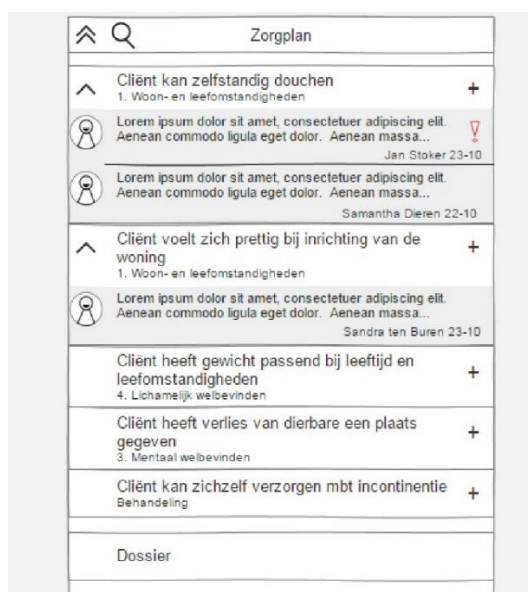


Figure 11.3: The button of the 'Dossier' is placed at the bottom of the information box, a little separated from the goals of the care plan.

7. Is it clear that one first needs to save a report before he can create follow-up actions?

Although everyone saved the report before creating a follow-up action, there was a lot of doubt.

8. Is the text for the follow-up actions clear?

No problems or doubts have been found in this step, so the text is clear.

9. Is it clear to the user what happens if a care provider is temporarily not available?

The participants often did not recognize the care provider to be absent. The participants had not seen it. One participant even thought that the name of the care provider was coloured grey to function as a hint that she had to select that particular name in the test. The participants who saw that she was not available had no trouble with selecting the locum.

10. Does this interface contribute to the communication between the user and other care providers?

Although it is very important in this research, it is not feasible to provide a satisfying answer to this question. As described before, this is something that cannot be tested by use of a usability test. The participants have therefore been asked to what they expect. The possibility to send messages after creating a report is appreciated by most of the participants and they felt that this is safer and provides a better overview than their current EHR.

11. Does the interface add value to the user?

All participants indicated that the new interface has an added value as compared to their current EHR. It should be taken into account that the current interfaces of the participants differ in functionality.

Other focus points

The participants were asked to create their own task and state what they thought of it compared to their current system. When creating their own tasks, it turned out that two participants wanted to add a goal/episode. Furthermore, two participants wanted to add a certain indicator of importance. One participant wanted to know when the last evaluation has been done, another participant wanted to see only the reports without a goal linked. These last two are both search functionalities.

One ECP wondered how she would be able to write a report in both an episode and a goal. This is connected to 'efficiency in text input' (chapter 9.2), which should be investigated further.

Two participants would like to see the disciplines next to the names of the care providers. One participant (ECP) wanted to work with another registration type and two participants thought that there were too many icons, although they expected that they would get used to it. Also, two participants thought that there is not enough colour and contrast in the interface, but this is out of the scope of the prototype. Finally, one nurse indicated that after a ward round of the ECP she has to report under several goals. She therefore suggested to create an extra button 'ward round' in which she could place these reports.

12 Phase 3: Design

This chapter describes the last part of this paper (see the figure to the right), this is the last design iteration. The impact of these design choices are not tested in this project. This final design is therefore the end result which has been transferred to Nedap. Below first some changes to the prototype are proposed. Then the list of requirements has been reviewed.



12.1 Proposed changes to the prototype

The icons were not always clear. This might be due to the appearance of the icons, the contrast and/or the size. It seemed as though the participants were not able to clearly distinguish the icons, because many selected all three icons; did not exclude an icon that could definitely not be the one they were searching for. Furthermore, in the second task it became clear that there were two issues with the exclamation mark. First the mark was not recognized to indicate that there is a message. Secondly the icon was not recognized as a button. Figure 12.1 shows a redesign of the icons. They are made more selectable, because they look more like buttons. The exclamation mark has been replaced by an envelope. A number at the right of the envelope indicates a new message, as is also done in many existing mail and chat programs. This stimulates the consistency of the interface. It is also made clear that they are connected to the report, because it looks like the icons are folded around the report. The new icons are incorporated in the new prototype.

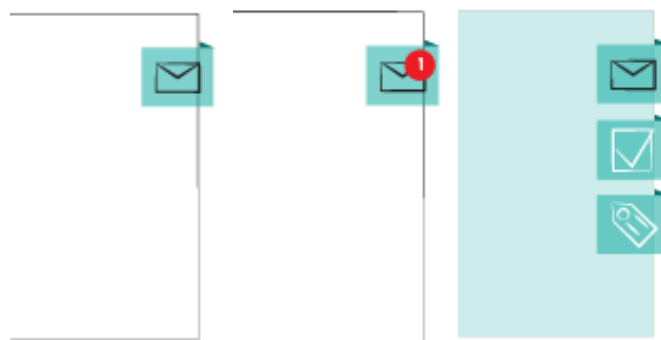


Figure 12.1: A redesign of the icons. The left figure shows that a message is linked to the report. When selecting the report, the other options (the right figure) are shown in a lighter colour. If the message is unread, the figure in the middle will appear, indicating the number of unread messages connected to the specific report.

Episodes and the care plan are separated in the current prototype, although in a multidisciplinary approach these should be linked. ECPs for example often write their report in the treatment plan (in this case one of the episodes) and also write a summary (and maybe some other additional information) in the care plan (the '*zorgleefplan*'). This last report is directed to the care sector, while the first is written for the ECP and maybe other medical specialists. It would therefore help the ECP to create a system that prevents him from entering text more than once (chapter 9.2). Another option might be to create an extra 'follow-up action', as suggested by a participant (ECP). After creating a report in one of the plans, one can link it to the other plan and change the text before saving it. Figure 12.2 shows an example (in Dutch). This functionality is not incorporated in the new prototype, but remains a recommendation.

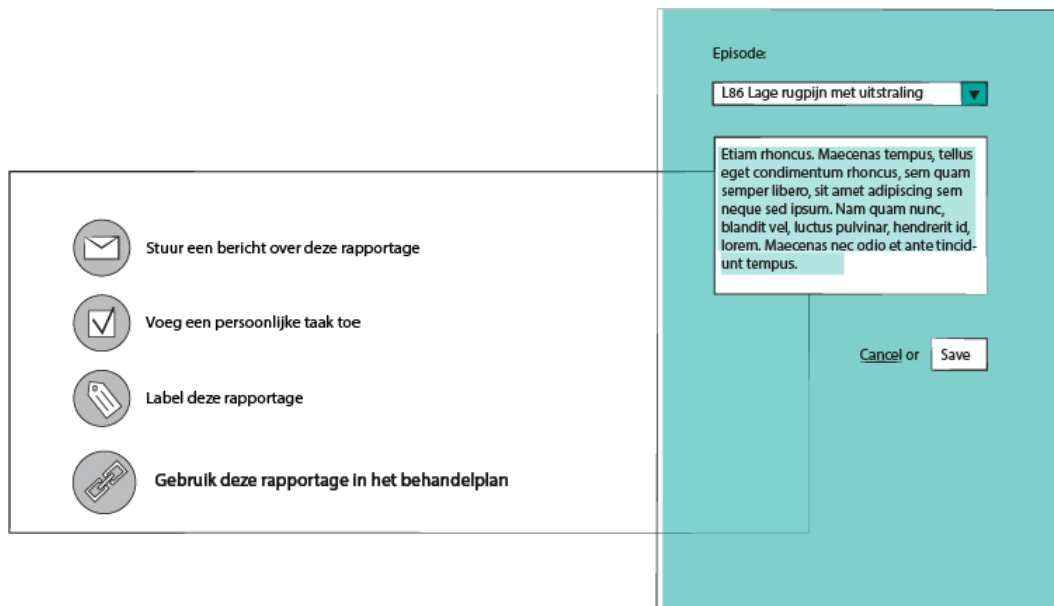


Figure 12.2: An example of what the follow up action could look like. At the left one can see the extra action button (the fourth button). When selecting this button, the right screen opens in which the user can select the episode and optionally change the text.

In chapter 9.3 it was mentioned that there are three purposes for which one would look at the reports: to see what the newest reports are, to search for something or to write a new report. The reports are strongly connected to the '*zorgleefplan*'. Another important reason to look at this '*zorgleefplan*' is however forgotten in the design: Getting informed about what to do. This is partly written in the newest reports, but more information about the tasks that need to be executed can be found in the care plan. The care plan should therefore be more prominently shown when the user opens a goal.

Eight out of ten participants thought that the name of the author of a report was shown above the report instead of beneath. This is caused by what one is used to in mail- and message applications, so therefore this is more consistent for the user. To avoid confusion, reports should be segregated more clearly. Since there was no specific reason to place the names underneath the reports, it seems more logical to place them above in the new prototype.

The difference between filter and search was not clear to all participants, which is not surprising. Every search query is in fact a filtering of the reports, so there is no clear reason why some filtering options would be placed under the 'filter icon', while others belong to the magnifier icon. To avoid confusion, it might be more logical to combine all search/filter options. One should still be able to filter on the labels and the disciplines (which was both appreciated well by all participants), but one should also be able to filter on search words in the same screen. Two participants also asked if it would be possible to filter the reports on a certain date or time span.

Furthermore, more feedback is needed when filtering. Some participants filtered the reports, but were not sure whether they succeeded or not. This is partly caused by the fake reports and because some filtering options did not work in the prototype, but the feedback is indeed minimal. The user has to select the filter icon again to check what he has selected. It would be more logical to show the filters, just like many modern search websites offer. Figure 12.3 shows an example of how this could be shown. The filter option is also incorporated in the next (final) prototype.

The prototype lacks feedback in other places too. For example, one participant thought she sent the message to the physiotherapist, but she did not properly click on the button 'send'. She just went on to the next step of the task, without noticing that she had not sent the message. Mistakes like these could be easily prevented by more feedback of the system.

Figure 12.3: Combination of the search and filter functionality. When opened it is always shown above the reports.

12.2 Requirements review

The requirements are reviewed to check to what extent the goals have been reached. Not all requirements could have been fulfilled, because some requirements can only be tested over a long period of time and only real life practice can tell.

1. The user should be encouraged to create reports connected to a goal

This first requirement could not be tested properly. It is confirmed that the participant is able to connect a report to a goal, but this does not indicate that the user will report on a goal in real life practice, because of the effects of time pressure, vague symptoms, et cetera. However, the design is focused on this problem and it is therefore thought that this requirement can be met. The goals are always shown, so the user is made aware of the available goals he can report on. Furthermore, a possibility is created to immediately report from a goal, by selecting the plus sign at the right (see figure 9.6). The button 'dossier' (under which one can report without a goal), is placed at the bottom to indicate that this should be used less. Also this button does not contain a plus sign, so the user has to first click on this page before he can add a report.

2. The user should be able to tag the reports

This requirement is met; a possibility is created to tag reports. In the usability test the participants had no difficulty with tagging reports.

3. The EHR should support work practices from the medical and care sector

This requirement is met, although only two work practices have been taken into account. More research should be done to other work practices and how well the design suits these practices. Furthermore, more research should be done to how the different work practices can be linked with each other (see figure 12.2 for an example). This becomes more important as more users with different work practices join the same record.

4. The user could be supported in using codes when writing reports

This requirement has not been met in the design. Due to the other design issues the 'could' requirement has not been taken into account. More about this requirement can be read in the conclusion and discussion (chapter 13).

5. The user must be able to learn, and to help and influence other care providers

These three purposes to communicate have all been taken into account in the design, so this requirement is met. The user is informed about the newest reports, new messages and tasks (**learn**). He can **help** others by creating reports and sending messages. The same functionalities are also meant for **influencing** each other. It would be very useful to see whether it is possible to offer a function to add an action from a message to one's agenda. More about this idea can be found in the discussion (chapter 13).

6. The user must be able to notify other care providers within the organization about a report

This requirement is met, because the functionality is added to the prototype. It has become an integration of another application 'Ons Messages'. With some adjustments this appeared to be very useful to use as replacement for an e-mail service, which the users currently use.

7. The user must be informed about the 'read' status of a report

The functionality is added only for the messages, not for the reports one has written. This is done due to the comments in the second phase. It would be too controlling to see whether people have read a report. However, if a user sends a message addressed to his colleague more feedback seems to be appreciated. This requirement is also influenced by the current other message services people use and causes more consistency for the user if implemented in the same way in this design.

8. The EHR must notify the user about important reports

This requirement is partly fulfilled. The main difficulty is to describe what is important. In the design it is stated that a report is important for the receiver, if someone notifies you about a report. The EHR notifies the user about these reports with an icon that is placed at that report. Furthermore, the message service 'Ons Messages' will provide a notification about a new message, which is linked to that report. However, it might not be true that the reports one receives a message about are the important reports. It can therefore not be certain whether the EHR notifies the user about important reports. It only notifies the user about messages.

9. The EHR must notify the user about tasks

This will be transferred to the application 'Ons Tasks'. This is an application that is currently in development, but it will combine tasks that are created from all different applications. It will show, for example, that the care plan of someone has to be renewed, and that someone else should go to the hairdresser, and that the user has to validate his working hours of yesterday. Since this is already a to-do list, it seems ideal to also include the tasks that are connected to a report.

10. The EHR must combine the reports from all disciplines about a certain problem (also family)

This requirement has been partly met (all disciplines are able to enter their reports in the same care plan), although there is still a gap between the reports in the treatment and care plan. More research is currently done by Nedap to this matter and it is therefore not treated in this research. As mentioned in the previous section it would be wise to create an option for the practitioners to reuse their texts.

11. The EHR must have authorization options

This requirement is partly met, because this is a rather technical requirement. One can indicate who is allowed to read the message and there is a separation of the care plan and the treatment plan. This way it is easy to isolate the treatment plan for some users.

12. Reports must be open or confidential

Reports can be made confidential as said in the previous requirement. There is even an option to indicate that only the user can read the report.

13. Reports must be factual

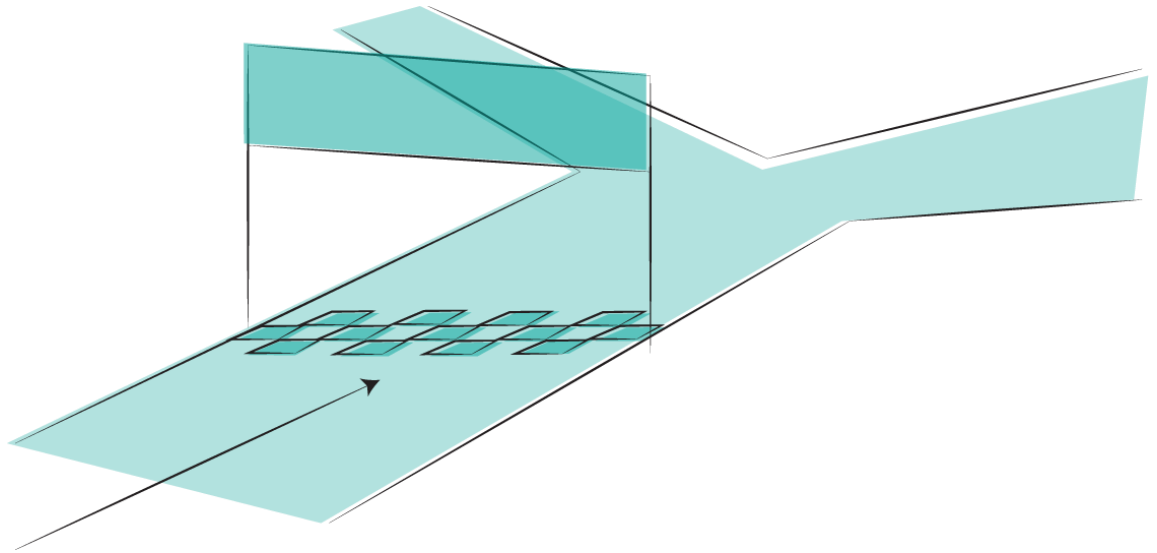
It cannot be stated whether this requirement is met or not, because this can only be found out in practice.

14. The communication must take place direct or indirect and asynchronous

All of these options are possible in the design, so this requirement is met.

15. The EHR should support prevent the user from sending a message to a non-available care provider

This requirement is met, although it is decided that the user should only be warned about sending a message to an absent care provider, instead of preventing it. It would then be left to the user whether he still wants to send the message to this person or to the locum.



CONCLUSIONS, DISCUSSION & REFERENCES

13 Conclusion and Discussion

In the previous section the list of requirements has been reviewed. At the end of this research, the research question will be repeated once more to close the loop:

In what way can the Electronic Health Record contribute to the communication between the care providers within the care process of the client to eventually optimize the quality of care?

This research showed that the EHR can contribute to the communication by integrating other applications to make sure that the user can help, learn, influence and relate in the same user interface. It suits the workflow of the care provider and makes the communication more efficient.

In the first phase of this research it has been found that improvements to the communication can be made concerning (among others) the report-functionality of an EHR. Quality of Care is defined by many aspects. In the scope of this research two important aspects were found to focus on: improvement of the quality of documentation and improvement of the cooperation between the care providers. The last aspect is evidently connected to communication, but a high quality of documentation is also needed to enable proper communication.

To support communication, the right tools should be available at the right moment. The participants in this research had provided a lot of input concerning what they want and need to provide a high quality of care with regard to their communication. Combined with supportive literature, requirements were determined. The design focuses on the part of the EHR where the reports about a client can be found, because this is a part with many design possibilities closely related to communication.

When reporting, users want to share information they just gathered to help other care providers so they are informed about the same situation. The messages can be confidential or open and often this communication is asynchronous. When reading reports on the other hand, users want to learn about what is important and what they need to do today.

Current EHRs only provide the opportunity to report and read reports. It is however thought that the Quality of Care can be improved if the user is stimulated to do more with a report. Communicating their message to others, creating tasks from the reports and tagging them are three aspects that were often mentioned by the participants and therefore integrated in the design.

Together with the participants, the design was made and refined to eventually create a wireframe. Most requirements have been met or are expected to be met when used in practice (chapter 12.1). The wireframe cannot be transferred exactly to a working prototype: first the interconnections with the other applications of Nedap should be further elaborated and assumptions from the last design phase should be tested. More about this test can be found in the next section (Discussion).

The participants in phase 3 were all very enthusiastic about the functionalities that were provided in the wireframe. It is very important that the user appreciates an interface, because this ensures that he will use it. Only when the user uses the EHR, communication can be improved through an EHR. The more the user will use the EHR to communicate about a client instead of using other communication systems, the less information about a client will be shared through these other devices and communication flows. Information about a client is then saved at a single place at which the user's work flow is supported to save time and effort.

13.1 Discussion

Some remarks have to be made concerning the accomplishment of this research. The findings of the last phase have not been tested. Furthermore, it could not be tested whether the use of this system would improve the communication between the care providers, not to mention the quality of care. It can only be assumed, based on the judgements of the participants.

Finding participants was difficult, especially since the first session had to take place in a holiday period. Although the number of participants is in the end satisfactory, some adjustments had to be made. As was mentioned in chapter 4.2, it was intended to execute the first session in pairs. However, due to the limited number of participants it was in some cases only possible to interview only one participant of an institution. It is not clear whether this has any consequences for the outcome of the research.

Beside time restrictions also the prototype software had some restrictions which caused that the solutions for 'efficiency in text input (section 9.2)' could not be tested. This is however still thought to be valuable and therefore recommended for further investigation (see future work).

No attention has been paid to requirement 4 (The user could be supported in using codes when writing reports). It was difficult to understand for the researcher of this project how reports could be saved in codes and this is a whole new subject compared to the other requirements. However, since Nedap is currently searching for options to save documented information in coded language, it is highly recommended to investigate the possibilities.

Finally, a remark should be made about the generation of the categories (chapter 5.1.2). The categories were created by three UX designers, but they have not been validated by other researchers. It cannot be predicted whether this check would have any effect on the categories. In the second phase, however, the sketches were shown to the participants to verify the ideas. Since this phase has not lead to new directions, it is thought that this validates the decisions in the first phase.

13.2 Future work

A few adjustments and design proposals have to be researched further. It should be investigated how one can efficiently reuse his text. Chapter 9.2 provides some examples, in chapter 12 also a solution to link a text to another report has been offered.

Furthermore, it would be useful to see whether tasks could be linked to messages. One of the purposes of communication was to influence colleagues. By sending a message the user often wants to get another person to do a certain action. In the current prototype the receiver has to create his own task in Ons Tasks or in his agenda. The flow would be better supported if the receiver only had to accept the task that was sent by the sender. This would prevent the receiver from making mistakes in copying the task and it would also save him time and effort. To apply this idea, more links between the applications have to be made. Further research should investigate the possibilities.

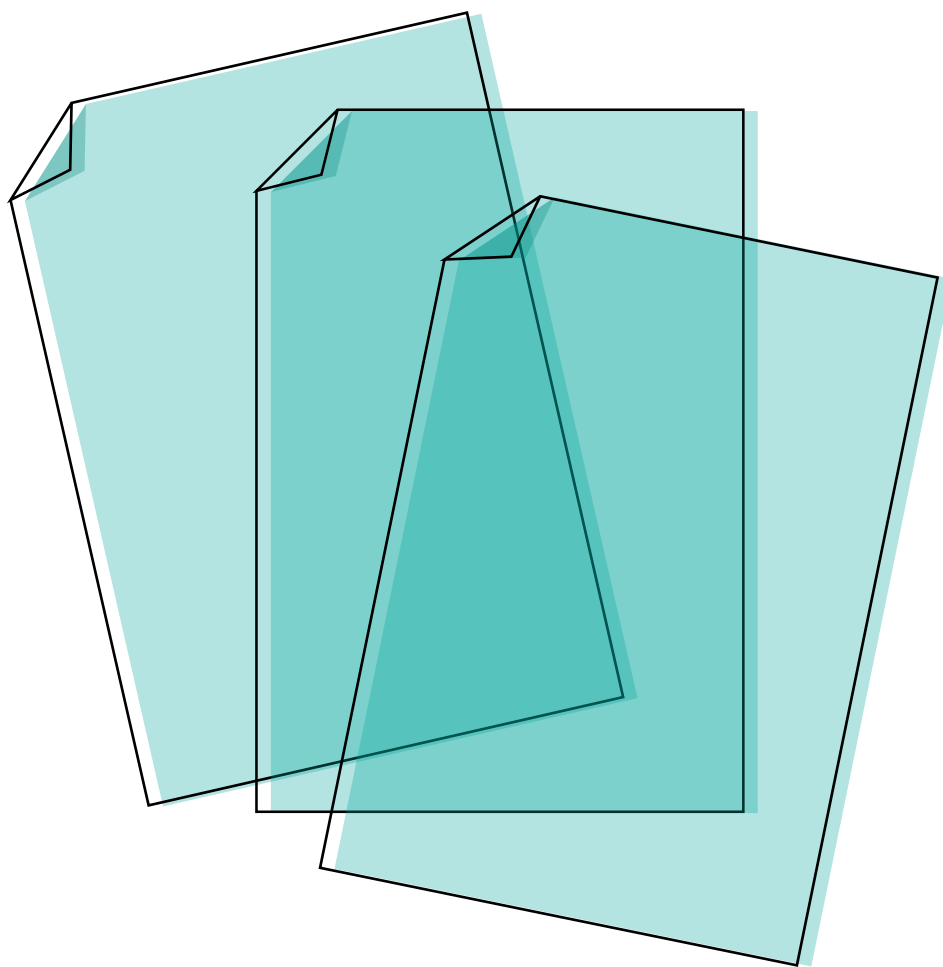
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APPENDICES

I. Glossary

In the Dutch care sector a lot of terms are used that are difficult to translate to the English language, because these terms do not exist or have a slightly different interpretation in other languages. Therefore these words are explained in the Glossary. Furthermore more information will be provided about the Nedap applications 'Ons Messages' and 'Ons Tasks'.

Nurse aides

In the Netherlands there are 5 degrees of nursing. The first degree is domestic help. They are not authorized to look into the EHR and are therefore not taken into account in this research. Degree 2 and 3 are called 'verzorgenden', degree 4 and 5 are 'verpleegkundigen'. In general these people are called nurses in English. However, in the Netherlands there is a clear difference in authorizations between the people with education degree 2/3 or 4/5. Because there is no proper translation for 'verzorgenden' to describe the job, they are called the nurse aides.

Zorgleefplan

The care plan model created by ActiZ (Dutch organization for care providers). The 'zorgleefplan' focusses on four domains: Mental wellbeing, physical wellbeing, participation and the housing and living conditions.

Episodes

Episode-orientated work is a method that is mostly used in the general practice and becoming popular in the elderly care sector. When a patient has a certain (new) problem, like head ache, a new episode is created. Every time the patient visits the general practitioner for a consult for the head ache, the process will be reported under this episode. However, if the patient has another problem, for example a broken arm, a new episode will be created. Many Elderly Care Physicians would like to work with this method.

OMAHA

The OMAHA system is based on three components: the client assessment, the care plan, and the client change and evaluation (Martin, Monsen, & Riemer, 2014). The client assessment contains of a classification scheme with 42 problems ordered into four domains. Based on this assessment a care plan is created based on 75 targets and one 'other'. These targets can then be rated during the care process (evaluation) on three concepts; knowledge, behaviour, and status. The OMAHA system is an American system that is probably becoming also a standard in the Dutch elderly care.

Ons Messages

Ons Messages (Dutch: 'Ons Berichten') is a message service provided by Nedap. Care providers can open this application from every other Nedap application they use. Messages can be sent to a colleague, but also to a group, like a team.

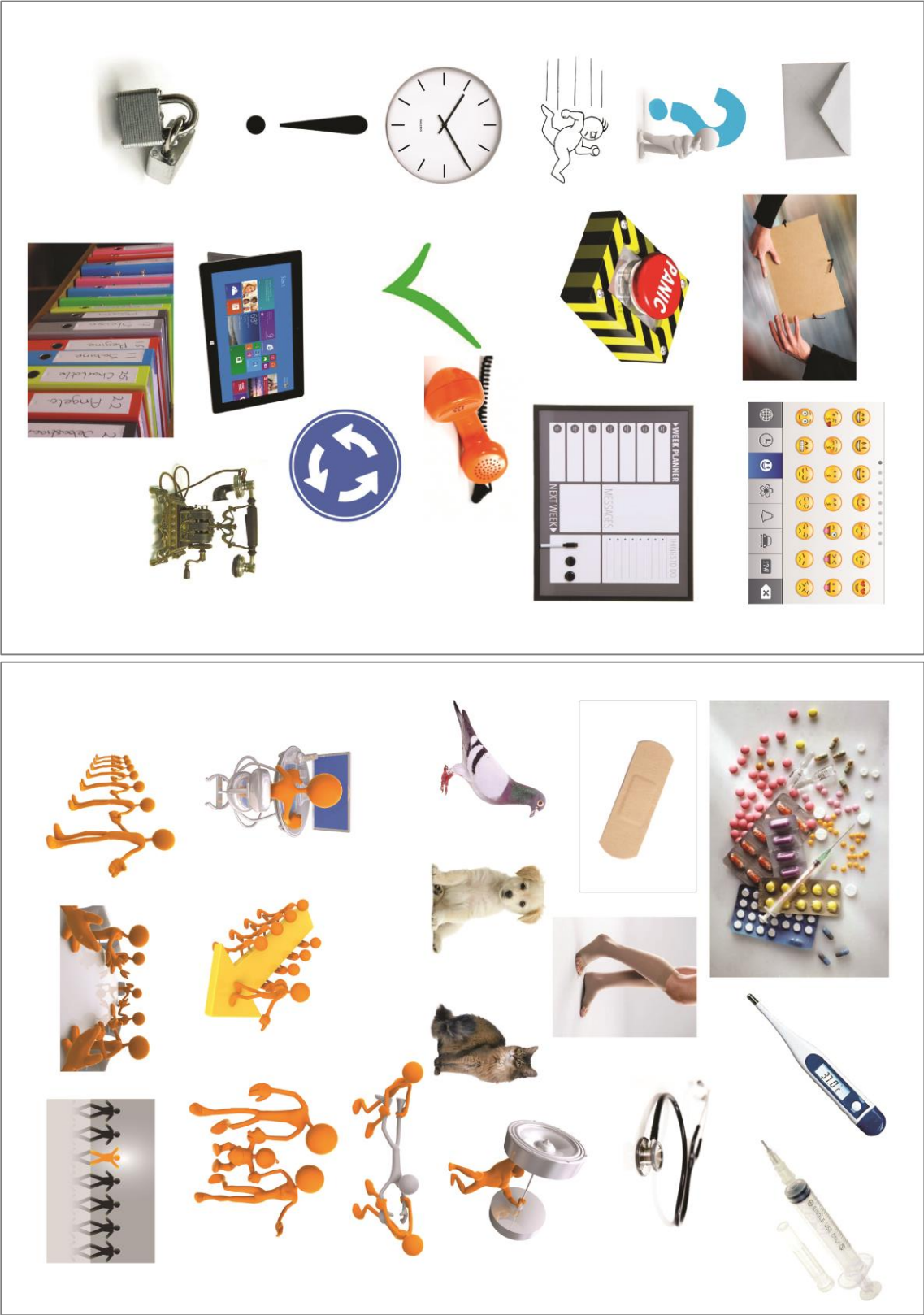
Ons Tasks

Ons Tasks (Dutch: 'Ons Taken') is in development at the moment. Just like Ons Messages this application can be opened from every other Nedap application the user is using. Tasks from agenda's are gathered and combined in a to-do list, which reminds the user of tasks he needs to do today.

List of Abbreviations

ECP: Elderly Care Physician
EHR: Electronic Health Record
MDM: Multi-Disciplinary Meeting
NP: Nurse Practitioner
QoC: Quality of Care

II. Pictures and words used for the trigger set



kort maar krachtig	ziekte		
uitgebreid	verdriet		
contactpersoon	vreugde		
beveiliging	1 op 1		
fysiotherapeut	samenwerking		
ergotherapeut	via-via		
verpleegkundige	veilig		
verzorgende	persoonlijk		
huisarts	zakelijk		
specialist ouderengeneeskunde	teambespreking		
gevoel	multidisciplinair overleg		
reanimatie	overdracht		
zorginstelling	telefoonnummer		
tijd	presentatie		
communicatie	partner		
sport	buurvrouw		
brein	gebeurtenis		
gedachten	ziekte		
groep	val		
zweten	wond		
collegas	pijn		
vraagbaak	vraag		
kracht	hulp		

psycholoog	
wat speelt er	
wie zijn er betrokken	
evalueren	
vreemdijkheid	
uitwisselen	
administratie	
papierwerk	
afspraken	
respect	
ongeluk/foutjes	
"niet altijd exact de regels volgen"	
bekwaam	
protocollen	
verantwoordelijke	
coördineren	
samen	
eenzaam	
uitzoeken	
realiseren/bewustworden	
leiding-gevende	

III. The Thirteen Principles of Display Design

Perceptual Principles

1. Make displays legible (or audible)

Legibility is necessary (although not sufficient) to create a usable interface. If the interface is not legible in the environment the interface can be used, no usable product can be made. One should think of contrast, noise et cetera.

2. Avoid absolute judgement limits

It is very hard for humans to judge the level of a represented variable on the basis of a single sensory variable which contains more than five levels. For example, if there is a light which can have six possible hues, the task 'if the light is amber, proceed with caution' is hard to execute (Wickens et al., 2004).

3. Top-down processing

'People perceive and interpret signals in accordance with what they expect to perceive on basis of their past experience' (Wickens et al., 2004, p. 187). This can be based on a long-term memory, or based on the information that is just gathered by the user. When the user read information that contradicts with his expectations, he needs more prove to believe the information is right.

4. Redundancy gain

Information is more likely to be interpreted correctly if this is repeated more than once with different physical forms. Imagine for example a traffic light: the placement and the colour both provide the same information in a different form. If one of the factors is degraded (for example when a person is colour-blind), the other form can still provide the information.

5. Similarity causes confusion: Use discriminable elements

Things that are different, should be displayed very different, to avoid confusion.

Mental Model Principles

6. Principle of pictorial realism

A display should look like the aspect it is representing. For example when talking about high and low temperatures, it should just like a thermometer providing the information with a vertical scale.

7. Principle of the moving part

Dynamic information should move in a pattern and direction that is compatible with the user's mental model of how the element moves in the physical model. Wickens et al. (2004) provide an example of a pilot. 'When the pilot thinks that the aircraft moves upward when altitude is gained, the moving element on an altimeter should also move upward with increasing altitude (Wickens et al., 2004, p. 189).

Principles based on Attention

8. Minimizing information access cost

It should be easy to find the information the user is searching for. It costs time and effort to move the user's attention from one display to another to gather the information. Little scanning should be required to access all information, although the legibility should be kept in mind.

9. Proximity compatibility principle

This principle is closely related to the Gestalt principles. Information that belongs together, should be place together, information that is not should be visually separated. It minimizes the information access costs too.

10. Principle of multiple resources

If a lot of information is involved, it might be better to divide the information to different resources (auditory and visual), instead of providing all information auditory and visually. It is then easier for humans to process information than when it all comes from the same resource.

Memory Principles

11. Replace memory with visual information: knowledge in the world

A user should not be required to retain important information only in his working or long-term memory. Checklists and menu's help the user to ease his memory. However, for example experts of a computer program would rather use short keys than a menu. A good balance should therefore be found.

12. Principle of predictive aiding

'Humans are not very good at predicting the future' (Wickens et al., 2004, p. 191). Proactive displays which indicate what will happen next are therefore often very effective and usable.

13. Principle of consistency

Old habits never die. A usable interface therefore takes into account the habits of a user, to provide a consistent interface.

Rapportage maken, onderverdelen en actie uitzetten

	Rapportage Bevatter delen	I
☐	☒ OK	Contact met de Samenleving
☐		Scheppen met rollen
☐		
☐		
☐	(+)	
oplaan		

Reportage	
☐  ☐  ☐ 	
☐  ☐  ☐ 	
☐  ☐  ☐ 	
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☐  ☐  ☐ 	
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Ontvangen van rapportages en verduidelijken

Startscherm

Opstartmenu toonen

23-08

25-08

Client scherm

Welkom terug

Er zijn wijzigingen in

Skopen met reken [R] [R]

Contact met de samenleving [R]

Task

Opmerking

deadline

OK

Zorgplan

Duel

opslaan

22-08 door mij

23-08 reactie van Biome

24-08 door Biome

Opmerking voor mij

reager

maak track

Rapportage

opslaan

1. The first screen represents a text field, in which a care provider can write his report. Next to the text field the goals/episodes are shown. In this case, the first goal is checked. If the person checks the second goal, screen two is shown.
2. After selecting a goal, the user is able to highlight a part of his text. This means that only the highlighted text belongs to the selected goal. In screen two one can see that one line is highlighted. The user has to press 'ok' to confirm his selection. Below the text field one can see three buttons. The puppet represents 'send a notification', the label means 'tag this report', the checkbox represents 'create a task for myself'. In this example, the first button is pressed. A field appears in screen 3.
3. The user is asked to select a person to which he would like to send a notification.
4. The second person in the left row is selected. The user can now if desired add a message and check whether the notification is urgent or not. If more than one goal is checked, one can also indicate to which goal this notification is relevant.
5. Screen 5 shows a part of the start screen a user can see. If a notification is sent, one can see it in this screen, categorized per client. Next to this list one can find the to-do list, in which the user can see the tasks for today.
6. If one opens the record of a client, a pop-up appears which shows at which goals new reports are added.
7. Screen 7 shows a part of a report list. It shows all reports of one goal. The green outlined boxes represent reports. The above report is written by the user of this example, he send a notification to 'Rianne'. Below the report one can see that the report is read by Rianne, because her picture is checked. She has also send a reaction, as one can see below the read receipt.
The next report is written by someone else, with a message to the user. From this message, the user can choose to 'react', or 'make a task'. If the user selects this second option, screen 8 will appear. On top of this screen, the number of open tasks, unread reports and notes are shown.
8. Screen 8 shows, at last, an example of a pop-up to create a task. A note and a deadline can be added before one saves the task.

V. Reactions to the design

Select goals/episodes afterwards				
Nurse aides		Nurses		Physicians
General	Positive: 2 Negative: 3	Positive: 1 Negative: 3		Positive: 2 Negative: 1
* one nurse aide stated that she had no preference in selecting goals before or afterwards				
Suggestions				
There should be a goal 'other', which later can be categorized by the responsible nurse		1	There should be a possibility to not link the report to a goal Keep in mind long and many goals	2 1
Negative remarks				
If you first write the report, there is a big change on useless or excessive information		1	If you first write the report, there is a big change on useless or excessive information	1
Often there is only one goal for a client		2	The record loses its effect if you can select multiple goals	2
Positive remarks				
It is very useful that you can immediately see the goals in a list besides the report		2	It is very useful that you can immediately see the goals in a list besides the report	1
Add notification				
Nurse aides		Nurses		Physicians
General	Positive: 2 Negative: 2	Positive: 4 Negative: 0		Positive: 3 Negative: 0
* two nurse aides stated that they would only want to use notifications for higher disciplines				
Suggestions				
What to do if the person who would work tomorrow is not there?		1	There should be a link between these messages and Ons Berchen	1
You should also be able to send messages to care providers who do not have acces to the record		2	Remove the goals Creating messages should be more difficult to avoid misuse	1 1
Messages should only be send to disciplines, not to the team		2	You should also be able to send messages to care providers who do not have acces to the record	1 2
Negative remarks				
The nurses and nurse aides read the reports, so notifying is useless		4		
Positive remarks				
Nice that you can involve other disciplines immediately It removes an action		1 1		I often have to refer clients, so it is nice to couple these actions
The link between reports and messages is very useful		1		
Tag reports				
Nurse aides		Nurses		Physicians
General	Positive: 2 Negative: 4	Positive: 4 Negative: 0		Positive: 1 Negative: 2
Suggestions				
Maybe a link could be created between some forms (like diabetes) and tagging of reports		1	How can you make sure that everyone tags the reports, so you don't miss things at the end?	1
Negative remarks				
Tagging is not useful for nurse aides (cannot come up with a reason why one should use it)		4		I don't know why I would use a tag
Positive remarks				
Tagging would be useful for the visit of the physician Currently I collect parts of written reports to create a MDM report		1 1	Tagging is very useful for MDM as cetera	4
				Tagging is useful, because it helps in remembering

<i>Show messages underneath reports</i>				
Nurse aides		Nurses		Physicians
General				
Positive: 2		Positive: 3		Positive: 3
Negative: 4		Negative: 1		Negative: 0
Suggestions				
Only show the messages at the views of the people to whom a message is directed to		1	Only actions should be stated in the record.	1
Do not limit the number of messages		1		1
You should be able to hide or fold in the messages		1	You should be able to hide or fold in the messages	2
Negative remarks				
There is a huge change that the record becomes a chatprogram		3		1
Positive remarks				
<i>Provide a read confirmation</i>				
Nurse aides		Nurses		Physicians
General				
Positive: 4		Positive: 4		Positive: 1
Negative: 2		Negative: 0		Negative: 2
Suggestions				
A button 'read' should be made available		2	A button 'read' should be made available	1
You have read the message after you have opened it		2	You have read the message after you have opened it	3
Negative remarks				
			I don't want to check my colleagues	2
Positive remarks				
<i>Provide actions from a received message</i>				
Nurse aides		Nurses		Physicians
General				
Positive: 4		Positive: 4		Positive: 3
Negative: 2		Negative: 0		Negative: 0
Suggestions				
It should be possible to create tasks from every report, whether it is directed to you or not.		1		1
It would be nice if you could sort of 'like' a report or message when someone did a good job		2		1
There should be a button 'place as a report'				
Button 'read'				
Negative remarks				
Positive remarks				
Great that you can immediately react		1		

VI. Brainstorm session

1. Welcome. Preceding the session, the participants have already read the scenario.
2. Explain goal: How can you make sure that the users do not 'misuse' the message and notification functionality? Explain the context and give scenario. Scenario (in Dutch):

Olaf werkt in verpleeghuis 'Zonnestraal', een verpleeghuis waar multidisciplinair werken hoog in het vaandel staat. Daarom maken ze gebruik van ONS om de dossiers van hun cliënten bij te houden.

Olaf is specialist ouderengeneeskunde en bezoekt veel cliënten in de week. Hij bekijkt niet elke ochtend de rapportages van al zijn cliënten. Daarom had Fenna (de verantwoordelijke verpleegkundige van mevrouw van Veen) gisteren gerapporteerd over mevrouw van Veen en had ze Olaf hierover genotificeerd. Mevrouw van Veen klaagde over pijn, maar Fenna kon niet goed de oorzaak vinden en het leek haar daarom een goed idee als Olaf er even naar wilde kijken.

Olaf onderzoekt mevrouw van Veen en vermoedt dat haar pijn te maken heeft met haar lighouding. Hij schrijft zijn onderzoek en diagnoses op in een rapportage en vinkt Julia, de ergotherapeute, aan. Hij voegt een kort berichtje voor haar toe om haar te vragen mee te kijken naar dit probleem. Hij slaat de rapportage op en gaat naar zijn volgende cliënt. 's Middags ziet hij dat Julia heeft gereageerd, ze gaat er vandaag nog mee aan de slag.

Olaf vindt het handig dat hij een notificatie heeft kunnen sturen naar Julia. Op deze manier heeft zij snel kunnen reageren op de gebeurtenis en blijft alle informatie binnen het dossier. Echter, steeds meer collega's beginnen de functie te waarderen en sturen notificaties naar Olaf. Hij heeft vandaag alweer drie notificaties van Fenna gekregen en zij is niet de enige die hem berichtjes stuurt. Vooral de nachtdienst heeft er een handje van. Soms heeft hij zoveel notificaties 's ochtends op zijn scherm, dat hij geen zin meer heeft om ze allemaal stuk voor stuk te bekijken. De kans dat hij daardoor een belangrijke rapportage mist wordt steeds groter.

'Pling!' Olaf kijkt naar zijn scherm. Een melding van Fenna. Hij klikt op de melding, waarna hij wordt doorgelinkt naar het dossier van de heer Swaferink. Verbaasd leest hij de rapportage: 'Meneer heeft lekker geslapen vannacht en kijkt uit naar het uitje met zijn familie vanmiddag'. Boos stuurt hij haar een bericht terug, de maat is vol. De functionaliteit, waar hij zelf zo blij mee was, wordt compleet misbruikt door sommige collega's. Dit soort berichten zijn wellicht interessant, maar niet noodzakelijk voor hem als arts om te moeten lezen. Misschien is het maar beter als de hele functionaliteit uit het systeem verwijderd wordt.

3. Brainwriting: Provide example sketches and empty sheets. Brainwriting is a technique in which the participants write some ideas on a sheet and then passes it to the participant on their left. This participant writes down some new ideas, inspired by the ideas that are already shown on the sheet. Some sketches are already shown to the participants to show some context and inspiration. Also for inspiration, some quotes are shown every time the participants pass their sheets.
4. If the sheet is back at the participant who started writing ideas on it, the brainwriting is over. Everyone then presents the ideas on his sheets to the rest of the team, so everyone is informed.
5. On the wall the enlarged sketches are hung. The participants are asked to go to the sketches and provide feedback and suggestions with sticky notes. In this stage the participants are up to date on the project and full of ideas. It is therefore thought to be useful to ask them to comment on the sketches to get even more input.
6. End of the session.

VII. Screenshots prototype

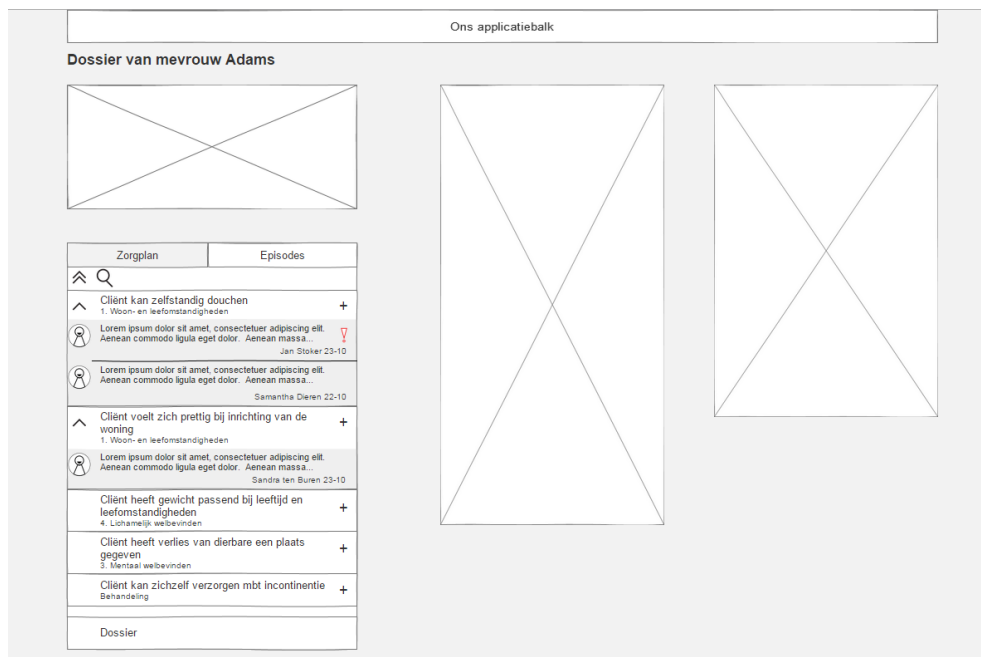


Figure VII.1: The start screen

This is the first view (the start screen) after one has selected a client. Placeholders have been placed for other information boxes, like general information about a client, allergic information, et cetera. At the left box can find the care plan. The care plan exists of buttons which represent the goals of the care plan. Every goal has a name and a domain beneath it (one of the four domains of the 'zorgleefplan'). In this screenshot, one can see that below goal 1 and 2 grey boxes are shown. These are the new reports since the last time the user has looked at this record. The reports disappear from this view after the user has viewed the concerned goal. At the bottom of this 'care plan' box, one can find the button 'dossier (record)'. If one selects this, all reports (regardless of the goal) will be shown (see figure VII.1 I). At the top of the 'care plan' box, one can see two buttons, the care plan and 'episodes'. Figure VII.2 will explain what happens if one clicks on the episode-button. Beneath two arrows are shown next to a magnifier. If one clicks on the two arrows, all goals will be folded (clicking on an arrow next to a goal will only fold that particular goal). The magnifier opens a search field, which enables the user to immediately search for words through the total care plan.

At the top of this screen a wide white bar is shown. This is the 'Ons applicatiebalk' and connects this application to the other applications of Ons. The name of the user will be shown here, a button to go to all tasks of the user and it shows whether and how many notifications are new. Furthermore, this bar allows the user to switch between this and other applications of Ons. The application bar is in development and is therefore included in the new design.

Ons applicatiebak	
Dossier van mevrouw Adams	
X	
	▼ L86 Lage rugpijn met uitstraling Rapportages + Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium. ☒ Naam van uzelf 15-09-14 12:20 Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem. Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Naam van uzelf 13-09-14 07:08 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Naam van uzelf 08-09-14 17:40 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Nam pretium turpis et arcu. Duis arcu tortor, suscipit eget, imperdiet nec, imperdiet iaculis, ipsum. Sed aliquam ultrices mauris. Integer ante arcu, accumsan a, consectetur eget, posuere ut, mauris. Praesent adipiscing. Phasellus ullamcorper ipsum rutrum nunc. Nunc nonummy metus. Vestibulum volutpat pretium libero. ☒ Naam van uzelf 12-07-14 10:34
Zorgplan Arts L86 Lage rugpijn met uitstraling Urine incontinentie Fysiotherapie L86 Lage rugpijn met uitstraling	Episodes
Journaal	

Figure VII.2: An episode-screen

This screen shows an example of what the episode-screens will look like. At the left box, the episodes are divided into boxes. One can see his own episodes (in this case of the ECP), but also of other involved disciplines (the physiotherapist in this example). The first episode is selected. At the right the reports about this episode are shown in chronological order. The functionalities of the reports are similar to those described at the care plan screens and will therefore not be explained into detail. The episode screens are only visible to the ones authorized to see them (ECPs and paramedical staff).

Dossier van mevrouw Adams		Oms applicatiebalk
X		
	+ ✓ Client kan zelfstandig douchen Woon- en leefomstandigheden Y Q Rapportages + Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium. Samantha Dieren 23-10-14 12:20 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden ✓ Client voelt zich prettig bij inrichting van de woning + 1. Woon- en leefomstandigheden Client heeft gewicht passend bij leeftijd en leefomstandigheden + 4. Lichamelijke welbevinden Client heeft verlies van dierbare een plaats gegeven + 3. Mentale welbevinden Client kan zichzelf verzorgen mbt incontinentie + Behandeling Dossier	
	 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden Y Q Rapportages + Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium. Samantha Dieren 23-10-14 12:20 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden ✓ Client voelt zich prettig bij inrichting van de woning + 1. Woon- en leefomstandigheden Client heeft gewicht passend bij leeftijd en leefomstandigheden + 4. Lichamelijke welbevinden Client heeft verlies van dierbare een plaats gegeven + 3. Mentale welbevinden Client kan zichzelf verzorgen mbt incontinentie + Behandeling Dossier	
	 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden Y Q Rapportages + Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium. Samantha Dieren 23-10-14 12:20 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden ✓ Client voelt zich prettig bij inrichting van de woning + 1. Woon- en leefomstandigheden Client heeft gewicht passend bij leeftijd en leefomstandigheden + 4. Lichamelijke welbevinden Client heeft verlies van dierbare een plaats gegeven + 3. Mentale welbevinden Client kan zichzelf verzorgen mbt incontinentie + Behandeling Dossier	
	 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden Y Q Rapportages + Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium. Samantha Dieren 23-10-14 12:20 Client kan zelfstandig douchen + 1. Woon- en leefomstandigheden ✓ Client voelt zich prettig bij inrichting van de woning + 1. Woon- en leefomstandigheden Client heeft gewicht passend bij leeftijd en leefomstandigheden +	

Figure VII.3: The first goal

The first goal in the left box has been selected to reach this screen. At the right a lot of new information appears. At the top the goal is written again. An arrow is shown at the left. Clicking on this box causes the box to unfold. More information about the goal like the related actions and changes are shown.

Below this box the reports are shown at chronological order. Every report is ordered in the same order: At the left a photo of the sender of this report is shown. The text represents the report and can be as long as necessary. If the text is shorter than three lines, empty space will be shown beneath the text, so the photo can still be shown completely. At the right some space is been kept open to show icons. The icons are only shown when a certain aspect is added to this report. The box of the first report shows an exclamation mark, which means a message is linked to this report. It is coloured red, because the message has not been read yet (see figure VII.4). The second report has a label connected to it, while the last report has a task that is connected to that report.

Below the text of one report, the name of the author and the time and date are written. A line is drawn between the report and the name to make clear that this is not part of the report. The line is not fully extended to indicate that it belongs to the report above the name instead of below.

One could draw an invisible line between the text of the reports and the icons at the right. Everything at the left is visible for everybody with the same authorities. What is shown at the right, differs per person. Messages can be send only to one user, tasks are personal and labels might be personal too (see figure VII.3).

The first two reports are shaded. These are the two new reports that have not been read by the user yet. If the user switches screens or refreshes the page, these shades will disappear. One can select every report. Figure VII.12 explains what happens when a user selects a report.

At the top of the 'reports' box a bar is shown with three icons and a text. The most left icon is a filter icon. More about the filter icon can be found at figure VII.10. Next to it, a magnifier is shown. This search option allows the user to search within the reports of one goal. The main use is meant to search for words (like 'back pain', or 'incontinence'). If one enters a search query, the reports will be filtered on this query. One can filter on discipline and label by using the filter icon (figure VII.10).

At the middle of the bar 'reports' is written. At the right a plus sign is shown. This icon represents 'add a report'. More will be explained at figure VII.5.

The screenshot displays the 'Ons applicatiebalk' interface. On the left, the 'Dossier van mevrouw Adams' is shown with a placeholder for a photo. Below this, a table lists 'Zorgplan' and 'Episodes'. The 'Zorgplan' table has columns for 'Zorgplan' and 'Episodes', with rows for 'Client kan zelfstandig douchen', 'Client voelt zich prettig bij inrichting van de woning', 'Client heeft gewicht passend bij leeftijd en leefomstandigheden', 'Client heeft verlies van dierbare een plaats gegeven', and 'Client kan zichzelf verzorgen mbt incontinentie'. The 'Episodes' table has a single row for 'Dossier'. The main area shows a list of reports. The first report is highlighted with a red background and a red exclamation mark icon. The second report is highlighted with a blue background and a magnifying glass icon. The third report is highlighted with a green background and a plus sign icon. The sidebar on the right shows 'Recente communicatie' with messages from 'Jan Stoker aan U' and 'Collega aan Team'.

Figure VII.4: Reading the message connected to a report

To get to this screen, the user has selected the red exclamation mark at the right of the first report. A window appears at the right of the screen showing the recent communication about Mrs Adams. The messages shown here are imported from the application 'Ons Messages'. This is a message service provided by Nedap, which works on the mobile phone and can be used in every application of Ons. It allows the user to send messages to single colleagues or groups/ teams of care providers.

The messages which are linked to Mrs Adams, are shown in this window 'recent communication'. This can be because Mrs Adams is mentioned in the message (like the third and fourth message in the example), or because the message is linked to a report. This is indicated by the text behind the paper clip (see the first, second and fifth message). The first message is shaded grey, because this is the message connected to the report that was selected by the user. At the top of the message the name of the sender and the name(s) of the receiver are shown. At the right, the number of reactions is shown. This design is adapted from the current design of Ons Messages. The only new part is the connection with the reports. If one selects a message, he is able to write a response.

The screenshot shows a web application interface for a patient's dossier. The top bar is labeled 'Ons applicatiebalk'. The main section is titled 'Dossier van mevrouw Adams'. On the left, there is a 'Zorgplan' (Care Plan) table with columns for 'Zorgplan' and 'Episodes'. The table lists several items, each with a plus sign in the 'Episodes' column. Below the table is a 'Dossier' section. On the right, there is a 'Rapportages' (Reports) section. It features a dropdown menu for 'Zichtbaarheid' (Visibility) with options 'Alleen ik', 'Alleen ik', and 'Ik en hoger'. Below this is a text area for writing a report. At the bottom right of the text area are buttons for 'Annuleer of' and 'Opslaan'. The 'Rapportages' section also displays a list of existing reports, each with a user icon, a title, and a timestamp.

Zorgplan	Episodes
Client kan zelfstandig douchen 1. Woon- en leefomstandigheden	+
Client voelt zich prettig bij inrichting van de woning 1. Woon- en leefomstandigheden	+
Client heeft gewicht passend bij leeftijd en leefomstandigheden 4. Lichamelijke welbevinden	+
Client heeft verlies van dierbare een plaats gegeven 3. Mentale welbevinden	+
Client kan zichzelf verzorgen mbt incontinentie Behandeling	+
Dossier	

Rapportages

Zichtbaarheid: Alleen ik Alleen ik Ik en hoger Iedereen Annuleer of Opslaan

Rapportages

Jan Stoker 23-10-14 12:20

Jan Stoker 23-10-14 12:20

Samantha Dieren 22-10-14 14:10

Samantha Dieren 20-10-14 17:00

Figure VII.5: Writing a new report

The user has to select the plus sign at the right top of the 'reports' box to reach this screen. A new box appears, showing a text field in which one can enter the report. One can enter who is allowed to read this report and save it. After saving the report, figure VII.6 will be shown.

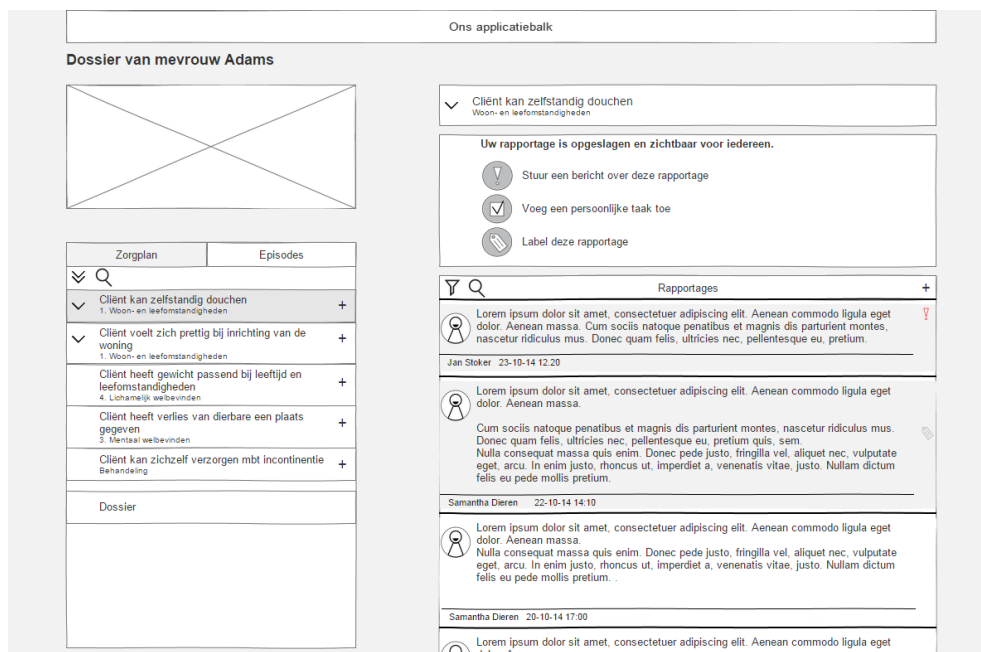


Figure VII.6: Your report has been saved

This screen is shown after the user has added his report. The user is enabled to connect actions to his just written report. The first option is to send a messages about this report (figure VII.7), the second to add a personal task (figure VII.8) and the last to label the report (figure VII.9).

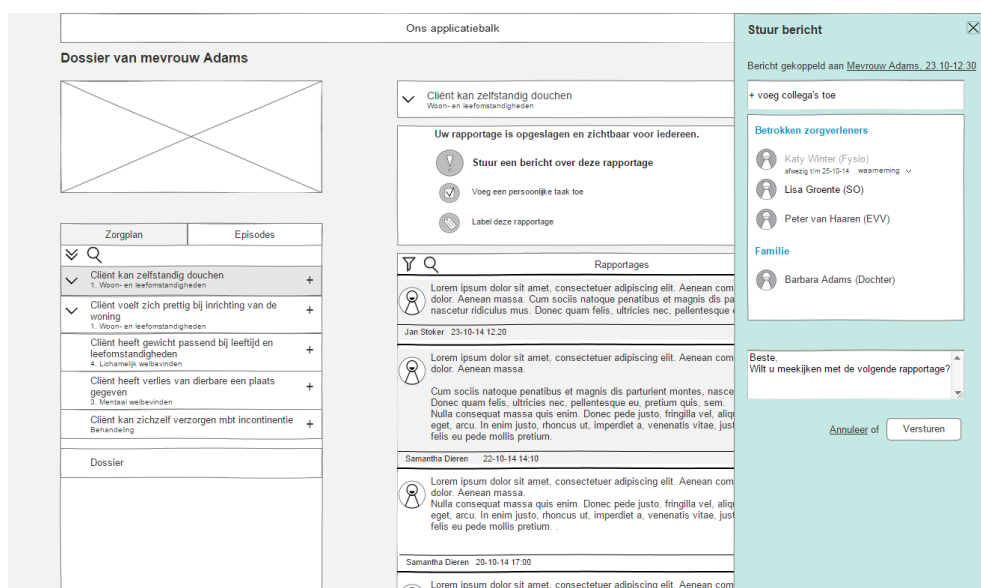


Figure VII.7: Send a message to a care provider about a report

If the user has selected the first action, this screen appears. A window is shown at the right, again adapted from 'Ons Messages'. Only the functionalities that are not implemented in the current Ons Messages will be explained here. Under the field where one can add colleagues, already the involved care providers of the client are shown, just like the family of the client. It is most likely that the user would like to send a message to one of these people, but the opportunity to inform other care providers is kept open by searching them in the top field. If the user wants to send a message to someone who is not allowed to read the report (because of non-allowance to the client's record, or because the user has indicated that this discipline is not allowed to read the report), the user is warned. If the user decides to send the message anyway, the report is copied into the message (so

only that report can be read by the receiver). There has been done no research to whether this solution is legal.

One might have noticed that the first involved care provider (Katy Winter) is shaded grey. This means that the care provider is currently not available. Below the name it is written until when the care provider is absent and the text 'observation' is shown, with an arrow. Clicking on this text reveals who the locum of this care provider is during his absence. It is always possible to select the absent care provider. The user is only warned that he might not respond soon.

Below the receivers a text field is shown, which already contains some text. This text states: 'Dear..., Can you please think along with me about this report?' The name(s) of the receiver(s) will be completed on the dots. The message is editable. It is already written to save some effort, but mainly to influence the user to use the message functionality in the right way. It shows that one should have said everything he needed to tell in the report and only refer to it in the message.

The screenshot shows a software interface for an Electronic Health Record (EHR). The main window is titled 'Dossier van mevrouw Adams' and contains a 'Zorgplan' (Care Plan) and 'Episodes' section. A sidebar on the right, titled 'Mijn Taken' (My Tasks), is open, showing a task linked to the report. The task details include a date, a time slot, and a list of tasks for 'Vandaag' (Today) and 'Morgen' (Tomorrow). The task is titled 'Taak gekoppeld aan Mevrouw Adams, 23-10-12-30'. The sidebar also shows a 'Datum' field and a 'Opmerking' (Note) field. The task details section shows a list of tasks for 'Vandaag' and 'Morgen', each with a time slot and a description. The task is titled 'Taak gekoppeld aan Mevrouw Adams, 23-10-12-30'. The sidebar also shows a 'Datum' field and a 'Opmerking' (Note) field. The task details section shows a list of tasks for 'Vandaag' and 'Morgen', each with a time slot and a description.

Figure VII.8: Create a task from a report

Selecting the second option in figure VII.6 leads the user to this window. The window is placed at the right and shows the user the option to add a task. This screen should be the same as when a user wants to open his tasks from the application bar at the top of the EHR. However, in this case the option 'add task' is already opened and linked to the report the user has written. The tasks for today and tomorrow are shown in the white boxes. At the top one can add a new task. Because the user has selected to add a task from the report he just wrote, the task is automatically connected to this report.

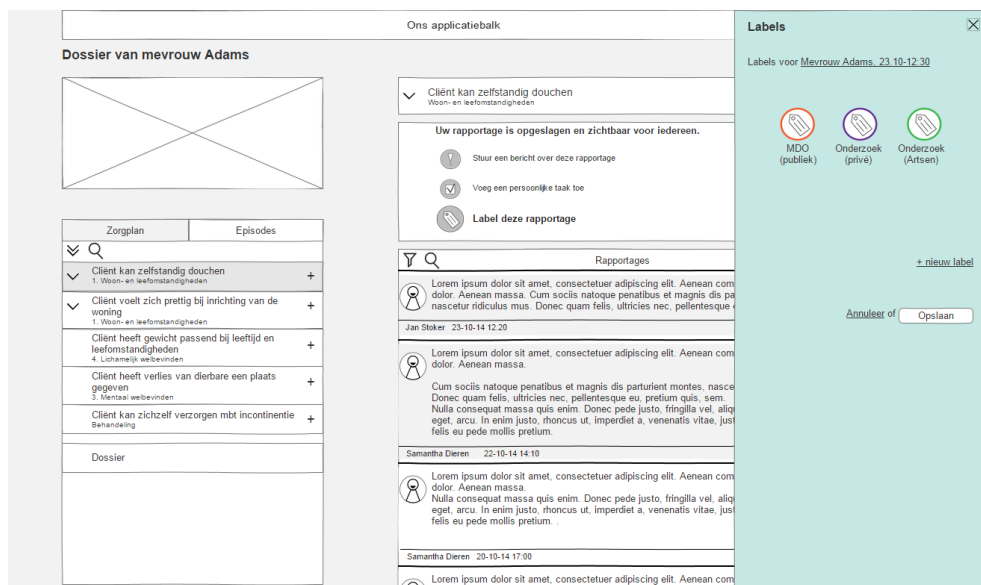


Figure VII.9: Label the report

Selecting the last option in figure VII.6 leads the user to this window. The existing labels are shown. One can select a label by clicking on it, or the text below. The text also shown between brackets what the scope of the label is. A label can be public (to be viewed and edited by all involved care providers), private (only visible for the user), or for a specified group of people. One can also add a new label. He can name the label, add a colour and specify who are allowed to view and edit the label.

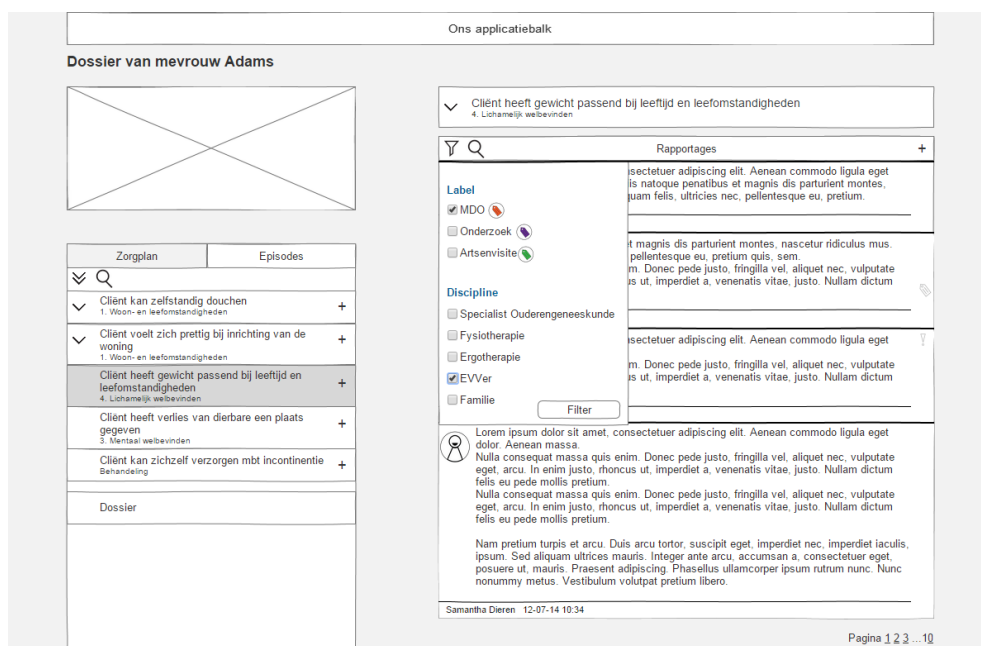


Figure VII.10: The filtering of reports

This screen shows how the user can filter the reports of a certain goal. The filters are grouped into 'labels' and 'disciplines'. One cannot filter on a specific person, but only on disciplines who wrote reports about the client. One can select as many filters as needed and clicks on the button 'filter' at the right bottom of the field to apply the filter.

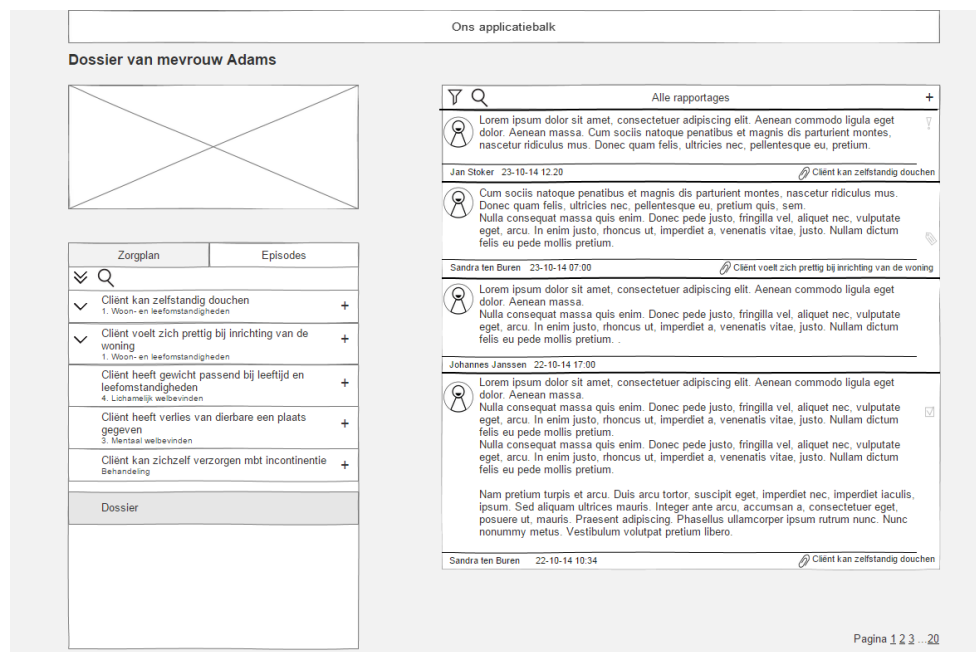


Figure VII.11: All reports (regardless of the goal) are shown

As was already described in figure VII.1, the care plan has a button called 'dossier'. Selecting this button leads the user to this screen. All reports are shown, regardless of the goal to which the report belongs. The user is also able to add a report here without a goal, because this was requested by the participants. The reports have the same appearance as those in figure VII.3, but in the right bottom corner of every report a paper clip is shown representing the goal the report is connected to. Clicking on this goal redirects the user to the page of that specific goal.

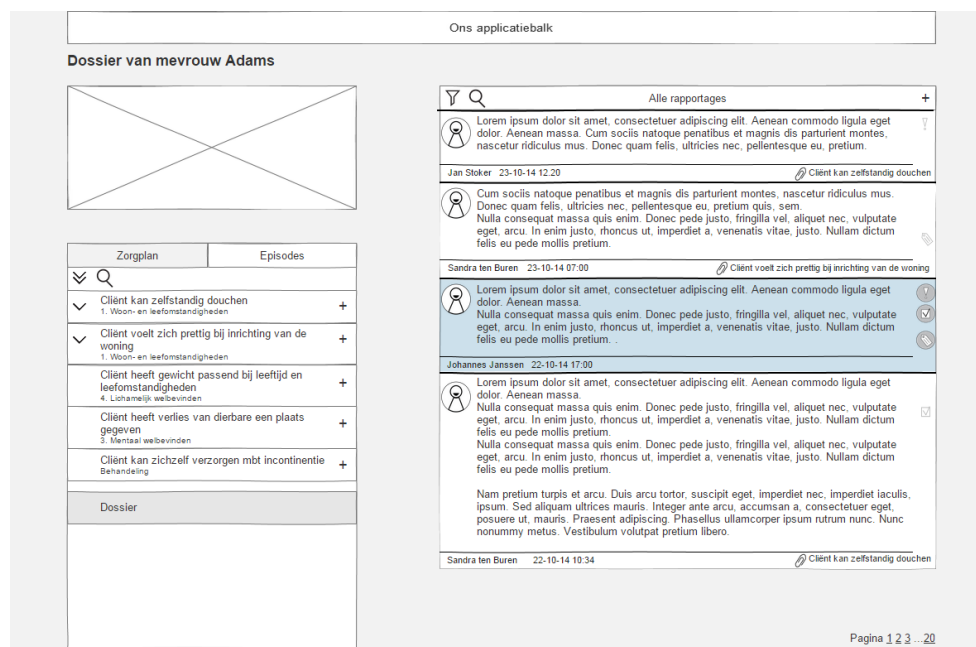


Figure VII.12: Selecting a report to see the possible actions

If one selects a report, it becomes shaded. At the right three buttons appear. These are the actions that can be done from a report and are the same as those that can be done after writing a report. This way the user is also able to add tasks, messages or labels later to his report, or to reports others have made.. The order in which the buttons are shown are equal to the order in figure VII.6. Clicking on one of the buttons shows the right window of figure VII.7, VII.8 or VII.9.

VIII. Task analysis

<i>Profession</i>	<i>Task 1</i>	<i>Task 2</i>	<i>Task 3</i>	<i>Task 4</i>	<i>Task 5</i>
practice nurse	0.30	1.30	2.30	4.00	1.00
nurse aide (ext)	0.40	2.30	4.00	2.00	1.00
ECP	2.30	1.30	6.00	6.00	4.00
ECP	4.00	4.00	6.00	3.00	4.00
ECP	2.00	3.00	6.00	4.00	1.00
nurse aide (int)	2.00	2.00	8.00	5.00	3.00
nurse aide (int)	0.30	3.00	5.00	4.00	1.30
nurse aide (ext)	1.00	2.00	7.00	4.00	6.00
nurse aide (ext)	0.30	4.00	9.00	5.00	3.00
nurse	1.00	1.00	4.00	2.00	2.00

Table VIII: This table shows the time results per task per participant. The red boxes indicate that the participant was not able to fulfil the task without help of the observatory. The four grey-shaded professions are participants who did not participate in the second phase and therefore had less knowledge of the functionalities.