Optimising the Care Journey at the Department of Cardiology at LUMC

Master Thesis - Brechtje Krijvenaar

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Enjoy reading my master thesis!

Abstract

The Dutch healthcare system is under increasing pressure from rising patient numbers, administrative burdens, and staff shortages. These challenges are felt throughout the healthcare sector, including academic hospitals such as the *Leids Universitair Medisch Centrum (LUMC)*. The cardiology department at the LUMC, in collaboration with TU Delft, has initiated a project to optimise their current care journey. This is done by improving workflow efficiency, reducing workload, and enhancing the wellbeing of healthcare professionals while maintaining high-quality patient care.

The project applies a strategic design approach with mixed methods. This includes qualitative research through interviews, observational studies, and Thematic Content Analysis (TCA). It identifies key problems in the current workflow, including administrative overload, fragmented communication, and a lack of transparency between internal systems, people, and technology. The findings indicate a misalignment of expectations patterns between internal healthcare professionals, patients, and external healthcare providers. This leads to decreased wellbeing, reduced collaboration, and professional burnout.

A strategic design framework was developed to address these challenges. This includes interventions for future implementation, such as a redesigned patient portal, a digital collaboration platform for interprofessional communication, and a knowledge data bank for medical and lifestyle information. The interventions aim to increase transparency, facilitate collaboration, and empower patients to engage in their care journey. By implementing the interventions, the cardiology department can improve workflow efficiency, enhance the wellbeing of internal healthcare professionals, and improve patient experience.

The project contributes to a wider discussion on healthcare system transformation and serves as a model for optimising care journeys. Future research should focus on evaluating the long-term impact of the interventions and their scalability across departments and other healthcare organisations.

Keywords: healthcare innovation, strategic design, workflow optimisation, patient experience, digital transformation, cardiology

Report Structure

The report is divided into seven chapters. The first four chapters focus on understanding the project's background and analysing the qualitative data. After defining the new problem areas and therefore problem statement, the first steps are made in designing interventions to optimise the care journey at the cardiology department. The design interventions are validated, and the viability and feasibility are presented. Finally, a general discussion and conclusion are provided to complete the report. The chapter content is as follows:

Chapter 1 General Introduction

This chapter provides information related to the project, such as the background, the healthcare context, problem definition, design assignment and the scope.

Chapter 2 Understanding the Cardiovascular System and Workflow

This chapter dives deeper into all the elements that form the workflow at the cardiology department. It shows the outcome of the observational research and interviews with internal healthcare professionals.

Chapter 3 Understanding Cardiovascular System Inefficiencies and Challenges

This chapter analyses the data from interviews with internal healthcare professionals and external healthcare providers, as well as focus group patient data to develop themes that represent the problems experienced in the system.

Chapter 4 Locating and Analysing the Challenges in the Cardiovascular Workflow

This chapter defines the locations and the relationships of the problems in the workflow. Furthermore, it describes which problems have the most impact on each other and the system.

Chapter 5 Framing the Design Direction

This chapter gathers all the insights from the research and analysis phase (chapters 2, 3 and 4), defines the frame of the problem, and the new problem statement and provides a design direction.

Chapter 6 Developing a Strategic Framework for Innovation

This chapter presents the strategic direction, including interventions. These are built from sketching the context, defining the stakeholders, and understanding what the cardiology department can influence.

Chapter 7 Discussion and Conclusion

To finalise the report, this chapter presents a conclusion, the viability and feasibility, recommendations, and the limitations of the project.

A visual representation of the report structure is made to help guide the reader through the report. A tailormade figure is added before the start of every chapter.

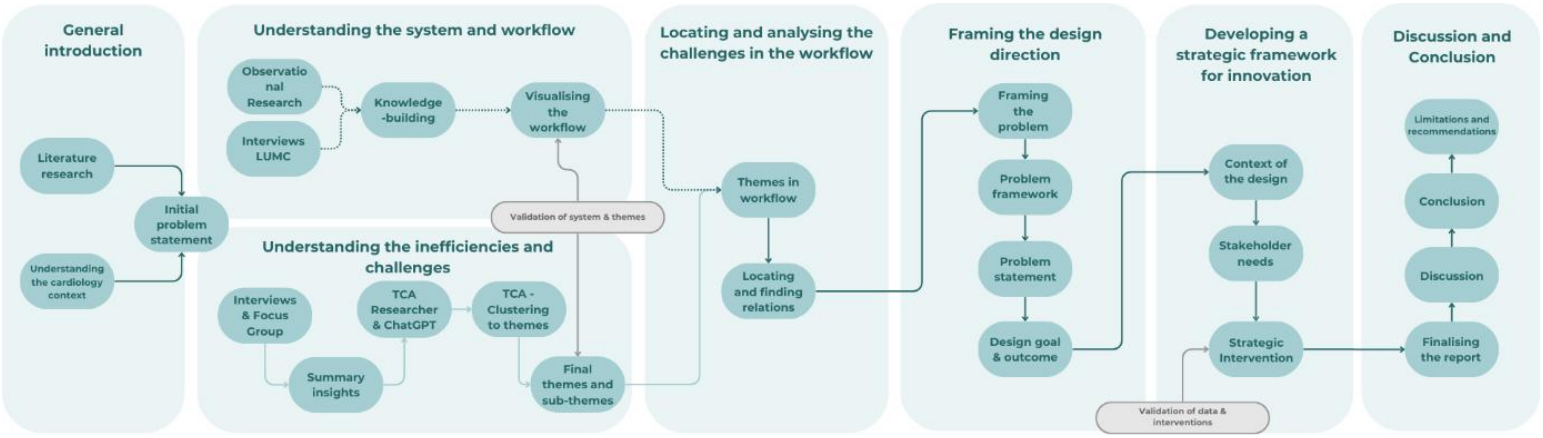


Table of Contents

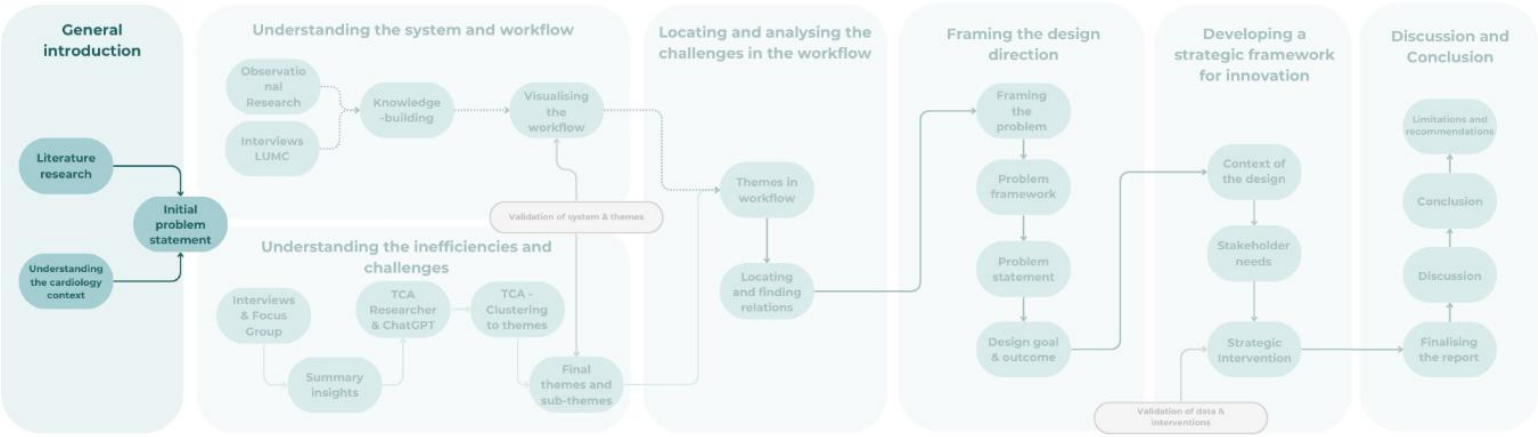
Abbreviations and Consistency

Several abbreviations and specific terminology are used within the healthcare domain to shorten text and identify people, procedures, and actions. This chapter provides an overview of abbreviations and terminology found in this report to help guide the reader.

AIOS	"Arts In Opleiding tot Specialist" Doctor in Training to become a Medical Specialist
ANIOS	"Arts Niet In Opleiding tot Specialist" Doctor Not in Training to become a Medical Specialist
DBC	"Diagnose Behandel Combinatie" Diagnosis Treatment Combination
Dienst	Working mandatory extra shifts outside the regular working hours
EPD	"Elektronisch Patiënten Dossier" Electronic Patient Dossier
EPDVision	EPD software specially made for the cardiology department at the LUMC
GP	General Practitioner
HC	Abbreviation for Healthcare
Healthcare professionals, internal	All individuals working within the LUMC
Healthcare providers, external	All individuals working within the healthcare domain outside of the LUMC (e.g. GP, health insurance company, second-line medical specialist)
HiX	EPD software made by Chipsoft
ICT	Information and Communication Technology
LUMC	"Leidsch Universitair Medisch Centrum" Leiden University Medical Centre
MDO	"Multidisciplinair Overleg" Multidisciplinary Consultation
MS	Medical Specialist
Procedure	Surgery, intervention in the body
TCA	Thematic Content Analysis
Treatment plan	Agreements during consult between doctor and patient about medication, adapting lifestyle to avoid risk factors, help outside the hospital, or procedure
TU Delft	"Technische Universiteit Delft" Technical University Delft

To better visualise the figures within the report, QR-codes are provided to show the visuals in high-quality. To provide the iterations before the final version a Miro board link is added below.

https://miro.com/app/board/uXjVLGRzEtg=/?share_link_id=6834124582



Chapter 1 General Introduction

The Dutch healthcare sector provides quality care and innovations around patient welfare. Furthermore, it creates new impulses for other organisations related to the care system and, in doing so, contributes to national economic growth (Pomp, 2010; Polder et al., 2020). However, the current care system in the Netherlands is under growing pressure, which has been increasing over the years.

The cause of the growing pressure originates from a diverse set of factors. The first is the fluctuating economic situation in the Netherlands and the budget divisions made by changing governments. Both impact the growth and autonomy of organisations within the system and their ability to provide affordable healthcare (Leensen, 2023; Vermeend & van Boxtel, 2010). The health crisis of COVID-19 also impacted the shape and accessibility of care that could be provided in that period. Afterwards, it led to an increased number of patients seeking care (RIVM, 2023). However, COVID-19 is not the only reason the number of patients is rising. The ageing of the population affects the influx of patients as well. Unfortunately, it works as a double-edged sword. On one hand, patients seeking care will live longer and will need care over a longer period. On the other hand, the current healthcare providers will reach retirement age. This leads to staff shortages, patient increases per staff, and an increased workload on the overall care system (VWS, 2024).

The growing pressure and additional workload make healthcare providers feel less satisfied with their professional job tasks and perceive that most of their time is dedicated to administrative work (van Driesten et al., 2021). Additionally, dissatisfaction and work pressure harm the quality of care provided to patients (Scheepers et al., 2015). To ensure that the healthcare system in the Netherlands delivers quality care a transformation is needed. The focus is on transitioning the current care system into an optimal system which reduces the workload and increases work satisfaction of healthcare professionals.

To understand the national problems experienced in the health sector, a case study is carried out in the cardiology department of the LUMC. The department is experiencing a decline in wellbeing and an increase in patient influx and work pressure as well. To address the problems, the cardiology department decided to collaborate with TU Delft on a project which is aiming to a

better understanding of the cardiology system and workflow. The project defines the problems resulting in finding design directions for an optimised system to improve wellbeing and reduce work pressure.

1.1 Background information

1.1.1 Dutch Healthcare System

The Dutch healthcare system provides the operational framework in this report. Therefore, to understand the context of healthcare, it is relevant to examine the national policies and the mode of operation.

The Dutch healthcare system is built on several principles: access to care for everyone, solidarity through compulsory and accessible health insurance, and good quality of care (VWS, 2016). These principles must be upheld in every health organisation. Furthermore, the healthcare system is organised through five systemic laws that form the baseline of Dutch care, which can be seen in Table 1.

Table 1 The five Dutch systemic healthcare laws

Law	Dutch name	Dutch Abbreviation	Content
Public Healthcare Act	Wet publieke gezondheid	Wpg	Provides the legal framework for health-promoting and protecting measures for the general Dutch population and specific groups. **Organised** and **executed** by local government i.e. municipalities.
Youth Act	Jeugdwet	Jw	Forms the basis for preventing growing-up and parenting issues, psychological challenges, and interventions for children's protection services. **Organised** and **executed** by local government i.e. municipalities.
Social Support Act	Wet maatschappelijke ondersteuning	Wmo	Obliges that municipalities organise suitable care for people with disabilities or psychosocial disorders. **Organised** and **executed** by local government i.e. municipalities.
Health Insurance Act	Zorgverzekeringswet	Zvw	Requires everyone living in the Netherlands to have health insurance. Basic insurance covers standard care from the GP, hospital, and pharmacist. **Organised** and **executed** by private health insurance companies.
Long-Term Care Act	Wet langdurige zorg	Wlz	Is in place to cover people who require intensive everyday care or close surveillance. **Organised** and **executed** on national level.

In addition to understanding the policies, it is necessary to comprehend the mode of operation in the Dutch healthcare system. The system is built in several layers of care called ‘lines’. Each line

offers specific care for the general population. The lines are in place to prevent unnecessary care and costly treatments (Burgt et al., 2005). Healthcare professionals between the lines can collaborate or consult about patient care.

Figure 1 shows the difference between the lines and examples of the connected healthcare professionals.

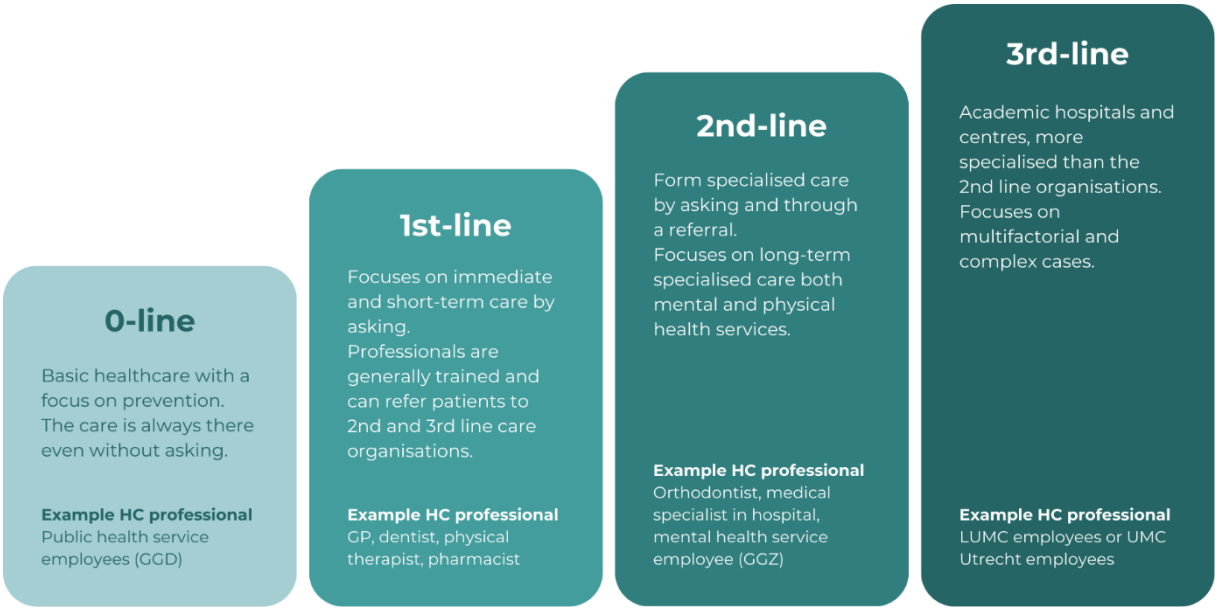


Figure 1 Division of care in the Dutch healthcare system

As seen in the figure above, Dutch healthcare is provided by a diverse group of organisations that are divided along the lines of care. In this report, a third-line academic hospital forms the framework of the case study. To understand what an academic hospital is, and which area is to be optimised in the cardiology department, it is necessary to take a closer look at the LUMC.

1.1.2 Leiden University Medical Centre (LUMC) Context

To understand the main stakeholders and clients of this report, I examined the LUMC and the cardiology department at the LUMC. The LUMC is an academic hospital and therefore belongs to the third line of care. An academic hospital is affiliated with a university, in this case, *Leiden University*. All departments provide care for complex and congenital diseases that require specialised facilities. In addition, academic hospitals are at the forefront of healthcare innovations.

The cardiology department is part of the *'Heart Lung Centre'* at the LUMC and has the goal of providing the best clinical, referral, and innovative care to cardiovascular patients. The department focuses on complex cardiovascular diseases, which is done through several care paths. Furthermore, the cardiology department is just one of many sub-systems within the LUMC. This means that the department must work both internally with all employees and with other departments. All sub-systems in their own right. This network of sub-systems adds another layer of complexity to the hospital. Problems are therefore often "wicked problems" due to their complexity and interconnected nature (Wong, 2022).

The cardiology department is divided into clinical and polyclinical care. The clinical care department provides treating the patient if a procedure is necessary and subsequently nursing them back to health. Clinical care includes heart monitoring or heart interventions, such as an ablation. The polyclinical care department, '*Polyclinic heart diseases'*, focuses on consultations with a cardiologist, AIOS and/or research of the heart function. The tests used for research are an ECG, cardiac ultrasound, Holter test, cycling test or pacemaker/ICD examination.

1.1.3 Rethinking Healthcare: Addressing Workload, Innovation and Gaps

Current challenges are influencing not only the healthcare professionals but the patients in need of care too. Firstly, healthcare professionals perceive a decrease in work satisfaction and an increase in additional workload, for example administrative tasks. Research shows that medical specialists spend around 40% of their time doing administration, which leads to less time doing the healthcare tasks they studied for and what provides work satisfaction (van Driesten et al., 2021). In addition, fragmentation of the system and the work culture within organisations leads to uncertainties and frustration. Healthcare professionals have the feeling they have less autonomy and control in their work field. Furthermore, there is a prevalent culture of working long and hard, which causes healthcare professionals to feel less satisfied and the drop-out rate increases (FMS, 2019).

In turn, the reduced wellbeing and increased pressure on healthcare professionals have a negative impact on the quality of care provided to patients. Research shows that work-related wellbeing impacts patient satisfaction, therapy loyalty, and personal aspects of the patient-doctor relationship (Scheepers et al., 2015).

Change is needed to improve wellbeing and reduce the workload for healthcare professionals, leading to improved patient care and satisfaction. Additionally, there is a growing opportunity to create an attractive and accessible care system that values people and technological and social innovation. This opportunity focuses on creating a healthier healthcare system that can grow and provide the necessary quality of care (Leensen, 2023). This project will contribute to this opportunity and will focus on the cardiology department at the LUMC as an example of how the care system can be improved.

However, integrating these new innovations in healthcare organisations is often not without problems either. Part of this problem is the failure to address the needs of the multiple stakeholders that interact within the care system. To help address these needs a strategic design approach can be of value. The following section will describe this approach in more detail.

1.1.4 A Strategic Design Approach

A strategic design approach is needed to address the challenges experienced by healthcare professionals, patients, and the cardiology department. Strategic design connects people's needs with possible new technologies and designs with the outcome of organisational viability (Canales Durón et al., 2019). The approach is necessary in this case study to translate the perspectives of all stakeholders involved into actionable steps to improve their experience. Furthermore, there is a high level of complexity in the case study, both in terms of activities and interactions. Strategic design can help with analysis and organisation as the core practices are that strategic design interventions are co-created between the designer and stakeholders. It

consists of practices that can be implemented efficiently and has an impact on multiple stakeholders (Calabretta et al., 2016).

In addition, the cardiology department is faced with “wicked problems” that do not have a definitive answer (Wong, 2022). The use of strategic design practices is beneficial in solving wicked problems by using co-creation to co-determine strategies and implementations for innovative outcomes (Calabretta & Gemser, 2017). Involving the healthcare professionals who experience the problems is part of finding solutions to optimise the workflow in which they operate.

To understand the diverse set of perspectives from multiple stakeholders, a human-centred design mindset should be used during the strategic design process (Searl et al., 2010; Carayon et al., 2020). Human-centred design is about understanding human needs and how design can respond to them with desirable solutions. With this approach, interactions between stakeholders and the environment are key to understanding their behaviour and needs (Giacomin, 2014). Furthermore, for the implementation of human-centred design in healthcare, the focus needs to be on engaging stakeholders from early on through the design process and adopting a systems approach by addressing interactions on different levels (Melles et al., 2021).

An understanding of human thought processes, emotions, and behaviours helps guide the strategic design of the optimal system and workflow. To develop a new system, both the perspectives of patients and healthcare professionals need to be used as stakeholders and sources for insights to find the gaps and opportunities (Erzberger & Prein, 1997).

1.2 Problem Statement

As reported in the literature, healthcare professionals in the Dutch healthcare sector are experiencing an increased workload, more patients, and less work satisfaction. These problems are also experienced in the cardiology department at the LUMC. The effects of these problems are affecting the quality of care provided and are leading to higher dropout rates, which subsequently increase the current work pressure. Improving the current system is necessary to improve the wellbeing of healthcare professionals and their interaction with patients. However, to improve a system, it is essential to understand all the elements on which the system is based: people, resources, and technology. This is done to understand every aspect of the system, and therefore the workflow, which is the operational frame of the cardiology department. The problem faced by the department is twofold. Firstly, the workflow needs to be clear, and secondly, the problems and challenges encountered need to be defined and localised.

The key factors to consider throughout the report are based on these two. The first part is the need to create transparency to understand the system they are working in. The second is to reduce work pressure and improve the wellbeing of internal healthcare professionals by understanding where the problems are.

1.2.1 Scope

As the problem faced by the cardiology department is twofold, the scope must also touch on both sides. On the one hand, it is necessary to understand the system in which the stakeholders work,

i.e. the system flow, the components, and the interactions between them. On the other hand, finding the problems within the system is essential to know where to innovate and design.

Therefore, the scope of this project is to first visualise the system by providing a **workflow** and all its components. Secondly, to define the problems in the cardiology system and to understand which problems need to be changed first. The problem finding and definition needs to be done from the perspective of both healthcare professional and patient. This will be the focus to understand their interactions and needs. Both the frustrations felt and the activities that improve wellbeing will be considered. This is needed to understand what is going well and what should be done differently in an optimised system.

The healthcare professionals considered are both internal employees in the cardiology department at the LUMC and external healthcare providers such as the GP and second-line medical specialist. This is necessary to understand the workflow from outside the LUMC hospital.

1.2.2 Solution Space and Research Questions

The design solution envisioned is a future-oriented strategy with several design interventions to improve the current system. This strategy will consider the context of healthcare professionals working internally at the cardiology department at LUMC, healthcare providers working externally with LUMC, and cardiovascular patients under care at LUMC. In addition to providing design interventions, the qualitative data outcomes will be delivered in a visually attractive and organised way. These outcomes can be stepping stones for other projects to delve deeper into design to improve the wellbeing of healthcare professionals.

To give guidance to the research process and to better understand the information needed to optimise the current system and find the problems within the following research questions were created:

1. How does the current workflow operate in the cardiology department?
2. What are the experiences of patients and healthcare professionals in the current workflow at LUMC?
    1. What are the problems that they face?
    2. What improves their wellbeing?
3. How can the current problems within the system be optimised?

1.3 Goal and Approach

1.3.1 Project Goal

To answer the research questions the following project goal is formed:

“The goal is to design strategic interventions, in line with the LUMC capabilities, for an optimised care path and workflow to find the gaps and fulfil the needs of both healthcare professionals and patients within the cardiology department.”

1.3.2 Project Approach

The start of the project consists of a broad approach to tackle the two parts of the problem defined in the problem statement. This involved defining the workflow and analysing the problems from the data. Defining the workflow involves several steps using both desk research and qualitative research methods. Finding the problems is mostly done based on qualitative research methods.

Afterwards, both outcomes were combined to find the design direction and reformulate the problem statement. The Improving Improvement Toolkit (IIToolkit) is used to develop the strategy and design interventions. This toolkit translates the outcomes of the report Engineering Better Care and offers a holistic technique to understand and design for complex systems such as the healthcare system (Clarksen et al., 2017).

All steps taken during the project include multiple iterations. In order to keep the report concise only the outcomes are presented.

The purpose of each stage with corresponding activities is described below.

Understanding the Cardiovascular System and Workflow

This chapter focuses on the implementation of several research methods to understand the cardiology department system and its components. Firstly, observational research is conducted in the polyclinic to obtain information about the consultation process, patient-doctor interactions and the use of technology. Second, interviews were conducted with internal healthcare professionals to understand their experiences within the system, with whom they interact and when. Finally, a conclusion is drawn to highlight the keywords that describe this phase.

Understanding the Cardiovascular System Inefficiencies and Challenges

Within this chapter, multiple steps were taken to find the final set of problems, portrayed as themes and sub-themes. Firstly, interviews were done with both internal and external healthcare professionals. This data was analysed and compared with insights found from focus group patient data. After summarising the relationship between the insights from both data sources, the clustering process, based on *Thematic Content Analysis,* could take place (Braun & Clarke, 2006). This method resulted in six themes, with accompanying sub-themes, representing the challenges and problems found in the data in the system. Finally, a conclusion is drawn that presents the keywords found.

Locating and Analysing the Challenges in the Cardiovascular Workflow

This chapter shows where the themes, portraying the problems and challenges, are in the workflow. By analysing the influence of the themes and sub-themes on each other and the system, the first steps could be made to define the reframed problem statement and the design direction for interventions.

Framing the Design Direction

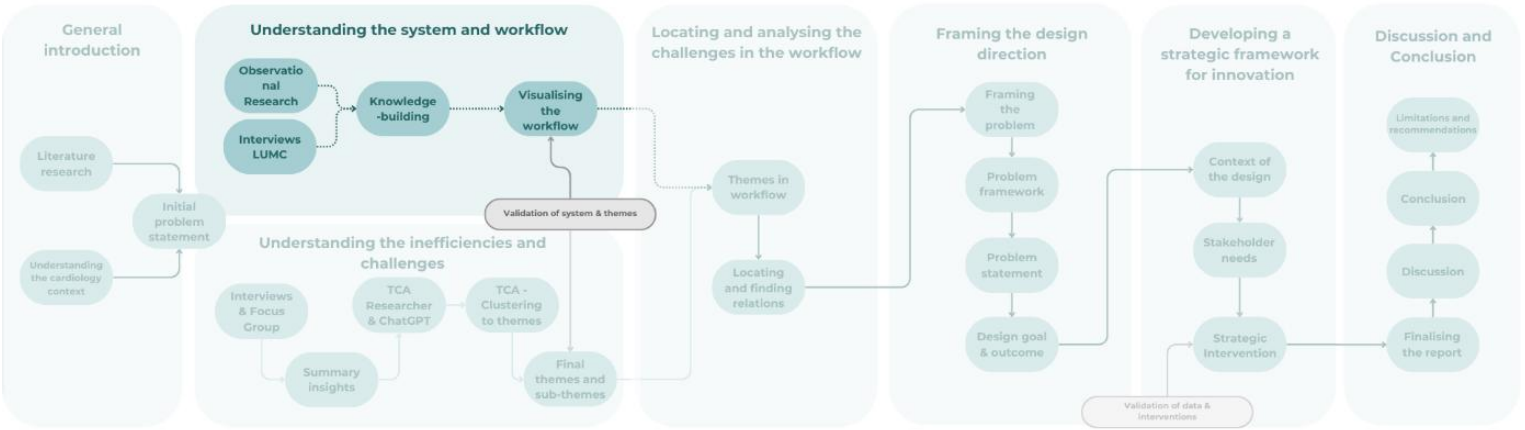
The design direction includes finding the common thread throughout all the steps of the project. It shows the steps taken to reformulate the problem statement and the problem framework based on Engineering Better Care (Clarkson et al., 2017). In addition, it highlights the main problem areas and therefore the space where intervention is needed. The chapter concludes with the design goal and the desired outcome.

Developing a Strategic Framework for Innovation

This chapter involves defining the context of the design based on the transparency framework established earlier. Once the context is clear, the stakeholders that influence the system and their needs are shown through a stakeholder map and a needs overview. Furthermore, the chapter provides the design interventions that are recommended to the cardiology department to address the problems they face. Finally, the viability and feasibility of the interventions are shown based on validation sessions.

Discussion and Conclusion

The final chapter concludes the entire report and provides a brief discussion of both the process and the results. It also presents the limitations and recommendations to conclude the report.



Chapter 2 Understanding the Cardiovascular System and Workflow

This chapter starts off with the project and focuses on answering the first research question '*How does the current workflow operate in the Cardiology department?*' Several steps were taken to answer this question. First, observational research is done during polyclinical hours to understand the patient's care journey during the first or repeated polyclinical consultation. Secondly, interviews with internal healthcare professionals were conducted to understand their role and contact moments during their workflow. After understanding the necessary information, this chapter shows the final visualisation of the system in the form of a workflow, which is both iterated and validated with stakeholders.

2.1 Data Collection through Observations

Observational research during polyclinical hours is done to understand the work tasks of a cardiologist/AIOS and it also shows the first interaction patients have with the cardiology system. During the observation the focus lay on the interaction between the patient and healthcare professional, the digital systems used and the challenges that occurred.

2.1.1 Method

The goal of the observation was to understand the patient flow in a real-life setting during a consultation appointment at the polyclinic (Creswell, 2008). During the observation, I have gathered insights about the digital systems used and the daily activities of a cardiologist/AIOS. The observations were made during the polyclinical hours of *Participant C4,* see Table 2, during which I have shadowed the cardiologist during work tasks and asked clarifying questions. Interactions with patients were not included in the observational plan and limited since the context of their visit was medical. However, I did observe the patient-cardiologist interaction since it provided valuable insights. The focus of this interaction was the type of questions asked, the flow of the conversation, and the emotional reaction. In addition, I observed the work tasks, types of consultations and the double-digital systems used. The observations were written down on paper and no photos were taken regarding the privacy regulations inside the hospital. Lastly,

during the observational research, I only have observed the e-consultation and the physical consultation the other types of consults were discussed.

The observation generated data in the form of written insights that I clustered based on their meaning and connection to one another. Descriptive data was generated that provided insights into the clinical side of the consultation and existing insights into the physical workflow, the interface of the *EPDVision* and *HiX*, and the consultation questions. In addition, interpreted data was generated that showed the emotional side of the consultation and existed of the patient-doctor interaction, reassurance, and relationship-building. These insights were analysed and afterwards visualised so I could understand the referral, reporting, intake & diagnosing, and repeat consultation stage of the overall workflow of the cardiology department.

2.1.2 Results

The observational research at the polyclinic created multiple outcomes regarding the understanding of the different types and mediums of consults and the timeframe per patient type. In addition, the actions and steps patients and cardiologists go through during consulting hours became apparent. These results helped in understanding the overall workflow that first-time and repeated patients go through, and which tools are used.

Consult and Patient-type

During a general poly consult day a cardiologist/AIOS has time slots for seventeen patients, including up to eight new patients. Every patient has a scheduled consult time of 10-15 minutes. This time frame applies to all types of consults, including phone consults (calling), written consults (email), video consulting through Teams (e-consult), and physical consults. The type of consult scheduled for the patient is based on the cardiologist's preference, the patient's preference, and the conversation's necessity. The type of consult is called the *mode of contact* (Cw) in the *EPDVision*, from here on this terminology is used. To understand the difference between them an overview is made, see Appendix A.

A new patient always has a physical consult. Repeating patient consults or quick check-ins can be video, phone or physical consults. Written consults are used often to react to previously asked questions or external consults with other healthcare professionals. This information helped in understanding the different modes of contact during the cardiology workflow.

The questions asked during consultation follow a specific pattern, which differs between cardiologists and is based on the complaints of the patient. The consultation flow can be found in Appendix A. The consultation flow provides an understanding of which information is necessary to discuss during consultation and what information aids cardiologists/AIOS to create a treatment plan. The visual in Appendix A is used during the design phase to understand which information can be prepared beforehand and which information needs to be discussed in-person.

Patient Journey during Polyclinical Consult

In addition to understanding the consultation flow, a patient journey map is made, Figure 2. A QR-code is added to provide a detailed version of the figure. The journey map shows the different actors, their actions, and the value exchange during poly consultation. Furthermore, the location and time are shown. Lastly, the journey map mentions challenges and touchpoints for every step.

This patient journey map shows both the e-consult and the physical consult flow since most stages are the same.

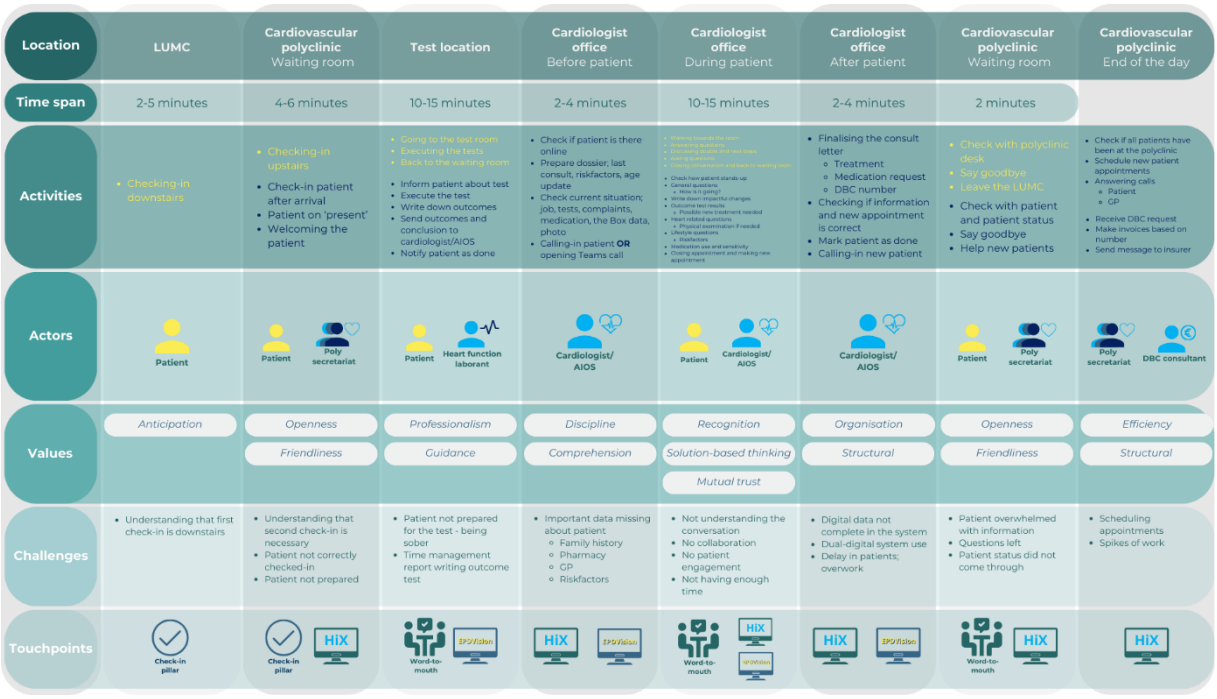


Figure 2 Patient care journey during the polyclinic cardiology

Furthermore, the journey map portrays all the steps that are needed for a patient to arrive at the polyclinic and to receive the care they need. The map visualised all activities done by a variety of people at the same time or immediately after one another. Therefore, the journey portrays the short time frame that internal healthcare professionals have to provide patient care. In addition, the use of different tools shows the complexity of the dual-digital systems that the cardiology department uses. The steps are explained below:

In the first step, only the patient is an active actor who needs to understand how to check in and get to their appointment on time. There is a feeling of anticipation and an interaction with the check-in pillar downstairs.

The second step portrays an interaction between the patient and the poly secretariat during which a value exchange of openness and friendliness occurs. The task focus is on correctly checking in the patient so the schedule will not be delayed.

After the patient is in contact with a heart function lab assistant to conduct several tests on the patient's heart function. The values of professionalism and guidance are prevalent and there is a challenge in conducting every step on time.

In the meantime, the cardiologist prepares the appointment by checking if the patients are present and by looking at their medical history. It is important to understand the situation to be able to help the patient in a short time frame.

After preparing the cardiologist interacts with the patient. There is an exchange of recognition, solution-based thinking, and mutual trust to be able to work together. Both parties need to engage in the conversation to provide the right care.

The patient leaves the consultation room, and the cardiologist needs to work quickly to finish the report. This needs to be done in detail and orderly.

The patient then will interact shortly with the poly secretariat to say their goodbyes. Afterwards, the poly secretariat will need to process the patient visit and the DBC consult will receive a notification to make the treatment invoice ready.

The visualisation of the patient journey map during polyclinical hours helped in understanding the complexity of polyclinical consultation and which stakeholders are involved. By providing this overview the final workflow could be made, mainly the stage repeat consultation. Furthermore, the visualisation of the patient care journey helped in understanding the task division between internal healthcare professionals and the problems they face.

2.1.3 Reflection

The observational research provided insights into the complexity of the activities, interactions and technology of the polyclinical side of the cardiology department. It also enabled the visualisation of the flow of consultation questions and the patient journey during polyclinical care. Both results helped to build the background knowledge to understand the workflow of the cardiology department. In addition, the results provided insights into the complexity of the relationship between stakeholders and the nature of their interactions. This is necessary to integrate both perspectives in the design of an optimised system.

2.2 Data Collection through Interviews

Interviews with internal healthcare professionals were conducted, during which their experiences and functions in the system became clear. To understand the workflow they work in, it is necessary to find out about work interaction, work balance, contact points, and weekly activities. The participants were all connected to the cardiology department but conducted different tasks based on their function and specialisation, see Table 2.

The diversity in function and therefore work tasks is necessary to receive a broad perspective of the system and its components.

Table 2 Overview participants of the interviews

Participant	Role	Organisation
P1	Team leader Heart function	Academic hospital
P4	Secretary staff	Academic hospital
C1	Cardiologist	Academic hospital
C2	Cardiologist	Academic hospital
C3	Cardiologist	Academic hospital
C4	Cardiologist	Academic hospital
C5	Cardiologist AIOS	Academic hospital

2.2.1 Method

The method I used were semi-structured interviews. This allowed for structured interviews with enough freedom to delve into other areas based on the conversational flow (Patton, 2015). The interviews were conducted in person to give a sense of comfort and security. I started the

interview with an explanation of the project, by introducing myself, and the signing of the consent form, see Appendix B. A minimum time of 30 minutes was advertised and required to interview participants. This is done to lower the threshold for participation.

To give structure and consistency to the interviews, I made an interview guide, see Appendix C. The interview guide consisted of three main themes: *work tasks and contact, care process and influence*, and *positive moments and challenges*. All interviews were conducted using this sequence to create consistent data. For visualising the workflow only theme B *Care process and influence* is used.

The type of data obtained from the interviews were audio recordings and observational notes. I gathered both and transcribed them using ATLAS.ti. The transcripts were analysed by using descriptive coding (Gibbs, 2007). The focus of the codes was to gain a general understanding of the cardiology system, the people, resources and technology, and the care journey.

2.2.2 Results

The data from the interview helped to answer the first research question of what the current system looks like. Therefore, the acquired data helped visualise the complexity of the cardiology department and its workflow. The data found helped to create an overview of the type of patients at the cardiology department and the type of data shared between healthcare organisations.

Cardiovascular Patient Profiles

Based on the insights gathered from the interviews with the internal healthcare professionals, there are three types of patients treated in the cardiology department, see Figure 3. The profiles are based on the patient's reoccurrence at the polyclinic, the reason for their visit, the patient's needs, and the possibility of being referred to the GP or second-line hospital.

The patient profiles provide a clear distinction to help understand the stages of the workflow in the cardiology department. They show that there are three options possible after the first consultation. There is the option of being kept in the loop for repeat consultations at the LUMC, patient one. The second option is that there is a procedure necessary to be healthy, patient two. The last option is to be referred to the GP since care is no longer needed at the LUMC, patient three.

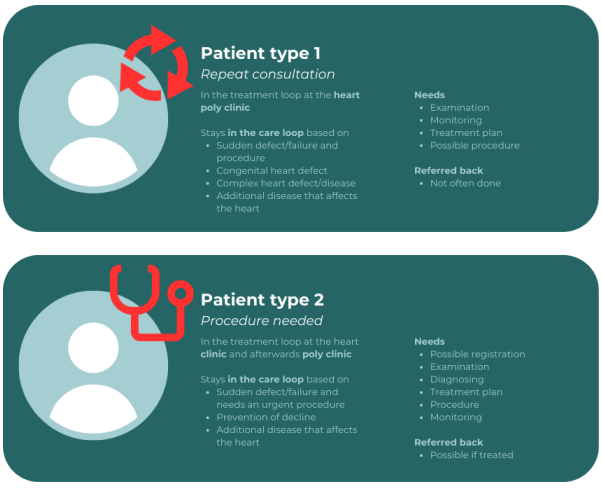


Figure 3 Patient profiles cardiology department

Data Map of the Cardiology Department

The cardiovascular care system contains multiple connected stakeholders, both inside and outside the LUMC environment. This connection can be a digital or in-person interaction, during which data is shared. To understand the different data streams between the stakeholders mentioned during the internal healthcare professional interviews, Figure 4 is made. The data map shows the different types of digital data exchanged between stakeholders. This is valuable for understanding the complexity of data exchange and to understand what information is needed to facilitate patient care. The stakeholders mentioned during the interviews in relation to data exchange are other internal LUMC departments, healthcare insurance companies, the patient at home, GP practices, second-line hospitals, and the pharmacy. These stakeholders are integrated in the data map.

The digital data streams are patient-specific and divided into the patient's BSN number, personal patient data, and medical data. Medical data is also divided into *disease and treatment specific*, *restricted* and *medication*. Restricted medical data is added to portray the obstacles different healthcare organisations experience when patient care is transferred. The thickness of the arrow shows the amount of data shared between stakeholders around patient care. For example, the BSN number arrow is quite thin since it is only used to refer the patient and identify them as real.

The data exchange in the figure includes all the necessary information that is needed for the stakeholders to collaborate. However, this data exchange shows the perfect scenario and differs from reality. The reality is that there are often restrictions between different healthcare organisations that make it harder to collaborate and coordinate patient care. Furthermore, patients need to give permission to be able to share information. The complexity of not being able to share all data with everyone is something that needs to be optimised for a better system.

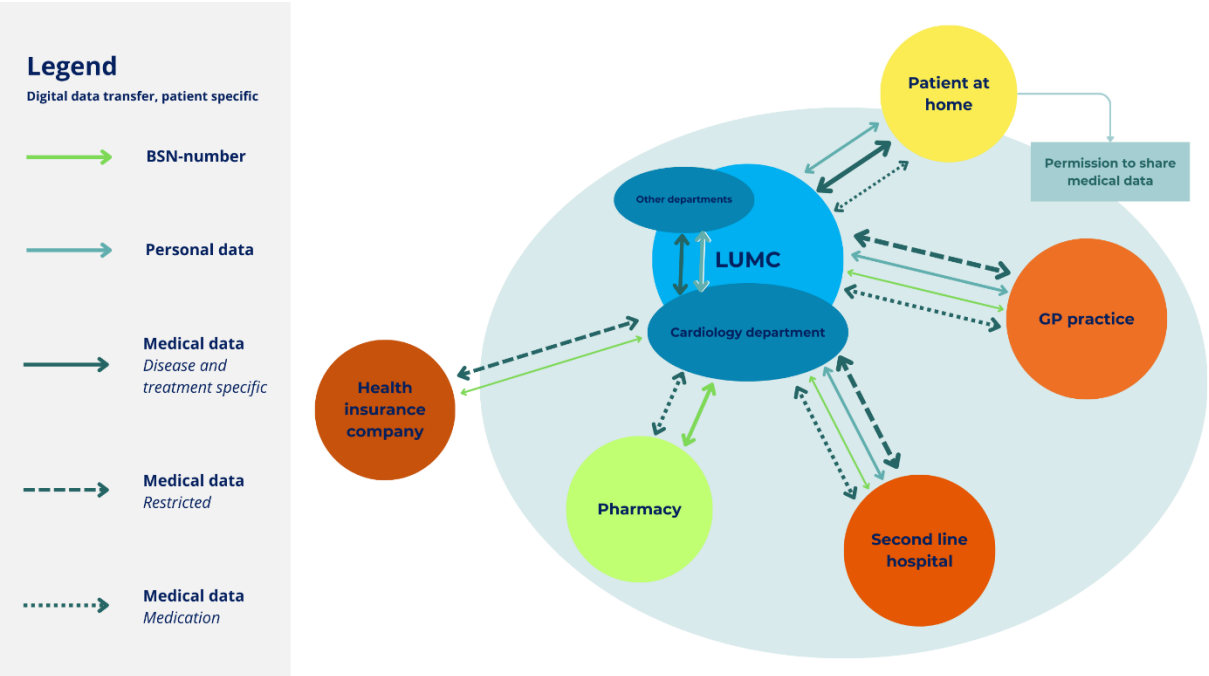


Figure 4 Data map in the cardiology system

2.2.3 Reflection

The interviews with internal healthcare professionals provided an insight into the diversity of patients seeking and receiving care at LUMC. It revealed the diversity of patients that the internal healthcare professionals work with on a daily basis. In addition, the interviews provided information about the complexity of patient-specific data exchange.

Understanding the types of patients helped to visualise the workflow of the cardiology department. In addition, understanding the data exchange revealed the problems experienced by internal healthcare professionals in collaborating and coordinating patient care. This result will be used to further define the problems in the cardiology department.

2.3 Final result: Visualising the Workflow of the Cardiology Department

The combination of the results from the observational research and interviews with internal healthcare professionals led to answering the first research question: *'How does the current workflow operate?'* To understand and visualise this current workflow several iterations are made, adding a more detailed layer at each step.

The final workflow is divided into relevant stakeholders, activities, and pathways. The context of the action is shown through the shape and colour of the activity and pathway. The workflow is visualised in Figure 5. A QR-code is provided to allow a detailed overview of the workflow and to view it alongside the stage explanation. The workflow portrayed in the figure shows the interpretation and perspective of the participants on the system they work in, which creates a subjective data set. Furthermore, not all patient routes into the cardiology department are considered in the workflow. Only patients that were referred from outside the LUMC through the GP or second-line hospitals were considered, the internal route and emergency route were not visualised.

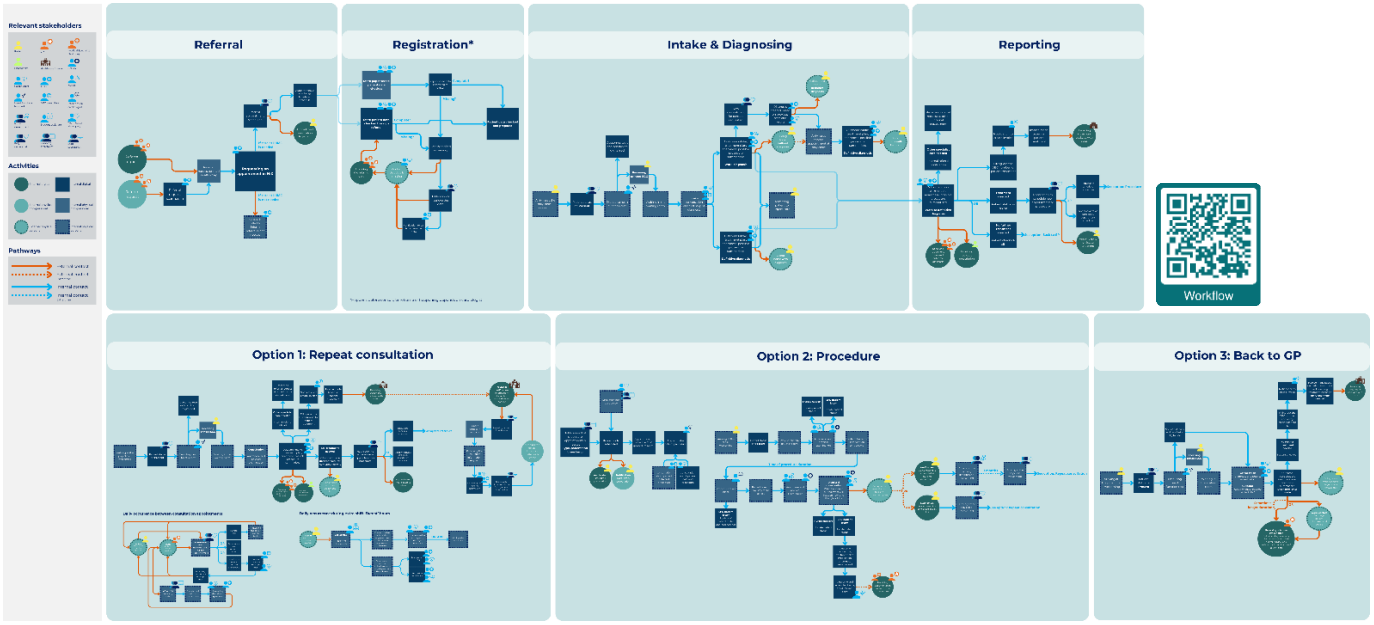


Figure 5 The workflow at the cardiology department

The system consists of multiple stages, which are divided into the physical actions that need to be taken before the workflow can progress. The first four stages *Referral*, *Registration*, *Intake & Diagnosing*, and *Reporting* are the same for every patient that will receive care at the cardiology department in the LUMC. The three options afterwards are based on the treatment a patient needs. The first option is repeat consult, this often occurs when a patient has a complex or congenital heart disease, or it is not yet clear what their disease is. The second option is that the patient needs a procedure, which means that an intervention is necessary to treat their heart complications. After the procedure, a patient often needs to stay in the *repeat consult* stage. The last option is that the patient is referred to the GP. This occurs when a patient does not meet the LUMC criteria, or the patient is well enough to go back into the care of the GP.

The relevant stakeholders are divided into groups and show all people and organisations that are connected to the cardiovascular workflow. The first group is small and represents the cardiovascular patient in yellow. The second group, in orange, are the external healthcare providers. The third group is the pharmacy in green and the fourth group is the healthcare insurer in dark orange. Finally, the fifth group are the internal healthcare professionals at the LUMC, shown in blue. The stakeholders are added to the activities to show the task division. If certain activities do not have a stakeholder, it means that the stakeholder before does that activity as well. It only changes when another stakeholder appears.

The activities in all seven stages represent the digital or non-digital actions and interactions in the workflow. They are divided into circles, representing external activities and interactions, and squares, representing internal activities and interactions. In addition, the interactions and activities are divided into digital, physical non-personal and physical personal. This is done to show the diversity and complexity of all stages.

The pathway between activities is divided in colour and shape. The orange arrows show that the action or interaction occurs between external and internal stakeholders. The blue arrows show that the interaction takes place internally at the LUMC. The dashed arrows represent that extra time is needed for the next activity to occur. In addition, the transparent arrows represent the connection between stages and therefore activities.

2.3.1 Explanation Workflow Stages

Referral stage

The referral stage shows the activities that need to take place to refer a patient to the LUMC and to the cardiology department. As shown in the diagram, a request must first be made from outside the hospital by the GP or a MS from a second-line hospital. The request can be through *ZorgDomein* or by post or fax. Once this request has been made, a physical copy is placed in the referral tray for the AIOS to check. They check the patient, match the patient with a patient ID and assess which tests the patient needs to attend and when. If the request is correct, the poly secretariat will schedule the final appointment and if not, a call must be made to the GP or MS and an email sent to clarify that the patient does not need third-line care. This call is often done by the AIOS on duty. In addition, the patient receives a mail if the appointments are scheduled with information regarding preparation, location, time, and the type of appointment.

Registration

The registration phase highlights the steps that take place after a patient has been scheduled. The cardiologist or AIOS needs to check that all the medical information they need is included in the referral request. Without this information, it is more difficult to understand the patient's history and develop a treatment plan. If certain medical or personal data is missing, there are several ways to retrieve it. The cardiologist may contact the GP or second-line MS, the poly secretariat may receive a message to retrieve the information or the AIOS may be assigned the task. After contacting the GP or MS, the missing personal or medical data will be sent to the cardiology department.

Intake & Diagnosing

The intake & diagnosis phase consists of both physical and digital activities. During this stage, the patient comes to the LUMC for the first time to have the necessary heart function tests done and to attend the consultation. During the consultation, the cardiologist or AIOS needs to review the results of the tests and listen to the patient. A diagnosis needs to be made based on the patient's symptoms, test results, family history and lifestyle. Often the diagnosis is a work diagnosis, which means the patient needs a second appointment to get a definitive answer to what is wrong. The second appointment can be either in person or by telephone. The patient may also receive their definitive diagnosis, or they may need to be admitted to urgent care if immediate care is required.

Reporting

The reporting phase consists only of digital activities and interactions. It shows the abundance of activities that need to take place after the patient consultation. The cardiologist/AIOS has several tasks that need to take place almost immediately to ensure that the appointment is completed, and the next steps can be taken. The consultation letter is completed and sent to the GP. The internal consultation letter includes the DBC number added to the information. This means that the DBC consultant receives a notification to start creating the invoice for the patient's health insurance. The poly secretariat receives a notification that the patient is ready and that a new appointment may need to be made. Sometimes the patient needs to be referred to another department, this is also done by the cardiologist/AIOS. The timeframe for these tasks is preferably after the patient leaves the room. However, this is not always the case due to stacked hours during the polyclinic.

Option: Repeat Consultation

The repeat consultation stage is one of the options that can occur after the first four. This option depicts the journey of a patient who needs to remain within the care of the LUMC. It also visualises several activities that take place simultaneously or during the waiting time between appointments.

When the patient arrives at the polyclinic for their follow-up appointment, the same activities take place as in the *Intake & Diagnosing* phase. However, in this case, the diagnosis is already clear, so the tests are done as a precaution and to check how the patient's heart is functioning. After the consultation, the cardiologist/AIOS must actively process the appointment so that the GP receives the consultation letter, the pharmacy receives the medication prescription, the DBC consultant can generate the invoice, and the poly secretariat can schedule a new appointment.

The DBC counsellor contacts the patient's health insurance company. The insurance company sometimes needs additional information about the patient and therefore contacts the LUMC. The staff secretariat receives this request and has a short line to the patient's cardiologist/AIOS to get the right information to write the insurance letter. This letter is printed on official LUMC paper and sent to the insurance company.

Between appointments, the patient or GP may have a question. During normal working hours, the poly secretariat can receive these calls between 9:00 and 11:30 AM, after this time frame the GP calls have been redirected to the staff secretariat. The outcome of the calls varies: an immediate callback, an e-consult is scheduled, or an email is sent. GP calls are often answered immediately or called back as soon as the patient's cardiologist/AIOS is free.

During extra shift *'dienst*' hours, there is a chance that the patient may need advice and calls the LUMC. Their call is answered at the call centre, often staffed by students, and transferred to the cardiologist/AIOS. However, only patients with a LVAD or congenital heart disease are allowed to have direct contact with their doctor. Other patients are not officially allowed to be transferred. However, this happens because the call centre is not allowed to answer patient questions during the calls.

Option: Procedure

The procedure stage is the second option after the first consultation or can happen after a repeat consultation. This phase also includes several activities that take place in succession. It is important to note that this phase is based on a short-stay intervention, such as an ablation procedure.

First, the procedure must be scheduled internally based on bed occupancy and the availability of the intervention cardiologist. This is done by the team leader *Heartpoly* and the planning secretariat. Once the procedure is scheduled, the patient receives a notification with the date, time and preparation required. This notification is both physical and digital. In addition, a consultation takes place between the interventional cardiologist and the patient's cardiologist/AIOS to prepare for the procedure.

When the patient arrives at the clinic in the day-stay room, there are brief moments of contact with the nurse and day-stay ANIOS, often employees the patient has never met before. The patient is prepared for the procedure, taken to the intervention centre (*CVIC*), and afterwards taken back to the day-stay room to rest. Before, during and after the procedure, the patient's status is updated in both the nurse's report and the patient's letter. Finally, the patient is informed of the outcome and what they need to be aware of during the discharge discussion. The final notes are added to the nurse’s rapport and the patient's letter, and the patient can go home. The patient's letter must be checked by a third cardiologist before it can be sent to the GP, often with a slight delay.

Depending on the procedure, the patient may return to their cardiologist/AIOS at the polyclinic for a repeat consultation, or they may be assisted by nurse specialists before returning to their cardiologist/AIOS after three months.

Option: Back to the GP

The final stage shows what happens when a patient no longer needs care at the LUMC. The initial activities are the same as for the follow-up visit. However, the cardiologist/AIOS will need to carry

out different tasks after the patient has left. A discharge letter is written summarising the outcome of the consultation and the heart function tests. The discharge letter includes the final diagnosis for the GP, why the patient is being discharged and what to look out for in the patient's care. Discharge advice could be given by telephone as well as by letter. In addition, the cardiologist/AIOS checks off the patient in the system and completes the DBC number. The DBC consultant then receives a notification to prepare the invoice to be sent to the patient's health insurance company.

Patients are discharged from the LUMC according to the department's criteria. However, these are not always followed by the staff, resulting in a smaller outflow than the inflow of patients. This happens when the patient wishes to remain within the LUMC care system or when the cardiologist acts for reasons of safety or convenience.

Validation of the Workflow

It is important to engage stakeholders early in the project and include them in the validation process. Therefore, to validate the details and stages in the workflow, two interviews were held. During these interviews, both the workflow and the themes portraying the problems were discussed. See Chapter 3 for the theme validation.

Both interviews were conducted with an AIOS from the cardiology department, who have not yet been interviewed. This was done to receive a more objective opinion about the acquired data of the workflow. The interviews were semi-structured and consisted of questions and a printed system journey to write or draw on. For the interview guide see Appendix E.

The questions focused on understanding the AIOS's roles in the system and what provided work satisfaction. Furthermore, after talking about the system and the themes there was time to highlight what they missed and/or what they think the main challenge is.

During the system validation, all stages were talked about with an explicit focus on who does what activity and if the complexity is portrayed correctly. Both interviews led to an improvement in the system visualisation, by adding extra activities and interactions. However, this change was made after both interviews were conducted therefore both workflows were looked at objectively and in the same way.

A specific observation is that the steps in the system could be interpreted differently, as the way of working is different for both participants. Their preference interferes with the steps of the workflow.

2.4 Conclusion and Limitations

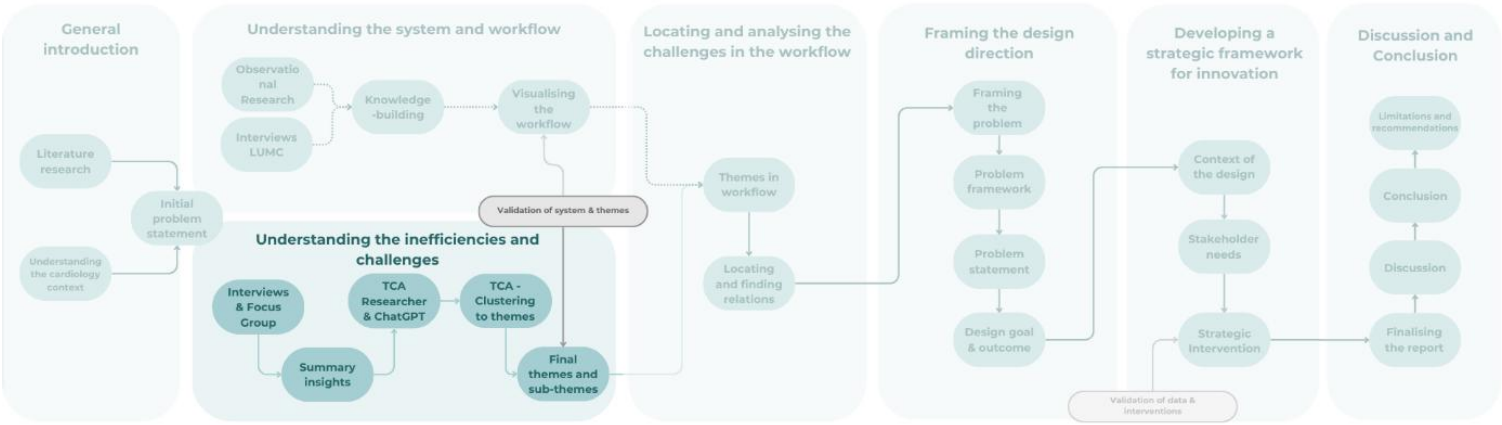
The visualisation of the workflow with the various layers of detail forms the conclusion of answering the research question: *'How does the current workflow operate in the Cardiology department?*' The visualised workflow shows the stages that patients go through and the people, technology, and materials they interact with. Furthermore, the workflow presents the three options of patient care after the first consultation. The operational side of the cardiology department is therefore represented through all seven stages.

Additionally, the analysis of the observational research and interview data revealed more than just the flow of the system. The responses from the interviews and the insights gathered from the

observation also revealed similarities and keywords that need to be considered in the next steps of the project.

It became clear that collaboration and effective communication are necessary for a well-functioning system. This is needed between patients and internal healthcare professionals, and between internal healthcare professionals and external healthcare providers. Furthermore, the source of work satisfaction and enjoyment were linked to direct patient contact during consultations. This contrasted with the frustration experienced when consultations and referrals were not prepared well and therefore took extra time and effort. Finally, knowing what to expect and at what stage of the care journey is still not properly communicated and becomes a barrier to collaboration. It is therefore important to improve transparency not only in the internal system but also between people that interact with one another and the technology used.

Lastly, since not all patient routes are visualised into the workflow it is important to further develop all stages. For example, the emergency route and the internal patient route are not shown and therefore a possible extra layer of complexity is missing. A recommendation would be to interview stakeholders who work in these routes to further develop the workflow. Furthermore, to further validate the workflow, validation sessions need to be held with a diverse set of employees of the cardiology department at the LUMC. This gives a better understanding of whether all the stages are correctly represented, and the details are realistic.



Chapter 3 Understanding Cardiovascular System Inefficiencies and Challenges

This chapter focuses on finding the themes that represent the problems experienced in the current care system at the cardiology department. This is necessary to find the challenges that decrease the wellbeing of internal healthcare professionals, provide work pressure, and reduce work satisfaction. In doing so, this chapter answers the second research question: *'What are the experiences of patients and healthcare professionals in the current workflow at LUMC?'* To answer this question and to find out what problems stakeholders face and what they enjoy, several research steps were taken. First, interviews were conducted with internal and external healthcare professionals and the data was analysed together with focus group patient data. Both sets of data produced insights that were clustered into themes. These themes and their sub-themes represent the problems experienced in the system.

3.1 Data Collection through Qualitative Research Methods

Engaging stakeholders in the process is necessary to delve into their experiences and feelings based on interactions with the system. To explore these experiences data was collected from stakeholders connected to the cardiology department at the LUMC. These stakeholders include internal LUMC employees, external healthcare providers, and cardiovascular patients. The internal and external healthcare professionals were interviewed, and the insights from patient data were collected through three external data sets. These data files were provided by the ongoing study *Cardiology Family Box* (2025). All participants are summarised in Table 3.

Table 3 Overview participants of the interviews

Participant	Role	Organisation
P1	Team leader Heart function	Academic hospital
P2	Child- and youth psychiatrist	Mental health institution
P3	General Practitioner (GP)	General practice Hoevelaken
P4	Secretary staff	Academic hospital
C1	Cardiologist	Academic hospital
C2	Cardiologist	Academic hospital
C3	Cardiologist	Academic hospital
C4	Cardiologist	Academic hospital
C5	Cardiologist AIOS	Academic hospital

The diversity in participants' knowledge and influence in the health system is necessary to receive a broad and diverse perspective. The patient data provides insights into the patient experience, their pain points and what goes well from their perspective. Healthcare professionals, both internal and external, can dive deeper into the relations, contact points, challenges, and which part of their work provides satisfaction. In addition, collecting data from healthcare professionals and patients provides information on which needs are in conflict and could cause friction.

3.1.1 Method and Result

The method I used for this part of the research was conducting semi-structured interviews. It allows for structured interviews with enough freedom to delve into other areas based on the conversational flow (Patton, 2015). The interviews are conducted in-person or through an online Teams call. I preferred the method of an in-person interview at the place of work to give a sense of comfort and security. Every interview started with an explanation of the project, an introduction of the researcher, and the signing of the consent form, see Appendix B. A minimum time of 30 minutes was advertised by me and required to interview the participant. This is done to lower the threshold for participation.

To give structure and consistency to the interviews, I made an interview guide, see Appendix C. The interview guide consisted of three main themes: *work tasks and contact*, *care process and influence*, and *positive moments and challenges*. All interviews I conducted used this sequence to create consistent data. The questions I asked were based on the participant's experience and perspective on their influence in the care system. The outcomes that I used for defining the problems experienced in the care system, were based on the answers from the first and last theme of the interview guide: *work tasks and contact*, and *positive moments and challenges*. The focus group sessions were conducted by PhD student J. Houwen, which meant no preparations were needed by me before receiving the right data.

The type of data I obtained from the interviews were audio recordings and observational notes. Both were gathered and transcribed using ATLAS.ti. The focus group data was shared in the form of transcribed audio recordings. The transcripts of both groups, the interviewees and focus group participants, were analysed by using descriptive coding (Gibbs, 2007). The focus of the codes, that I applied to both data groups, had overlap and a few differences. Both data groups included the following divisions: a general understanding of the cardiology system and workflow, what goes well, what are possible wins, what are challenges, and what could be possible solutions.

The focus group data had additional codes around their specific needs as a patient, encompassing two themes '*feeling'* and '*happening*.' I did this to dive deeper into the layers of care, which are actual actions and emotional reactions. The interview transcripts from healthcare professionals had additional codes that included the perceived work pleasure/ satisfaction, how to guard employee values, consultation flow, work activities, and contact points. These codes gave an extra dimension to the diversity in healthcare professionals and how their work tasks affect their view of the current system.

The **result** were codes that represented the experiences and perspectives of the stakeholder groups: internal healthcare professionals, patients and external healthcare providers. This data was only available on ATLAS.ti and therefore another step of data summarisation was needed before I could find the main problems and challenges.

3.2 Data Summarising

In order to summarise and therefore understand the general data from the interviews and focus group data, two separate maps were created. Both maps were made to summarise the data by simplifying the output and identifying whether all the codes looked normal or whether anything stood out.

The maps present a clear overview of the insights and codes gathered from the transcripts. They provide a clear distinction between the information related to the codes and the connections between them. A map was created for the healthcare professionals, internal and external, and the cardiovascular patients.

3.2.1 Method

To understand the coded datasets from the interviews and focus groups, I made an overview. This overview divided the insights, and codes, into vertical panels that all focused on specific content that was found. Therefore, providing a summary of all data outputs. The content of the vertical panels of healthcare professionals differed from the patient's vertical panels since the codes were dissimilar. I divided the healthcare panels into the following content: *General, Work Satisfaction, What Goes Well, Possible Wins, Challenges*, and *Possible Solutions*. The patient panels included *General, What Goes Well, Possible Wins, Challenges*, and *Possible Solutions*.

Because I arranged the insights in vertical rows, it was possible to connect the insights to find the hidden meaning. By connecting the insights, the relationships between them became clear, as well as how certain insights influenced each other.

The next step I had to do, was analysing the insights by using the theory of *Thematic Content Analysis* to detect patterns and provide detailed data. This is done in the next section *3.3 Data Analysis*.

3.2.2 Result

Two maps were made to summarise the insights from the interviews and focus group data.

Outcome Healthcare professional map

The healthcare professional map, Figure 6, is divided into six different vertical panels that show insights that are interrelated to each other.

The *General* panel provides information about the general understanding of the care system in the cardiology department, it provides specific work tasks of different healthcare professionals and the levels of care in the Netherlands. It also provides information about the EPD. This panel helped to validate the workflow and its various stages.

The panel on *Work Satisfaction* delves into the positive side of the system, which is used as feedback to show that not everything is going wrong. Most participants mentioned the energy they get from contact with patients and colleagues. In particular, the variety of patient care and working together to create an appropriate treatment plan. In addition, the variety of tasks in an academic hospital creates satisfaction. The tasks are not only medical but also focus on education, organisation, technology, and research.

In addition, the *What Goes Well* panel shows that certain actions and interactions in the system are successful. This helps to structure the to-be-developed strategy. However, what goes well was always accompanied by a *'but it could and should be better'*. For every positive aspect, there was also a negative one. For example, there is a general feeling that the LUMC has good contact with GPs. But the GPs do not see it that way, there are often long telephone queues, and it is hard to get through to the right cardiologist/AIOS.

Possible Wins and *Challenges* focus on the negatives of the system and form the largest group. These findings are used to understand and discover the problem areas and gaps in the system by clustering them using *Thematic Content Analysis*. These findings focus on both tangible barriers, such as the use of the dual-digital systems or administrative burdens, and intangible problems, such as the working atmosphere and resistance to change.

The final panel, *Solutions*, provides insights that can be used as inspiration for the interventions and strategies to be developed. For example, an online waiting room for video consultations, or a regional-wide system to share medical data between healthcare organisations.

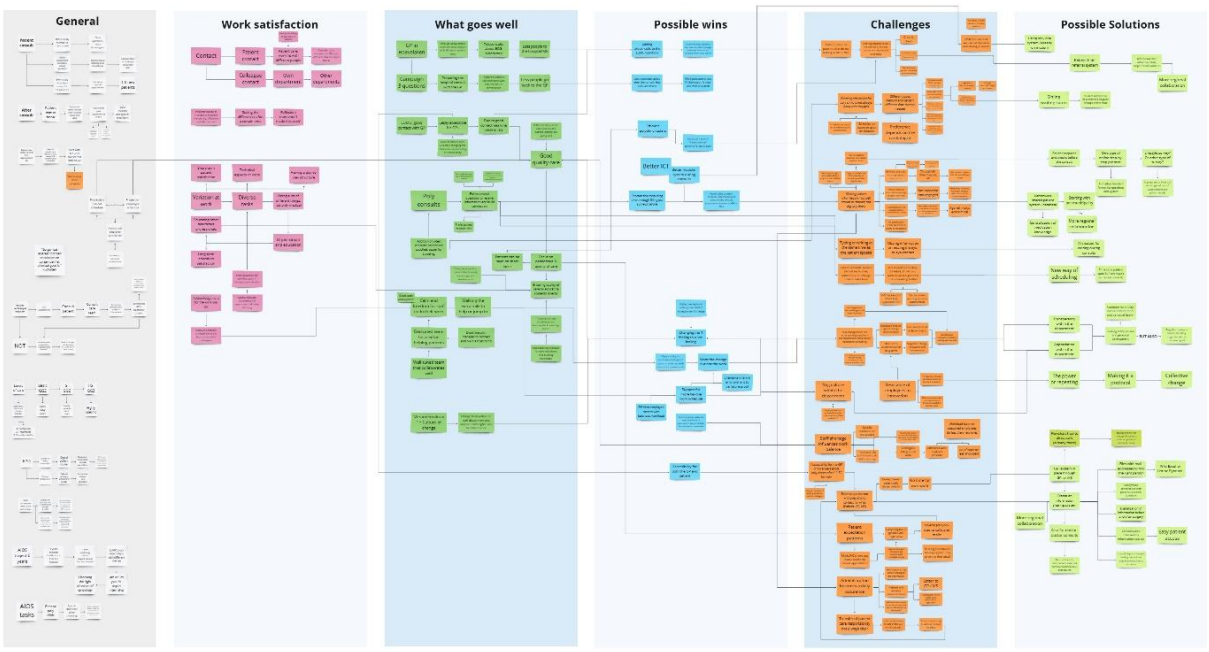


Figure 6 The insight overview map of healthcare professional data

Outcome patient map

The patient map, see Figure 7, is different from the healthcare professional's map. Not only is the content different, but the number of panels is also not the same. There is a total of five vertical panels. The first panel, *General*, contains patient experience quotes that focus on how the patient perceives the care system and therefore less informative on how it works.

The *What Goes Well* panel shows that certain actions and interactions that patients experience in the workflow are successful. Patients mention that they increasingly learn to listen to their bodies and that the presence of a multidisciplinary team has a positive effect on their mentality.

Both the panel's *Possible Wins* and *Challenges* focus on the negative patient experiences in the care system. These insights are also used to understand and discover the problem areas and gaps in the system by clustering them using *Thematic Content Analysis*. Both tangible and intangible examples of what needs to be changed are given. For example, the psychological difficulties of being a patient are not considered. Another tangible problem is the *MijnLUMC* app, which is confusing and not user-friendly.

The last panel, *Solutions*, provides insights that can be used as inspiration for the interventions and the strategy to be developed. These solutions focus on creating a platform for mental and emotional support and a trusted information distribution system.

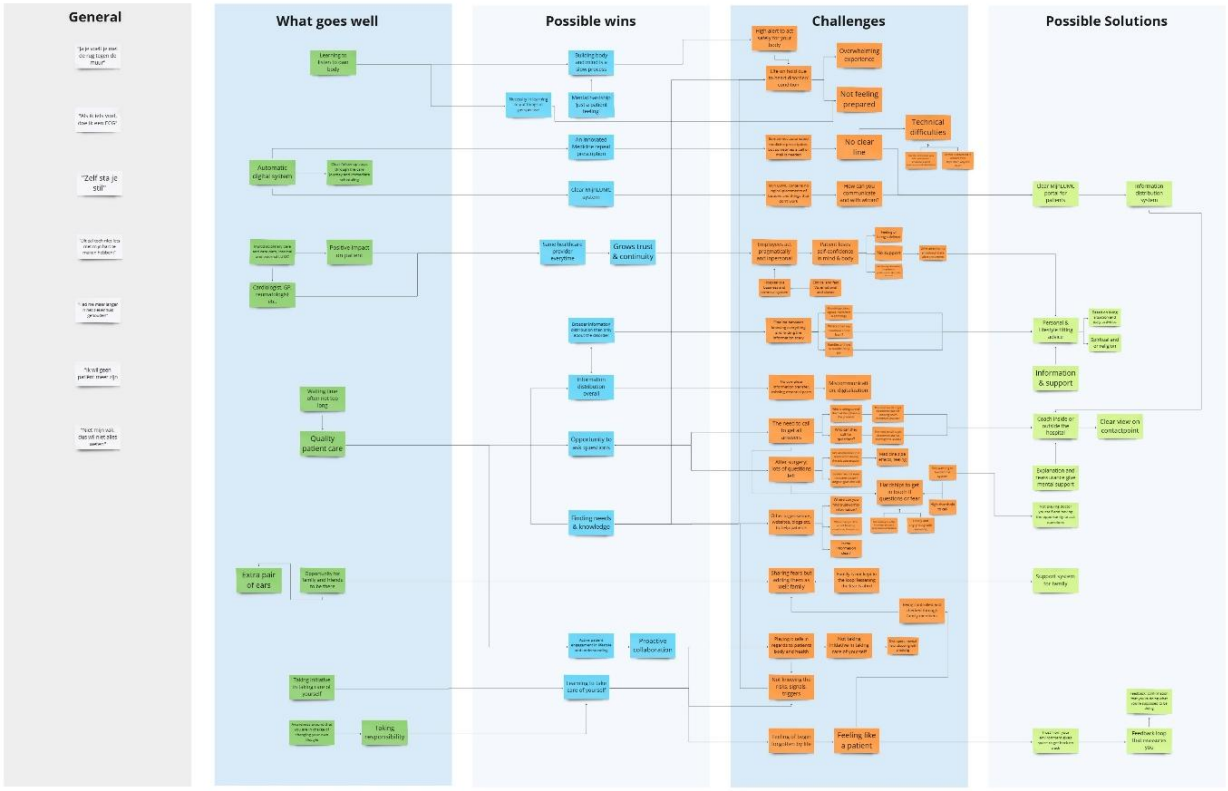


Figure 7 The insight overview map of patient data

3.3 Data Analysis to define the Themes

The insights (codes) from both maps were analysed using the theory of *Thematic Content Analysis* to detect patterns and provide rich data (Braun & Clarke, 2006). The goal of using *Thematic Content Analysis* (TCA) was to define the problems in the system. The insights used were therefore from the panels *Possible Wins* and *Challenges*. Multiple iterations were made to define the final set of themes and sub-themes that portray the problems.

3.3.1 Method

The analysis I have done on the summarised insights (codes) is based on the six steps from *Thematic Content Analysis* (Braun & Clarke, 2006). After familiarisation with the data and the generation of initial codes, the search for themes began. The insights from both patients and healthcare professionals were combined to create clusters. This was first done for the panel *Possible Wins* and *Challenges* separately. By clustering the insights based on the meaning of the content, I made four clusters for *Possible Wins* and ten clusters for *Challenges*. The number of clusters did not yet represent the right data found during the research. I had to do a second round of iteration to review the clusters. In addition, to validate the new version of the clusters, I used ChatGPT as an aid.

The following method was used by me to prompt ChatGPT to conduct *Thematic Content Analysis*. Firstly, ChatGPT was prompted to help find themes from transcripts by using *Thematic Content Analysis*. All transcripts were uploaded into the program and the first iteration of themes was made; six themes were generated by ChatGPT. Secondly, to add a layer to the themes I asked

ChatGPT to look into the subthemes that were connected to the six generated themes. After this prompt, all six themes received three subthemes with a short description of the meaning behind them. Since it is important to be transparent about the found data and themes, ChatGPT was prompted to add the codes found from the transcripts to the themes. I did this step two times.

The clusters made by me and ChatGPT were reviewed to understand the differences in nuance and to see if there was any overlap. Both sets of clusters were similar in finding the meaning of the data. However, there was a difference in portraying the meaning. ChatGPT was less personal and more objective in defining the themes and subthemes, this was a contrast with the clusters I found. These were more personal and showed the emotional factors as well.

The final step was to combine my clusters and the clusters from ChatGPT to create the final set of themes. After combining both sets, I created six themes with several sub-themes ranging from three to eight. However, the number of sub-themes was too high for several themes, so another round of iteration was needed to finalise the result. After the final round of iteration, I have created six themes with accompanying sub-themes between three and five. These portray the problems found in the data sets.

3.3.2 Results

Finally, six themes with accompanying sub-themes were found by clustering the insights from the panels *Possible Wins* and *Challenges*. These six themes portray the problems experienced in the system at the cardiology department. The several sub-themes, in turn, explain in detail the types of problems. The final six themes and subthemes are seen in Table 4 below.

Table 4 The six themes that portray the gaps and problems found

Themes		**Sub-themes**	
1	Internal Culture LUMC	1.1	Consideration work balance
		1.2	Layers of the decision tree
		1.3	Necessity of changing the collective mindset
2	Patient Care and Experience	2.1	Direct contact and consult
		2.2	Role and influence of family
		2.3	Experience patient during referral and treatment.
		2.4	Knowledge processing
		2.5	Clash emotion against efficiency.
3	Education and Training of Medical Staff	3.1	Training Medical Employees
		3.2	Balance between Education and Clinical Care
		3.3	Long-term Influence of Education
4	Collaboration and Communication	4.1	Internal communication inside the hospital
		4.2	External communication with other health organisations (GP, second-line MS, insurance)
		4.3	Communication as support
		4.4	Knowledge and clarity
5	Care Processes and Efficiency	5.1	Administrative load
		5.2	Access to medical information
		5.3	Patient admission
		5.4	Efficiency in patient stream
6	Technological Aspects of Care	6.1	Digitisation as support tool
		6.2	Restrictions of data sharing
		6.3	Challenges of integration and innovation of technologies*

**Specifying the main challenges in sub-theme 6.3*: resistance against using technology, integration of IT systems both internal and external with data sharing in mind, and the dual digital system use at LUMC.

Theme 1 - Internal Culture LUMC

This theme focuses on the way the decisions and innovations are introduced, discussed, and managed inside the LUMC based on their decision tree. Since the LUMC is an academic hospital, a certain hierarchical structure is in place, that is not always easy to work with. Furthermore, the theme touches upon the work culture of the employees, which is often high-pressure, focused on the individual and resistant to change and novel innovations. It is necessary to implement an active culture where change is possible and during which the focus is on changing the collective mindset. Furthermore, the work environment should take the personal and work situation of the employees into account to consider the work balance.

Theme 2 - Patient Care and Experience

This theme focuses on the perspective of the interaction of patients, their families and healthcare professionals. There is joy in providing the care that patients need, however, during the consults there is a quick pace of transferring knowledge with the focus on the medical side. Patients might not feel prepared to receive all this information and have a hard time processing the knowledge. In addition, the emotional needs of patients are seen as interfering with the daily schedule of their provider since the expectation pattern is focused on quick and right now. This creates a conflict between emotion and efficiency during patient-doctor contact. Furthermore, family members influence both the care path of patients and their emotional state by interacting with both.

Theme 3 - Education and Training of Medical Staff

This theme focuses on the importance of educating and training the new generation of medical employees. The influence of these actions, both knowledge-enhancing and practical training, has a long-term impact on the system which is sometimes not recognised by employees. Failure to understand the long-term impact of training harms the need to understand why it is necessary. Furthermore, the addition of training and education creates an extra challenge in finding a balance between daily clinical tasks and providing educational support.

Theme 4 - Collaboration and Communication

This theme focuses on not only the internal communication within the hospital but also the external communication between healthcare organisations, for example, GPs, second-line hospitals and insurance companies. The inefficiencies in communication methods and complex paths create the issue of non-existent or lacking collaboration between stakeholders, both internally and externally. Additionally, there is a missing link to using clear communication as support instead of a tool. This is necessary to aid the need to provide clear and qualitative knowledge. Information should not be dumped onto a collaborating party but effectively used to prevent mishaps.

Theme 5 - Care Processes and Efficiency

This theme focuses on several factors that influence the efficiency of the current care processes. Patient admission is often based on safety and the lack of specific knowledge, which leads to a longer wait time for testing and consultation. On the other hand, safety and security become the reason that patients do not leave the LUMC care even if it is possible. Both effect the high number of patient influx and lower number of patient outflow. In addition, the consult schedules are not prepared for the diversity in patients, health complexities, time needed or the work schedules of the healthcare professionals. The accumulation of tasks brings additional administration that

needs to be done after work hours. Once patients are admitted to hospital, efficiency is affected by the amount of time spent on administration and the inability to access up-to-date medical information due to data exchange restrictions.

Theme 6 - Technological Aspects of Care

This theme focuses on the integration of digitalisation in care. Both new and existing medical technologies find challenges in the acceptance of employees. The restrictions of IT systems such as *EPDVision* & *HiX* are the main pain points due to two reasons; the dual-digital system use is confusing and connecting medical patient data with and to other health organisations is a complex process. Medical data exchange is restricted by nationwide regulations. Furthermore, the digital system is lacking in acting as a support tool. A modular system is necessary to ease the digital burden.

Validation Themes

Stakeholder engagement and validation during the process is important, therefore two interviews were conducted to validate the problems identified in the data. During these interviews both the workflow and the themes were talked about, see Chapter 2 for the workflow validation.

Both interviews were conducted with an AIOS from the cardiology department, who have not yet been interviewed. This was necessary to receive a more objective opinion about the themes that portray the problems within the cardiovascular system. The interviews were semi-structured and consisted of questions and a printed workflow to interact with. For the interview guide see Appendix E.

The questions focused on understanding their roles in the system and what provided work satisfaction. Furthermore, after talking about the system and the themes there was time to highlight what they missed and/or what they think the main challenge is.

During the theme validation, all themes and subthemes were explained, after every theme there was space to react. After walking through all the themes there was a brief discussion about the importance of every identified problem and their first thoughts. Both participants resonated with the problems and highlighted the importance of certain aspects, such as administrative load "*75% is computer work and 25% patient contact*". Another focus point was the internal culture "*Due to the time pressure and workload there is not much time for each other*."

The insight gathered during these interviews will be used in the design direction and designing interventions.

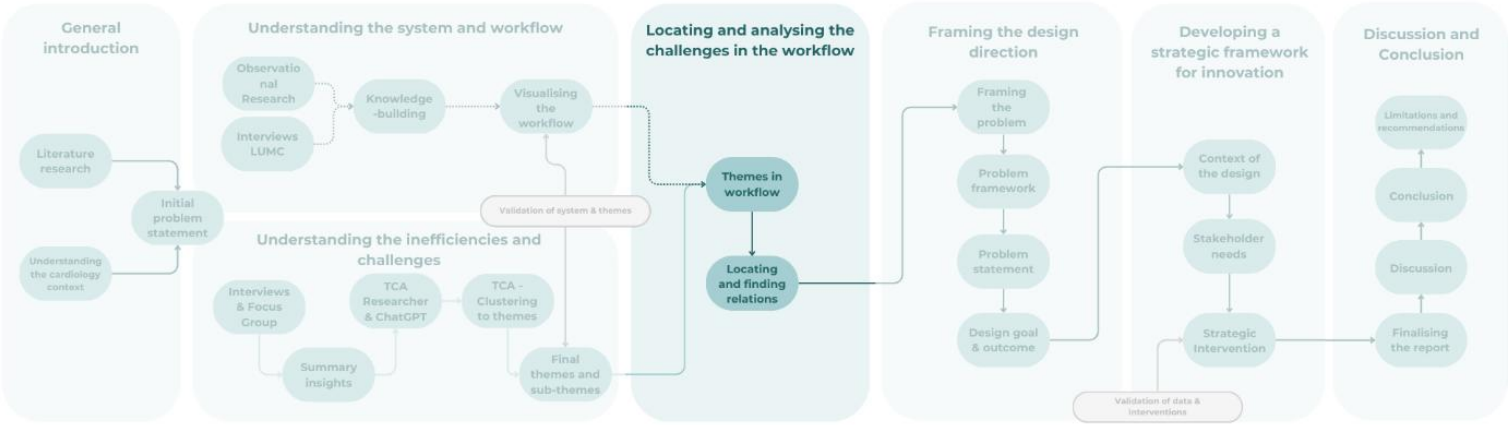
3.4 Conclusion and Limitations

The six themes with their accompanying sub-themes are containing the conclusion of this part of the report and answer the research question: *'What are the experiences of patients and healthcare professionals in the current workflow at LUMC?'* Furthermore, they form the core of locating the problems experienced in the cardiology department. In the next chapter, the themes will be placed in the workflow to analyse where they occur, and which themes form the core problem.

Next to answering the research question the gathered data also showed keywords that connect them and reveal the common thread through all insights. It became apparent that to increase the wellbeing of internal healthcare professionals the work pressure needs to decrease. Furthermore,

aligning the expectation patterns of the patients, and external healthcare providers with the internal healthcare professionals is necessary to decrease the workload. Therefore, improving the collaboration between all three stakeholders is key to a functional workflow where high-quality care is provided.

Lastly, since the *Thematic Content Analysis* is conducted by only one researcher a certain level of subjectivity is apparent in the final results. To work against the subjectivity ChatGPT is used for a second analysis. However, since ChatGPT works on the prompts of the researcher it is important to keep in mind that the outcomes still include a level of subjectiveness. To reach a more objective view of the data it is recommended to review the codes and insights with other researchers to iterate on the final themes and sub-themes.



Chapter 4 Locating and Analysing the Challenges in the Cardiovascular Workflow

To answer the third research question *'How can the current problems within the system be optimised?'* it is necessary to understand how the problems (themes) found are located within the workflow. Once the location and internal relationships become clear, a direction can be given on optimising the current system. This is the focus of Chapter 4.

First, the relationship between the themes and the system is shown, highlighting where the themes can be found in the workflow. Afterwards, the themes, which together represent the hotspot within the workflow, are mentioned. All other relationships of themes and sub-themes are found in Appendix D. The hotspots are used in the next chapter to define the design direction.

4.1 Theme-workflow Connection and Influence

By placing the themes in the workflow, the location and its influence became apparent. This is necessary to understand what locations and interactions form the biggest challenge in the workflow. The placement of the themes is based on the collected data and done by one researcher.

4.1.1 Method

The first step of placing the themes in the workflow was starting with the first problem statement so I could evaluate the target. Additionally, I had to keep in mind which themes had a direct or indirect influence on the system. The placement of the themes was used to be able to define the key influences and therefore the key problem areas. I placed the themes in the workflow by analysing the data outcomes, the quotes of the participants and understanding what a sub-theme meant.

Once all the themes and their associated sub-themes had been placed in the workflow, I described the relationships. I did this to understand how and in what way the themes were connected in the workflow. In addition, their direct or indirect influence became clear. The

method I used was to go through the workflow stage by stage and summarise all the sub-themes that were connected. A connection is described as: influencing the same activity or pathway.

4.1.2 Results

By placing the themes within the workflow, it became apparent that certain sub-themes occurred more frequently than others. It also became clear that almost no sub-theme appeared alone in the workflow. Most of the time there was a connection between sub-themes that represented the real problem in certain activities.

The final placement of the themes and connected experience quote can be seen in Figure 8. A QR-code is provided to view the figure in detail and to use it alongside the theme placement explanation. The influence and the relationship between the themes and subthemes are described underneath Figure 8. For every theme there is a short description of where it occurs in the workflow, accompanied by an example quote from the interviews or focus group patient data to support the placement. The Dutch quotes are accompanied by an English translation, the meaning of the quotes may differ slightly due to the use of English words. A detailed description of the placement of the themes and sub-themes can be found in Appendix D.

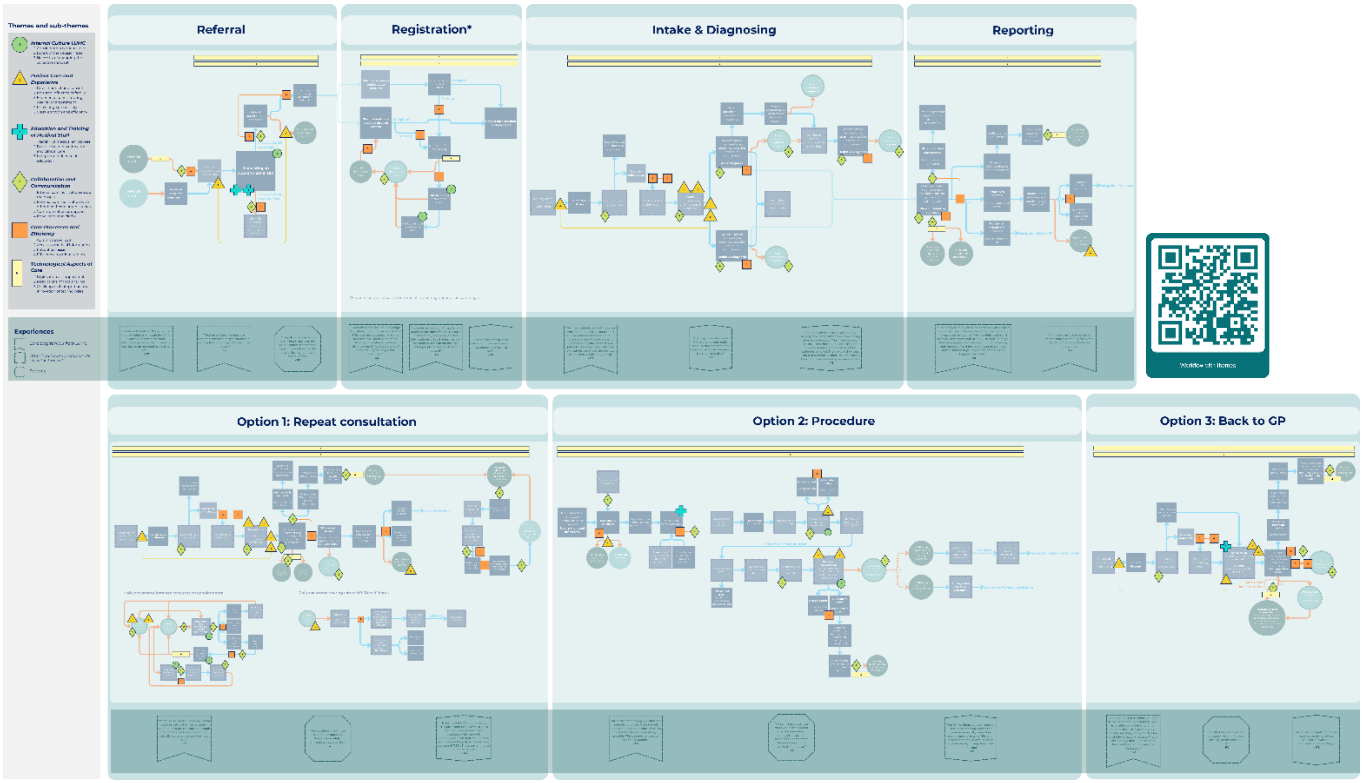


Figure 8 The workflow and the defined problems

Theme 1 - Internal Culture LUMC

1.1 Consideration work balance

This theme mostly occurs during inefficiencies in the work divisions at the LUMC, both during clinical and non-clinical tasks and internal and external interactions. The problem portrays inefficiencies in the division of specific tasks and the division of workload, which is now often based on the experience and duration of someone's employment. An unfair division of work creates a lot of work on fewer shoulders.

- *P4 - "Dan hoop ik dat er meer draagvlak voor komt, om dan soms wat flexibeler dingen in te delen."*
- *P4 - "I hope there will be more support to make things more flexible sometimes."*

1.2 Layers of the decision tree

Has a shadow influence on the workflow and mostly influences the implementation of new ideas, technologies and innovation. This problem is connected to the internal healthcare professionals, their work environment, and the hierarchical system within the hospital.

- *C1 - "Het lastige hier is van de poli dat het een duaal management is, waar we allemaal tegenaan lopen. En waar ik ook vooral tegenaan loop... alles moet in overleg en dat brengt frustraties mee."*
- *C1 – "The tricky thing here at the polyclinic is that it is dual management, which we all run into. And what I often run into... everything has to be done in mutual agreement and that brings frustrations."*

1.3 Necessity of changing the collective mindset

Has a procuring influence on the employees and their way of work, mostly focused on collaborating with employees in the department itself. Shows the necessity of having a collective 'we-feeling' instead of the now occurring 'I-feeling.' Furthermore, it portrays the resistance employees can have to changes.

- *P1 – "Er zijn veel organisatorische veranderingen doorgevoerd, maar medewerkers zijn vaak terughoudend omdat ze onzeker zijn over de nieuwe werkmethoden."*
- *P1 – "Many organisational changes have been made, but employees are often reluctant because they are unsure about the new working methods."*

Theme 2 - Patient Care and Experience

2.1 Direct contact and consult

Healthcare professionals get a lot of energy and joy from direct patient contact, however often the healthcare professionals' expectation patterns clash with the patient's expectation patterns and needs. This creates friction in the workflow. This theme mostly occurs during direct contact and interaction between patients and healthcare professionals.

- *C2 - "...en de poli, dat is meer directe, positieve feedback. Je doet een ingreep en de patiënt zegt, nou dokter, wat fijn dat het gebeurd is en dat het zo goed gelukt is."*
- *C2 – "...and the poly, which is more direct, positive feedback. You operate and the patient says, well doctor, how nice that it happened and worked out so well."*

2.2 Role and influence of family

The presence of family during the consultation can help the patient, however, they can also be overly concerned and create a fearful feeling, which often occurs during the consultation at the hospital or at home.

- *FG - "En prompt kreeg ik weer die hartkloppingen. Dus dan ga ik gelijk... gelijk bellen."*
- *FG – "And suddenly I got those palpitations again. So, then I immediately... immediately start calling."*

2.3 Experience patient during referral and treatment
Occurs at the beginning of the patient getting in contact with the cardiovascular system through referral. Additionally, it happens when the patient is at the LUMC during their appointment and when they receive information about their appointment. This theme focuses on the journey of the patient through the system with their emotions at the centre.

- *C5 - "Bij de hartbewaking zien we vaak patiënten die snel geholpen moeten worden, maar door de drukte kan dit niet altijd meteen. Dit leidt soms tot stressvolle situaties."*
- *C5 – "At cardiac monitoring, we often see patients who need to be helped quickly, but due to packed schedules, this is not always immediately possible. This sometimes leads to stressful situations."*

2.4 Knowledge processing
Happens mostly during conversations inside the hospital, both during the intake, repeat consults and procedure conversations. This theme focuses on the patient and their ability to listen, understand and react to the medical information provided and the process around it.

- *FG - "Wat ik een beetje gemist heb, is gewoon dat ik een arts een keer zou zien na de operatie... al heb ik nooit meer een arts na de operatie gezien. Ik heb alleen een belletje gehad."*
- *FG – "What I missed was just, that I would see a doctor after the procedure... in the end I never saw a doctor after the procedure. I only received a phone call."*

2.5 Clash emotion against efficiency
Occurs during contact moments between the patient and healthcare professional since the timeframe of conversations is relatively short. In addition, the clash happens if the patient is at home and feels the need to call. The workflow of the healthcare professional is then disturbed. This theme highlights the difference between the fast-paced hospital environment versus the emotion-based patient.

- *C3 - "Wat ook heel vervelend is, is dat patiënten ons zelf bellen op het dienstzijn of via de telefoniste worden doorgeschakeld. Waardoor we eigenlijk niet zo goed toekomen aan het werk wat we moeten doen."*
- *C3 – "What is also very troublesome, is that patients call us themselves during work hours or are transferred through the operator. As a result, we do not actually get to do the work we need to do."*

Theme 3 - Education and Training of Medical Staff

3.1 Training medical employees
The training of new medical employees is an additional task that all employees must partake in, often its influence is in the shadows of the workflow. However, the outcome of the training occurs in specific tasks or influences the decisions new employees make.

- *C2 - "Het opleiden van jonge artsen geeft veel voldoening, maar het vereist ook dat ervaren medewerkers tijd vrijmaken van hun reguliere werkzaamheden."*
- *C2 – "Training young doctors is very rewarding, but it also requires experienced staff to take time from their regular duties."*

3.2 Balance between education and clinical care
Since all employees train new employees and students this theme has an effect in the shadows of the system. It shows the additional work tasks and finding a balance between clinical and educational tasks.

- *C3 - "Soms is het lastig om de balans te vinden tussen het geven van onderwijs en het uitvoeren van directe patiëntenzorg, vooral wanneer er veel studenten tegelijk zijn."*
- *C3 – "Sometimes it is difficult to balance teaching and performing direct patient care, especially when there are many students at the same time."*

3.3 Long-term influence of education
The long-term effect of education shows in the form of experienced employees and their ability to assess and adjust patient care. The influence of this theme has no direct effect on the workflow but more on the activities and interactions.

- *C2 - "Maar de opleiding is meer lange termijn. Je bent natuurlijk bezig om dingen te verbeteren. Op een gegeven moment denk je, het loopt eigenlijk allemaal best wel lekker. Dat is een beetje meer lange termijn bevrediging."*
- *C2 – "But education is more long-term. You are, of course, working to improve things. At some point you think, it is actually all going quite well. That is the more long-term gratification."*

Theme 4 - Collaboration and Communication

4.1 Internal communication inside the hospital
Occurs at almost all stages of the workflow and is mostly accompanied by an administrative load. It is normal to stay in touch with colleagues during patient care. However, due to other influences (technology or time), communication is not always done correctly or takes time.

- *P2 - "Er zit gewoon heel veel tijd in hoe en met wie je overlegt. Hoe groter, hoe meer de kans op ruis ontstaat."*
- *P2 – "There is just a lot of time in how and with whom you consult. The bigger, the more chance of noise."*

4.2 External communication with other health organisations
Problems often arise in the workflow due to different ways of working, unknown and complex steps to get in touch, or lack of accessibility. External organisations find it difficult to communicate with the LUMC and its employees.

- *P3 - "Na de uitbehandeling van de patiënt wordt de zorg niet altijd even goed overgedragen, de communicatie mist"*
- *P3 – "After the out treatment of the patient, care is not always transferred well, the communication is lacking."*

4.3 Communication as support
Happens when the patient is at home or is going home. Focuses on where to find the right type of information and understanding where and when questions can be asked. Is also in line with

patient preparation for their next consult. Portrays that in the current workflow, information is often dropped, instead of being offered as support.

- *C3 - "En de vraag is een beetje waar je die patiënten naar toe verwijst. Dus, waar ik wel behoefte aan heb, is betrouwbare, digitale informatie voor patiënten. Want als je gaat Google-en kun je alles vinden. De goede dingen, de slechte dingen, de dingen die niet waar zijn. Dus dat is heel lastig voor patiënten want die kunnen dat onderscheid niet maken."*
- *C3 – "And the question is where you refer those patients to. So, what I do need is reliable, digital information for patients. Because if you Google, you can find anything. The good, the bad and things that are not true. That is exceedingly difficult for patients because they cannot make the distinction."*

4.4 Knowledge and clarity

Occurs mostly during patient-doctor interactions where there is a constant flow of information exchange. In addition, this theme happens during the finalisation of the consult letter for external communication and for updates on the patient's treatment. Since there is a need to filter the right information for the right people.

- *FG- "Niet mijn vak dus ik wil niet alles weten."*
- *FG – "Not my profession so I do not want to know everything."*

Theme 5 - Care Process and Efficiency

5.1 Administrative load

Administrative load often occurs between communication and interaction, both physical and digital. This is because everything that happens needs to be written down. In addition, the preparation for certain care activities also needs additional proof and argumentation, often done digitally and written down. Lastly, the administrative load is present in the workflow when there is an abundance of steps that need to happen before information can be directly written down.

- *C5 - "Het loopt al uit omdat iemand later is vanwege die hartfunctietesten. Dan ga ik niet even mijn deur sluiten om al mijn administratie op orde te krijgen en dan pas de volgende. Dan ga je gewoon in één keer door. Omdat mensen al drie kwartier in de wachtkamer zitten. Je mag je administratie in je eigen tijd doen en dit laatste... dat gebeurt heel vaak."*
- *C5 – "It is already running late since someone was delayed due to their heart function tests. Then I am not going to just close my door to fix my administration and then call in the next patient. You just work in one go. Because people are already waiting in the waiting room for forty-five minutes. You can do your own administration in your own time and this. This happens very often."*

5.2 Access to medical information

The access to medical data is happening during the registration phase. Since this is the moment that the LUMC needs the information to add the patient to their digital system and understand with who they are dealing. The urgency of access to medical information is better portrayed during emergency care. However, this route is not visualised in the current workflow.

- *C2 - "Problemen zitten rondom kennisoverdracht van en naar de verwijzer. Die EPD's zijn grotendeels, zeker om voorgeschiedenis, allemaal vrije tekst en ik ben echt veel tijd kwijt*

soms om chaotische voorgeschiedenissen fatsoenlijk in onze EPD te krijgen. Medicatie gaat dan via het landelijk schakelpunt. Dat gaat vaak goed, maar lang niet altijd. Mensen hebben geen toestemming gegeven of het staat er niet in. Voor allergieën moet je alles apart opnieuw gaan invoeren. De informatie is er wel, maar niet op de goede manier digitaal. Dus je moet alles weer apart, van allerlei bronnen halen, van pdf's, moet je in het EPD zien te klikken. Ik ben daar echt heel veel tijd mee kwijt, met het compleet maken van de poli-brief."

- *C2 – "Problems occur around knowledge transfer from and to the referrer. The EPDs are mostly, especially history, free text and I spend a lot of time decently translating the chaotic history in our EPD. The medication goes through a national point. That often goes well, but not always. People did not give permission, or it was not there. For allergies, you gave to re-enter everything separately. The information is there, but not digitally in the right way. So, you have to retrieve everything from separate sources, pdf's, into the EPD. I spend a lot of time completing the poly letter."*

5.3 Patient admission

Occurs at the beginning and end of the workflow as it represents the admission and discharge of patients to create an efficient flow and balance in the number of patients. The admission of patients is not yet done correctly. The criteria are often not followed because GPs, specialists and patients act out of fear. In addition, patients are kept in the LUMC system when they could be referred back to the GP as their problem is no longer complex.

- *C3 - "Ik denk ook dat heel veel van de, ongeveer 30 procent, van de nieuwe verwijzingen, via de huisarts bijvoorbeeld, of soms ook hier intern, dat kan op een andere manier afgehandeld worden. Dus die hoeven we helemaal niet te zien."*
- *C3 – "I believe that about 30 per cent of the new referrals, through the GP for example, or sometimes from here internally, can be handled in another way. So, we do not need to see them at all."*

5.4 Efficiency in patient stream

This theme occurs in both scheduling the patients and the patient journey during heart function tests, consultation, and the procedure itself. It portrays the not-thought-through appointment accumulation per cardiologist and thus the issue of delays during the polyclinical and clinical hours.

- *C5 - "Ik vraag me soms ook af of de poli niet efficiënter kan. Want als ik naar het spreken van mijn supervisor kijk dan heeft ze dertig contacten. E een stuk of tien is fysiek, maar dat betekent dat ze nog twintig mensen moet bellen na haar spreekuur. Dat doet ze ervoor, dat doet ze erna en een dag erna. Maar dat is toch niet te doen. Er zouden toch kaders en rasters moeten zijn. Ze heeft niet zo heel veel keus, want die mensen moeten gezien en geholpen worden. Maar dat ligt dan gewoon bij één persoon en ik heb niet het idee dat andere mensen het veel rustiger hebben."*
- *C5 – "I sometimes wonder if the polyclinic could not be more efficient. Because, if I look at my supervisor, she has thirty patients. About ten of them are physical, but that means that she has to call twenty more people after her polyclinical hours. She does that before, after or the day after. But surely that is not doable. There should be frames and grids. She*

does not have that much choice, because those people need help. But that just lies with one person, and I do not feel that other people have it much more relaxed."

Theme 6 Technological Aspects of Care

6.1 Digitalisation as support tool

Occurs in all phases since it focuses on the integration of digital tools for support during work tasks and communication. Digitisation is not always done correctly due to resistance or lack of knowledge.

- *C2 - "Problemen ontstaan vaak doordat verwijzingen uit andere organisaties niet volledig zijn, wat extra tijd en werk vergt."*
- *C2 – "Problems often arise because referrals from other organisations are not complete, which requires extra time at work."*

6.2 Restrictions of data sharing

These restrictions happen during external communication. This has to do with a lack of synchronized digital and technical systems between health organisations. Data sharing is harder to do if the digital system cannot correctly collaborate and synchronise. In all phases, this sub-theme occurs in the same way.

- *C3 - Het is natuurlijk omdat we geen landelijk EPD hebben... het geeft enorm veel werk, wat eigenlijk zonde van de tijd is"*
- *C3 – "It is obvious since we do not have a national EPD... it gives an enormous amount of work, which is actually a waste of time."*

6.3 Challenges of integration and innovation of technologies

Appears as an overarching theme in the workflow as it focuses on the challenges that arise at all stages and actions. The challenges focus on human resistance and the dual-digital system use.

- *C3 - "Het gebruik van echo's en MRI's is essentieel, maar het gebrek aan integratie van IT-systemen maakt het moeilijk om alle informatie bij te houden."*
- *C3 – "The use of ultrasounds and MRIs is essential, but the lack of integration of IT systems makes it difficult to keep track of all the information."*

4.2 Analysing the Root Causes of the Challenges

This paragraph shows the themes that influence each other and the workflow the most. Each combination includes a short description of what activity or interaction they have influenced in the workflow.

Balance between enjoyment and information overload

Direct contact during consultations and discussions is where healthcare professionals get the most enjoyment out of their work (*sub-theme 2.1*). However, these interactions often reveal a conflict between the efficiency of healthcare professionals and the emotional state of patients (*sub-theme 2.5*). A lot of information is exchanged in a short period, and there is an imbalance

between the medical knowledge and the patient's knowledge. This can lead to confusion. In addition, the patient may not want to know the specific medical information being shared and may prefer to focus on the personal impact.

Expectations and patient engagement

The connection between the three sub-themes *Direct contact and consult (2.1), Experience patient during referral and treatment (2.3),* and *Clash emotion against efficiency (2.5)* is based on the experience of the healthcare professional versus the experience of the patient. The hospital is a technical system that aims to provide high-quality care in a short time. This often clashes with the emotional side of care and the emotional roller coaster the patient is riding. It is therefore necessary to balance the expectations of healthcare professionals with the engagement of the patient in their process.

Family members effect on the patient

The family of the patient often has an influence on the patient's wellbeing and the way they process information (*sub-theme 2.2*). They can either help the patient take care of themselves or treat the patient as if they were made of glass. In this case, the family's anxiety can create fear in the patient and increase their doubts about their body and health. The presence of family members during consultations and at home can therefore affect the patient's mental capacity to understand and process the provided information (*sub-theme 2.4*).

Fine line between understanding and being overloaded

There is a fine line between what a patient needs to know and what they are able or willing to process. As patients often come from non-medical backgrounds and have varying levels of education, there is a conflict between providing clarity about the situation and heart disease and the patient's processing time (*sub-theme 2.4*). In the fast-paced hospital environment, patients can be overwhelmed with information, leading to confusion and frustration (*sub-theme 4.4*).

Negative effect of incomplete communication

The sub-themes *Knowledge and clarity (4.4)* and *Administrative load (5.1)* influence each other in such a way that if knowledge is not clear and communicated correctly, a communicative feedback loop will result in additional workload. If there is a feeling that not enough medical knowledge, personal knowledge, or reassurance is being passed on to the patient, there will be a lot of phone calls or emails which will disrupt working time. In addition, incomplete communication of information to the GP or other healthcare organisations could also lead to a flood of messages and calls.

Internal communication overload

Internal communication often involves managing emails, phone calls, patient files, and other documents (*sub-theme 4.1*). The necessary steps in internal communication and collaboration need to be written down each time, and often include multiple employees, creating an administrative burden (*sub-theme 5.1*). In addition, to provide the right care for the patient, there is always internal communication to ensure that the next steps can be taken. This includes referrals as well as making new appointments or scheduling procedures.

Inefficiencies lead to unnecessary administration

The combination of *Administrative load (5.1)* and *Efficiency in patient stream (5.4)* shows that if there is a lack of efficiency in patient flow, there will be a lot of extra administrative work. For example, if too many patients are admitted to the LUMC care system, there will be an accumulation of files and data to sift through. There will also be an increase in polyclinic and clinic hours to see all the patients on time. A delay in consulting hours due to stacked schedules could result in overtime. Furthermore, if patient admissions are inefficient, patients who do not need to be seen at the LUMC may be admitted. This leads to unnecessary administration.

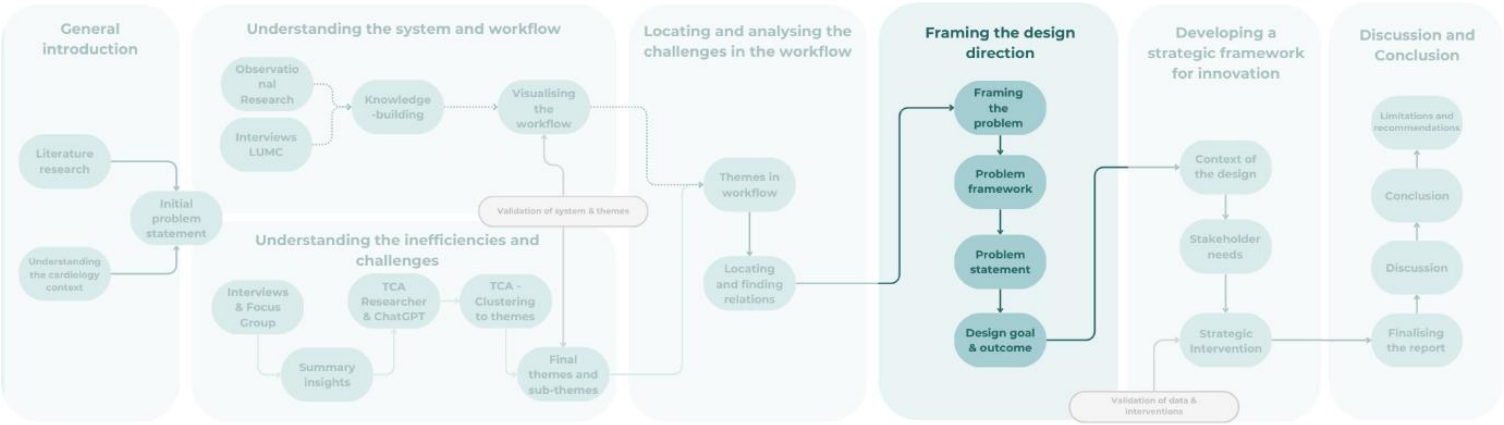
4.3 Conclusion and Limitations

The aim of this chapter was to take the first steps towards answering the research question: *'How can the current problems within the system be optimised?'* These first steps have been achieved since the theme location and influence are now known. The hotspots have also been identified. These hotspots represent the themes that most influence each other and the workflow. By delving deeper into the meaning of the hotspots, the next step of reframing the problem statement and finding a design direction to optimise the care journey can be taken.

Looking into the deeper layer of what connects these themes, it is clear that there is a misalignment of expectation patterns. This misalignment occurs between the patient and internal healthcare professionals, between the internal healthcare professionals, and between the internal healthcare professionals and external healthcare providers. The misalignment occurs because there is a lack of transparency in both the internal system, the technology, and the people who interact with each other. There is no clear understanding of what people in the system need from each other and what actions need to be taken. Furthermore, there is a need for better preparation, which in turn will lead to more fluent communication. This will create a collaborative environment where the patient, internal healthcare professionals, and external healthcare providers can work together and know what to expect of each other. This outcome will be used in the next step of reframing the problem statement and defining the design direction.

By aligning the expectation patterns, problems identified across the cardiovascular system can be solved. Therefore, by addressing the problems at a higher level, the experience of all three stakeholder groups can be optimised. The transparency that should be created between internal healthcare professionals, patients, and external healthcare providers promotes collaboration, patient engagement, and coordination of patient care. Patients need to understand that the best care is being provided, however a certain level of preparation is required to be able to provide care. In addition, external healthcare providers need to learn the workflow of the LUMC to facilitate the flow of preparation and to understand the level of collaboration that is possible. Finally, internal healthcare professionals need to understand each other's roles and be open to innovation. Without collaboration, an optimised system cannot be achieved.

Lastly, the placement of themes is done by only one researcher, which means that there is a high degree of subjectivity. To make the data output more viable, it is necessary to go through the theme placement again, but with more than one researcher. Triangulation of the data output is important to make the theme placement credible and viable to work within the next steps.



Chapter 5 Framing the Design Direction

This chapter combines the research findings from all the chapters to frame and identify the key problem. After framing the new problem statement, a design direction can be made. This design direction helps to answer the third research question: *'How can the current problems in the system be optimised?'*

5.1 Framing the Problem

To connect and understand every part of the information found through the literature background and the qualitative research methods it is necessary to review the deeper layers of all research outcomes. This will frame the problem of the project. Every step that is done throughout the project focuses on a specific problem. To find this problem an overview is made per phase to find the occurring questions and the key connections, see Appendix F.

Going through all the data, step by step, it becomes clear that the focus of the project should not only be on the internal healthcare professionals at the LUMC. The problems identified show a more complex relationship between the internal healthcare professionals, the patients, and the external healthcare providers. Therefore, to find the key problem, it is necessary to look at what goes wrong between these three stakeholder groups.

The problem that is identified between the three groups, internal healthcare professionals, patients, and external healthcare providers, is the misalignment in expectation patterns. This means that there is a lack of understanding of what the other party needs, what they can do, and what their communication style is. There is a lack of transparency in both the internal system, the technology, and the people. These problems can often be improved by preparing the interactions and collaborations. However, this problem does portray a fundamental shift. If there is a certain want to tackle this "wicked problem" for which there is not one solution, a shift at system level needs to start being realised. During which a transformation occurs from fragmentation and misalignment in expectation patterns to transparency at system level.

In the end, the following sentence summarises the identified misalignments:

*"The main goal is to **improve the wellbeing** of the internal healthcare professional and to create comfort. This is done by creating **transparency** and improving the **preparation** process for **fluent communication**."*

To summarise the findings a framework is made, which can be seen in Figure 9. This framework portrays the overarching problem and leads to defining the new and final problem statement. The elements within the framework show what is needed to help all three stakeholder groups understand in what context they collaborate. It elaborates on the importance of communicating, in the same way, to be able to provide high-quality care. The framework is now based on the cardiology department at LUMC and therefore the relationship between the internal healthcare professionals at LUMC, cardiovascular patients, and collaborating external healthcare providers.

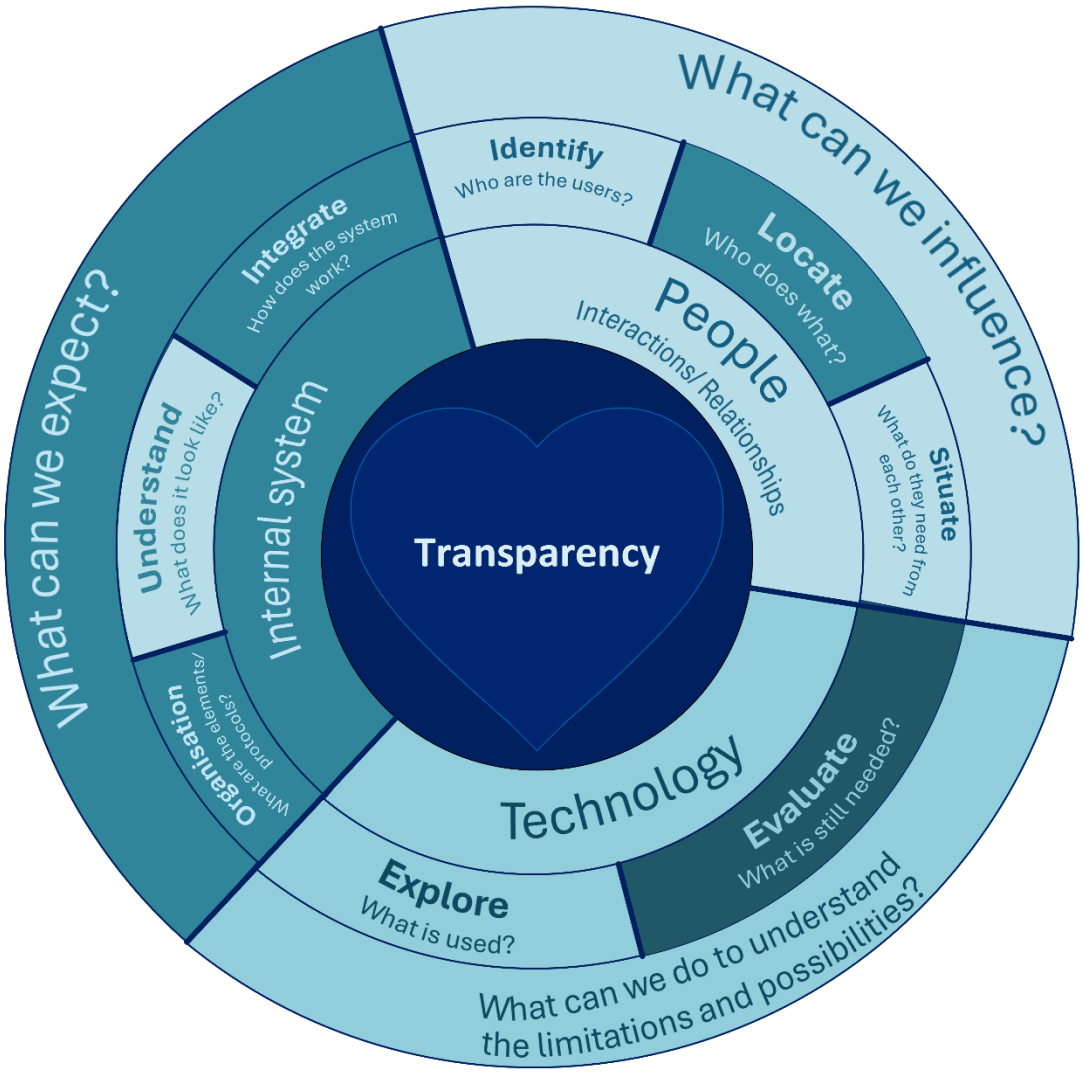


Figure 9 Transparency framework

Transparency

Lack of transparency is at the heart of the problem. It appears in three environmental elements: the internal system, the people (interactions/relationships) and the technology. Looking at the **internal system**, there is a need to understand what the system looks like, how it is organised, i.e. what are the elements/protocols, and its integration, i.e. how does the system work. The internal

system concludes with *'what can we expect'*, which shows a need to know what each stakeholder can expect in the system they are interacting with.

The second element **people** represent the interactions/relationships between the different stakeholders. It shows that there is a need to identify, i.e. who the users are, to locate, i.e. who does what, and to situate, i.e. what they need from each other. Having understood all three, it is necessary to know *'what can we influence'*, i.e. what human factors we need to consider in our interactions and behaviour.

The final element **technology** is the most tangible of the three and includes the technological tools that are part of the internal system with which people interact. It represents the need to explore, i.e. what is being used, and to evaluate, i.e. what is still needed. Technology shows that it is important to understand the limitations and possibilities of the digital world to be as transparent as possible.

Preparation for communication

Preparation for communication is the activity that becomes a solution to the framework. It shows the importance of knowing what needs to be done and what can be done in the time someone has. It is both digital and physical. There is part that can be prepared and shared digitally and part that must be done physically between the different stakeholders: internal healthcare professionals, patients, and external healthcare providers.

Validation Problem and Framework

The conclusion of the research data is that improving the wellbeing of internal healthcare professionals is at the heart of improving communication and collaboration with patients and external healthcare providers. To understand if these insights are correct, existing literature is compared.

Research shows that healthcare professionals working in hospitals are at risk of stress and burnout due to the characteristics of their work (Gonçalves et al., 2019). These characteristics often relate to work overload, intentions to change services but lack of support, relationships at work, leading training activities and dealing with patients. The rate of healthcare professionals experiencing high stress and burnout is around 70%. These can be divided into three different types, namely work stressors, personal life stressors, and stressors that intersect work and personal life (Rink et al., 2023). Overworked professionals are prone to making errors that affect patient care and external communication. It is therefore necessary to support health professionals by offering flexibility and additional support services.

The framework for presenting the problem is based on the research data as well as validated by existing frameworks. The 'interprofessional communication and collaboration' framework portrays the importance of interprofessional collaboration and all the factors that are required to achieve it. It also promotes effective teamwork for interprofessional patient care to provide high-quality patient care and ensure patient safety (Lapum et al., 2021). However, this framework only focused on the human interaction part of the system and did not include the technological and systems aspects of the problem. Therefore, the framework was used as a source of inspiration.
In addition, the Engineering Better Care method uses a series of questions to approach a system. The division of these questions focuses on people, design, systems, and risk. This division is a better way of introducing a system and all its elements. The visual representation of these questions helped to frame the final problem framework (Clarkson et al., 2017). However, this method lacked the technological aspects of the system. As the digital barriers were evident in the data analysis, it was necessary to apply them in the system.

The final framework includes the people, where the interaction and relationships are outlined, the internal system, the context in which the problem occurs, and finally the technology, where the tools and possibilities are mentioned.

5.2 Introducing the Problem Statement

As mentioned earlier, the need for transparency and preparation between the three parties involved, internal healthcare professionals, patients, and external healthcare providers, is most evident in the misalignment of expectation patterns. Patients expect personal attention and enough time to receive the care they need. On the other hand, internal healthcare professionals have a strict schedule and a variety of tasks during their week, which means that time is precious. Finally, external healthcare providers have their organisational manners and ways of working, so how they work with the LUMC can be unknown and difficult to understand.

Therefore, the locations in the system can be defined using the key problems of *'transparency'* and *'preparation for fluent communication'*. These locations show the interactions where the expectation patterns of all three parties clash most. Finding these interactions is necessary to understand where intervention is most needed in this complex care system.

If the exact location of the misalignment is pinpointed, the following areas in Figure 10 appear for every stakeholder.

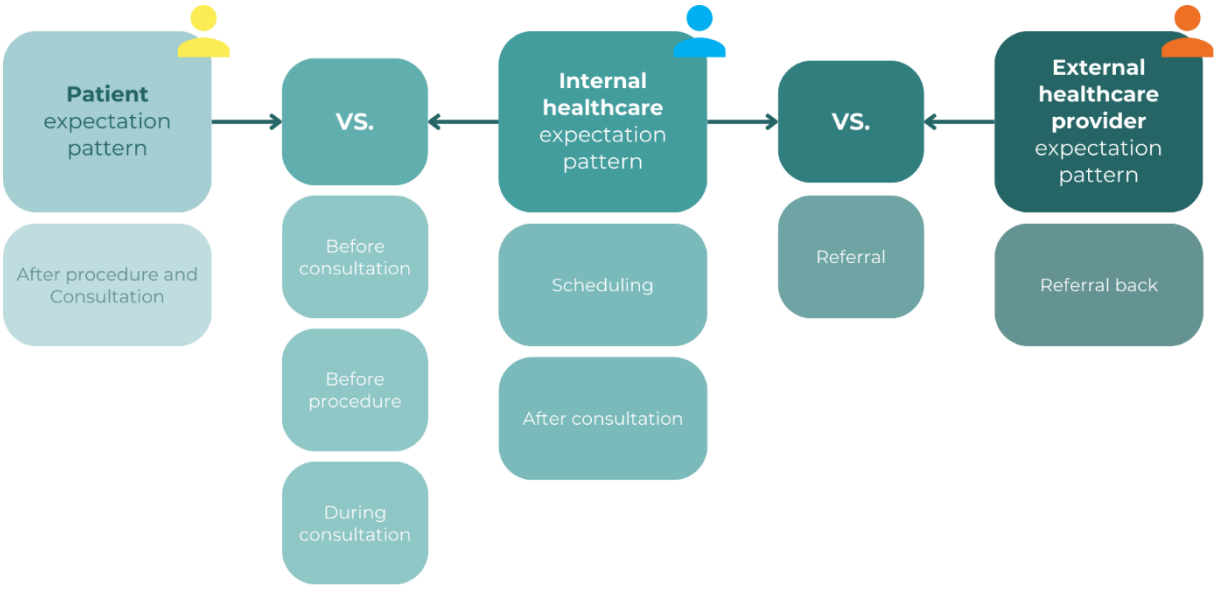


Figure 10 Problem areas based on misalignment of expectation patterns

An overview is made to understand the influence of '*transparency*' and '*preparation for fluent communication*' on the imbalanced interactions in the care journey. Table 5 shows what is missing and therefore what is needed per interaction.

Table 5 Relationship between needs and the imbalance in expectation patterns

	Patient expectation pattern	**Patient vs. internal healthcare professional**	**Internal healthcare professional expectation pattern**	**Internal vs. external healthcare professional**	**External healthcare professional expectation pattern**
Transparency	Medical knowledge	Communication	Roster and timetable	Effective communication	Medical information
	Personal situation	Education		Patient care	Personal information
	Medical and personal advice			Differences workflow	Communication; how and when
Preparation for fluent communication	Knowledge through multiple mediums	Questions about health	Communication; how and when	Consultation letters	Medical information
		Questions about the personal situation			Personal information
	Actions taken at home	Bringing in the right information (medical and personal)		The time needed for processing and finalising	Sharing data; what and in what timeframe
		Prepare body and mind			

After understanding the relationship between the key needs and their exact location within the workflow, the problem statement could be made. The problem statement focuses on the

misalignment of expectation patterns between all three parties: the internal healthcare professionals, the cardiovascular patients, and the external healthcare providers.

5.2.1 Final Problem Statement

The problem statement is explained by first describing the current situation, the problem itself and the impact if nothing is done.

Current Situation

The cardiology department at the LUMC faces increasing challenges in meeting the needs and expectations of internal healthcare professionals, patients, and external healthcare providers. Internal professionals are limited by time, digital resources and administrative tasks that impact their wellbeing. The influx of patients is increasing, and each patient expects personalised care with enough time to address their situation. At the same time, external healthcare providers (e.g. GPs, second-line MS) are experiencing disconnections in communication, digital systems, and processes, causing delays, and reducing collaboration.

The Problem

The mismatched expectations and fragmented workflows lead to **frustration**, **reduced collaboration** and **emotional burnout** among internal healthcare professionals. Patients experience **complexity**, **frustration,** and sometimes **inconsistent care journeys**, while external providers **struggle to coordinate patient care** with the department. The absence of clear processes, communication pathways and preparation tools affect these challenges and makes it **harder to deliver high-quality care**.

Impact

If left unaddressed, the current issues will continue to affect the wellbeing of internal healthcare professionals, increase dropout rates, and reduce the quality of patient care. In addition, strained relationships with external healthcare providers can lead to inefficiencies and missed opportunities for seamless, collaborative care, impacting the department and its ability to effectively meet patient needs.

5.3 Final Design Goal

This final paragraph shows the design goal, and the outcome based on the problem statement. Both are needed to design strategic interventions that optimise the current system.

Design Goal

The aim is to **improve the wellbeing of internal healthcare professionals** and create comfort by **providing transparency** within the system and **improving the preparation process** for **fluent communication** with the patient and external healthcare providers.

Desired Outcome

The desired outcome is a cohesive strategy with interventions that align the expectations of internal healthcare professionals, patients, and external healthcare providers. By improving transparency, streamlining preparation processes, and fostering fluid, integrated communication

a more collaborative environment is created. During this, the wellbeing of internal healthcare professionals is improved, and an effective and comfortable experience is ensured for all.

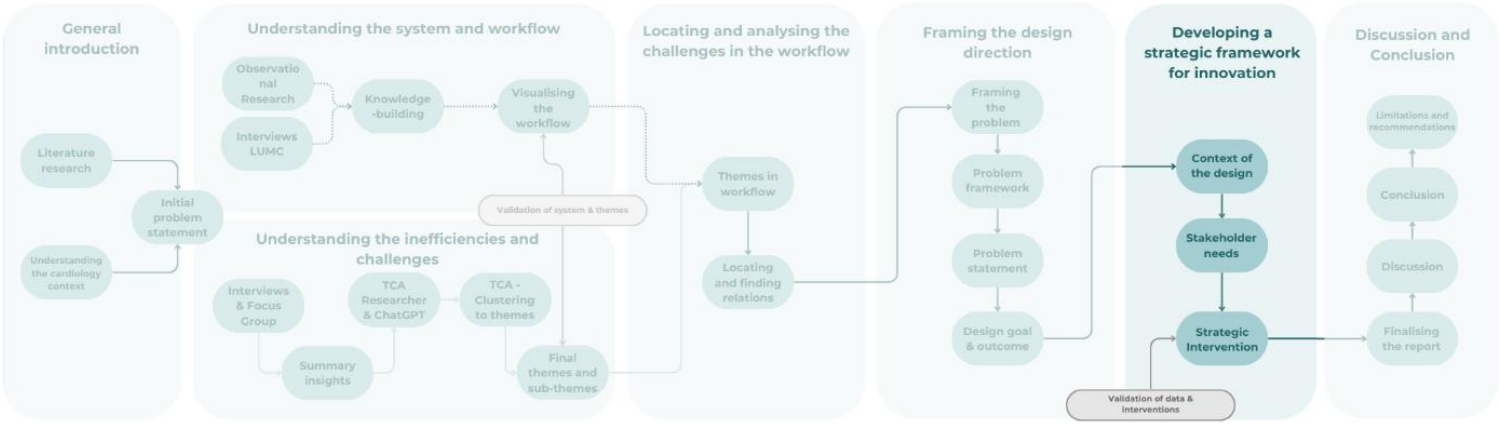
5.4 Conclusion and Limitations

The aim of this chapter was to propose a reframed problem statement that captures the deeper laying problem of the cardiology department. Furthermore, the aim was to create a design direction based on the reframed problem statement to start the design process and answer the research question: '*How can the current problems in the system be optimised?'* In the end, both the new problem statement and the design direction were framed and formed the starting point for the design interventions.

The problem statement captures the issue of misalignment of expectations between internal healthcare professionals, patients, and external healthcare providers. It also highlights a shift in perspective from fragmentation and misalignment to the need for system-level transparency. Transparency in the internal system, people and technology can improve the preparation processes for fluent communication. Transparency can create a deeper understanding of what the other party needs, what they can do and what their communication style is.

The problem of the need for transparency to improve wellbeing and preparation processes are found within the cardiology department at the LUMC. However, further research is needed to establish whether this problem is also evident in other departments within the LUMC or in other hospitals. If the lack of transparency and misalignment of expectation patterns is indeed an equivalent problem elsewhere, then a more nationwide system change is needed.

Finally, the defined design goal and outcome provided direction to address the problem of misalignment between internal healthcare professionals, patients, and external healthcare providers. However, the outcome of designing a coherent strategy may not be achieved within this report. The focus will be on developing recommendations for future-oriented interventions that are easy to implement in the workflow of the cardiology department.



Chapter 6 Developing a Strategic Framework for Innovation

This chapter shows the final development of the strategic design for the cardiology department at the LUMC, which focuses on several interventions that are future oriented. These interventions aim to solve the problems found during the case study. In addition, this chapter answers the final research question: *'How can the current problems within the system be optimised?'* The previous chapters focused on laying out the groundwork for defining the current problems, where the problems are located, and the design goal.

Firstly, the context of the design interventions is given based on the previously proposed framework. Secondly, the stakeholders and their needs are identified, afterwards several design interventions are presented. The chapter ends with the viability and feasibility of the proposed interventions.

6.1 Context of the Design

Sketching the context of the design helps in considering the users, the activities, the environment, and the technology that interacts with the cardiology department's system. Therefore, the context includes the location and all of its elements. To give an overview of the context where this report focuses its design, the previously introduced framework is used in paragraph 5.1. This framework describes the internal system, the people interacting, and the technology used.

Internal system

Organisation – What are the elements/ protocols?

The elements of the internal system are based on the culture of the academic hospital LUMC. Which includes their behavioural code, hospital-wide protocols, and the hierarchy of the governing body.

Understand – What does the system look like?

The internal system at the cardiology department exists of several stages that portray the workflow, see Chapter 2. This workflow shows the tangible activities that different stakeholders participate in to provide care.

Integrate – How does the system perform?

The system performs well in the care of complex cardiovascular patients. However, many activities and communication pathways are not yet being performed correctly. The wellbeing of internal healthcare professionals is at risk due to their heavy workload. In addition, communication and collaboration with external healthcare providers and patients are not effective, which affects the quality of care.

People

Identify – Who are the users?

The users of the internal system are divers and connected to both the medical and non-medical sector. The users can be active participants such as the cardiologist, AIOS, poly secretariat, GPs, patients, or the healthcare insurance company. The users could also have a more background influence such as the family of the patient or support organisations such as *Basalt* or *Harteraad*. The next paragraph dives deeper into the users of the internal system.

Locate – Who does what?

A quick breakdown of users includes internal healthcare professionals, patients and their families, and external healthcare providers. Internal healthcare professionals organise and provide care for patients within the LUMC hospital. External healthcare providers ensure that the patient is referred to the organisation that can provide the care they need and that someone is responsible for the patient's care. The patient and their social circle are focused on taking responsibility for care outside the healthcare organisations.

Situate – What do they need from each other?

All users expect a certain level of trust and respectful interaction. In addition, all users need to have a clear common goal to work towards and to know that others are working towards it with equal effort.

Technology

Explore – What is used?

The internal system at the LUMC uses both the software of *EPDVision* and *HiX* to schedule appointments and to communicate patient test outcomes and treatments. These systems are integrated with *Microsoft Teams*, to communicate with patients, and with *ZorgDomein*, to communicate with other healthcare organisations. Furthermore, inside the hospital, *HiX* and *Microsoft Outlook* are used for interdepartmental communication.

Evaluate – What is still needed?

There is a need to use only one of the two systems in the cardiology department, and the first steps have already been taken. There is also a need for easier access to medical data between different healthcare organisations. Finally, there is a lot of medical information available on the internet, but there is no database to which patients and family members can be referred when additional information is needed.

6.2 Stakeholder Involvement and Needs

This section identifies the different stakeholders involved in the cardiology system at the LUMC. It also shows the level of influence of each stakeholder and concludes with the needs of the stakeholders who are most affected.

6.2.1 Stakeholder definition

The cardiology department is a complex system that involves multiple stakeholders, care pathways and resources. Stakeholders are interested in seeing the system perform well and can be described by their function, title, and needs. The stakeholders can be divided into several groups, both in the medical and non-medical sectors. The stakeholders are divided into the following groups: *Internal LUMC, External LUMC – medical, Support organisations, Social circle of the patient*, and *Software*. By dividing the stakeholders into groups, it becomes easier to understand their influence on each other and the system, see Figure 11. The inner circle shows the stakeholders who influence each other and the system the most. The second circle shows the stakeholders who are active in the system and interact with the stakeholders from the inner circle. The outer circle represents stakeholders mentioned in the system and interacts with other stakeholders but does not have a prominent influence on the inner stakeholders and therefore the workflow.

The most affected stakeholders in the system are the internal healthcare professionals, i.e. the cardiologists, the AIOS and the three secretariats. These are the people who carry out most of the tasks described in the workflow in this report. The content and execution of the tasks of all stakeholders are critical to patient care and both are therefore considered in the design interventions. Other affected stakeholders are the external healthcare providers, i.e. GPs and medical specialists, and lastly the patients. Both parties are involved in the workflow and influence the system and the quality of care. Therefore, external healthcare providers and patients will also be considered for the design interventions.

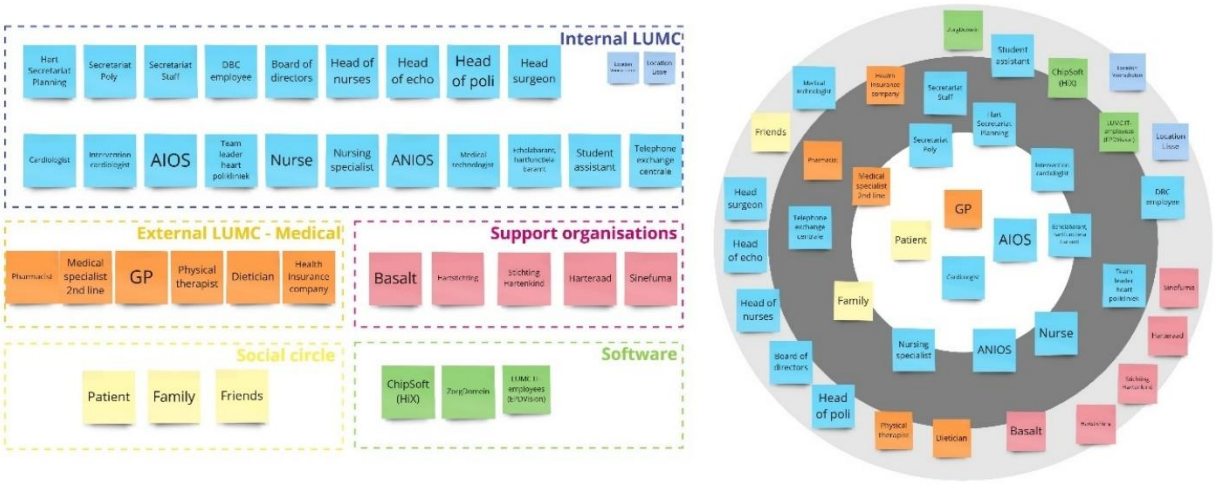


Figure 11 Stakeholder groups and influence circle

6.2.2 Stakeholder needs

The method used to define the stakeholder needs is based on Engineering Better Care (2019). Per affected stakeholder group it describes a sentence that portrays their need at the specific stage

in the workflow. These locations are based on the stages that portray the disbalance between the expectation patterns of the three most affected parties: internal healthcare professionals, patients, and external healthcare providers. Not all stages include needs for all stakeholders. The needs found are used to design interventions and to understand what must happen at what stage to solve the needs.

To provide a quick understanding of the needs per stakeholder group a summary is made of the tables found in Appendix G. The internal healthcare professionals are split into two different groups. One group is the cardiologist and AIOS, the other group are the three secretariats. This is done since the cardiologist/AIOS are directly providing care to the patient and become '*action takers.*' On the other hand, the secretariats are providing the opportunity to provide care, they become '*enablers*'. Their needs are different per stage and therefore described separately.

The ***'action takers'*** need a work culture in which there is a focus on their personal wellbeing and preference-based communication. This means that there is an opportunity to connect with colleagues to discuss how to work together and how to behave towards each other. It also means having access to the right information at the right time. Both from patients and external healthcare providers. In addition, there is a need for tools to help understand whether the knowledge and data being shared is being received. Transparency in the preparation process of others also help the '*action takers' to* prepare for their own daily tasks.

The ***'enablers'*** need a work culture that is focused on their personal wellbeing and therefore focused on creating an efficient workflow where there is a clear work-task balance. To create this efficient workflow, there is a need for tools that provide clarity and transparency into patient scheduling and *'action taker'* preferences. There is also a need for transparency in understanding whether data exchanges have been received and well prepared in advance. This is necessary so that the *'enablers'* can prepare the follow-up actions and not overwork themselves.

Patients need personalised care during which they are met on their own educational and emotional level. This means that the care provided fits with their lifestyle, activities, and goals. Furthermore, the knowledge exchange needs to be accessible and easy to understand so that patients can educate themselves and are engaged in their own care path. Without the proper tools the need for transparency is disregarded and the patient is not able to properly prepare their care journey.

The **external healthcare providers** need to feel included in the patient care and understand where their responsibilities lay. This needs to be done by having clear communication paths that support collaboration between healthcare organisations. In addition, there is a need for transparency in understanding what data can be shared and is necessary to share as well. This is needed so external healthcare providers can prepare the transfer of patient care.

6.3 Proposed Design Interventions

This paragraph will dive deeper into the design interventions created to solve the problems experienced in the workflow. The interventions are based on the misalignment in expectation patterns between the three main stakeholder groups: internal healthcare professionals, patients,

and external healthcare providers. Therefore, the design intervention focusses on the stakeholders' needs for improving the transparency in the internal system, between people, and technology. In addition, it focuses on how to improve the preparation process for fluent communication and collaboration. Figure 12 shows an overview of the three types of imbalanced interactions with the proposed interventions. In addition, the figure highlights what steps need to be taken to reach the final design proposition the interventions propose. Underneath the figure, a more detailed description of each intervention is given.

Important to mention is that the interventions are future oriented and propose an ideal situation. Therefore, the recommendations might seem out if reach in the near future. However, by implementing the interventions step-by-step the final value and proposed design changes can be reached. Furthermore, the proposed design interventions are not the only solution to the "wicked problem" experienced by the cardiology department. The design recommendations are made based on the outcomes shown in this report.

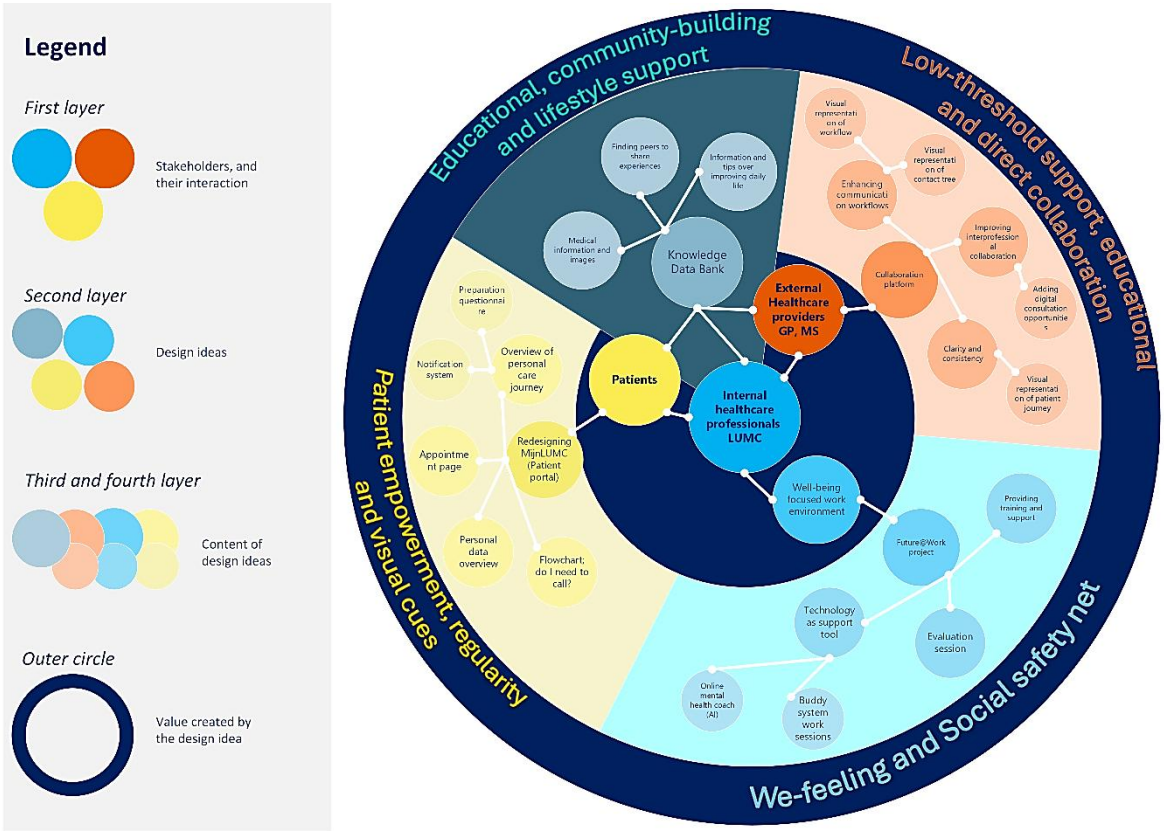


Figure 12 Design intervention overview

6.3.1 Intervention Internal healthcare professionals

Idea Wellbeing focused Work

This idea includes support for professional wellbeing and iterative improvement. Furthermore, the goal is to introduce initiatives to reduce professional burnout, such as wellbeing programs, behavioural changes, and resource optimisation. This is in line with what research shows, which is that the work environment needs to enable work satisfaction and engagement to be efficient and sustainable (Yildiz and Yildiz, 2022). The LUMC started a project Future@Work that introduces the internal focus of wellbeing at work. Since the LUMC has started this project and

therefore covers the need for a wellbeing focus, only a short description is given of what it entails and why it is important to improve the internal work culture of an organisation.

Future@Work initiative by the LUMC

The LUMC has already initiated a behavioural change program for the working environment in the hospital. The LUMC's *'Driven by Health'* strategy included a focus on strengthening internal culture. There was a feeling that the culture was not bad, but that there was room for improvement and to change certain aspects. During the first half of 2024, there were several organisational sessions on the desired culture of the LUMC, with a wide range of staff looking at the core values and desired behaviours. These sessions resulted in a refined code of conduct which was shared with current and new employees. This was the first outcome of the Future@Work program.

The next step of the program was to have teams actively work on behaviour change. For this purpose, a Future@Work sprint methodology has been developed, enabling LUMC teams to participate with the support and resources they need. The goal of these sessions is to understand the team's current culture, what can be done differently, develop interventions to change behaviour, and create a timeline with different interventions on how to achieve these goals.

The overall aim of the project is to work towards a safe, transparent, and honest working environment where everyone enjoys working together. This is done by raising awareness of how we behave towards each other and understanding what can be done to improve.

Value creation through wellbeing programs

Introducing a program that dives deeper into the work culture and employee behaviour is valuable in proposing interventions to improve wellbeing and reduce burn-out. Research shows that awareness and being engaged in the design process are the first steps in understanding that change needs to happen (Adnan et al., 2022). Therefore, by allowing the LUMC employees to be part of the design teams at an early stage and providing the right organisational resources, a higher level of engagement will take place. In this way, the LUMC employees become co-designers of new ideas, making is easier to adapt and integrate these new ideas (Tahvanainen et al., 2024). Furthermore, the design solutions that are created during the Future@Work project can be diverse. For example, providing digital solutions as an outcome is effective in improving the wellbeing of healthcare professionals, as well as the work culture and task performance (Ilola et al., 2024).

The value that Future@Work can bring is significant for both the internal work culture and the wellbeing of the LUMC employees. This is in line with the beginning of the project where the wellbeing of internal healthcare professionals was highlighted as being at risk of decline. It is however necessary to include the employees in all stages to ensure that integration of new ideas takes place, and a sense of ownership is felt.

6.3.2 Intervention Patients and Internal healthcare professionals

Idea Redesigning the Patient Portal

This idea includes technological integration, streamlining processes, and delivering seamless personal care journeys. The goal is to implement user-friendly software and platforms on the *MijnLUMC* patient portal that is helping to bridge communication and workflow gaps. This software aims to include intuitive preparation steps that enable patients to enter appointments

well-informed and prepared. Furthermore, the interface should both be easy to use and easy to work with. By using data-driven insights the interface shows personalised care plans and improves patient outcomes. By redesigning the patient portal, it is necessary to also redesign the *HiX* portal of the internal healthcare professionals. This is needed to implement the changes made in the patient portal into the workflow and digital system of the employees.

Redesigning the *MijnLUMC* is a low-threshold intervention since the company behind *HiX*, *ChipSoft*, is the developer behind the portal. Therefore, implementing changes that fit in *ChipSoft's* toolbox and expertise is easier to do. Other parties that are involved in redesigning the portal are the IT-department of the LUMC, the cardiology department and patients. The last two groups, the cardiology department and patients, should have influence in the design specifics and functions that they need to use the platform. The IT-department should support *ChipSoft* in integrating the new functions and designs and to let the digital systems work seamlessly.

Recommendations for redesigning the new patient portal

The new patient portal needs to be designed to be easy to use and accessible. The first page should provide a quick overview of all functionalities and include the patient profile, appointment management, preparation, and a contact checklist, see Figure 13. The figure is made in Dutch since the client is based in the Netherlands. Furthermore, the first page should include the personal care journey of the patient. This journey shows step by step where the patient is in their own process. Every activity has its own colour and shape to make the distinction between activities easier. In addition, the care journey shows what needs to be done before the next activity. By clicking on the shape, more information is shown to the patient. Adding the care journey of the patient allows the patient to understand what is going on and where they are in their care process. Furthermore, information is given to the patient on how to prepare for the next steps in their care journey. This allows the patient to be engaged in their care process. Changes in the care journey should be communicated with the patient almost immediately so that no miscommunication can take place.

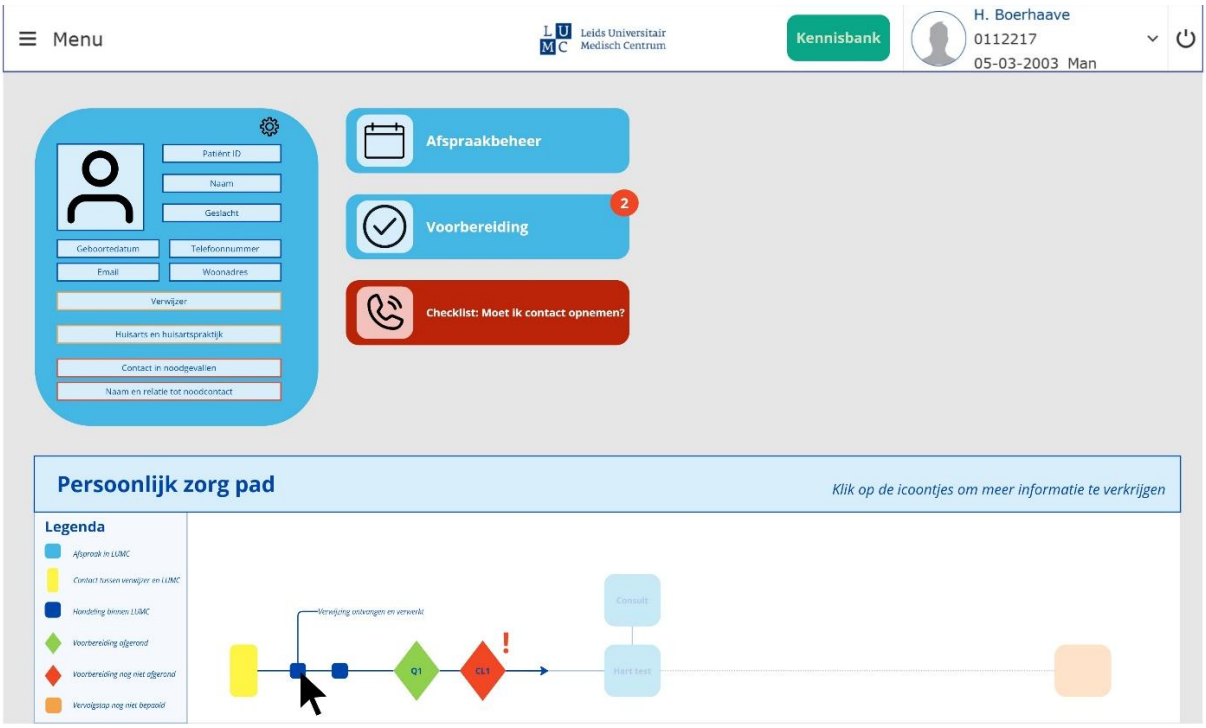


Figure 13 Patient portal redesign

The patient profile needs to show an overview of necessary data for both the LUMC and the patient themselves. By allowing the patient to take control in checking if every part of the data is correct, the patient is preparing for their care journey inside the LUMC. Furthermore, by filling out and by synchronising all the data, the internal healthcare professionals will receive the correct information per patient. Therefore, less time is needed during the consultation to ask confirming questions.

The appointment management '*Afspraakbeheer'* page should provide a visual representation of the appointment time, date, and location. A recommendation for the visualisation is to show the appointments in a timeline, this creates a logical order of activities. The appointment management page should also include a clear summary of how to make a new appointment, how to reschedule or how to cancel appointments on time.

The preparation '*Voorbereiding'* page should include the necessary steps that are needed to prepare the next activity in the patient's care journey, can be seen in Figure 14. By allowing the patient to directly see what needs to be done and by allowing them to immediately click on the necessary preparation activity, the platform helps in preparing the appointment. This not only is helpful for the patient but also helps the internal healthcare professional. The information that the patient provides is the same information that is asked during consultations. Preparation activities can be checking personal data, watching videos or lifestyle questionnaires. In addition, reminders should be sent to the patient if certain preparation activities are not done yet. These should be sent to their phone and email address.

The last option that should be integrated into the portal is the 'Should I get in touch?' Checklist, '*Moet ik contact opnemen?'* This button provides information to the patient in which a decision can be made if there is a need to contact the cardiology department. Recommended is to provide the information in form of a flowchart since this is an easy and clear visualisation of the thought

process of a patient. By adding this function, the non-necessary calls by patients during the day will be less.

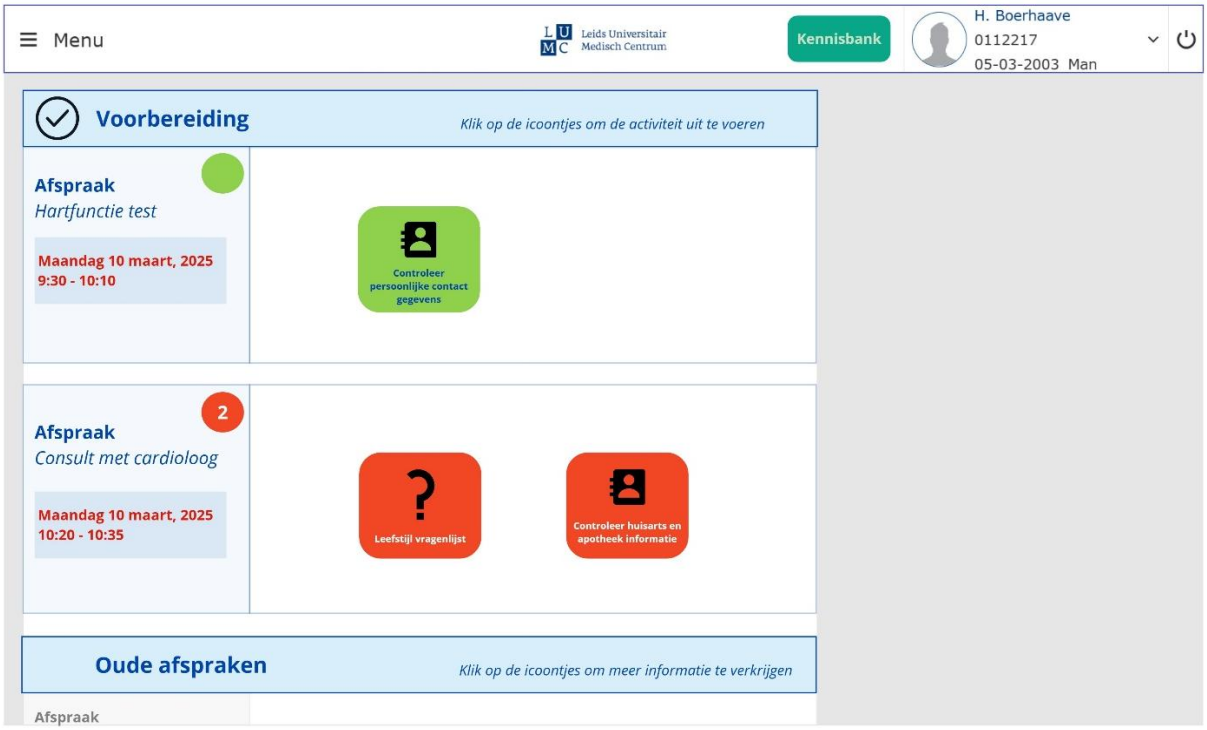


Figure 14 Patient portal redesign – Preparation page

Recommendations for redesigning the new internal healthcare professional platform

The design changes for the *HiX* portal are based on the changes made for the patients and the external healthcare providers. The first page should provide a clear overview of all the patients arriving at the cardiology department for that specific day, see Figure 15. All patient profiles are folded and can be opened by clicking on the arrow down. Adding this function makes sure that all patient profiles fit on one page and not much scrolling needs to be done. There is a distinction between new patients and repeated patients in both information and visual cues. This is necessary as new patients are likely to be new to the system and therefore need different preparation than known patients. The patient profiles should also include a visual cue of the type of consultation and an option to check the patient's care journey and preparation stage. Providing all this information is needed to help the internal healthcare professional prepare their day and workflow. By providing an overview of all necessary patient data tasks will become easier.

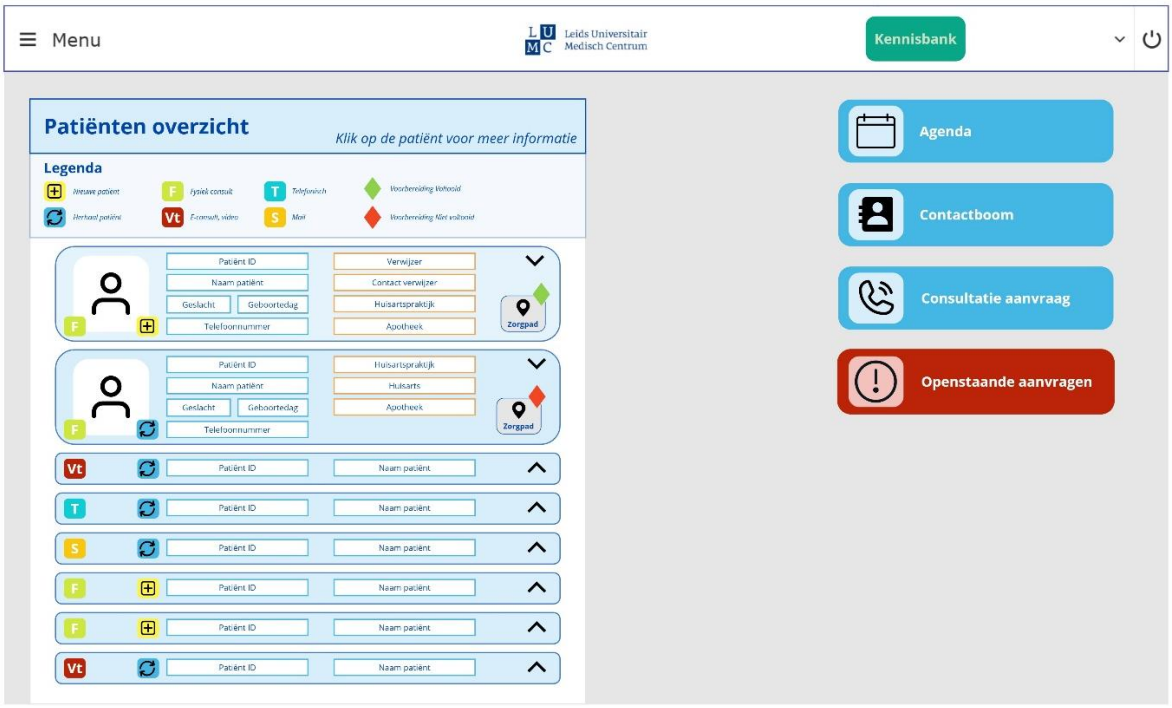


Figure 15 Internal healthcare professional portal redesign

By clicking on the patient more information should be provided (see Figure 16). This is based on the current *HiX* system for the patient letter. In addition to all the necessary questions and information that needs to be gathered an overview of the patient profile, visual cues for type of patient and appointment type needs to be shown. This allows easy access to necessary information. Furthermore, the test outcomes should be available to show on the screen as well since this is needed during consultation. It will allow the internal healthcare professionals to have an overview of both summarised information and the medical background of the patient.

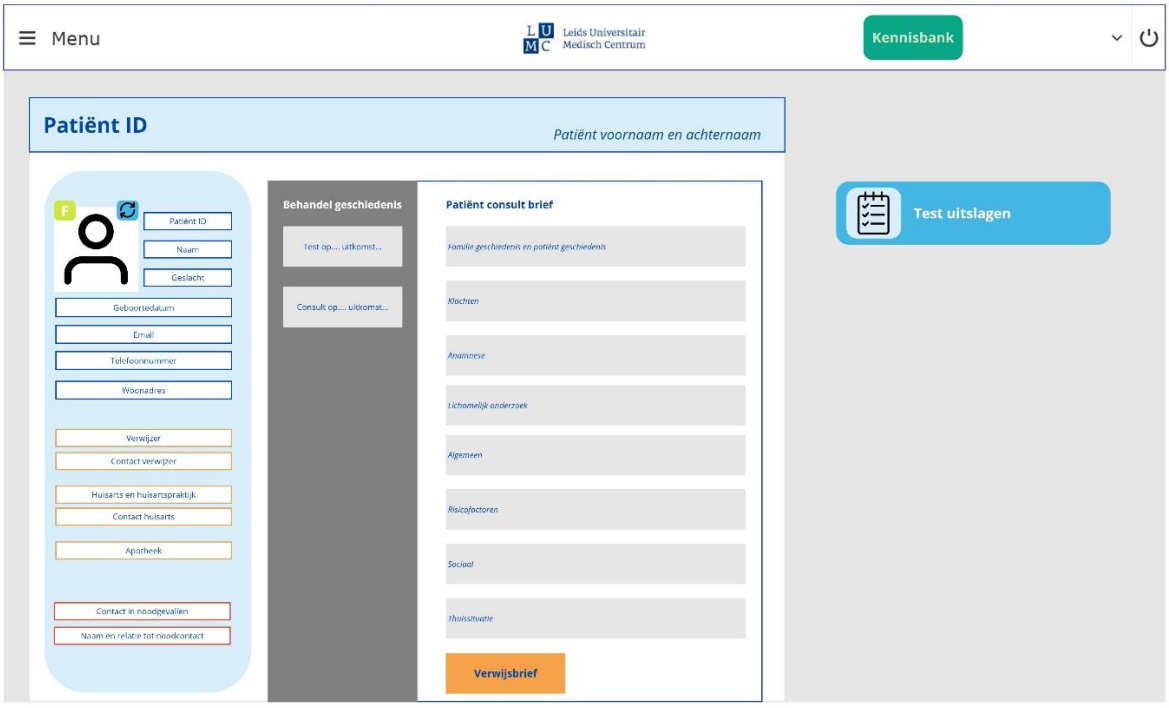


Figure 16 Internal healthcare professional portal redesign – Patient page

Going back to the first page, it should also include buttons for the agenda, contact tree, consultation request, and open requests. The agenda page should open the internal healthcare professional's agenda for the week, this function should stay the same as the current *HiX* system.

The contact tree '*Contactboom'* should provide an overview of departmental phone numbers and names of colleagues that collaborate closely with another. This is needed to allow internal healthcare professionals to quickly connect to the right person they need. In addition, this creates a transparent way of knowing with whom you work within one department.

The option '*Consultatie aanvraag'* or consultation request, should be integrated into the portal. This option allows internal and external healthcare professionals to closely collaborate with one another. By requesting a digital phone or e-consult an appointment can be made those fits within personal schedules. The digital consultation should be used as an educational tool or to discuss patient care. The button open requests '*Openstaande aanvragen'* is connected to this function and should show the messages and requests that have not been answered. This function empowers the internal healthcare professional to choose when answering fits in their schedule.

Value by redesigning the portals

The value of the redesigned digital portal is comparable for both patients and internal healthcare professionals. The portal provides the opportunity for patients to be engaged in their own care path and empowered to take the lead. The value of redesigning the patient portal by offering care journey orientation is crucial for patient cooperation and is needed since digital systems are often designed without taking the patients' needs into account (Åhlfeldt et al., 2016). Furthermore, by showing personalised care paths and treatment plans the patient is treated as a unique individual which increases their level of engagement (Sanz et al., 2021)

A prepared patient, in turn, helps internal healthcare professionals in their preparation tasks and effective use of time. By creating transparency in the patient's process a certain level of control is provided and relevant patient data can be checked beforehand (Åhlfeldt et al., 2016). This solves the problem defined before of patients not knowing what to do and how to prepare. The time used for patient care can now be used effectively.

Lastly, by providing a clear view of the care journey and information, the platform creates consistency and regularity. The patient should feel stimulated to dive deep into their care journey and pathology to understand what is needed to receive the care they need.

6.3.3 Intervention External healthcare providers and Internal healthcare professionals

Idea Designing a Collaborative Portal

This idea includes enhancing communication and collaboration across stakeholders and building robust partnerships. The goal is to create a mutual understanding of processes and the internal system by standardising workflows and reporting activities. This will ensure clarity and consistency, and facilitate communication between internal and external healthcare professionals. By standardising workflows, clear guidelines and pathways become the norm, leading to efficient shared patient management.

Furthermore, there is a need to improve real-time communication and collaboration between internal and external healthcare providers. This will be achieved by including digital call and chat consultations to the workflow of both internal and external healthcare professionals. These digital consultations can be scheduled and give the opportunity to stop the patient influx of patients that do not need care in an academic hospital.

To achieve both goals, a digital collaboration platform needs to be designed and implemented. This platform can be an extension of the existing *MijnLUMC*. However, instead of patients logging in, external healthcare providers can log in. Since *ChipSoft*, the company behind *HiX*, is the developer of *MijnLUMC*, an adaptation can be made more easily. In addition, by creating a new interface for interprofessional collaboration, the *HiX* interface for internal healthcare professionals also needs to be modified. For these recommendations, see paragraph 6.3.2.

Additionally, collaboration is needed with the IT-department of the LUMC, internal healthcare professionals and external healthcare professionals. The last two are used to understand the needs that the new functions of the platform need to portray. The IT-department will support *ChipSoft* in integrating the new functions into the internal digital systems.

An often-mentioned need during the project was to create a regional-wide medical data sharing system. For this project, designing this system is out-of-scope due to the extensive external collaboration that needs to occur before it can be approved. Therefore, it is not included in redesigning the new portal. However, a few recommendations are made on how to shape a regional-wide sharing system. These recommendations can be found in Appendix H.

Recommendations for designing the interprofessional collaboration platform

The design of the portal for external healthcare providers should be based on the same design structure as the patient portal, see Figure 17. Which means that the same interface structure can be used for both and therefore will cost less time. The external healthcare provider portal should include a user profile were both personal and work-related information can be added. The profile includes the IT domain and communication preferences as well, this is done so both parties understand how to communicate with each other.

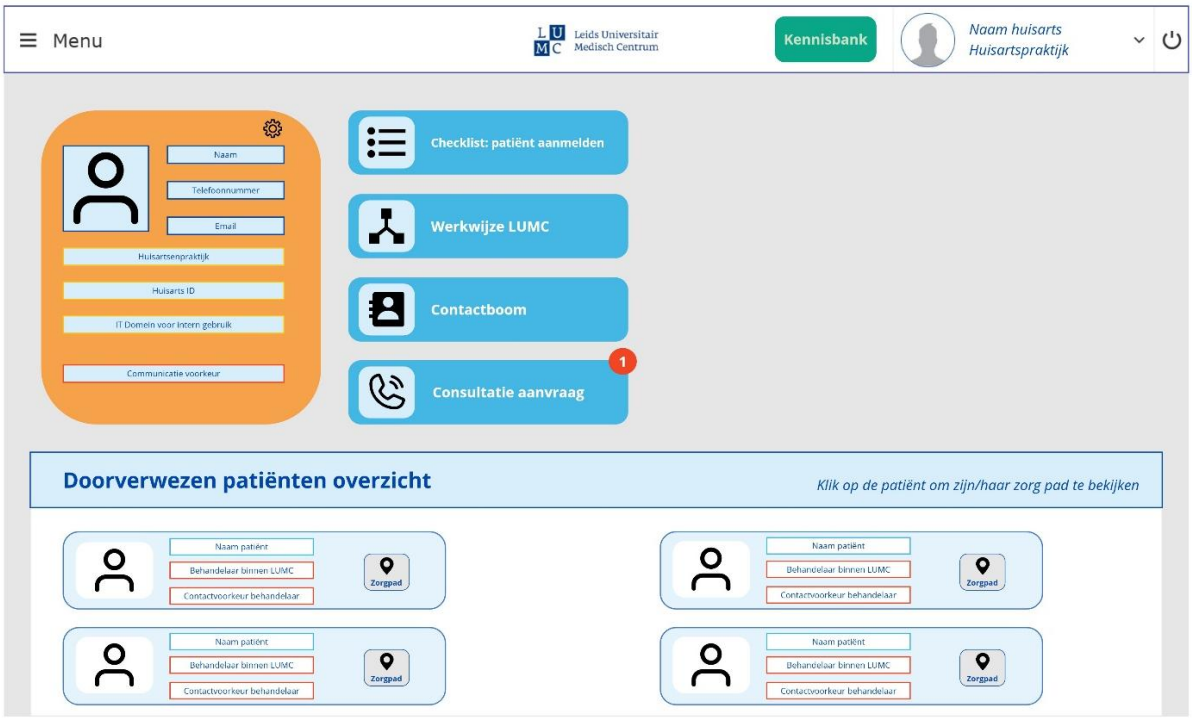


Figure 17 External healthcare portal design

The main page should also include the functions checklist to refer patients, workflow of LUMC, the contact tree, and consultation request. In addition, to immediately provide a clear and concise overview of the external healthcare providers referred patients a visual patient summary should be added. This summary should include all the patients connected to the provider and shows the internal healthcare professional that provides care to the patient as well. Furthermore, the care journey of the patient can be seen by clicking on the button. This provides transparency to the external healthcare provider. By understanding where in the process their patient is, who oversees the patient's care, and with who they need to contact inside the LUMC.

The function checklist to refer patients '*Checklist: patient aanmelden*' should be integrated into the portal. This will allow external healthcare providers to check if the patient they want to refer, needs care inside an academic hospital. Furthermore, the checklist should show how a referral should be made and what personal and medical information needs to be included. Recommended is to show the checklist as a flowchart based on the LUMC patient criteria.

The workflow of the LUMC '*Werkwijze LUMC*' should be added to provide transparency and mutual understanding of work tasks and structures. The portal should allow several topics to be shown in shape of text, an image, or a pdf to download, Figure 18. This functionality should be used to educate how the cardiology department works and to help understand the general care journey of a patient.

The contact tree '*Contactboom*' should be a flowchart to shows step-by-step how external healthcare providers can connect with the cardiology department. This function helps in visualising the correct communication pathways.

Lastly, the consultation request '*Consultatie aanvraag*' should be integrated into the portal since it promotes interprofessional collaboration. This function should allow external and internal

healthcare professionals to schedule an appointment to discuss patients or coordinate patient care. It allows for meaningful and accessible collaboration.

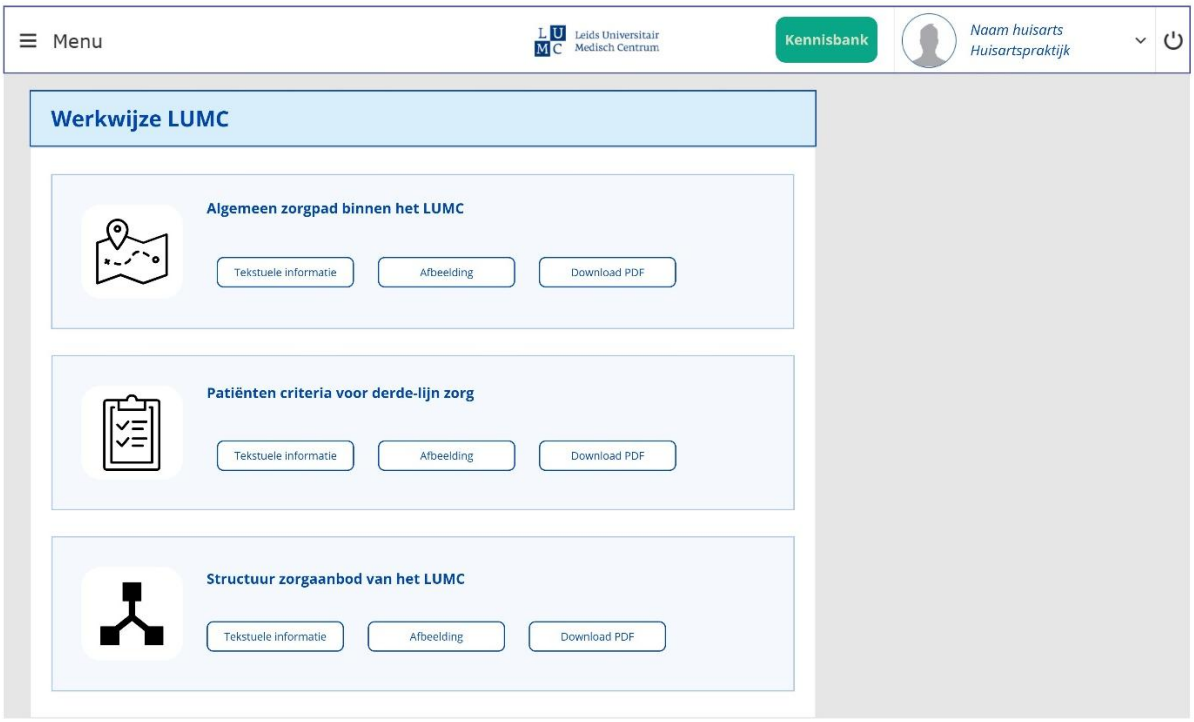


Figure 18 External healthcare portal design – Workflow LUMC

Value of integrating a collaboration portal

The value of the collaboration portal is that it can bridge the gap between different healthcare organisations and their healthcare professionals. This is done by providing a portal where professional perspectives can be viewed, communication preferences can be shared, and task sharing can be clarified. Research shows that providing a channel for both informal communication and active consultation leads to a better collaboration experience and higher quality of care (Schot et al., 2020). However, it is important that both internal and external healthcare professionals continually support the collaboration for it to be fruitful.

The portal provides value in promoting transparency between internal and external healthcare professionals by visualising the care journey of the referred patient. Defining care tasks based on this journey helps to reduce misunderstandings and improve collaborative patient care (Raptis et al., 2012).

Finally, the platform will not remove all barriers to interprofessional collaboration, but it will help to guide the need for collaboration. It will improve communication and help create a mutual understanding of each other's workflows and roles. The main value of the collaborative portal is to provide better and more coordinated patient care.

6.3.4 Intervention Internal healthcare professionals, Patients, and External healthcare providers

Idea Knowledge Data Bank

This idea includes technology integration and development. The goal is to create a user-friendly platform that bridges a knowledge gap between medical and non-medical stakeholders. This

knowledge-sharing system focuses on providing a digital overview of cardiovascular information and procedures, community-building platforms, and external support organisations. The platform is of use for both patients and external healthcare providers and is connected through the *MijnLUMC* portal. However, it is not necessary to have a personalised log-in to enter the knowledge data bank.

The knowledge data bank summarises the information in a concise way and includes both text and visual support in form of images and videos. Additional website links are provided to the right organisation if the user wants to dive deeper into certain information. Furthermore, contact information is shown as well if the user wants immediate contact. The knowledge data bank provides a safe and trustworthy space for users to find the right information. Additionally, the data bank can become a place where healthcare professionals refer patients to if they want additional information or if they need to prepare themselves for a procedure

To create this knowledge data bank a collaboration needs to take place between the LUMC, cardiovascular information forums (*Harteraad, Hartstichting, Thuisarts, Basalt, Sinefuma,* etc.*)* and community-building platforms (*Hartgroep, Erfelijke Hartziekten, Patiëntenvereniging Aangeboren Hartafwijkingen,* etc.*)*. Furthermore, the IT-department needs to help creating the webpage where all information can be gathered.

The LUMC website contains a lot of medical and procedural information, however, it is not presented well to patients. This means that the information on the website can be summarised on the new knowledge data bank to ease access to necessary information.

Recommendations for designing the knowledge data bank

The knowledge data bank should be integrated into all the portals mentioned before for the patient, internal healthcare professional, and external healthcare provider. This is done by adding a button that directs the user to the knowledge data bank. This needs to be done to show that the LUMC is the owner of the site, but that the site is an open source and can be used by anyone.

The first page should be clear and simple, see Figure 19. It should provide a short description on how to use the data bank. In addition, the following topics should be provided: medical information, preparation procedures, lifestyle support and tips, peers, and partnerships.

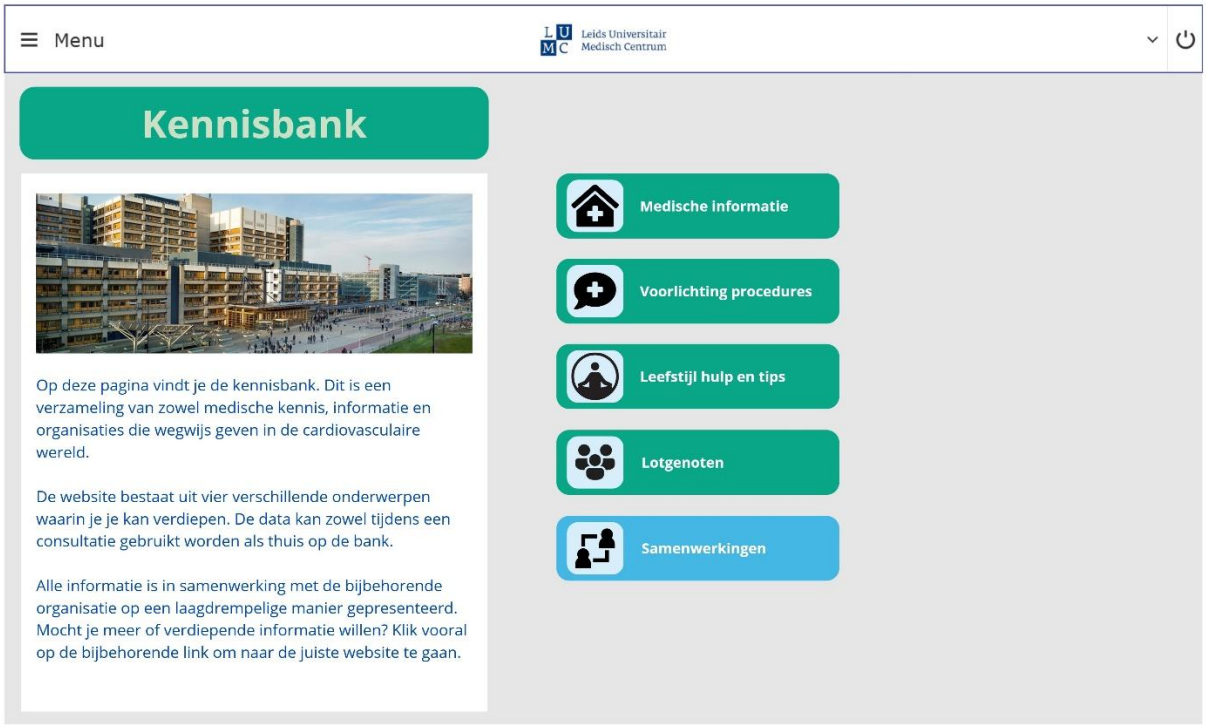


Figure 19 Knowledge data bank redesign

The medical information '*Medische informatie'* should provide practical medical knowledge in a short and summarised way. All information should include visuals and the link to the partner website for more and deeper information. This allows the data bank to make information accessible for all users and to provide support in helping to find a deeper understanding. Topics that should be included are: *heart diseases and disorders*, *ICD/LVAD*, and a *checklist 'Moet ik contact opnemen?*' or 'Should I get in touch?'. These topics cover the information exchanged before, during and after consultation and procedures.

The button preparation procedures '*Voorlichting procedures'* should provide an overview of the procedures offered at the cardiology department, how to prepare for them, what the after-care entails, and what to expect. This information should be supported by visuals and videos to help get the message across. By gathering all information about procedures at one place it becomes easier for the patient to find the necessary knowledge and for internal healthcare professionals to refer patients to the correct place.

Lifestyle support and tips '*Leefstijl hulp en tips'* should provide the user with information about their daily life, activities, and habits. The topics that should be included are driving and insurance, quit smoking and physical activity, and food and drinks. These topics portray both factors that are often related to health risks and topics that might influence the daily life of users. By including these topics in the portal, the right information becomes accessible. In addition, the information needs to be supported by visuals, a summary, and links to partner websites for more information. By providing the contact information of partners as well, the user can more easily get in touch after reading the information.

The function peers *'Lotgenoten'* should provide an overview of the different community platforms for cardiovascular patients. Every option should be assisted by the logo of the organisation, a brief introduction, and a clear link to be directed to the correct webpage. By providing a clear overview

of all types of peer communities, it will create low-threshold access to emotional support that they need but did not know how to find.

Lastly, the collaboration page *'Samenwerkingen'* shows a list of all the partners who have collaborated to produce the information and visual overviews in the knowledge data bank. This page provides transparency in collaborations and allows users to understand that the cardiovascular world is built on partnerships.

Value by designing a knowledge data bank

The value of the knowledge data bank is that it will offer educational support by providing information that patients and other users may need. Topics range from pathology information to preparation for specific procedures. Restructuring the existing information from both partner websites and the LUMC website into one database will help patients who have difficulties with self-management (Peytremann-Bridevaux et al., 20212).

Furthermore, the data bank offers a place for community-building and finding support in other patients or organisations that can help emotionally. Finding a community can contribute to a higher quality of care as it increases patient empowerment, but it is necessary to include the perspective of healthcare professionals to improve the trustworthiness (Johansson et al., 2021). Therefore, by integrating community-building into the knowledge data bank adds a level of trust is to the information provided.

Lastly, there is also the opportunity to dive deeper into the patient's lifestyle to understand what can be changed and where to find the help to change it. The data bank allows patients to be empowered and find help themselves when they need it. By providing accessible contact information, the first step to change is smaller.

6.4 Validation Design Interventions

To validate the design interventions and to define the viability and feasibility of the ideas, four validation sessions were held. These sessions were held with participants from Table 3, who all participated in the project before. During the thirty-minute sessions, the context was sketched and the new problem definition proposed. Afterwards the design interventions were talked through, both the map and the newly designed portals. Based on the validation sessions the design interventions were iterated, and the final versions were made. Furthermore, the insights gathered from the sessions helped define the viability and feasibility of the designs.

6.4.1 Viability

All the proposed design interventions aim to improve efficiency, reduce work pressure, and improve communication within the cardiology department. This will lead to a higher quality of care. In addition, the interventions aim to reduce inefficiencies by optimising the internal processes, streamlining the care journey, and integrating digital tools. They also promote an improvement of internal healthcare professional wellbeing. This is the base on which this case study was launched, the need to improve wellbeing and reduce work pressure.

The viability of the project depends on employee commitment, technological feasibility, and stakeholder adaptation. The technological feasibility depends on the toolbox of *ChipSoft* and their ability and willingness to implement new functionalities in both *HiX* and the *MijnLUMC* portal. Redesigning the *MijnLUMC* portal and adding extra features requires investment. However, it also offers long-term value by reducing workload and improving collaboration with both patients and external healthcare providers. Collaboration with external healthcare providers is essential for seamless communication and patient care. Resistance to change within hospital culture poses as a challenge, requiring iterative implementation and training programs. But tackling the internal work culture by providing the right resources and support seems attainable.

6.4.2 Feasibility

The proposed design interventions present both opportunities and challenges that affect the feasibility. Challenges that influence the implementation are organisational readiness, technological infrastructure, and the willingness of external stakeholders to collaborate. Despite the challenges, there are several factors that support the feasibility of the design interventions. By basing the interventions on the actual needs of patients and internal and external healthcare professionals, the interventions portray what is currently missing. Additionally, engaging multiple stakeholders in the design interventions, both internal at the LUMC and external, enhances the change of implementation and acceptance.

The short-term interventions, such as implementing wellbeing programs and redesigning the *MijnLUMC* patient and internal healthcare professional portal, are highly feasible due to institutional ownership and the availability of the digital infrastructure. However, *ChipSoft* will need to be convinced of the importance of changing the portals for them to see the need. Medium-term interventions, such as a collaborative portal for internal and external healthcare professionals, have medium-high feasibility as they require the design of a new portal, coordination with GPs and second-line MSs, and streamlining of administrative workflows. While both design interventions are technically feasible, both require stakeholder collaboration to ensure implementation.

The feasibility of implementing the proposed design interventions is high for internal process improvements, but more complex for broader changes. Prioritising interventions such as improving work culture, digital integration, and improving communication pathways will provide the most immediate benefits. However, long-term solutions, particularly the regional-wide data-sharing system, will require extensive and coordinated efforts beyond the direct control of the cardiology department. By implementing the short- and medium-term design interventions effectively, the cardiology department can be at the forefront of future innovations in patient care and interprofessional collaboration. This means that the outcomes of the case study can be implemented in other LUMC departments and possibly in the future in other hospitals as well.

6.5 Conclusion

The goal of this chapter was to answer the final research question: *'How can the current problems within the system be optimised?'* To answer the question the context was sketched, and the main stakeholders and their needs were defined. Both helped in creating the intervention map that

focused on solving the lack of transparency and preparation processes between the three stakeholder groups: internal healthcare professionals, patients, and external healthcare providers.

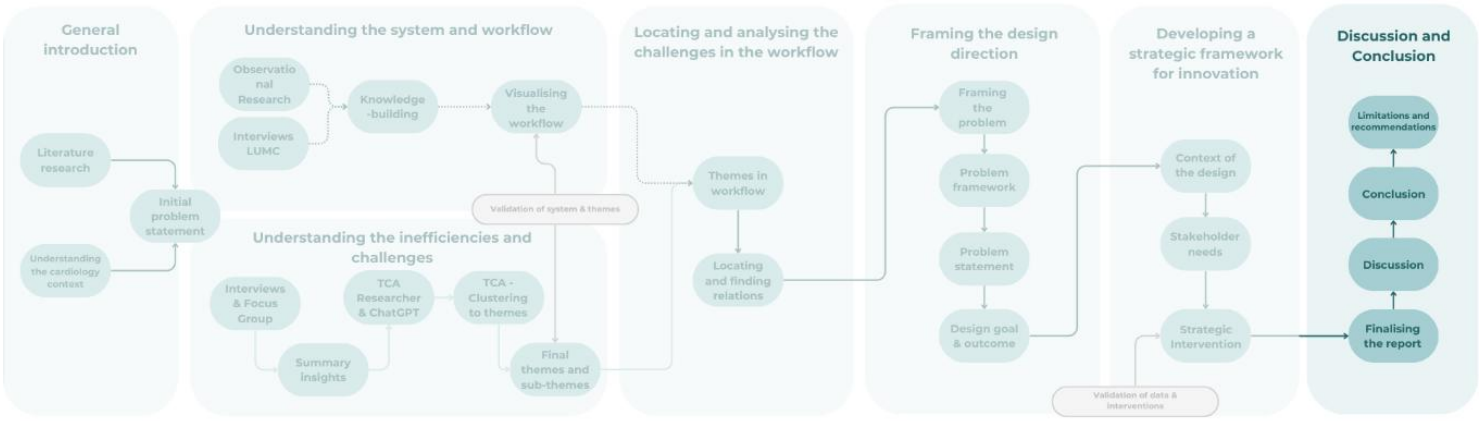
The proposed portals include transparency by providing a clear overview of where the patient is in their care journey. Furthermore, it shows the preparation needed for referrals, consultations, procedures, and communication between organisations. By gathering trustworthy medical and lifestyle information it allows for transparency in exchanging trustworthy knowledge where the source is clear.

The portals also provide a space for preparing fluent communication by presenting the necessary tools. This is done through visual reminders, insights in the correct workflow, and accessible collaboration opportunities.

All of the design interventions include future recommendations aimed not only at improving workflow efficiency, but also at increasing work satisfaction and reducing work pressure. The functionality of the portals should take over certain activities that create barriers and consumer unnecessary time. By providing the opportunity to improve the workflow, the wellbeing of internal healthcare professionals should increase.

In addition, the viability and feasibility of the designed interventions were based on challenges such as organisational willingness and readiness, technological infrastructure, and sense of ownership. However, as the interventions were designed to fit within the strategic objectives of the LUMC and the reach of the cardiology departments, the interventions have a high degree of adaptability. Therefore, the interventions are viable and feasible if sufficient resources, training, and leadership support are provided.

Furthermore, all interventions could have a long-term impact, which extends beyond the cardiology department. In the end, offering a scalable model for other departments facing similar challenges.



Chapter 7 Discussion and Conclusion

This final chapter provides a discussion of the processes and outcomes. It also concludes the project by reflecting on the case study and the limitations of design interventions aimed at reducing work pressure and increasing wellbeing and transparency.

7.1 Discussion

This project has explored the problems experienced within the cardiology department at the LUMC. Using it as a case study to reflect wider challenges within the Dutch healthcare system. The findings reveal a complex mix of structural, cultural, and technological factors that contribute to inefficiency, administrative burden, reduced wellbeing, and potential harm to patient care.

One of the key findings of this research is the misalignment of expectation patterns between the internal healthcare professionals, patients, and external healthcare providers. This misalignment is due to a lack of transparency in the internal system, between people, and technology. In addition, ineffective preparation processes and fragmented communication paths also effect the relationship between all three stakeholders. The research findings suggest that improving the transparency of the internal system, fostering collaboration, and enhancing digital tools could help reduce the workload of healthcare professionals and improve the patient experience.

The proposed design interventions focus on using strategic design as a method to address the problems and inefficiencies in the cardiovascular care system. Using human-centred design principles, the research highlights the importance of stakeholder engagement throughout the process. This is done to understand the needs of all stakeholders and to co-design the final design outcomes. LUMC's Future@Work initiative, which focuses on behavioural and cultural change, is in line with these findings and provides a promising framework for addressing wellbeing problems in the work environment.

Furthermore, the scalability of the proposed interventions is important for discussion. While this research was conducted within the cardiology department at the LUMC, the challenges identified - such as administrative overload, inefficient workflows, and ineffective interprofessional collaboration - are likely to be present in more Dutch healthcare organisations. Therefore, the

transparency framework and proposed interventions could be adapted to other departments and hospitals. Potentially driving systemic challenges across the Dutch healthcare sector.

However, to implement these design interventions a change in both organisational structure and technological infrastructure is required. Resistance to change, particularly regarding workflow changes and digital implementation, could slow the adoption process. Additionally, the viability of large-scale regional data-sharing systems depends on political decisions and cross-organisational collaboration.

7.2 Conclusion

This report aimed to optimise the care journey in the cardiology department at the LUMC, focusing on reducing workload and increasing the wellbeing of internal healthcare professionals, as well as, improving collaboration and enhancing patient experience. Through qualitative research two fundamental problems were identified, the first being a lack of transparency in the system. Internal healthcare professionals, patients and external healthcare providers do not have clear expectations about workflows, communication pathways and preferences, and responsibilities. The lack of transparency leads to inefficiency, administrative burden, and frustration. The second fundamental issue, related to the lack of transparency, is the inefficiency in preparation processes and communication. The lack of streamlined workflows and digital support tools creates an additional workload, particularly for internal healthcare professionals, who experience increased stress and reduced work satisfaction.

To address these problems, this project proposed four strategic design interventions. The first is to improve wellbeing in the workplace, which is being done through LUMC's Future@Work initiative. This initiative promotes a supportive and transparent work culture. The second intervention is the redesign of the *MijnLUMC* patient portal to improve patient engagement, streamline consultations and procedure preparation, and reduce unnecessary administrative work. In addition, the third intervention is the development of a collaborative portal for interprofessional communication. This will facilitate structured digital interactions between internal and external healthcare professionals. The last proposed intervention is the creation of a knowledge database to provide patients and healthcare professionals with reliable medical information, lifestyle advice, and community support.

These design interventions are in line with wider healthcare trends that emphasise digital transformation, patient empowerment, and interprofessional collaboration. By implementing these strategies, the LUMC may reduce inefficiencies, support its healthcare professionals, and improve the patient experience.

7.3 Limitations and Recommendations

Although this report provides valuable insights, several limitations need to be addressed. There was limited diversity of participants during the project, with most participants being male cardiologists. Fewer female internal and external healthcare professionals were interviewed. Future research should ensure that there is greater gender and role diversity. Furthermore, the

perspectives of nurses and heart test technicians were not included. This limits the scope of the research. Given their crucial role in patient care, future studies should include their insights.

Additionally, the workflow analysis focused only on external referrals by GPs or second-line hospitals. Emergency and internal patient pathways were excluded from the visualisation and theme placement. Delving deeper into all patient pathways will provide a more holistic view of the cardiology system and all stakeholders involved. It would allow for more dimension in the complexity of the cardiovascular workflow.

The final limitation is the need for further iterative validation. The proposed design interventions require further iteration and stakeholder validation. Future research should conduct pilot studies and assess their impact before full-scale implementation.

7.4 Final Remarks

The findings of this report will provide a blueprint for optimising care journeys, not only within the LUMC but also in other healthcare organisations facing similar challenges. By prioritising transparency, structured preparation, and digital innovation, hospitals can improve the wellbeing of healthcare professionals. Furthermore, they can enhance collaboration and ultimately deliver better patient care.

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Appendix

Appendix A Outcomes Research Methods to understand the knowledge-building process

The cardiovascular consults at the cardiology department follow a specific flow. This flow can be found in Figure A1. The level of detail of specific questions differs per cardiologist and the complaints of the patient. However, the general flow is the same.

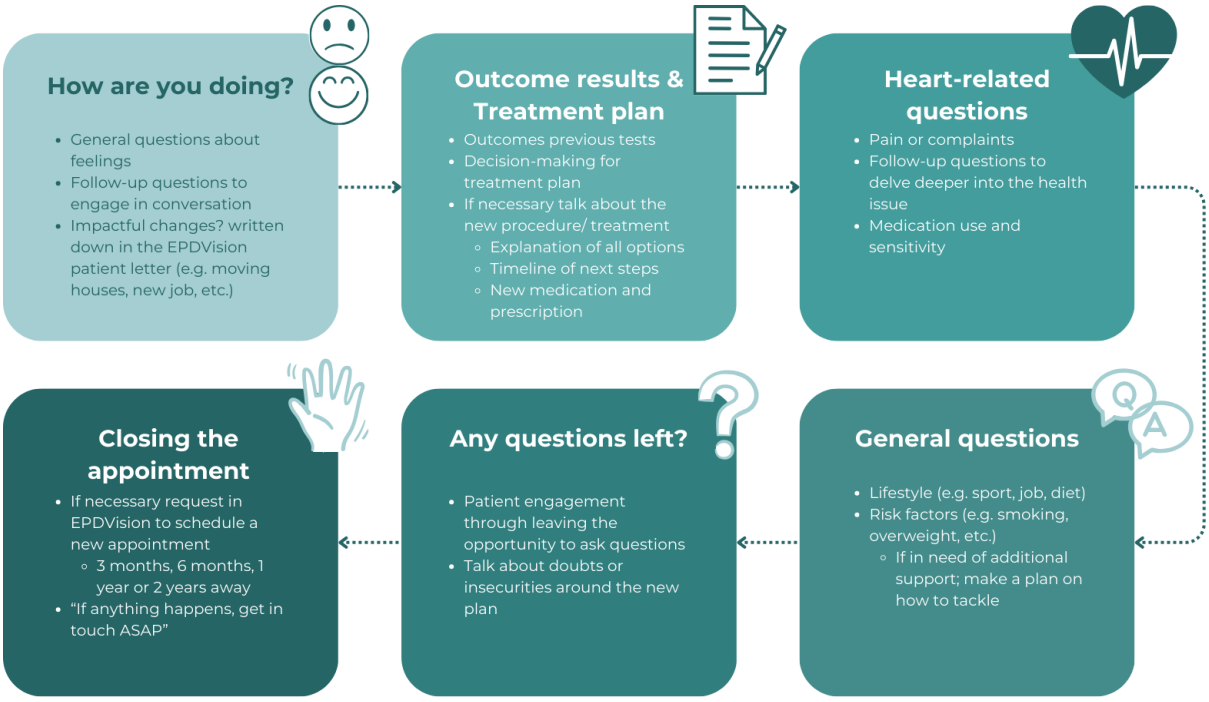

Figure A1 Conversational flow consult

Table 1A shows the different modes of contact that are scheduled. These can be found in the *HiX* and *EPDVision* systems to give the cardiologists an overview of their timetable during the poly-consult hours.

Table 1A Overview type of consults

Mode of Contact (Cw)	**Abbreviation in *EPDVision***	**Schedule**	**Remarks**
Phone consult	T	No specific time	• Called through work phone in the staff office or at the polyclinic room. • If the number is not updated patient cannot be reached • Patients scheduled at the same time
Written consult (email)	S	No specific time	• Message through *EPDVision*
Video consult (e-consult)	Vt	Specific time	• E-consult through Teams, accessible through

			the *MijnLUMC* portal for patients • Teams accessible for cardiologists through *EPDVision* • If not online, the patient gets a phone call
Physical consult	F	Specific time	• Body language extra factor to look out for

At the start of the day, the patient selection page is opened on *EPDVision* to review the schedule of the day. In this overview, the number of patients and their names per cardiologist can be seen. Furthermore, this main page shows the type of appointment, repeat (H) or first (E), and the mode of contact (Cw). The overview also shows if the patient is a smoker. Next to the patient data, the scheduled heart function tests with their corresponding times are shown. These tests are often scheduled before the consult with the cardiologist, so the patient does not have to travel twice. The tests shown in the overview are Echo 1, 2, 3, Bike, Holter, PMICD and ECG. For every test, the time scheduled is shown and if the patient is present. Lastly, the time and room for the cardiologist consult are displayed.

The *EPDVision* window screen that is used during all modes of consultation contains several components of patient data, as shown in Figure A2. These are used during the conversation for diagnosing and creating a treatment plan. Furthermore, this window displays the patient treatment tree containing all appointments and procedures, and the old consultation letters. Before the patient comes into the consultation room at the polyclinic, the cardiologist uses this window to reconnect with the patient and their disease. Additionally, if important data is missing, the cardiologist will ask for clarification during the consultation.

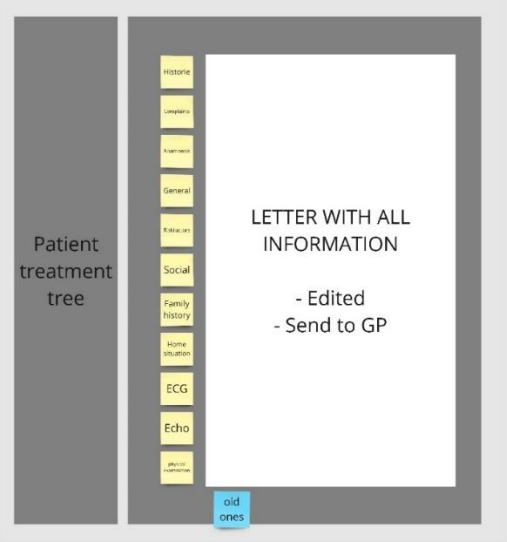

Figure A2 EPDVision consultation window

Appendix B Consent Form in Dutch

Participanten Informatie

Afstudeeronderzoek: Optimising the Care Journey at the Department of Cardiology LUMC

Inleiding

Geachte heer/mevrouw,

Met deze informatiebrief wil ik u graag informeren over mijn afstudeeronderzoek binnen de afdeling cardiologie van het LUMC. Daarnaast wil ik u graag vragen of u wilt meedoen aan mijn onderzoek. Voor het onderzoek ben ik opzoek naar de ervaringen en belevingen zorgmedewerkers en hartpatiënten om het complete zorgsysteem binnen de afdeling cardiologie in kaart te brengen.

Meedoen is volledig vrijwillig en u kunt ieder moment uw medewerking stopzetten. In dit document kunt u lezen om wat voor onderzoek het gaat en wat het er van u verwacht wordt als u wilt participeren. Mocht u vragen hebben dan kunt u altijd de onderzoeker om uitleg vragen.

1. Algemene informatie

Om te identificeren hoe het huidige systeem eruitziet bij de afdeling cardiologie en hoe het optimale systeem ontworpen moet worden, is er binnen het LUMC een onderzoek gestart. Het optimale systeem heeft als doel werkdruk te verminderen en het verbeteren van werkplezier en de doorstroom. Dit onderzoek wordt ondersteund door een team van zorgprofessionals en ontwerpers. Voor het onderzoek zijn we benieuwd naar uw visie rondom de fases binnen het zorgproces bij de afdeling cardiologie. Hierbij staan uw belevingen en ervaringen centraal.

2. Wat is het doel van het onderzoek?

Het doel van het onderzoek is inzicht krijgen in hoe het actuele zorgproces en de actuele patiëntenreis eruitziet, waarbij alle belanghebbende, communicatiemethoden, obstakels en waardes in kaart worden gebracht. Deze factoren worden gebruikt om vervolgens de gaten binnen het systeem te vinden. De gaten en knelpunten zullen de basis vormen naar het visualiseren van het optimale systeem, hiervoor kunnen meerdere strategieën ontworpen worden. Hiervoor is uw kennis en ervaring ontzettend waardevol.

3. Wat is de achtergrond van het onderzoek?

Uit onderzoek is gebleken dat het zorgstelsel in Nederland onder grote druk staat, hierdoor neemt het werkplezier van artsen af, de werkdruk neemt toe en ontstaat er minder tijd voor patiënten. Het LUMC zet zich in om op tijd een oplossing te bedenken om het gefragmenteerde systeem binnen de afdeling cardiologie in kaart te brengen en te herontwerpen. Het is belangrijk om het herontwerpen van het systeem op een strategische manier te doen en vanuit het perspectief van belanghebbende, in dit geval zowel de patiënt als zorgmedewerker. Om vanuit de behoefte en waardes te ontwerpen gaan wij graag het gesprek aan om zo de juiste inzichten te krijgen.

4. Hoe verloopt het onderzoek?

Het onderzoek bestaat uit individuele interviews. Het interview wordt begeleid door de onderzoeker en zal in het Nederlands zijn. In totaal zal het gesprek ongeveer 30 minuten duren.
De vragen gaan voornamelijk over uw ervaringen en belevingen, over het zorgproces en de eventuele drempels die u heeft meegemaakt.

De interviews zullen op het LUMC gehouden worden in een nader te bepalen locatie.

5. Wanneer stopt het onderzoek?

Het onderzoek stopt in twee situaties

- U wilt zelf stoppen. Dat mag op ieder moment. Meldt dit dan bij de onderzoeker. U hoeft niet te vertellen waarom u stopt.
- Het interview is voltooid.

6. Welke gegevens hebben wij nodig?

De volgende gegevens zijn er nodig en zullen worden bewaard;

- Naam
- Geslacht
- Leeftijd
- Contactgegevens (e-mailadres, telefoonnummer)

Daarnaast zullen tijdens het onderzoek, na toestemming, de volgende gegevens worden verzameld;

- Audio-opnames
- Geanonimiseerd verslag
- Geanonimiseerde foto's

7. Wat doen we met uw gegevens?

De verschillende gegevensbronnen die verzameld en bewaard worden: audio, foto's en persoonsgegevens zijn nodig om de vragen die in dit onderzoek worden gesteld te beantwoorden en de resultaten te kunnen publiceren. Daarom vragen wij om uw toestemming voor het gebruik van deze gegevens.

Welke gegevens bewaren we?

- Ten behoeve van het onderzoek bewaren we alleen het verslag van het interview (geanonimiseerd), eventuele foto's (geanonimiseerd), uw geslacht en leeftijd.
- Uw naam en contactgegevens worden alleen gebruikt voor het contact tussen u en de onderzoeker. De audio-opname wordt na het uittypen verwijderd.

Hoe lang bewaren we uw gegevens?

De gegevens moeten maximaal vijftien (15) jaar bewaard worden, conform de regels vanuit het LUMC.

8. Hoe beschermen we uw privacy?

Hoe beschermen we uw privacy?

De verkregen persoonsgegevens en de onderzoeksgegevens zullen in afzonderlijke mappen worden opgeslagen. Het bestand met persoonsgegevens (waaronder naam, leeftijd, geslacht, contactgegevens) wordt versleuteld. De namen, de contactgegevens, de leeftijd en het geslacht van elke deelnemer wordt bewaard op een manier die niet traceerbaar is. Na het transcriberen van elk interview zullen de audiobestanden onmiddellijk worden verwijderd. Verder zullen de transcripten volledig geanonimiseerd worden: herleidbare gegevens zullen worden weggelaten. Ook afbeeldingen zullen worden aangepast zodat ze niet traceerbaar zijn.

Kunt u uw toestemming voor het gebruik van uw gegevens weer intrekken?

U kunt uw toestemming voor het gebruik van uw gegevens op ieder moment intrekken.

Wilt u meer weten over uw privacy?

- Wilt u meer weten over uw rechten bij de verwerking van persoonsgegevens? Kijk dan op https://www.autoriteitpersoonsgegevens.nl/
- Heeft u vragen over uw rechten? Of heeft u een klacht over de verwerking van uw persoonsgegevens? Neem dan contact op met degene die verantwoordelijk is voor de verwerking van uw persoonsgegevens. Voor uw onderzoek is dat: Het LUMC en/of de TU Delft. Zie bijlage A en B voor contactgegevens, en website.
- Als u klachten heeft over de verwerking van uw persoonsgegevens, raden we u aan om deze eerst te bespreken met het onderzoeksteam. U kunt ook naar de Functionaris Gegevensbescherming van het LUMC gaan. Of u dient een klacht in bij de Autoriteit Persoonsgegevens.

9. Heeft u vragen?

Vragen over het onderzoek kunt u altijd stellen aan de onderzoeker.
Heeft u een klacht? Bespreek dit dan met de onderzoeker.

10. Hoe geeft u toestemming voor het onderzoek?

Wilt u meedoen? Dan vult u het toestemmingsformulier in dat u bij deze informatiebrief vindt. Hier kunt u een toestemmingsformulier vinden. U en de onderzoeker krijgen allebei een getekende versie van deze toestemmingsverklaring.

Dank voor uw tijd.

Met vriendelijke groeten,

Brechtje Krijvenaar, master afstudeerstudent aan de TU Delft

11. Bijlagen bij deze informatie

A. Contactgegevens LUMC
B. Contactgegevens TU Delft
C. Toestemmingsformulier

Bijlage A: contactgegevens voor Leids Medisch Universitair Centrum

Contactgegevens afstudeerder
B. Krijvenaar
Technisch Universiteit Delft & LUMC
Master afstudeerder

Contactgegevens begeleiders vanuit LUMC
Ir. J. Houwen
LUMC & Technische Universiteit Delft
Design, Organisation and Strategy

Prof. dr. D.E. Atsma
Leids Universitair Medisch Centrum (LUMC)
Hart Long Centrum
Albinusdreef 2 2333 ZA Leiden

Klachten:
Bij klachten kunt u zich wenden tot de klachtenfunctionaris van het LUMC via email: U kunt ook telefonisch contact opnemen met het secretariaat van Directoraat Kwaliteit en Patiëntveiligheid . Zij zullen u doorverbinden naar de dienstdoende klachtenfunctionaris.

Functionaris voor de Gegevensbescherming van de instelling:
Wanneer u vragen heeft over de bescherming van uw privacy kunt u contact opnemen de functionarissen gegevensbescherming van het LUMC (FG) Contactgegevens LUMC:
Albinusdreef 2
2333 ZA Leiden

Voor meer informatie over uw rechten zie de website van het LUMC
https://www.lumc.nl/12367/Deelnemers-wetenschappelijk-onderzoek/

Bijlage B: contactgegevens voor Technische Universiteit Delft

Contactgegevens afstudeerder
B. Krijvenaar
Technisch Universiteit Delft & LUMC
Master afstudeerder

Contactgegevens begeleiders vanuit TU Delft
Prof. dr. ir. M.S. Kleinsmann*
Technische Universiteit Delft
Design, Organisation and Strategy
Landbergstraat 15, 2628 CE Delft

Ir. Y. Sun
Technische Universiteit Delft
Human-centered design
Landbergstraat 15, 2628 CE Delft

Klachten:
Bij klachten kunt u zich wenden tot de klachtenfunctionaris van de TU Delft via email: Klacht-tnw@tudelft.nl. Zij zullen u doorverbinden naar de dienstdoende klachtenfunctionaris.

Functionaris voor de Gegevensbescherming van de instelling:
Wanneer u vragen heeft over de bescherming van uw privacy kunt u contact opnemen de functionarissen gegevensbescherming van de TU Delft (FG) via fg@tudelft.nl
Contactgegevens TU Delft:
Jaffalaan 9a
2628 BX, Delft
Centraal telefoonnummer: (015) 27 88012
Voor meer informatie over uw rechten zie de website van de TU Delft
https://www.tudelft.nl/privacy-statement

**Prof. dr. ir. M.S. Kleinsmann is ook werkzaam binnen het LUMC, voor dit project is ze echter met name het aanspreekpunt vanuit de TU Delft*

Bijlage C: toestemmingsformulier proefpersoon

Behorende bij

Afstudeeronderzoek: Optimising the Care Journey at the Department of Cardiology LUMC

- Ik heb de informatiebrief gelezen. Ook kon ik vragen stellen. Mijn vragen zijn goed genoeg beantwoord. Ik had genoeg tijd om te beslissen of ik meedoe.
- Ik weet dat meedoen vrijwillig is. Ook weet ik dat ik op ieder moment kan beslissen om toch niet mee te doen aan het onderzoek. Of om ermee te stoppen. Ik hoef dan niet te zeggen waarom ik wil stoppen.
- Ik geef de onderzoekers toestemming om mijn gegevens te verzamelen en gebruiken. De onderzoekers doen dit alleen om de onderzoeksvraag van dit onderzoek te beantwoorden.
- Ik geef toestemming voor een (fysiek) interview/ persoonlijk gesprek (volgens RIVM-regels)
- Ik geef toestemming om een audio-opname van het interview te maken.
    - o Ja
    - o Nee
- Ik geef toestemming om afbeeldingen te maken
    - o Ja
    - o Nee
- Ik wil meedoen aan dit onderzoek.

Mijn naam is (participant): …….

Handtekening: ……..…. Datum: __/ __/ __

Ik verklaar dat ik deze proefpersoon volledig heb geïnformeerd over het genoemde onderzoek.

Wordt er tijdens het onderzoek informatie bekend die de toestemming van de participant kan beïnvloeden? Dan laat ik dit op tijd weten aan deze deelnemer.

Naam onderzoeker (of diens vertegenwoordiger): Brechtje Krijvenaar
Handtekening: .....… Datum: __/ __/ __

Appendix C Explorative Interview Guide in Dutch

Interview Gids

Het verkennen van hoe patiënten en zorgprofessionals het huidige systeem zien en ervaren om zo de gaten en vergeten behoefte in kaart te brengen.

Checklist voor het starten

- Privékamer of wachtkamer (patiënten)
- Uitgeprint toestemmingsformulier en een pen
  - Zorgmedewerker
  - Patiënt
- Uitgeprinte vragenlijst (Interview gids)
- Audio-opname apparatuur (het liefst twee als dat mogelijk is)
- Onderzoeksmateriaal / voor de gedachte
  - Post-its
  - Stiften
  - Groot vel papier
- Camera
- Koffie en thee (melk, suiker etc.)
- Iets lekkers voor bij de koffie
- Boekje voor aantekeningen
- Een glimlach en een hoop nieuwsgierigheid

1. Introductie Onderzoeker

- Begroeten en voorstellen van de onderzoeker
  - Student, afstuderen Strategic Product Design; focus op organisaties innoveren vanuit een strategische en overkoepelende blik
    Met de specialisatie Medisign
  - TU Delft en LUMC samenwerking
- Introduceren van het afstudeerproject en het doel
- Toelichting op het doel:
  - Afstudeerproject opgezet vanuit de afdeling cardiologie binnen het LUMC
  - Er zijn al een langere tijdproblemen binnen het zorgsysteem. De toenemende patiëntenstroom, de bezuinigingen en het uitvallen van zorgmedewerkers zorgen voor een ingewikkeld vraagstuk. Er ontstaat minder tijd voor patiënten en een toename van werkdruk op zorgmedewerkers.
    Het is fijn om weer een goed beeld te krijgen van wat het precieze huidige systeem is en waar de complexiteit/ moeilijkheden zitten. Belangrijk om dit te doen uit het perspectief van de mens, zowel patiënt als zorgverlener.
  - Mijn doel is de zorgstroom verbeteren, werkdruk laten afnemen en het werkplezier vergroten door het systeem te optimaliseren. Daar heb ik uw inzichten, ervaringen en ook waarden/ gevoelens bij nodig.
- Garantie voor anonimiteit en vertrouwelijkheid van de gesprekken
  - Ondertekenen consent formulier
- Toestemming vragen voor het opnemen van het interview
- Interview structuur doorspreken.
  - Semi-structureel, open gesprekken
- Verdere vragen?

2. Kennismaking en Introductie Deelnemer

- Introductie van de deelnemer met korte voorstelronde (5 min)
  - Naam

    - Leeftijd
    - Hobby's / interesses
    - Ervaring met hartziekten/ afdeling cardiologie.
    - Werkervaring
        - Hoe lang werkzaam binnen het LUMC
- Doorspreken interview thema's en activiteiten (5 min)

3. Thematische Verkenning LUMC Medewerker

Thema A Werkzaamheden LUMC medewerker

- Welke taak vervult u binnen het LUMC?
- Waar haalt u werkplezier uit?
- Contactmomenten
    - Met wie.
    - Waar

Thema B Zorgproces - Papier op tafel

- Hoe verloopt het zorgproces voor u
    - Afspraken patiënt
    - Welke stappen
    - Met wie werkt u samen
- In welke fases bent u betrokken
- Verantwoordelijkheid zorg patiënten
    - Wanneer binnen het LUMC
    - Buiten het LUMC

Thema C Positieve momenten en uitdagingen

- Wat gaat er goed binnen de zorg?
- Waar zitten de grootste uitdagingen?
    - Werkdruk ervaren?
    - Waar?
- Waar is nog veel over te overwinnen?
- Waar wilt u zich inzetten?
    - Heeft u al ideeën?

4. Thematische Verkenning Patiënt Langer de Tijd

Thema A Zorgproces

- Het vaststellen van belangrijke momenten gedurende het zorgproces
    - Breder dan alleen medische zorg
    - Bespreken van elke stap die wordt gemaakt, wie is daar aanwezig, wat wordt erbij gevoeld, en hoe ziet het eruit
    - Met wie contact?
    - Snelheid proces

Thema B Ondersteuning binnen de Zorg

- Op welke manier was er begeleiding?
    - Wie was daarbij betrokken?
- Zijn er momenten geweest dat het niet duidelijk was?
    - Niet duidelijk bij je moest zijn?
    - Niet duidelijk waar informatie gevonden kon worden?
    - Patiënten gegevens onduidelijk?

Thema C Positieve momenten, obstakels, frustraties

- Wat gaat er goed binnen de zorg?
- In welke fase is er meer nodig?
    - Door wie?
    - Welke manier?

- Waar kan waarde gewonnen worden?

5. Thematische Verkenning Patiënt Kort de Tijd

Als er een snel gesprek kan plaatsvinden tijdens het wachten in de wachtkamer

1. Eerste blik op contact en pad binnen het LUMC
    a. Met wie contact
    b. Hoe snel
2. Obstakels of juist dingen die heel soepel gaan
3. Gevoel dat behoeftes vervullen
4. Waardes en meningen in acht genomen
5. Interesse om meer te babbelen over mening/ ervaring

6. Afsluiting

- Korte samenvatting van belangrijke inzichten, gericht op waar de deelnemer de focus op heeft gelegd.
- Gelegenheid om laatste punten aan te kaarten vanuit de deelnemer.
- Bevestiging anonimiteit en aanbod om resultaten van het onderzoek te ontvangen na afronding.
- Danken voor de tijd en moeite die de deelnemer heeft willen stoppen in het onderzoek.
- Toestemming vragen voor een mogelijke follow-up.
- Nogmaals bedankt en afscheid nemen.

Appendix D Table Theme Relationship and Influence

Table 2A Overview theme relationship and location

Theme	Sub-theme	Occurs at	Connects to
1 Internal Culture LUMC	*1.1 Consideration work balance*	This theme mostly occurs during inefficiencies in the work division during tasks and interactions. Both in the division of specific tasks and the division of workload, which is based on the experience and duration of someone's employment. Lot of work on fewer shoulders. • Referral: Requesting appointments by the AIOS during the night shift, concluding when a patient needs what type of care. In addition, deciding which tests patients need to participate in and in what time frame. • Registration: Requesting missing information from the GP about the patient, a complex multiple-step communication system, does not happen directly. The question from the cardiologist often needs to go through the poly secretariat. • Repeat Consult: Receiving calls and emails from patients or the GP/ MS, a multiple-step process to connect with the right person. In addition, different functions outside the polyclinic take on the calls. • Procedure: The anamneses with the patient before and after the procedure are done in duplicate; the same information in different files.	• Training medical employees & Long-term influence of education ○ Work balance is based on the place of the employee in the hierarchical and educative ladder. ○ There is a balance between needing to do your tasks (clinical care) and education. ○ During Referral • Knowledge & Clarity ○ Placing two functions on the same task creates additional workload for both. ○ During Procedure • Internal communication inside the hospital ○ By trying to divide the workload in specific time frames over multiple functions there is an imbalance of workload during the day. ○ During Repeat Consult • External communication outside the hospital ○ By placing the external communication at one specific function (poly secretariat) there is an imbalance in workload. ○ During Registration • Administrative load ○ A non-fair and less thorough division of work tasks creates an imbalance of work between employees. ○ During Registration
	1.2 Layers of the decision tree	Has a shadow influence on the implementation of new ideas, technologies and innovation. Is connected to the healthcare professionals and the way the internal LUMC system is set up.	
	1.3 Necessity of changing the collective	Has a procuring influence on the employees and their way of work, mostly collaborating in the department itself. Shows the necessity of having a collective we-feeling instead of thinking about the individual and yourself.	
2 Patient Care and Experience	*2.1 Direct contact and consult*	Healthcare professionals get a lot of energy and joy from direct patient contact, however often the healthcare professionals' expectation patterns clash with the patient's expectation patterns and needs. This creates friction in the system flow.	• Experience Patient during referral and treatment & Clash emotion and efficiency. ○ The direct consult and contact between patient and caregiver bring both joy and interfere with the efficient system in the hospital. Since the

		This theme mostly occurs during direct contact and interaction between patients and healthcare professionals. • Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP: during the consult, the HP takes joy in helping the patient with complex issues and questions.	hospital has a tight and overloaded schedule the patient is a pion and is not able to schedule in their own time. ○ During Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP ○ Often seen together in triplicate in the system. • Clash emotion and efficiency. ○ Contradictory sub-theme, receiving the most joy in patient contact against the need to be efficient, during the direct contact at the polyclinic the patients' needs are undermined by the technical system in the hospital. ○ During Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP ○ Often seen together in the system.
	2.2 Role and influence of family	The presence of family during the consult can help the patient, however, they can also be overly concerned and create a fearful feeling, which often occurs during the consult or at home. • Intake & Diagnosing AND Back to GP: influences the consultation question flow and lends an extra ear to listen to the information. • Repeat Consult influences the consultation question flow and lends an extra ear to listen to the information. In addition, at home, the family can influence the patient to get in touch if there are questions or doubts. • Procedure: After the procedure, the family can lend an extra ear to listen to the information, influence the question flow and support the patient.	• Knowledge processing ○ Family can be of extra help in processing the knowledge and information gained during the consults and after a procedure. ○ During Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP ○ Often seen in the system. • Clash emotion against efficiency & Knowledge and clarity. ○ Family influences the emotional state of the patient, which can create the need for communication out of fear. This interferes with the efficiency that the hospital portrays against the emotional needs of the patient. On one hand, there is a need for knowledge and an understanding of what will happen on the other and the emotional side can be overwhelming.
	2.3 Experience patient during referral and treatment	Occurs at the beginning of the patient connecting with the system through referral. Additionally, it happens when the patient is at the LUMC during their appointment and when they receive information about their appointment. This theme focuses on the flow of the patient through the system with their emotions at the centre. • Referral: the patient is referred to external organisations and is then in the dark until they receive a notification. • Intake & Diagnosing: when the patient has their first consult, they often need to do tests and wait in the waiting room, during which delays can happen. • Reporting: the patient needs to wait for the notification for the follow-up meeting, procedure, and invoice for their treatment • Repeat Consult: when the patient has their repeat consult every time, they arrive there is time for tests,	• Direct contact and consult & Clash emotion against efficiency ○ See 2.1 ○ Often seen together in triplicate in the system. • Efficiency in data stream ○ Scheduling the patient needs to be done efficiently, mostly from the perspective of the hospital. This means that the patient needs to wait on the hospital system and messages. ○ During the consults the patient can experience a delay which influences the efficiency of the patient stream inside the hospital, patients can experience this negatively. ○ During Referral AND Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP

		waiting and delays with afterwards a notification for the follow-up appointment, medication prescription and invoice.
		• Procedure: the patient is waiting for the notification of the procedure time and preparation. After the procedure is done the patient needs to be back in the consult flow for a check-up.
		• Back to GP: when the patient has their consult, they need to do tests and wait in the waiting room, during which delays can happen.
			• Patient Admission
			  ○ The patient is referred through an external health party, a delay can happen during this admission which means that the patient needs to wait longer.
			  ○ During Referral

	2.4 Knowledge processing	Happens mostly during conversations inside the hospital, both during the intake, repeat consults and procedure conversations. This theme focuses on the patient and their ability to listen, understand and react to the medical information provided and the process around it.
		• Intake & Diagnosing AND Repeat Consult AND Back to GP: the patient and HP are conversating about the cardiovascular disease and treatment plans, since the patient is often not medically educated, or the experience can be overwhelming this takes more time than scheduled.
		• Procedure: the patient and HP are communicating about the intervention and the possible side effects, since a procedure can be an overwhelming experience and the patient is not medically educated, processing everything is harder. Furthermore, not having the same doctor as during your consult or who did the procedure affects the patient.
			• Clash emotion and efficiency.
			  ○ Processing everything that is going on with the patient is often emotional and overwhelming, the HP often needs to be efficient and thus adds a lot of information in a short amount of time.
			  ○ During Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP
			• Role and influence of family
			  ○ See 2.2
			  ○ Often seen together in the system.
			• Knowledge and clarity
			  ○ On one hand the patient needs clarity and the right amount of knowledge to understand what is going on and what is going to happen, this is needed to decide together and to be able to connect. The processing time of patients can differ from the time the HP has, which means that processing can happen outside of the hospital.
			  ○ During Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP
			  ○ Often seen together in the system.

	2.5 Clash emotion against efficiency	Occurs during contact moments between the patient and healthcare professional since the timeframe of speaking is relatively short. In addition, the clash happens if the patient is at home and feels the need to call. The workflow of the healthcare professional is then disturbed. This theme highlights the difference between the fast-paced hospital environment versus the emotion-based patient.
		• Intake & Diagnosing: the short time frame of the HP during the consult interferes with the emotional feelings of the patient.
		• Repeat Consult: the short time frame of the HP during the consult interferes with the emotional feelings of the patient. In addition, during the work hours of the HP, the patient calls with questions regarding their health. This forms an interruption. Furthermore, the disturbances during "Dienst" (on-call hours) are often unnecessary but happen due to
			• Direct contact and consult & Experience patient during referral and treatment
			  ○ See 2.1
			  ○ Often seen together in triplicate in the system.
			• Direct contact and consult
			  ○ See 2.1
			  ○ Often seen together in the system.
			• Role and influence of family & Knowledge and clarity
			  ○ See 2.2

		a lack of staff. Patients suddenly have direct contact with the healthcare professionals. • Procedure: after the procedure, the patient receives a dismissal conversation before leaving the hospital. In addition, the patient is not being helped by the same cardiologist or surgeon after the intervention.	

3 Education and Training of Medical Staff	*3.1 Training medical employees*	Training is an extra task that all employees must partake in, often the influence is in the shadows of the system. However, it occurs in specific tasks or as an influence.
		• Referral: the AIOS needs to take on the extra task of placing the patient within the system and determine when and how they need help.
		• Procedure: during meetings, the AIOS can learn about how to collaborate with other employees and how to decide what the patients need.
			• Long-term influence of education
			  ○ The longer the AIOS is in service at the LUMC the better their patient assessment will be, they also create an environment where they become the teacher in the system.
			  ○ During Referral
			• Influences 'Administrative load & Internal communication inside the hospital'
			  ○ By creating a knowledge base and a learning atmosphere internal communication and the amount of administration will be better. The AIOS learns how to connect and with who, this will need fewer steps after years of experience.
			  ○ During Procedure
			• Consideration work balance
			  ○ See 1.1

	3.2 Balance between education and clinical care	Since all employees train new employees and students this theme has an effect in the shadows of the system.	

	3.3 Long-term influence of education	The long-term effect of education shows in the form of experience and the ability to assess and adjust patient care.
		• Referral: The AIOS will become a doctor who will then be able to train and assess new AIOS employees.
		• Back to GP: After having an education it becomes easier to assess a patient and their need of care within an academic hospital.
			• Training medical employees
			  ○ See 3.1
			• Patient Admission
			  ○ There is a need to correctly admit patients into the hospital, patient admission is therefore something an HP learns during work. Furthermore, understanding when a patient no longer needs the care inside the LUMC is also something that will improve over the years due to experience and understanding of the criteria.
			  ○ During Referral AND Back to GP

4 Collaboration and Communication	*4.1 Internal Communication inside the hospital*	Occurs at all stages of the system and is mostly accompanied by administrative load. It is normal to stay in touch with colleagues during patient care. However, due to other influences (technology or time), communication is not always done correctly or takes time.
		• Referral: The AIOS needs to communicate correctly the new patient admission and their assigned number with the poly secretariat
			• Consideration work balance
			  ○ The division and the execution of tasks create extra steps within the internal communication system.
			  ○ During Referral AND Repeat Consult
			• Administrative load

		• Reporting: After the patient status is 'done' multiple communication systems need to take place. A notification needs to be made to create an invoice, and a new appointment needs to be scheduled. • Repeat Consult: After the patient status is 'done' multiple communication systems need to take place. A notification needs to be made to create an invoice, and a new appointment needs to be scheduled. Furthermore, if there are any questions from the patient, GP, or insurance company between appointments a multistep process takes place of internal relocation of a call or email. • Procedure: Before the procedure can take place there is often a consult between the cardiologist and the surgeon, and between the team leader and the planning secretariat to see the bed occupancy. After the patient status is 'done' multiple communication systems need to take place. A notification needs to be made to create an invoice, and a new appointment needs to be scheduled. • Back to GP: After the patient status is 'done' multiple communication systems need to take place. A notification needs to be made to create an invoice and to start the referral back to the GP.	○ Multiple steps needed for contact create an extra administrative load. ○ After conducting steps in the patient care system multiple steps need to be taken to progress into the next stage. This often means an additional administrative load to rearrange everything. ○ During Reporting AND Repeat Consult AND Procedure AND Back to GP ○ Often seen together in the system. • Efficiency in patient stream ○ Scheduling the patient according to the preference and timetable of the cardiologist and surgeon needs communication to understand. ○ Outsourcing the patient back needs communicating efficiently and without mistakes to all parties. ○ During Referral AND Back to GP
	4.2 External communication with other health organisations (GP, second-line hospital, insurance companies)	Often in the system, problems arise due to not having the same systems, complex steps to get in touch or the lack of transparency and accessibility in how to get in touch. External organisations experience a hurdle in getting in touch with the LUMC and its employees. • Referral: Before the patient is admitted to the LUMC they need to be referred by an external health organisation. This referral can be done digitally or through paperwork. Since there is no one-line on how to do it and since the systems are not synced this is often not complete or complicated. • Registration: If patient data is missing (medical or personal) the cardiologist needs to communicate through the poly secretariat to receive the right data. This is a process with many steps and through multiple digital systems. • Reporting AND Procedure: After consultation, the consult letter is sent to the GP containing information about the patient, this happens every time and includes everything that is discussed. The GP receives therefore not only the necessary information and important changes but also information that could be disregarded. • Repeat Consult: After consultation, the consult letter is sent to the GP containing information about the patient, this happens every time and includes everything that is discussed. The GP receives therefore not only the necessary information and important changes but also information that could be disregarded. In addition, if in between consults the GP or MS has a question there is a complex	• Consideration work balance ○ The communication lines to stay in contact with external parties are not always the easiest. Often different steps through different employees are now necessary to receive information or to send messages. ○ During Referral AND Registration AND Repeat Consult • Administrative Load ○ By having a complex system in place to communicate with external parties more employees receive a bigger load of work. In addition, the correct referral and the non-synced systems create an additional workload to understand and register the patient and their data. ○ During Registration AND Repeat Consult AND Back to GP • Patient Admission ○ The external communication around the admission of patients can be lacking in a way that the correct information is not shared, or that a patient is sent to the LUMC too soon. ○ By adding correct communication or professional consultation this issue could be resolved. ○ During Referral

		multi-step process to go through, and the accessibility and clarity of communication are not always clear. Insurance companies experience the same hurdles in receiving the right information and understanding who to contact.
		• Back to GP: After consultation, the consult letter is sent to the GP containing information about the patient, if possible, the patient can be referred to the GP's care. The communication for the return is not always done right or takes a while.
			• Restrictions of data sharing
			  ○ Always together within the system.
			  ○ Since the digital systems of health organisations are hard to synchronize and share data between, there is a prominent problem with data sharing. This creates hurdles in understanding each other's data, creates extra time for steps and makes accessibility harder.
			  ○ During Referral AND Reporting AND Repeat Consult AND Procedure AND Back to GP

	4.3 Communication as support	Happens when the patient is at home or is going home. Focuses on where to find the right type of information and understanding where and when questions can be asked. Is also in line with patient preparation for their next consult. • Intake & Diagnosing AND Repeat Consult AND Procedure AND Back to GP: after the consult, the patient might feel the need to ask more questions, to understand what is going on or to look deeper into their experience. It is necessary to aid the patient in where to find support.	

	4.4 Knowledge and Clarity	Occurs mostly during patient-doctor interactions where there is a constant flow of information exchange. In addition, this theme happens during the finalisation of the consult letter for external communication. Since there is we need to filter the right information for the right people.
		• Intake & Diagnosing AND Back to GP: during the tests and the consult there is a hurdle in information exchange. The fast-paced environment leaves less time for clarity and understanding of the situation. Furthermore, the levels of education do not align. The consult letter also needs to hold the right information for the right people. This letter should filter out unnecessary things and include the most important updates.
		• Reporting: The consult letters also need to contain the right information for the right people. This letter should filter out unnecessary things and include the most important updates.
		• Repeat Consult: during the tests and the consult there is a hurdle in information exchange. The fast-paced environment leaves less time for clarity and understanding of the situation. Furthermore, the levels of education do not align. The consult letter also needs to hold the right information for the right people. This letter should filter out unnecessary things and include the most important updates. In addition, if the patient is at home questions could arise and then clarity and knowledge become a need.
		• Procedure: during the before-procedure consult and dismissal conversation there is a hurdle in information exchange. The fast-paced environment leaves less time for clarity and understanding of the
			• Consideration work balance
			  ○ See 1.1
			• Clash emotion and efficiency & Role and influence of family.
			  ○ See 2.2
			• Knowledge processing
			  ○ Often seen together in the system.
			  ○ See 2.4
			• Administrative load
			  ○ Often seen in the system
			  ○ During and after performing the cardiovascular tests and consult there is a short timeframe where the results and the right information needs to be exchanged. This needs to be done both physical but also administrative. The administration a short time frame creates an extra load on top of the work done. sometimes the need to explain or clarify can come between other working tasks, which creates a build-up.
			  ○ During Intake & Diagnosing AND Reporting AND Repeat Consult AND Procedure AND Back to GP

		situation. Furthermore, the levels of education do not align. The consult letter also needs to hold the right information for the right people. This letter should filter out unnecessary things and include the most important updates.	

5 Care Process and Efficiency	*5.1 Administrative load*	Administrative load often occurs between communication and interaction, both physical and digital. This is because everything that happens needs to be written down. In addition, the preparation for something to happen also needs additional proof and argumentation, often done digitally and written down.
		• Registration: if patient data is missing during registration multiple communication steps need to take place. Each step, if the referral is not done correctly, creates an extra workload for the employee.
		• Intake & Diagnosing: After each test and consult a quick review and result needs to be made, this creates a time-pressured administrative load. Furthermore, the consult letter needs to be sent with the right information and finished on the same day, it is not always possible to finish on time.
		• Reporting: The consult letter needs to be sent with the right information and finished on the same day, it is not always possible to finish on time if there is a delay in patients. Furthermore, the internal communication to take the next steps in patient care also creates an additional workload.
		• Repeat Consult: After each test and consult a quick review and result needs to be made, this creates a time-pressured administrative load. Furthermore, the consult letter needs to be sent with the right information and finished on the same day, it is not always possible to finish on time. The internal communication to take the next steps in patient care and/or taking phone calls during other work tasks also creates an additional workload. Every call is turned into an action; another call, an email, a notification in *EPDVision* or an appointment.
		• Procedure: preparing the procedure takes time and often turns into a multidisciplinary meeting with the cardiologist and surgeon, all decisions need to be written down. During the consult before the procedure, both the nurse and the surgeon talk with the patient and write everything down in the consult letter. This happens during the dismissal conversation as well.
		• Back to GP: After each test and consult a quick review and result needs to be made, this creates a time-pressured administrative load. Furthermore, the consult letter needs to be sent with the right information and finished on the same day, it is not always possible to finish on time. For a referral back multiple employees need to take steps to process the action.
			• Internal communication inside the hospital
			  ○ Often seen in the system
			  ○ See 4.1
			• External communication outside the hospital
			  ○ See 4.2
			• Consideration work balance
			  ○ See 1.1
			• Restrictions of data sharing
			  ○ When data sharing is harder or restricted an additional load of work will occur, this is since multiple steps need to be taken to receive or share the right information. It is not only a digital restriction it also focusses on the right data that can be shared. This filtering process also creates a hurdle.
			  ○ During Registration AND Reporting AND Repeat Consult AND Procedure AND Back to GP
			• Knowledge and clarity
			  ○ Often seen together in the system.
			  ○ See 4.4
			• Patient admission
			  ○ Referring the patient back to the GP creates extra workload since multiple steps within the hospital system need to take place.
			  ○ During Back to GP
			• Access to medical information
			  ○ Not having access to medical registration forms is an additional load of administration since multiple steps need to take place to understand and find the right information.
			  ○ During Registration
			• Efficiency in patient stream
			  ○ Not only in scheduling the patients but also the patient appointments running late during polyclinical hours. If this does not happen efficiently everything will run later than planned.
			  ○ If the patient stream is not effective it creates an additional load in administration and lost time.
			  ○ Occurs often together in the system.

			○ During Intake & Diagnosing AND Repeat Consult AND Back to GP
	5.2 Access to medical information	The access to medical data is happening during the registration phase since this is the moment that the LUMC needs the information to add the patient to their system and understand with who they are dealing. • Registration: The cardiologist needs to understand who the patient is. Furthermore, the right medical information is necessary to ease the consultation flow and to spare time.	• Administrative load ○ See 5.1 • Restrictions of data sharing ○ An incorrect system integration or an incorrect referral can be a hurdle in sharing the correct medical data. ○ During Registration
	5.3 Patient admission	Occurs at the beginning and at the end of the system flow since it represents the admission and letting go of the patients to create an efficient stream and balance in load. Patient admission is not yet done correctly, and the criteria are often not maintained since GPs, MS and patients act out of fear. In addition, patients are being kept in the LUMC system even though they could be referred to the GP since their problem is no longer complex. • Referral: Patients are being sent to an academic hospital out of fear or insecurity, this creates an influx of new patients. • Back to GP: Patients are being kept in the LUMC flow instead of leaving, this creates a build-up of patients that do not necessarily need to be there.	• Experience patient during referral and treatment. ○ See 2.3 • Administrative load ○ See 5.1 • Long-term influence of education ○ Education influences the ability to select. ○ See 3.3
	5.4 Efficiency in patient stream	This theme occurs in both scheduling the patients and the patient journey during tests, consultations, and the procedure itself. It portrays the not-though-through appointment accumulation per cardiologist and thus the issue of delays during the polyclinical hours. • Referral AND Registration AND Reporting AND Procedure shows that the scheduling of the patient is not based on the time needed per patient (new vs old) and the time slots left. • Intake & diagnosing focus on the accumulation and the life stream of patients during polyclinical hours. The efficiency is based on the delays in appointments and the availability of tests and resources. • Repeat Consult: focus on the accumulation and the life stream of patients during polyclinical hours. The efficiency is based on the delays in appointments and the availability of tests and resources. In addition, shows that the scheduling of the patient is not based on the time needed per patient (new vs old) and the time slots left. • Back to GP: shows that the scheduling of the patient is not based on the time needed per patient (new vs old) and the time slots left. Furthermore, it shows that efficiency is not always reached by outsourcing patients back to the GP, which means they stay within the LUMC system.	• Administrative load ○ See 5.1 • Experience patient during referral and treatment. ○ See 2.3 • Internal communication inside the hospital ○ Scheduling ○ See 4.1

6 Technological Aspects of Care	*6.1 Digitalisation as support tool*	Occurs in all phases since it focuses on the integration of digital tools for support during work tasks and communication tools. Digitisation is not always done correctly due to resistance or lack of knowledge.	• Challenges of integration and innovation of technologies
			  ○ Overarching through all stages.
			  ○ Closely related to each other since a lack of integration and innovation causes friction in using digital tools as support instead of seeing it as an obstacle.

	6.2 Restrictions of data sharing	The restrictions happen during external communication, this has to do with a lack of synchronized digital and technical systems between health organisations. Data sharing is harder to do if the digital system cannot correctly collaborate. In all stages, this theme occurs in the same way.	• Access to medical information
			  ○ See 5.2
			• Administrative load
			  ○ See 5.1
			• External communication outside the hospital
			  ○ See 4.2

	6.3 Challenges of integration and innovation of technologies	Occurs as an overarching theme in the system flow, since it focuses on the challenges that occur during all stages and actions. The challenges focus on both human resistance and dual system use.	• Digitalisation as support tool
			  ○ Overarching through all stages.
			  ○ See 6.1

Appendix E Validation Interview System & Themes

Interview Gids

Het valideren van het systeem en de problemen/gaten die zijn gevonden is de volgende stap in het begrijpen van de complexiteit in de afdeling cardiologie. Validatie van het huidige systeem zal gedaan worden met zorgprofessionals.

Checklist voor het starten

- Privékamer
- Uitgeprint toestemmingsformulier en een pen
  - Zorgmedewerker
- Uitgeprinte vragenlijst (Interview gids)
- Audio-opname apparatuur
- Onderzoeksmateriaal/ voor de gedachte
  - Stiften
  - Groot vel papier
- Camera
- Boekje voor aantekeningen
- Een glimlach en een hoop nieuwsgierigheid

1. Introductie Onderzoeker

- Begroeten en voorstellen van de onderzoeker
  - Student, afstuderen Strategic Product Design; focus op organisaties innoveren vanuit een strategische en overkoepelende blik
    Met de specialisatie Medisign
  - TU Delft en LUMC-samenwerking
- Introduceren van het afstudeerproject en het doel
- Toelichting op het doel:
  - Afstudeerproject opgezet vanuit de afdeling cardiologie binnen het LUMC
  - Er zijn al langere tijdproblemen binnen het zorgsysteem. De toenemende patiëntenstroom, de bezuinigingen en het uitvallen van zorgmedewerkers zorgen voor een ingewikkeld vraagstuk. Er ontstaat minder tijd voor patiënten en een toename van werkdruk op zorgmedewerkers.
    Het is fijn om weer een goed beeld te krijgen van wat het precieze huidige systeem is en waar de complexiteit/ moeilijkheden zitten. Belangrijk om dit te doen uit het perspectief van de mens, zowel patiënt als zorgverlener.
  - Mijn doel is de zorgstroom verbeteren, werkdruk laten afnemen en het werkplezier vergroten door het systeem te optimaliseren. Daar heb ik uw inzichten, ervaringen en ook waarden/ gevoelens bij nodig.
  - Het eerste systeem is geschetst tijdens de onderzoeksfase, hierna zijn de gelokaliseerde problemen in het systeem gezet. Om het hele systeem te valideren en te kijken of de problemen op de juiste plek zitten, is het belangrijk om met de belanghebbende samen te zitten.
- Garantie voor anonimiteit en vertrouwelijkheid van de gesprekken
  - Ondertekenen consentformulier
- Toestemming vragen voor het opnemen van het interview
- Interview structuur doorspreken
  - Semi-structured, open gesprekken
- Verdere vragen?

2. Kennismaking en Introductie Deelnemer

- Introductie van de deelnemer met korte voorstelronde (5 min)
  - Naam

    - Leeftijd
    - Ervaring met hartziekten/ afdeling cardiologie
- Doorspreken interview thema's en activiteiten (5 min)

3. Thematische Verkenning LUMC Medewerker

Thema A Werkzaamheden LUMC medewerker

- Welke taak vervult u binnen het LUMC?
- Waar haalt u werkplezier uit?
- Wat geeft u werkdruk?
- Contactmomenten
    - Met wie
    - Waar

Thema B Zorgproces en gaten systeem - Papier op tafel

- Kijkend naar het systeem zien we de volgende fases
    - Per fase langsgaan
- De volgende thema's zijn gevonden -> thema's vertegenwoordigen de problemen
- Plaatsing in het systeem
    - Hoe zou u dat doen?
    - Wie en wat komt er dan bij kijken?
    - Al oplossingen voor bedacht?

Thema C Positieve momenten en uitdagingen

- Wat gaat er goed binnen de zorg?
- Waar zitten de grootste uitdagingen die u heeft gemist in het systeem?
- Waar is nog veel over te overwinnen?
- Waar wilt u zich inzetten?
    - Heeft u al ideeën?

6. Afsluiting

- Korte samenvatting van belangrijke inzichten, gericht op waar de deelnemer de focus op heeft gelegd.
- Gelegenheid om laatste punten aan te kaarten vanuit de deelnemer.
- Bevestiging anonimiteit en aanbod om resultaten van het onderzoek te ontvangen na afronding.
- Danken voor de tijd en moeite die de deelnemer heeft willen stoppen in het onderzoek.
- Toestemming vragen voor een mogelijke follow-up.
- Nogmaals bedankt en afscheid nemen.

Appendix F Reviewing Research Outcome

Project Brief

The project brief shows that the *wellbeing* of healthcare professionals and reducing their work pressure is the main connecter. Furthermore, the project brief highlights that understanding the system you work in and your place in the system is important for the workflow to function correctly.

Keywords

- Wellbeing
- Decreasing pressure
- Transparency
    - Knowledge transfer: when do we need to share what information?

Main questions

1. Where are the work frustrations coming from?
2. Where do healthcare professionals gain have fun at work?
3. What are the concrete problems and gaps experienced?
4. What can be done to improve the current system?

Literature Research

Within the literature research it became clear that the wellbeing of the healthcare professionals is the main connecter between all factors that influence the system. Furthermore, increasing the work pressure will affect the wellbeing of the healthcare professionals in a positive way. Understanding the system and its component is important for it to function well.

Keywords

- Wellbeing
- Decreasing pressure
- Transparency
    - Knowledge transfer: when do we need to share what information?

Main questions

1. How can the wellbeing be improved and the pressure reduced on healthcare professionals?
    a. How can the patient-doctor relationship be improved?
2. How can an attractive and accessible system be created?
    a. What does this system look like?

First Problem Statement

The first problem statement focuses on one part of the problem, which is that the wellbeing of the healthcare professionals is the main connection between the components of the system. In this statement the influence of the patients and of external healthcare providers is left out.

Keywords

- Wellbeing

Main questions

1. How can the wellbeing of healthcare professionals be improved?
2. How can the patient-doctor relationship be improved to add to patient satisfaction and quality of care?

Observational Research

During the observational research it became clear that collaboration and effective communication is the core for a well-functioning system. Both between internal healthcare professionals and with patients. Furthermore, the source of work satisfaction and joy comes from direct patient contact during consultations, the main goals therefore should be on how to optimise this to improve wellbeing.

Keywords

- Preparation is key.
- Transparency
    - What to expect in which phase
    - Knowledge transfer: when to share what type of information?
- Wellbeing

Main questions

1. How can the current system be improved?
2. How can the focus be on what goes well to improve work satisfaction?
3. How can the patient-doctor relationship be improved?
4. How can the workflow be improved to create extra time?

Focus Group Patient Data

This part of the research focuses on the patient experience during their own care path. It introduces a new side to the problem area. The focus point of patient experience lies in the effective collaboration with their provider. It is necessary to understand what they need to do and what exactly is going on. Therefore, managing expectations needs to be effective. Furthermore, since all patients have different lives and different diseases it is necessary to deliver person-focused care where their individual situation is considered.

Keywords

- Transparency
    - Knowledge transfer: when to share what type of information?
- Communications leads to collaboration.
- Patient expectation pattern
- Individual and personalised care

Main questions

1. How can the patient experience during their care path be improved?
2. How can the right amount of knowledge be provided at the right time?

Interviews

The interviews were conducted with both internal and external healthcare professionals, which led to a diverse data set. Within the data it became apparent that to increase the wellbeing of internal healthcare professionals the work pressure needs to decrease. The key components to lessen the work burden are task division and scheduling, it is important to understand what the expectations are of all people involved. Furthermore, collaboration between internal and external healthcare professionals are key in a functional workflow with less workload.

Keywords

- Quality of care
- Transparency
    - Knowing what to expect and when
    - Knowledge transfer, when to share what information
- Communication and preparation are key.
- Mutual understanding between two healthcare parties
    - Conflict between the importance of your own tasks versus what you need from one another

Main questions

1. How can work satisfaction be improved?
2. How can the focus switch on what goes well instead of what goes wrong?
3. What is needed to reduce the workload?
4. How can the wellbeing have improved and therefore the quality of care?
5. How can a mutual understanding be created?
    a. Between patient and doctor
    b. Between internal doctors and external doctors
    c. Between internal employees

Appendix G Stakeholder needs per stage

Referral stage

Table 3A The needs per stakeholder

Referral		
	Transparency	**Preparation for communication**
As a patient…	I need to experience care from several providers as if it is from one so that they all know my medical history.	I need to be able to easily permit care so that all providers receive my medical and personal data.
As an internal healthcare professional *Cardiologist/AIOS*	I need access to a patient's medical data so that I can create a suitable treatment timeframe.	I need to receive the right medical and personal history of the patient so that I can prepare the consultation and provide quality care.
As an internal healthcare professional *Poly/planning secretariat*	I need access to a patient's personal information and treatment timeline so that I can schedule and communicate accordingly.	
As an external healthcare provider	I need to have a clear communication plan so that they understand the patient's care needs and medical data.	I need to understand what data through what medium is to be shared so that the communication will be fluent.

Scheduling

Table 4A The needs per stakeholder

Scheduling		
	Transparency	**Preparation for communication**
As a patient…	I need to know when my care is transferred to another care institute so that I can schedule my life accordingly.	I need to understand when and what I can do before my appointment so that my appointment runs smoothly.
As an internal healthcare professional *Cardiologist/AIOS*	I need to be able to schedule patients according to my preference so that I do not feel overworked.	I need to be able to communicate with the secretariat so that an optimal schedule is made for new and repeated patients.
As an internal healthcare professional *Poly/planning secretariat*	I need to be able to use the system differently so that the scheduling can be simpler.	I need to understand how to combine patients so that the workflow improves.
As an external healthcare provider	I need to know when the care is transferred to the LUMC so that we can provide high-quality care.	

Before consultation

Table 5A The needs per stakeholder

Before consultation

	Transparency	Preparation for communication
As a patient…	I need to understand what I need to do and when so that I feel ready for my appointment.	I need to use the help of tools so that I can prepare my consultation.
As an internal healthcare professional *Cardiologist/AIOS*	I need to know that the patient received the necessary information so that the consultation runs smoothly.	I need to prepare the patient information so that there will be no delays during the polyclinic.
As an internal healthcare professional *Poly/planning secretariat*	I need to understand that the patient received the appointment so that the schedule will not be harmed.	

Before procedure

Table 6A The needs per stakeholder

Before consultation		
	Transparency	**Preparation for communication**
As a patient…	I need to understand what will happen to my body so that I can learn how to take care of myself.	I need easily accessible information so that I can be sure that I educate myself properly.
As an internal healthcare professional *Cardiologist/AIOS*	I need to educate the patient so that fewer questions will be asked, and they understand what will happen.	I need the patient's personal life information so that I can give the right care according to their situation.

During consultation

Table 7A The needs per stakeholder

During consultation		
	Transparency	**Preparation for communication**
As a patient…	I need to receive the right knowledge about my disease on a level that I understand so that I can engage in my health.	I need to research my personal and health situation so that I can ask the right questions to receive personal care.
As an internal healthcare professional *Cardiologist/AIOS*	I need honest answers from patients so that I can understand their personal situations in which they need care.	I need clear and concise information so that I can easily make a treatment plan and consult letter.

After consultation and procedure

Table 8A The needs per stakeholder

After consultation and procedure		
	Transparency	**Preparation for communication**
As a patient…	I need insights into what my treatment plan is and who to contact so that I can take responsibility for my care.	

As an internal healthcare professional *Cardiologist/AIOS*	I need a clear system so that I can easily transfer the right information to the right person.	I need the right work tasks so that I can do my work on time and not overwork myself.
As an internal healthcare professional *Poly/planning secretariat*	I need a clear communication system so that patient questions do not fall through the cracks or fill out my day.	I need the right work tasks so that I can do my work on time and not overwork myself.
As an external healthcare provider	I need understandable communication so that the responsibility of patient care is clear.	I need a timeframe for receiving the consult letter so that I can keep up to date with patient care.

Referral back to the GP

Table 9A The needs per stakeholder

Referral back to the GP		
	Transparency	**Preparation for communication**
As a patient…	I need a clear goodbye conversation with information so that I know that I no longer need care at LUMC.	
As an internal healthcare professional *Cardiologist/AIOS*	I need clear patient criteria so that the patient is not too long under the care of LUMC.	I need time to correctly transfer the patient to the GP so that the questions and confusion will be minimal.
As an internal healthcare professional *Poly/planning secretariat*	I need a clear communication system so that the transfer of the patient runs smoothly.	
As an external healthcare provider	I need a timely referral back request with a diagnosis so that the patient care responsibility is back on time.	I need to have a patient communication system so that I can help the patient understand their care is back to me.

Appendix H Out-of-Scope intervention: Regional medical data sharing system

Idea Out-of-Scope: Regional medical data sharing system

The data showed that there was a need for a way to easily share medical data between healthcare organisations. This is out-of-scope for this project; however, recommendations are made that might help understand which steps are needed to be able to achieve this. Inspiration for these recommendations were gathered through the E-health system in Estonia which is operational since 2008 (Doupi et al., 2010; e-Estonia, n.d.).

The idea includes enhancing communication and collaboration across stakeholders and building robust partnerships. The goal is to improve the exchange of medical and personal data between healthcare organisations by developing a regional medical data exchange system, an e-health system. The data should contain summaries of visits, treatments, discharges, referrals, diagnostic reports, and medical procedures.

The e-health system will be integrated with an easy-to-use interface and functionality that allows patients to easily permit sharing their data. Furthermore, patients have insight into with which organisations they want to share what type of data and can see who accessed their data.

The e-health system will be integrated in the existing digital portal of the health organisations. Therefore, it will become a medical infrastructure that connects different healthcare organisations.

Steps and activities to reach the goal

A regional-wide workshop needs to take place to bring together all stakeholders that want to participate in a regional-based medical data exchange system. The workshop can be facilitated by a design company or strategic consultancy. The stakeholders can include the LUMC, GP practices, 2nd-line hospitals, and pharmacies. The goal of the workshop is to get everyone on the same line and understanding the needs per stakeholder. Furthermore, an action plan needs to be created with specific tasks to understand who needs to what and when. It should include arguments as well, as to why the e-health system is needed in the region. At the end of the workshop several stakeholders will be assigned to write out the action plan and a letter to the municipalities and Ministry VWS. A timeline should also be established on when the goals must be reached.

A political discussion needs to be triggered by the argumentation and action plan, during which the commitment to develop a medical shared information system across health organisations is discussed. The action plan proposed by the different stakeholders needs to be approved to be able to guide the development of the medical sharing system, the e-health system. If approves a new action plan regarding the development of the e-health system needs to be made, including funding, safety and security, patient IDs; digital pins or DigiD based or..., and integration of the different IT systems. A foundation should be created that guides and protects the E-health system, and therefore the development plan.

After the approvement and action plan creation the digital transformation starts as well as the development of an electronic care summary system. Legislation is needed to be able to require

all healthcare organisations to upload information to the e-health system. In addition, the online patient portal is designed and tested. There is feedback needed from both patient and healthcare organisations.

The development and implementation of Blockchain technology to enhance security and ensuring data integrity and protection against threats should start as well. This technology is necessary to safeguard all sensitive patient-based health information. Blockchain technology is a structure that stores transactional data, the block, in several databases, the chain, in a network connected through peer-to-peer nodes.

The patient portal now can be launched for regionwide use. During which active monitoring is needed to support the e-health system and ensure security and safety

Who is involved?

- The board of directors of the LUMC
- Several departments of the LUMC

External collaboration

- GP practices
    - De Limes
    - Westland
    - Schievliet, locatie Delft
    - Hadoks
    - etc.
- 2nd-line hospitals
    - Alrijne Ziekenhuis
    - Reinier de Graaf Gasthuis
    - HagaZiekenhuis
    - Groene Hart ziekenhuis
    - etc.
- Pharmacies
    - Nachtapotheek De Limes Leiderdorp
    - Dienstapotheek Bollenstreek Voorhout
    - Apotheek Lijnbaan Den Haag
    - etc.
- Municipalities from Regio West
    - Haaglanden (Delft, Den Haag, Leidschendam-Voorburg, Midden-Delfland, Pijnacker-Nootdorp, Rijswijk, Wassenaar, Westland, Zoetermeer)
    - Hollands Midden (Alphen aan den Rijn, Bodegraven-Reeuwijk, Gouda, Krimpenerwaard, Waddinxveen, Zuidplas)
- Dutch government
    - Ministerie van Volksgezondheid, Welzijn en Sport
        - Ministry of Health, Welfare and Sport

What value is created?

A region-wide data exchange reduces the administrative burden caused by restrictions on data sharing. It also makes it easier for healthcare organisations to work together, as there is no longer a communication barrier. The care process will be more efficient.

Ownership

- Initiative needs to be taken by different health organisations that portray the need to work together and show a plan on how and when they want to collaborate.
- Privacy and data ownership need to be centralised and governed by the municipality or Dutch government.
- Health data belongs to the individual concerned and need to be always protected. Furthermore, they have the right to view their own health records, restrict access to their information, and monitor who has viewed their data.
- All healthcare providers are obligated to contribute data to the e-health sharing system. However, access to this database will be controlled. Only licensed medical specialists can access the system.

E-health system enablers

- Accountability
    - Legislation to require healthcare providers to maintain the needed infrastructure to connect through the e-health system and upload the necessary patient data
    - The e-health system permanently records all users that access the medical data to increase transparency and accountability.
- Incentives
    - Financial penalties need to be put in place for healthcare organisations if they do not comply with the contracts
- Information
    - The entire population is registered to the e-health system through their patient ID or DigiD
    - A central data-exchange platform that is integrated into the organisational digital systems with secured access
    - The newly created e-health foundation monitors and evaluates the data

Appendix I Project Brief

TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	Krijvenaar	7341	
Initials	B.L.W.		
Given name	Brechtje		
Student number	4833198		

IDE master(s)	IPD ☐	DfI ☐	SPD ✓	
2nd non-IDE master				
Individual programme *(date of approval)*				
Medisign	✓			
HPM	☐			

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Maaike Kleinsmann	dept./section	Design, Organisation and Strategy
mentor	Yingtao Sun	dept./section	Human-Centred Design
2nd mentor	Julian Houwen, LUMC		
client:	Douwe Atsma, LUMC		
city:	Delft & Leiden	country:	The Netherlands
optional comments			

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in by the Chair of the supervisory team

Sign for approval (Chair)

Maaike Kleinsmann - IO Digitally signed by Maaike Kleinsmann - IO Date: 2024.09.12 16:10:22 +02'00'

Name prof. dr. ir Maaike Kleinsmann Date 12 sept 2024 Signature

CHECK ON STUDY PROGRESS

To be filled in by SSC E&SA (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total _____ EC

Of which, taking conditional requirements into account, can be part of the exam programme _____ EC

★	YES	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Robin den Braber

Digitaal ondertekend door Robin den Braber
Datum: 2024.09.24 08:02:15 +02'00'

Name Robin den Braber Date 24 sept 2024 Signature

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is ...

★	ALLOWED to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Monique von Morgen

Digitally signed by Monique von Morgen
Date: 2024.09.26 11:04:28 +02'00'

Name Monique von Morgen Date 26 Sep 2024 Signature

DESIGN FOR our future

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Personal Project Brief – IDE Master Graduation Project

Name student Brechtje Krijvenaar **Student number** 4,833,198

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Optimising the Care Journey at the Department of Cardiology LUMC

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

This graduation project is assigned by the Department of Cardiology at Leiden University Medical Centre (LUMC) and is based in the hospital environment. The project focuses specifically on the cardiology department; however, the brief also takes into account the other departments within the hospital since there is inter-departmental collaboration during patient care. During the project, it is necessary to consider not only this inter-departmental relationship but also the protocols and quality requirements of the LUMC.

The project was initiated by the cardiology department, who felt that steps needed to be taken to optimise the current system. Within the department, there is growing pressure on the healthcare providers through a rising patient influx. This leads to the risk of job dissatisfaction and might compromise the welfare of the healthcare professionals. In addition to the healthcare professional's perspective, it is important to consider the patient's perspective. Patient care is a multi-stage process that takes time. The inefficiencies that now exist within the department create uncertainty for patients and frustrations for the healthcare providers.

Understanding human thought processes, emotions, and behaviours will help guide the design of the optimal system within the cardiology department. To develop this new system, patients and healthcare providers will be used as stakeholders and sources for insights that will help visualise the gaps and opportunities. Other stakeholders within the project will be healthcare providers from other departments (doctors, nurses, etc.) and General Practitioners outside of the hospital.

To finalise the project insights into valuable results certain steps have to take place, these can be found in Figure 1.

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introduction (continued): space for images

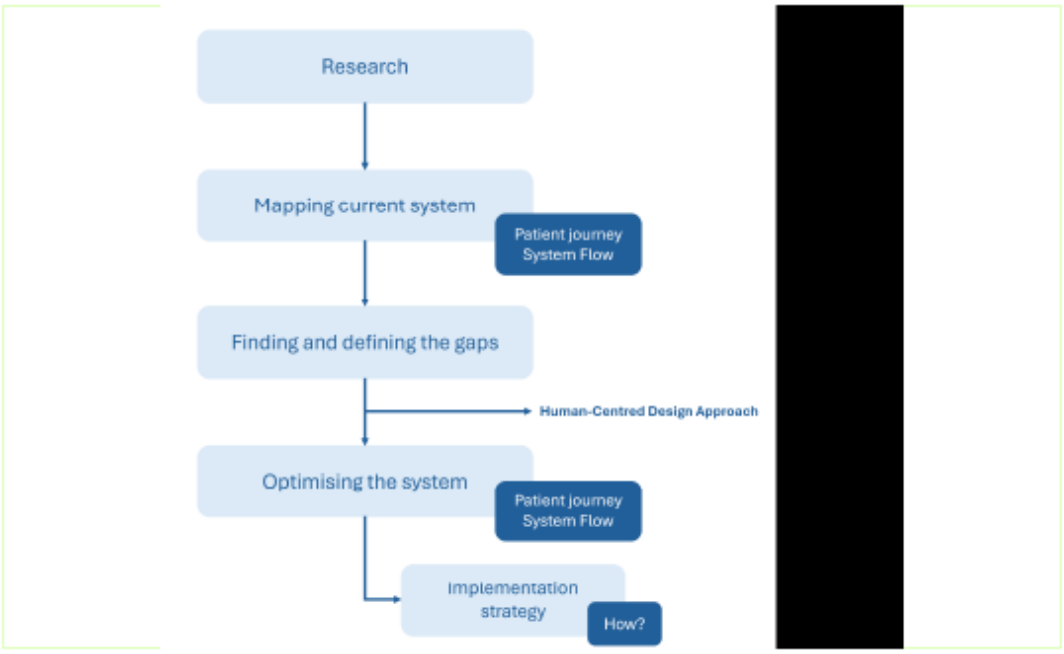

image / figure 1 Steps of graduation project

image / figure 2

DESIGN FOR our future

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Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

Over the years the pressure on the healthcare system has increased, this has to do with the changing economic situation, budget divisions, the health crisis of COVID-19, and the increased numbers of patients seeking care. The addition of a fragmented system creates more uncertainties as well. This growing pressure on healthcare providers leads to a viable risk of decreased professional and job satisfaction. This could mean a risk of reduced quality of care since the pressure on healthcare professionals takes away their welfare. Adding increased administrative tasks takes away the focus on the core of their work; human care. It is important to look at the current health system, in this case, the cardiology department to understand the gaps and how to improve. Additionally, by using a human-centred design approach the perspectives of both the caregivers and patients will be taken into account.

The main question will be: How can the existing care journey at the Department of Cardiology at LUMC be optimised to reduce burdens on healthcare professionals and add value to patients?

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Design a strategy for an optimised care path and system flow to find the gaps and fulfil the latent needs of both healthcare providers and patients within the Cardiology Department.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

The method that will be used during the project is based on the method from the University of Cambridge; the Improving Improvement Toolkit. The toolkit itself is very broad so there will be a selection of steps and activities that will be implemented. The steps that will be looked into are;
1. Understand the context
2. Define the problem
3. Develop the Solution with Collect the Evidence

The activities and tools to complete these steps will be semi-structured interviews with both healthcare providers and patients, experience mapping exercises to uncover latent needs and feelings, creating system maps and describing clinical processes, describing patient journeys and creating a stakeholder map. Furthermore, a stakeholder analysis will be done and a storyboard of the patient journey will be created to visualise and validate the findings.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	12 September 2024
Mid-term evaluation	22 Nov 2024
Green light meeting	3 feb 2025
Graduation ceremony	4 mrt 2025

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	✓
For how many project weeks	9
Number of project days per week	4,0

Comments:
Extra elective; Design in Health: Theory & Practice. I want to follow this course to help aid me through the rules & regulations within the hospital environment

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

My interest has always been in the medical field. My mom and my grandma studied medicine; through them, I often hear misconceptions, frustrations and obstacles that have happened or are happening. This led to my interest in designing within this field. Since I am no product designer and find designing for a large audience more fascinating, my focus became strategic design. Within this field, I am interested in looking into innovating current medical systems by implementing new strategies. The insights for these new strategies are found through both desk research and talking with stakeholders and target groups.

I often mention to friends and family that I am fascinated by starting conversations with strangers since I learn something new every time. Being curious is one of my main characteristics and in this case, led to starting this graduation project. I am curious to find out how the current system in the cardiology department works, which stakeholders influence one another, what is the role of technology, and how we can positively influence the relationship between the patient and the healthcare professionals.
What I want to learn and develop during my graduation project;
1. Be better at doing desk research
2. Navigate through interviews on my own with different types of people
3. Dive into the medical world and understand there jargon
4. Create new strategies that are easy to implement in a fast-paced environment

Appendix J QR-code overview

Patient Journey

Workflow

Workflow with themes

TU Delft

Leids Universitair Medisch Centrum