

Designing a digital Metro Mapping tool

A service design tool for improving healthcare



Master thesis

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TU Delft

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Preface

Dear reader,

You are holding the final result of my graduation project, which marks the final step of my Master's in Strategic Product Design at Delft University of Technology. Over the past five months, I have dedicated myself to the development of a digital Metro Mapping tool: an innovative way to support healthcare professionals in co-designing and optimising care pathways. It has been a challenging, enriching, and valuable learning journey.

This thesis reflects not only the outcome of my research and design work, but also the many conversations, location visits, collaborations, and moments of reflection I experienced along the way. I feel grateful for all the people who helped shape this project.

First, I would like to thank my graduation committee. Thank you for your feedback, kind encouragement, and the trust you placed in me. To my chair, Bart Bluemink: thank you for challenging me to stay critical and focused, helping me to narrow my scope when needed, while also giving me the freedom to shape the project in my own way. To my mentor, Marieke Sonneveld: thank you for always taking the time to think along with me. I really appreciated your sharp perspective and your expertise in healthcare. And last but not least, to my company supervisor, Rémon van den Bergh: thank you for your ongoing guidance and support, and for sharing your UX research skills. I truly enjoyed working with all three of you!

I would also like to thank Online Department for making me feel so welcome during my time there. It was a pleasure to be part of such an open and inspiring team. I learned a lot from all the designers. Not only because of their UX expertise, but also because they were always approachable, supportive, and simply great to work with.

I am thankful to everyone who contributed to this project through interviews, co-creation, or feedback sessions. Without your openness, time, and insights, this work would not have been possible. A special thanks goes to Reinalda Schaaphok, Noa Smolenaars, Shannon van Hoorn, and Marleen de Mul for their recurring involvement and the valuable perspectives they shared from within the healthcare domain. I also want to thank all those who preferred to stay anonymous: your input was just as essential.

To my friends and family, thank you for your encouragement, curiosity, and support. I would also like to thank everyone else who has shaped my years as a student in Delft. I look back on this period with great appreciation.

I am proud to share this work and hope you enjoy reading it!

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Glossary

Care pathway

A structured, multidisciplinary care plan that outlines essential steps in the care of patients with a specific clinical problem. It defines who does what, when.

Care programming

Strategic planning and organisation of care for a specific patient population, often covering multiple care pathways and settings.

EHR = Electronic Health Record

A digital system for storing and managing patient health information, often used to document care and support communication between healthcare providers.

GP = General practitioner

A doctor based in the community who treats patients with minor illnesses and refers those with serious conditions to a hospital.

HCPs = Healthcare professionals

A collective term for individuals who are trained to provide healthcare services. This includes, among others, doctors, nurses, physician assistants, medical specialists, psychologists, and therapists.

Hybrid care

A care delivery model that combines digital (e.g. video consultations, online monitoring) and in-person interactions. It aims to provide more flexible, accessible, and efficient care tailored to the patient's needs and context.

IZA = Integraal Zorgakkoord ('Integral Care Agreement')

A national agreement in the Netherlands between the Ministry of Health, insurers, healthcare providers, and patient organisations. It aims to improve collaboration, affordability, and quality of care by focusing on prevention, regional collaboration, and the right care in the right place.

MM = Metro Mapping

A service design tool to visualize and (re)design care pathways.

SDM = Shared decision making

A process in which patients and healthcare professionals work together to make decisions about care. It combines the best available medical evidence with the patient's personal values, preferences, and circumstances.

Transmural care

Refers to care that is coordinated across different healthcare settings, such as between the hospital and primary care. It focuses on continuity and integration of care beyond organisational boundaries.

UX = User Experience

The discipline of designing and optimising how users interact with a product, service, or system. In healthcare, it often refers to how intuitive, helpful, and satisfying digital tools are for professionals and patients.

Visio

A diagramming and vector graphics application offered by Microsoft that allows users to create various types of diagrams. Visio is currently used to create Metro Maps.

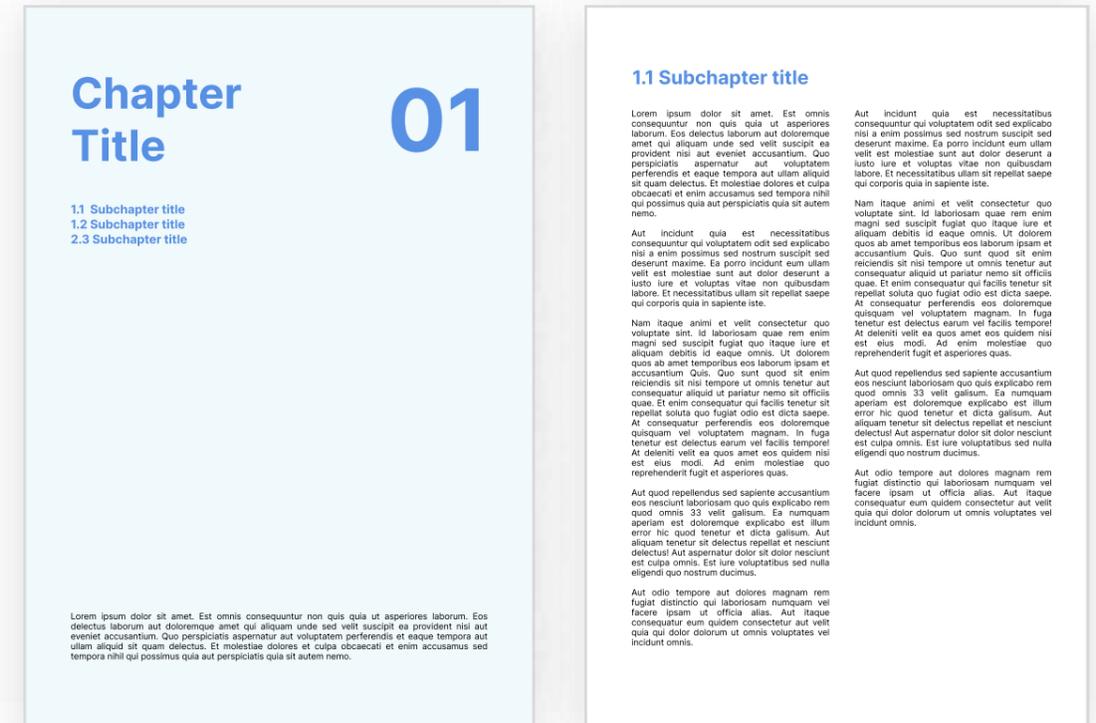
Note on terminology:

Care pathway vs. Metro Map

In this report, the terms 'care pathway' and 'Metro Map' are sometimes used alongside or near interchangeably. However, they refer to distinct concepts. A care pathway outlines the actual sequence of steps, roles, and decisions involved in delivering care to a patient. A Metro Map is a design method to *visualise* a care pathway, which helps to structure, understand, and communicate the care pathway more clearly. A Metro Map is like a language in which a care pathway can be expressed.

Still, because the two are closely linked in both practice and discussion, they are frequently addressed together throughout this report. This choice is intentional and reflects the practical overlap between the two.

Reading guide



Each chapter starts with a coloured title page. The colour corresponds to a phase in the **Double Diamond model**, helping the reader quickly understand where the chapter fits in the overall process. Each title page also provides an overview of the subchapters and an short introduction.



Key takeaway

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"Quote" - Participant 1

Quotes are presented in grey blocks, illustrating findings with direct input from stakeholders.

These coloured blocks highlight key takeaways, summaries, or other important insights.

Executive summary

The healthcare sector is under increasing pressure due to rising demand, staff shortages, and fragmented collaboration. To improve coordination and put patients at the center, care pathways are gaining importance. Metro Mapping, a relatively new design service method, offers a promising method to visualise and co-design these pathways in a more collaborative and structured way. However, its adoption in daily practice remains limited, partly due to the lack of a dedicated digital tool.

This graduation project focused on the development of such a digital Metro Mapping tool, aiming to support broader and more sustainable use in healthcare settings. The central question was: how can healthcare professionals effectively optimise care pathways and improve patient care with the support of a digital Metro Mapping tool?

Research

To answer this, I investigated what enables and hinders the adoption of Metro Mapping, and how a digital tool could help overcome these barriers. Insights were gathered through literature research and a wide range of interviews with healthcare professionals, designers, researchers, and advisors. This led to a structured understanding of key enablers, challenges, and barriers, which were clustered to inform a strategic direction. Based on these insights, the following future vision was defined:

"Metro Maps are dynamic documents that are evolving, shared visual blueprints that support coordination, communication and better patient outcomes."

This vision was translated into concrete design principles, outlining what the tool should offer in terms of usability, flexibility, and collaboration. Throughout the design process, I organised co-creation sessions and interim feedback sessions, making sure that the outcome stayed grounded in real-world needs and constraints.

Based on these principles and user input, a wide range of possible features was developed. These were prioritised into two categories:

- Required features: a mix of must-haves and highly desired features, which were included in the prototype
- Future wishes: valuable additions for later development, but with less priority for now

Results

The result is a concept for a digital Metro Mapping tool that incorporates all required features and translates them into a clear and flexible interface. The design includes layered interactions, role-based views, and modular building blocks.

Key features include a drag-and-drop builder, clickable layers, filtering per user type, and layers and phases that can be collapsed or expanded. It allows for real-time co-creation, linking files, and navigating through different levels of details. By bringing everything together in one place, the tool reduces duplication, increases clarity, and enables more efficient collaboration.

In validation sessions, stakeholders confirmed its potential to better align care teams, support shared ownership, and improve quality and safety. An IT expert validated its technical feasibility, provided that the interface and data layers are separated and existing IT systems (e.g. Zenya or EHRs) are taken into account.

The report concludes with clear recommendations for next steps, including implementation considerations and collaboration opportunities. This project does not aim to deliver a finished product, but provides a strong, validated foundation for further development of the Metro Mapping tool.

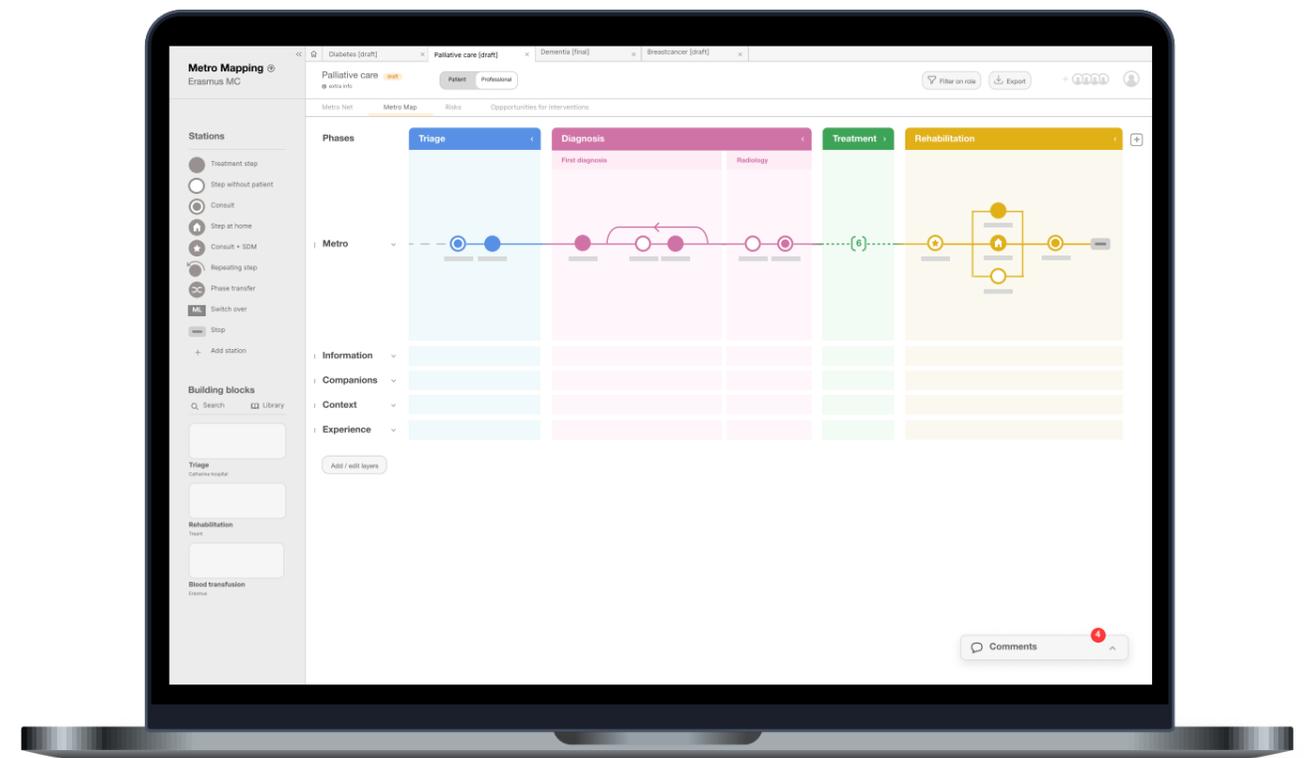


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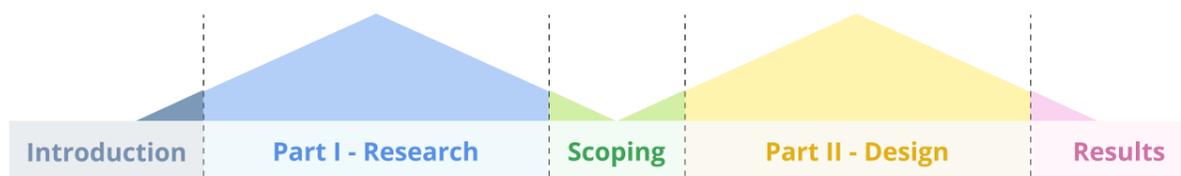
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Introduction

01

- 1.1 Project introduction
- 1.2 Stakeholders
- 1.3 Project approach

This chapter starts by highlighting the relevance of this graduation project. It describes how the healthcare sector is under pressure, and how care pathways and Metro Mapping could play a role in improving this situation. I will explain the general scope of the project and the project approach. Also, I present the original research questions and design goal that served as the base of this project.

1.1 Project introduction

Context

The healthcare sector in the Netherlands is under pressure. The Dutch coalition agreement acknowledges the challenges within this sector, such as the increasing demand and the workforce shortage (Rijksoverheid, 2024). In 2022, the government established the Integral Care Agreement (IZA). It was signed by a wide range of parties in the healthcare sector, such as umbrella organisations of hospitals, mental health care, and elderly care. The goal of IZA is to improve Dutch healthcare and prepare it for the future, emphasizing on aspects such as regional cooperation, digitalisation, and data sharing (Ministerie van Volksgezondheid, Welzijn en Sport, 2022).

Delivering patient-centered care across fragmented systems is complex, leading to inefficiencies and hindering collaboration (Bahle et al., 2023). One important challenge is the lack of governance and proper documentation in designing care pathways. Metro Mapping presents a promising solution to improve this situation.

Metro Mapping

Metro Mapping is a relatively new service design method by which care pathways can be designed and optimised in a visual way (see Figure 1). It can be used to improve patient experience and help with clinical challenges, for example, around shared decision making and multidisciplinary collaboration. By enabling co-creation among diverse stakeholders, this approach helps to create more effective and streamlined care processes, ultimately improving healthcare outcomes. Metro Mapping will be further explained in Chapter 5.

While Metro Mapping was originally developed to support shared decision-making in oncology (Griffioen et al., 2022), it has demonstrated potential for broader applications across healthcare. The Metro Mapping Foundation's mission is to improve and promote healthcare and the well-being of patients, their loved ones and caregivers through this methodology (Metro Mapping Foundation, n.d.a).



Figure 1: Schematic overview of a Metro Map (Metro Mapping Foundation, n.d.a)

Problem

Although Metro Mapping holds significant potential, its practical application remains limited. A major barrier is the lack of a scalable, user-friendly, digital tool that meets the needs of healthcare professionals, who often lack design expertise. Currently, the only tool used for Metro Mapping is Microsoft Visio, which is complex, unsuitable for collaboration across multiple institutions (transmural care), and limited in functionality. As a result, Metro Mapping has yet to realise its full potential within healthcare innovation.

Project aim

This project aims to address these challenges by developing a user-friendly, digital Metro Mapping tool. The opportunity lies in creating a scalable solution that not only supports healthcare professionals in co-creating improved care pathways, but also demonstrates the added value of these interventions to healthcare institutions, policymakers, and other stakeholders.

The tool will ultimately contribute to better, more efficient, and patient-centered healthcare. The focus of this project is to create a concept for this tool. The validated concept should act as a concrete use case for further development in Dutch healthcare, aligning with the goals of the Integral Care Agreement (IZA).

The original project brief can be found in Appendix A. The goal of this project was as follows:

“Enable healthcare professionals to co-create (optimised) care pathways and improve patient care by designing and validating a prototype for a user-friendly, digital Metro Mapping tool that facilitates effective collaboration and decision-making in the healthcare sector.”

To ensure the research phase (first diamond) of this project was sufficiently narrow, three research questions were defined:

- **RQ1:** What are common practices in healthcare for designing and optimizing care pathways?
- **RQ2:** What is the current state of Metro Mapping as a methodology and what are key enablers, challenges, and barriers to its adoption?
- **RQ3:** What are important trends and developments in the healthcare sector?

For the design phase (second diamond), the following design question was defined:

- **RQ4:** How can healthcare professionals effectively optimise care pathways and improve patient care with the support of a digital (enabled) Metro Mapping tool?

An overview of these questions is visualised in Figure 2. The following subchapter outlines the approach and structure used to investigate these questions.

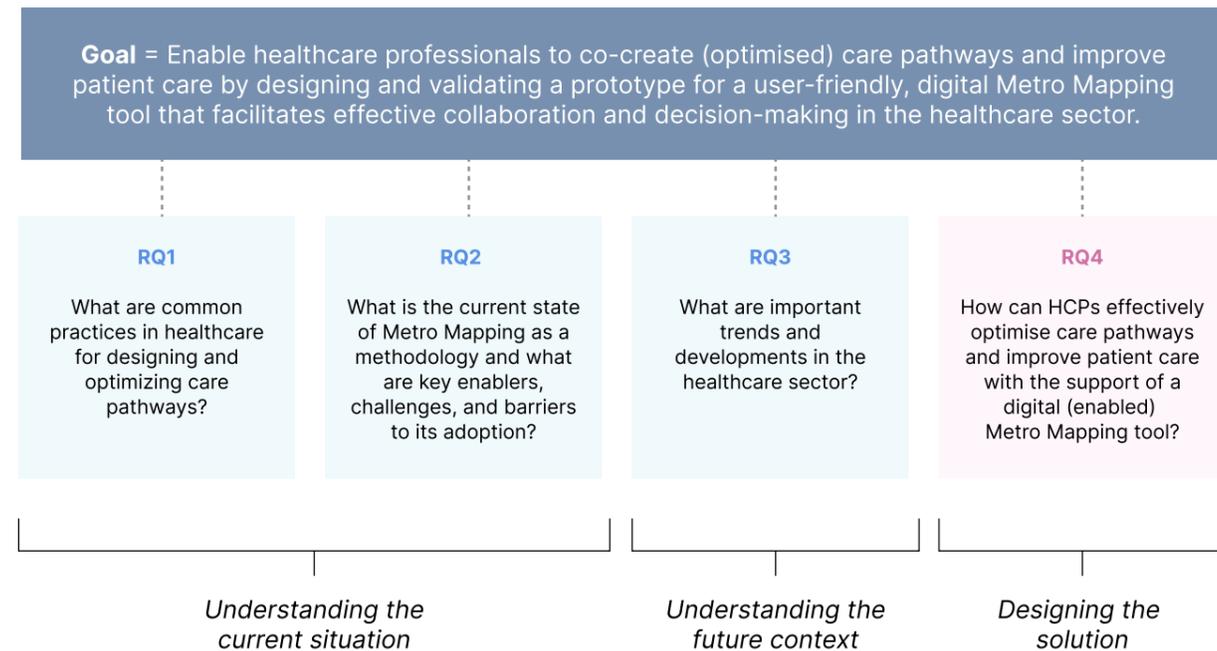


Figure 2: Overview of research goal and questions

1.2 Stakeholders

Online Department

My graduation internship takes place at Online Department, supervised by Rémon van den Bergh. Online Department is a digital design agency specialised in user experience (UX), service design, and digital strategy. They help organisations to create meaningful digital products and services that are not only functional and visually appealing, but also deeply grounded in user needs.

Furthermore, Online Department teaches organisations how to apply Metro Mapping. Their experience in both Metro Mapping and designing user-friendly, digital solutions makes them a perfect fit for this project.

TU Delft

This thesis is the final part of the Strategic Product Design master's programme at TU Delft, where I have learned to approach complex challenges with a human-centered and strategic design mindset.

This project is supervised by Bart Bluemink and Marieke Sonneveld of the Faculty of Industrial Design Engineering. They have provided guidance through their expertises in strategic design, healthcare, and academic research.

Metro Mapping Foundation

Although the Metro Mapping Foundation is not a direct stakeholder in this project, I felt it was important to acknowledge its relevance, especially given the close connections within my graduation context. One of my TU Delft supervisors, Bart Bluemink, is a board member of the foundation. That is also why I have positioned him between TU Delft and the Metro Mapping Foundation in Figure 3. Additionally, Online Department is involved in organizing events for the Metro Mapping Foundation.

The foundation plays an important role in keeping Metro Mapping an open and evolving methodology. Also, I want to emphasise the importance of building upon and contributing to a collective knowledge base, rather than developing isolated solutions. My hope is that this project not only benefits the chosen case for my thesis, but also aligns with and enriches the broader Metro Mapping ecosystem.

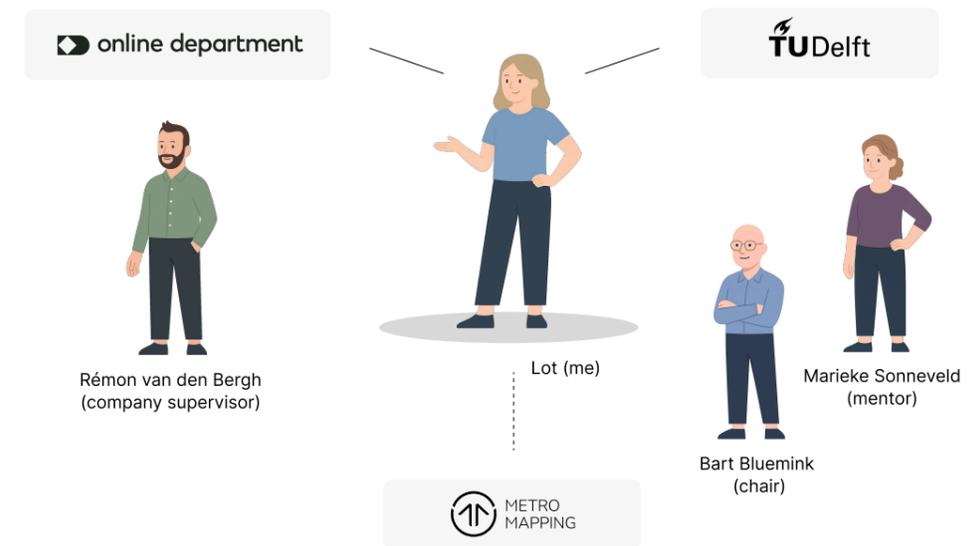


Figure 3: Stakeholder overview

1.3 Project approach

To structure this project, I used the Double Diamond framework as a guide. This framework was developed by the Design Council and divides the design process into four phases: Discover, Define, Develop, and Deliver (Design Council, 2019). Although the framework is visualised as a linear process, the reality of design is far more dynamic: design processes are iterative and rarely linear. Steps within and between the two diamonds are frequently revisited, refined, and repeated as new insights emerge. The approach is visualised in Figure 4.

1. Discover

I conducted research by combining desk research, in-depth interviews, and reviewing existing tools and methods. The aim was to build a solid understanding of the context in which this project takes place. As I entered this domain with little to zero prior knowledge, it was important for me to start wide. I then gradually narrowed my focus. I have visualised the various layers of my topic domain in Figure 3. You will find this visualisation at the start of Chapters 3, 4, and 5, defining on which layer it is focused.

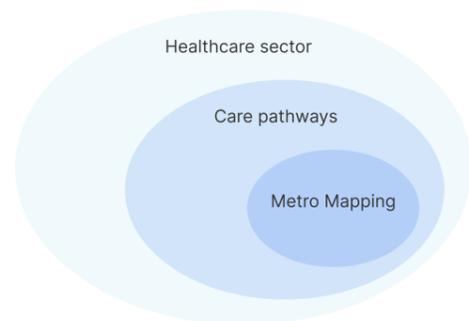


Figure 4: Different layers of the topic domain

First, I explored the healthcare context in general, looking at trends, ambitions (e.g. the Integral Care Agreement), and systemic challenges such as workforce shortages. From there, I zoomed in on care pathways. I explored how care pathways are designed and how they matter. This helped me understand the role of care pathways in improving coordination and quality of care.

After gaining this foundational understanding, I took a closer look at Metro Mapping: a service design method that can be used to visualise and co-create care pathways.

By taking this layered approach, I was able to define the scope of my project and identify where I could create the most impact. I found it important to take the broader context into account.

2. Define

In the Define phase, I started translating the broad insights from the Discovery phase into a clearer problem definition and design focus. To analyze the insights gathered on Metro Mapping, I used the Enablers, Challenges, Barriers model by Gartner and Côte (2023) as a structure (see Chapter 2.2 for further explanation of this model). This allowed me to identify key factors that influence the implementation of Metro Mapping.

In addition, I collected input on user needs and initial expectations regarding the functionalities and design of a Metro Mapping tool. This included insights from interviews, hospital visits, and discussions with domain experts. The Define phase concluded with a clearer understanding of:

- The most relevant needs to address
- The value a Metro Mapping tool could offer
- The vision and design principles that should guide the design process

Iterative approach

Although the Discover and Define phases are presented as distinct stages, in practice they overlapped a bit. While I was already clustering and synthesizing findings around certain topics, I was still gathering new information through interviews or desk research on others. This iterative approach enabled me to continuously refine my understanding and progressively narrow the scope.

3. Develop

These outcomes of the first diamond provided a strong foundation for ideation in the next phase. The transition to the second diamond started with the scoping phase, in which I translated the insights to the future vision, design principles, and design goal. I started doing ideation activities such as brainstorming, co-creation sessions, and sketching out initial concepts. I explored different functionalities, interface patterns, and ways the tool could support the key tasks identified earlier.

Rather than generating multiple divergent concepts, I chose to work towards one coherent tool vision. Throughout the process, I continuously gathered feedback from stakeholders through feedback sessions, for which I used mockups and clickable prototypes to communicate my ideas. This helped me iterate and refine the concept.

4. Deliver

Finally, I integrated all outcomes into a structured concept for a first version of the Metro Mapping tool. This includes a prioritised list of required features, supported user validation, as well as mock-ups and a prototype that demonstrate how these features could be integrated into a tool. This has been used during validation sessions with stakeholders.

Furthermore, I give concrete recommendations, additional feature ideas, and implementation considerations to guide future development of the Metro Mapping tool.

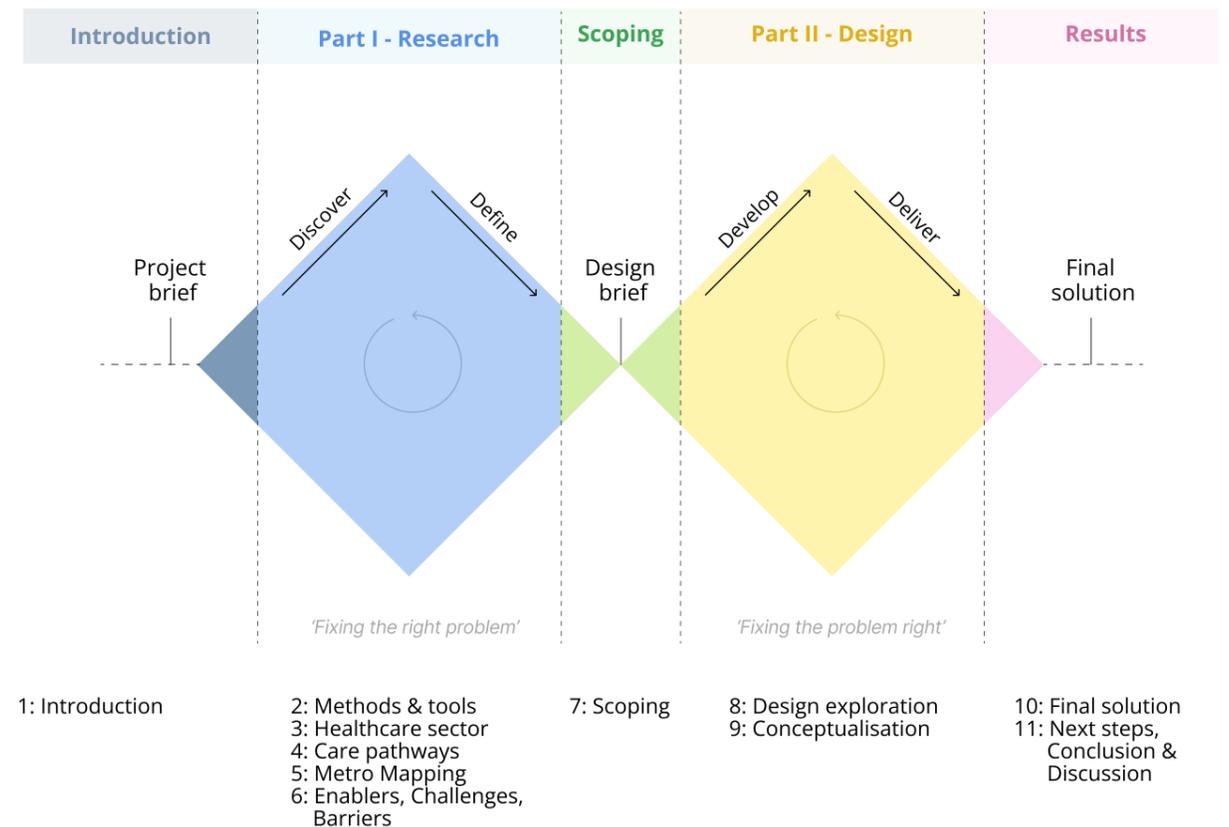


Figure 5: Double diamond approach

Methods & Tools

02

- 2.1 Service design
- 2.2 Used frameworks
- 2.3 Interviews

2.1 Service design

Service design applies design principles to think through the meaning and experience of services for people in a service system (Shaw et al., 2018). It is based on four principles, as described by Saco & Goncalves (2008):

- The aim of service design is to create services that are useful, desirable, effective, and efficient
- It has a human-centered approach, focusing on customer experience and the quality of service
- It has an holistic approach, considering strategic, system, process, and touch-point design decisions
- It is an iterative and systematic process

Service design in healthcare

While customer experience is key to success in all services, in a healthcare context the service being delivered also intends to achieve a more important goal: improving or even saving lives (Shaw et al., 2018).

These service design principles form the foundation of this project. They guide the way I explore user needs, engage stakeholders, and iteratively develop a final concept. Following a holistic approach, I aim to not only understand what needs to be designed, but also the broader context in which the tool should function. After all, even the most promising solution has little value if it cannot be implemented effectively.

Key takeaway 2.1

A human-centered, holistic, and iterative approach is essential. Not only to design a useful tool, but to make sure it fits within the complex healthcare system.

2.2 Used frameworks

2.2.1 Quadruple aim

In healthcare services, key outcomes are often measured against the Quadruple Aim framework, as introduced by Bodenheimer and Sinsky (2014). The four goals include:

1. Enhanced patient experience
2. Improved population health outcomes
3. Reducing healthcare costs
4. Improving the work life and satisfaction of healthcare professionals (HCPs)

Bodenheimer and Sinsky expanded the original Triple Aim model, as introduced by the Institute for Healthcare Improvement (Berwick et al., 2008), by adding a fourth dimension, recognizing that optimizing health system performance and achieving the original three aims would be impossible without addressing the well-being and satisfaction of the healthcare workforce (Figure 6). This holistic approach not only optimises care delivery but also ensures that the needs of patients and HCPs are addressed.

This fourth aim is particularly relevant to my project: by designing a user-friendly alternative for the current Metro Mapping tool in Visio (which doesn't fit the needs of HCPs), this project aims to reduce frustration, support collaboration, and contribute to a more satisfying working experience.

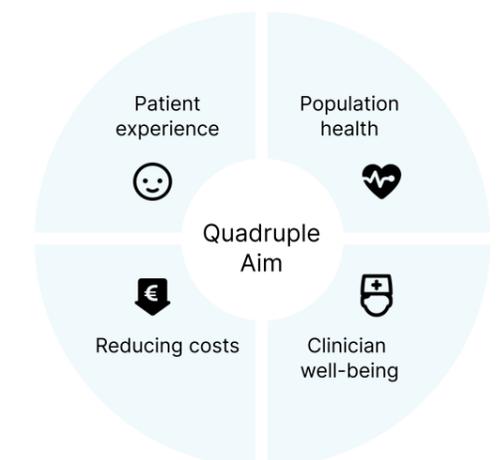


Figure 6: The Quadruple Aim framework (Bodenheimer & Sinsky, 2014)

This chapter outlines how service design principles, interviews, and relevant theoretical frameworks have been applied to guide the research phase of this project. It explores how design can support the adoption and implementation of Metro Mapping in healthcare, and introduces the key models that structure the research. These frameworks are briefly introduced here and will be further discussed in the corresponding chapters.

2.2.2 Tool+Team+Routine Framework

Shaw et al. (2018) emphasise that it is not enough to simply implement digital technologies, such as an app or digital system, in healthcare. Innovation in digital care requires that we also look closely at service design, or how to better design care around that technology for patients and caregivers. Digital innovation in healthcare is not just about new technology: it's about improving the entire care process, with technology being a tool to make care smarter and more patient-friendly.

For digital solutions to truly improve care, it must be considered whether they:

- Are easy to use
- Fit into the collaborative structure and workflows of healthcare teams
- Connect to existing processes

Many digital healthcare innovations fail because there is no clear value proposition. Shaw et al. mention Value Proposition Design (VPD) as a method for establishing actual value of a new tool for the different people who interact with it.

VPD encourages to introduce modifications where feasible to make the technology even more valuable to their needs, emphasizing the fourth service design principle: working iteratively.

When a new tool (generally a technology) is introduced in healthcare, it's never simply about the tool itself: it's about the new service. That service comes to life through the interaction between the tool, the team who uses it, and the routines built around it.

This framework, as shown in Figure 7, is highly relevant to my project. While the goal is to design an improved, digital version of Metro Mapping, success depends on more than just improving the methodology itself. The solution must also support the teams who work with it and fit into their daily routines. By considering all three elements, this project aims to create a solution that is not only usable, but also adoptable and valuable in real-world healthcare settings.

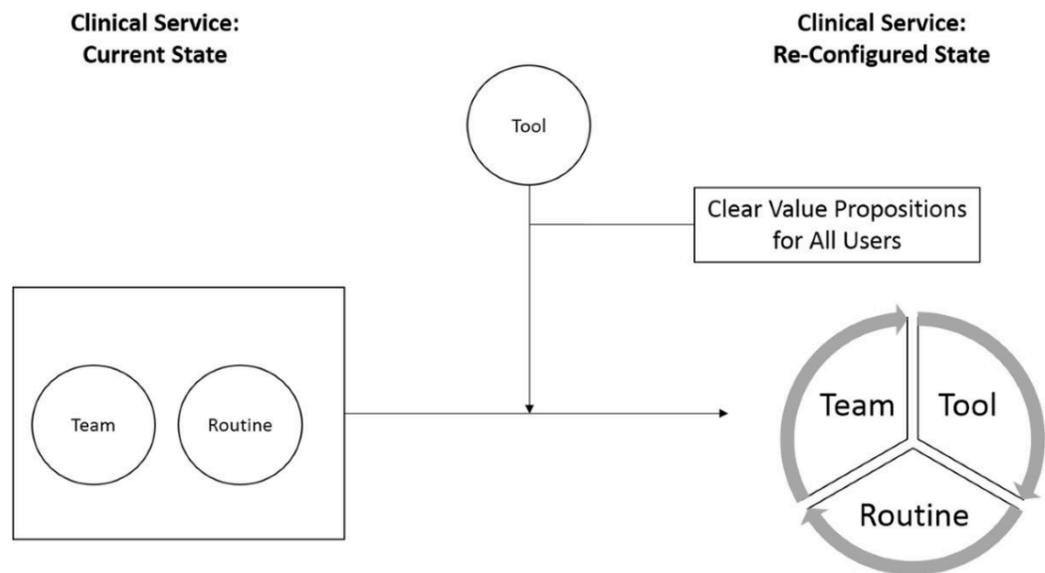


Figure 7: Tool+Team+Routine framework (Shaw et al., 2018)

Why a tool alone is not enough

We now understand that expecting a tool to directly contribute to the Quadruple Aim (as illustrated in Figure 9) is too simplistic. As emphasised by Shaw et al. (2018), the success of any digital innovation in healthcare depends not only on the tool itself, but also on how it is implemented within a functioning team and embedded into existing daily routines.

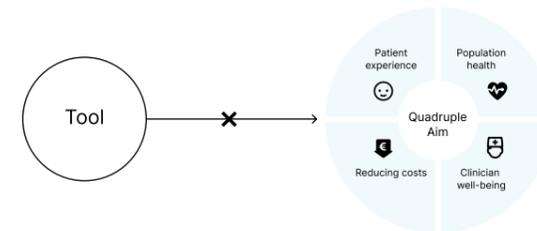


Figure 9: A tool doesn't just contribute to the Quadruple Aim by itself

A tool will only have meaningful impact if:

- The **team** understands and values its purpose
- It fits seamlessly into the **routines** of the team

To illustrate this, I developed an integrated framework (Figure 10) that expands on Shaw et al.'s Tool+Team+Routine model by linking it to the desired outcomes of the Quadruple Aim. The model acts as an 'implementation engine': if all parts of the engine are aligned and functioning, the system can start generating real impact (Quadruple Aim). It visualises how aligning tools, teams, and routines around clear user value propositions (via the Value Proposition Canvas) can drive meaningful impact in healthcare.

The idea is simple but critical: if the first gear isn't turning — because the tool doesn't fit the workflow, the team isn't engaged, or routines aren't adapted — then the second gear can't move either. In other words: impact can't be achieved without effective implementation.

This integrated framework shows that it's not just about designing a usable tool, but it also needs to work and get supported in practice. It bridges the gap between design and impact. I will refer back to it in the chapter about implementation.

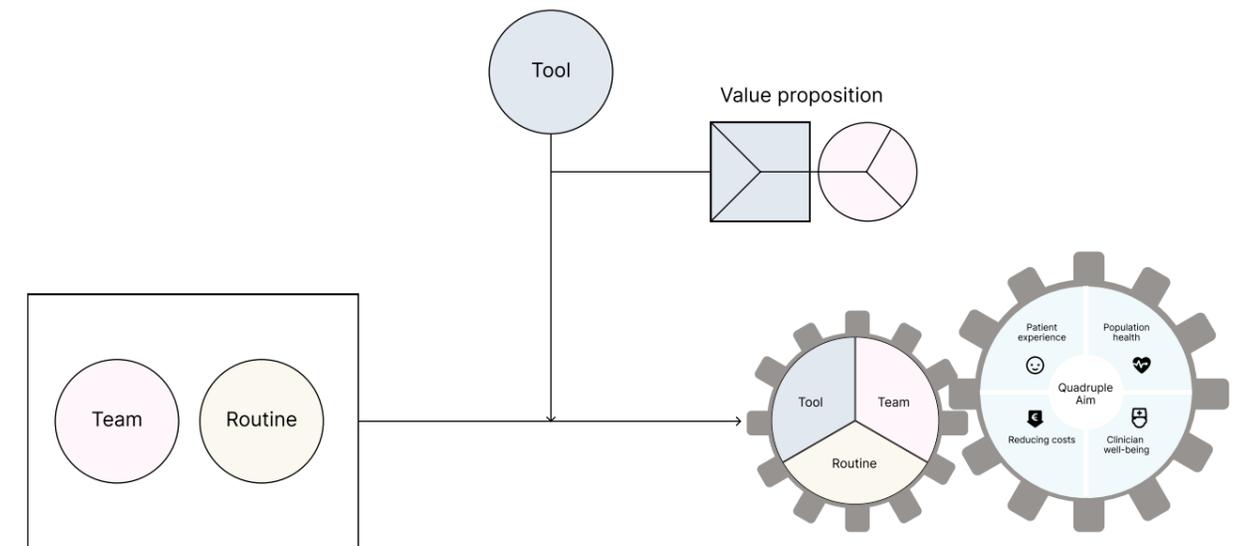


Figure 10: Integrated framework idea combining the Tool+Team+Routine framework, the Quadruple Aim, and the Value Proposition Canvas

2.2.3 Enablers, Challenges and Barriers model

To analyze the current implementation context of Metro Mapping, I used the conceptual model developed by Gartner and Côté (2023), as shown in Figure 11. This analysis can be found in Chapter 6. The model identifies key enablers, challenges, and barriers that influence the successful implementation of innovations within care pathways. It was developed based on qualitative research into a variety of technological, clinical, organisational, and social innovations in healthcare.

Although the model was not created specifically for Metro Mapping, it offers a relevant lens to assess the factors that either support or hinder its adoption. The framework emphasises that implementing innovation in healthcare is rarely just a technical or procedural challenge: it is influenced by professional culture, resource availability, leadership, and the ability to continuously adapt.

In this project, I applied the model to structure findings from literature and interviews. It helped me to identify:

- Which enablers are already present in the current context
- What challenges need to be addressed to move forward
- Which barriers might block the sustainable integration of Metro Mapping in daily practice

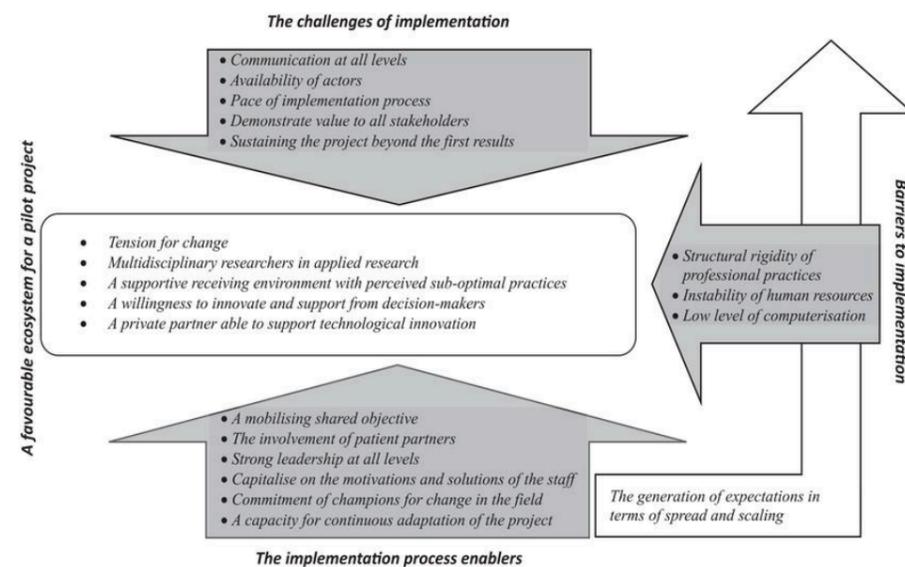


Figure 11: Conceptual model of the enablers, challenges and barriers to implementing innovations in care pathways (Gartner & Côté, 2023).

This structured analysis supported a more strategic understanding of the implementation landscape and supported directly into answering RQ2: “What is the current state of Metro Mapping as a methodology, and what are key enablers, challenges, and barriers to its adoption?”

2.2.4 The Common Eye model

Metro Mapping is a co-creative method bringing together diverse stakeholders to design care pathways together. In the case of transmural care, this collaboration even spans across multiple organisations, such as hospitals, general practices, and rehabilitation centers. These organisations often operate under different conditions and priorities, making a structured collaboration crucial.

To better understand what makes such collaboration effective, I applied the Common Eye model (Figure 12) developed by Kaats and Opheij (2012). This model was recommended to me during an interview with Dominiek Rutters: a healthcare expert with a background in communication sciences and a lot of leadership experience in the healthcare sector. She was director of a regional organisation for general practitioner care.



Figure 12: The Common Eye model (Kaats & Opheij, 2012)

The model gives five interdependent preconditions for successful collaboration:

- **Ambition:** Is there a shared and meaningful goal that all partners are committed to?
- **Interests:** Are the mutual and individual interests of the partners aligned?
- **Relationships:** Is there trust, openness, and willingness to engage in dialogue?
- **Organisation:** Are governance structures, roles, and decision-making processes clearly defined?
- **Process:** Are there agreements on how collaboration is structured, paced, and evaluated?

From Rutter’s strategic perspective, she emphasised that a shared ambition among all involved parties is essential as a starting point. Without a clear, common goal, collaboration won’t be successful.

The Common Eye model is particularly relevant for Metro Mapping, as the method requires different actors to work together not only during the mapping process itself, but also to implement and maintain the outcomes. Without strong collaboration and attention to these five conditions, Metro Mapping risks becoming a ‘one-off exercise’ instead of a sustainable improvement tool.

Connection to previous models

The Common Eye model ties in well with the Tool+Team+Routine framework by Shaw et al. (2018), which highlights that a tool alone isn’t enough. For it to work in practice, it has to be used by real teams and fit into their daily routines. The Common Eye model helps break down what those teams and routines need in order to collaborate effectively.

In addition, its five conditions also relate closely to the goals of the Quadruple Aim. A shared ambition and good working relationships can help improve the patient experience and outcomes, while clear processes and structures can reduce friction and make work more efficient for professionals.

By using the Common Eye model alongside the implementation and impact frameworks discussed earlier, I was able to take a more holistic view of what makes Metro Mapping not only usable, but also workable in practice.

Key takeaways 2.2

This project combines impact-, value-, and collaboration-oriented frameworks:

- **Quadruple Aim framework:** used to evaluate the broader impact on patients, HCPs, costs, and population health
- **Tool+Task+Routine framework:** used to explore how the tool should fit into daily routines and team workflows
- **Enablers, Challenges and Barriers:** helped identify what supports or hinders the adoption of Metro Mapping in practice
- **Common Eye model:** used to understand how to align partners around a shared goal and create sustainable collaboration

These perspectives help to address both what the tool should do, and also how it can succeed in practice.

2.3 Interviews

Interview methodology

For this research, I have conducted multiple semi-structured in-depth interviews to gain a deeper understanding of care pathways and the current use of Metro Mapping. This method was chosen because it offers a balance between structure and flexibility: it allowed me to prepare guiding questions, while also creating space for interviewees to share their own stories and perspectives beyond the predefined questions (Adams, 2015).

Each interview lasted approximately 45 to 80 minutes, depending on the availability and preferences of the participants. Most respondents were very open and enthusiastic about sharing their experiences, often extending the conversation beyond the scheduled time. A semi-structured approach was especially suitable for this research because it allowed me to compare responses across participants while still tailoring the interview to each specific context and role. This was important given the variety of perspectives involved, which is further explained in the 'participants' section.

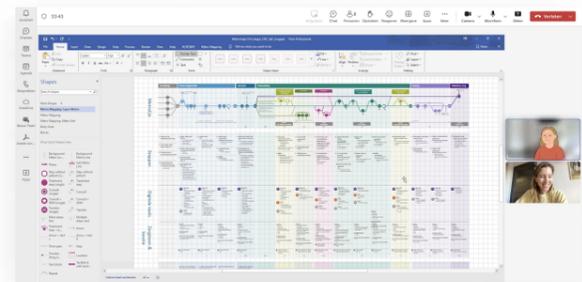


Figure 13: Online interview

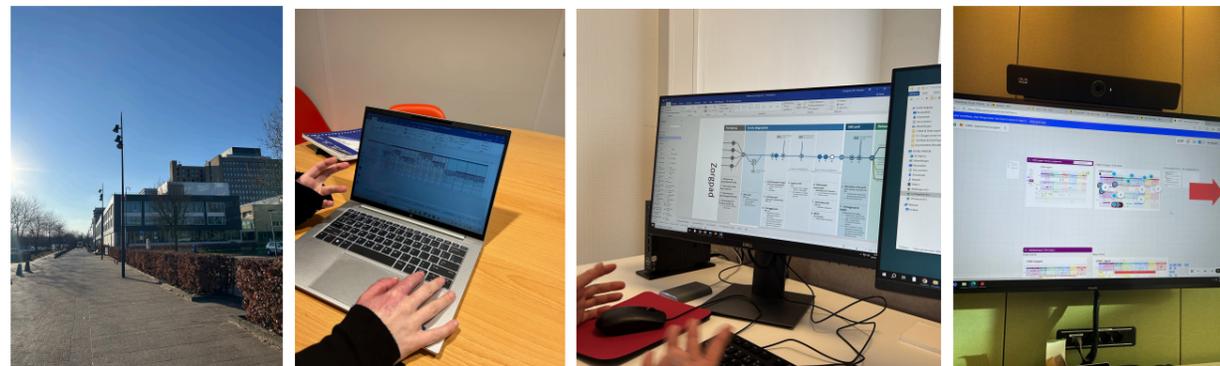


Figure 14: Location visits (pictures taken at the Catharina Hospital, Erasmus, and the Scheper Hospital)

Context

Besides online interviews (Figure 13), I tried to conduct most interviews in person, because that could provide richer conversations and allowed the participants to show how they worked in their own environment.

I visited a range of different institutions (Figure 14), such as the Scheper hospital of Treant in Emmen, the Catharina Hospital in Eindhoven, Basalt rehabilitation center in The Hague, Auris audiological center in Rotterdam, and Erasmus University. This offered me the opportunity to explore how care pathways and/or Metro Maps are used across different types of care.

Process

The semi-structured interviews followed several key steps, inspired by standard qualitative research practice (e.g. Kallio et al., 2016):

1. Developing an interview guide based on the research questions and early desk research
2. Recruiting participants through snowball sampling and expert connections
3. Conducting interviews in a conversational style while ensuring core topics were covered
4. Audio-recording and summarizing key insights after each session
5. Thematic analysis to identify trends and/or enablers, challenges, and barriers related to Metro Mapping

Participants

In total, I interviewed 14 people with different roles and backgrounds relevant to my project scope. The group was diverse, which helped me gain insights from various angles of the healthcare system. The participants included:

- **Healthcare staff**, such as a general practitioner, quality & safety advisors, and care pathway program managers
- **Researchers**, including postdoctoral researchers and other academics working on topics such as Metro Mapping and digital innovation in healthcare.
- **Design and innovation experts**, such as service designers, innovation advisors, and product managers
- **Organisational leaders**, including an executive director with expertise in regional collaboration in primary care

An overview of all participants is provided in Table 1. I will refer to them as P+[number], for example 'P4'.

	Profession / background	Organisation	Interview date	Contact
P1	Product manager; Visionary thinker within healthcare	Life Mobility, Van Zorg Verzekerd	14-02-2025 & 14-03-2025	Online
P2	General practitioner	Praktijk Botman & Bylard	17-02-2025	In person
P3	Service designer; Metro Mapping practitioner	TU Delft, Metro Mapping Foundation	05-03-2025	Online
P4	Quality & Safety advisor	Treant	06-03-2025	In person
P5	Assistant professor Digital Innovation; Action researcher	Erasmus School of Health Policy & Management	14-03-2025	Online
P6	Executive director; Driving force behind regional healthcare collaboration	Cohaesie BV	17-03-2025	Online
P7	Chair of the Quality & Safety department	Basalt Rehabilitation	18-03-2025	In person
P8	Postdoctoral researcher PhD within VBHC	Erasmus School of Health Policy & Management	18-03-2025	In person
P9	Innovation advisor	Auris Audiology Center Rotterdam	18-03-2025	In person
P10	Care pathway designer	Catharina Hospital Eindhoven	19-03-2025	In person
P11	Program manager care pathways	Radboud University Medical Center	26-03-2025	Online
P12	Quality & Safety advisor	Rehabilitation center	01-04-2025	Online
P13	Program manager elderly care	Delta dokters	01-04-2025	Online
P14	Psychologist	GGZ inGeest	02-04-2025	In person

Table 1: Participant overview

Interview guide

Although each interview was tailored to the role and background of the participant, the overall structure remained largely consistent. The interviews typically followed the following flow:

- **Introduction:** breaking the ice, introducing the project and goal of the interview, explaining the consent form
- **Background:** discussing the background of the participant and their role within the organisation
- **Care pathways** (if applicable): how they are currently designed, documented, and used within the organisation
- **Metro Mapping** (if applicable): the participant's experience with the method, perceived value, weaknesses, and implementation challenges
- **Future outlook:** how they envision improvements in care pathway tooling and/or Metro Mapping, and identifying future trends
- **Closing:** thanking the participant, asking for suggestions for other potential interviewees (snowballing)

In addition to this basic structure, I prepared a list of potential questions for each theme to guide the conversation. Depending on the participant's expertise, certain themes were emphasised more than others. The basic interview guide can be found in Appendix A.

General remarks

Because the interviews were conducted throughout the entire research phase and provided insights that are relevant across multiple chapters of this thesis, I used this section to give a general introduction to the interview approach and methodology. In the following chapters, specific findings from the interviews will be discussed in more detail and placed within the broader context of the research.

During the design phase, I reached out to various participants again to invite them for feedback and validation sessions.

Key takeaways 2.3

- 14 semi-structured interviews were conducted with a large variety of stakeholders.
- In the design phase, some participants were reinvited for feedback and/or validation sessions.

Context Exploration

of the healthcare sector

03

- 3.1 Context analysis
- 3.2 Integral Care Agreement (IZA)
- 3.3 Digitalisation in healthcare
- 3.4 Interview insights

This chapter provides a broader understanding of the current developments in the Dutch healthcare sector, covering the first 'layer' of the topic domain, as explained in Chapter 1.3. It outlines key trends, challenges, and opportunities that shape the context in which care pathways, and tools like Metro Mapping, are developed and implemented. While this chapter does not go into extensive detail, as it falls outside the main scope of this project, it is important to first consider the bigger picture and explore the broader healthcare landscape.



3.1 Context analysis

To understand the challenges and opportunities for improving care pathways, it is essential to first explore the broader context of the Dutch healthcare system. Healthcare organisations are dealing with several urgent challenges, which increases the pressure to improve how care is delivered. I did a DESTEP analysis to structure and summarise the most important trends and developments. This model explores six external forces: Demographic, Economic, Social/Cultural, Technological, Environmental, and Political (Frue, 2022). Below, I will briefly discuss the most important insights per external force. The full analysis can be found in Appendix B.

Demographic

The Dutch population is aging rapidly, which increases the demand for healthcare services (Rijksoverheid, 2024). This trend is accompanied by a rise in chronic illnesses and a growing pressure on the healthcare workforce, which is already facing significant shortages.

Economic

Rising costs and budget constraints push healthcare institutions to deliver care more efficiently. This creates a growing interest in cost-effective solutions, such as digital health technologies and standardised care pathways. The Integral Care Agreement (IZA) also emphasises "appropriate care" (passende zorg), which includes streamlining processes to avoid unnecessary treatments (Rijksoverheid, 2023).

Social/Cultural

Patients expect more personalised and accessible care. There is a cultural shift toward shared decision-making and collaboration across care domains. This also affects how new tools, like Metro Mapping, are received and integrated into practice. Acceptance depends not only on usability but also on how well these tools support meaningful dialogue between professionals and patients.

Technological

Technological developments are accelerating, including the rise of e-health, AI, and real-time monitoring. At the same time, integration with existing systems (e.g. EHRs) remains a challenge. The success of innovations often depends on how well such a fit is.

Environmental

Sustainability is becoming more important in healthcare innovation. There is growing awareness of the environmental impact of digital infrastructure, such as data centers, but also of the potential for digital tools to reduce unnecessary physical appointments, travel, and waste.

Political

National policies are increasingly steering toward digitalisation, prevention, and data-driven care. The IZA and JZOJP set the direction for the coming years, while other policies introduce stricter regulations on data privacy and information exchange. These factors directly impact how care innovations can be developed and implemented. In the next section (Chapter 3.2), the IZA and JZOJP will be further discussed.

Key takeaways 3.1

The Dutch healthcare system is under pressure from several directions:

- **Demographic:** ageing population increases demand
- **Economic:** cost-efficiency is needed to deal with shortages
- **Social/cultural:** care must be more accessible, shared, and personalised
- **Technological:** digital tools grow fast, but must fit daily practice
- **Environmental:** sustainability plays a growing role in care logistics
- **Political:** national policies such as the IZA shape the direction for care innovation

3.2 Integral Care Agreement (IZA)

As mentioned in Chapter 1.1, the Integral Healthcare Agreement (IZA) is a national agreement between the Dutch government and many healthcare stakeholders. It aims to make the healthcare system more future-proof by promoting collaboration and focusing on value. Here, I will give a brief overview of this agreement, based on the IZA document as provided by Ministerie van Volksgezondheid, Welzijn, en Sport (2022).

Goals and themes

The IZA focuses on three main goals:

- Keeping care *accessible*
- Keeping care of *good quality*
- Keeping care *affordable*

To achieve this, the IZA encourages parties in the healthcare field to work together across domains, such as hospitals, general practitioners, and municipalities. A central concept is "**appropriate care**" (in Dutch: *passende zorg*), which is care that adds real value for the patient, avoids unnecessary treatments, and makes smart use of people and resources.

To turn these goals into action, the IZA outlines eight concrete themes (see Appendix C for the full list). Several of these are especially relevant to this project:

- **Value-driven care**
Care should focus on outcomes that matter to the patient. HCPs are encouraged to phase out ineffective care and continuously improve.
- **Regional collaboration**
Providers, municipalities, and insurers are expected to collaborate more closely through joint regional plans and improved coordination.
- **Better integrated care for people with complex or long-term needs**
Better coordination between mental health, primary care, and the social domain is needed. Early, digital, and blended care approaches are promoted.
- **Digitalisation and data exchange**
By 2025, digital access to personal health records should be standard. Hybrid care is encouraged: digital when possible, in-person when needed.

The right care in the right place

A key policy direction in the IZA is "The Right Care in the Right Place" ("Juiste Zorg op de Juiste Plek", JZOJP). Introduced in 2018 and now reinforced, it aims to shift care away from hospitals toward more appropriate, often local or digital, settings (RVS, 2018; Ministerie van VWS, 2022). The idea is simple: not all care needs to happen in a hospital. Bringing care closer to home can make it more efficient, sustainable, and patient-friendly.

This policy is closely linked to the concept of appropriate care, which focuses on avoiding over-treatment and tailoring care to what truly benefits the patient. It also reflects growing pressure on the healthcare system and the need to innovate.

For this project, the JZOJP vision is very relevant. Redesigning care pathways and identifying what care should happen where, when, and by whom, is a crucial step in making this vision a reality. Metro Mapping can support this by helping professionals collaboratively rethink and reorganise care.

Relevance of the IZA in this project

Several IZA themes and principles directly align with care pathway design: value-driven care, regional collaboration, and better integration of services all highlight the need for structured, well-coordinated, and patient-centered care processes. Care pathways help achieve this by clearly defining roles, timing, and responsibilities across organisations.

The IZA also emphasises the importance of digitalisation and hybrid care becoming the new norm. This shift highlights the need for tools for clearly structuring and communicating care pathways. Chapter 3.3 will further explore the role of digital transformation in healthcare.

Key takeaway 3.2

The IZA is a key policy direction that highlights the urgency for tools like Metro Mapping. It aligns with ongoing trends in healthcare, including digital transformation, cross-organisational collaboration, and patient-centered care.

3.3 Digitalisation in healthcare

Digitalisation is one of the key enablers of future-proof healthcare, as also emphasised in the Integral Care Agreement (IZA). In this section, I briefly outline the most relevant developments and challenges. A more detailed explanation can be found in Appendix D (e.g. Baelde et al., 2023; Rijksoverheid, 2023; Davey, 2025).

- **Hybrid care** is becoming the new standard, combining physical and digital care depending on what is most appropriate for the patient.
- **Data exchange and interoperability** remain major challenges, despite legislative efforts like the Wegiz to enforce electronic data sharing.
- **Personal Health Environments** (PGOs) are being developed to give patients more control over their own health information.
- **AI and decision support tools** are emerging rapidly, offering new possibilities but also raising ethical and practical concerns.
- **Cybersecurity and privacy** are increasingly important as more sensitive health data is handled digitally.
- **Digital literacy** is still a barrier for both patients and professionals, especially in terms of accessibility, usability, and inclusivity.

Financial benefits of digitalisation

Another reason why digitalisation is high on the agenda is its economic potential. A study by SiRM (Baelde et al., 2023), commissioned by the Dutch Ministry of Health, estimates that digital care could lead to a net financial gain of at least **€1.3 billion by 2028**. This gain comes mainly from productivity improvements, such as fewer in-person visits (Figure 15). In addition to financial savings, productivity gains through digital care can also help reduce workforce shortages (Figure 16).



Figure 15: Estimated annual revenues, costs, and investments of digital and hybrid care (Baelde et al., 2023)

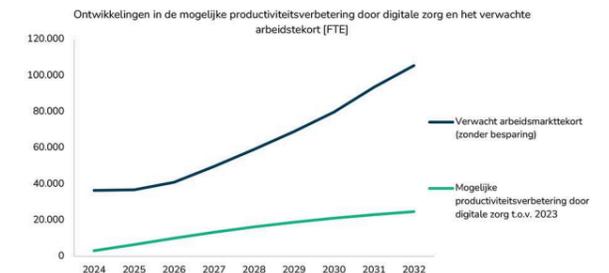


Figure 16: Estimated potential additional productivity gains from appropriate use of digital care (Baelde et al., 2023).

This study emphasises the opportunity that lies in digitalisation in healthcare. A first step could be to establish clear care pathways, so healthcare teams gain a clear and shared understanding of the current situation and can identify opportunities for improvement. As discussed in the next chapter, Metro Mapping can support this by making processes more visible, structured, and collaborative.

Key takeaway 3.3

Digitalisation offers great opportunities to improve the quality, accessibility, and efficiency of care – but only when systems can communicate, users feel supported, and privacy is protected.

3.4 Interview insights

As described in Chapter 2.3, the qualitative data for this research was gathered from 14 semi-structured interviews. A complete overview of the interview insights, categorised per research question and summarised per participant, can be found in Appendix E.

In this chapter, I will focus on the key insights related specifically to participants' future outlook on the healthcare system. This will support me in answering **RQ3: What are important trends and developments in the healthcare sector?** Other interview insights will be discussed in later chapters in relation to specific research questions.

I have divided the main insights into five themes. For each, I give a short summary, followed by some key insights and quotes.

1. Collaboration & systemic change

Participants emphasised the need for a more integrated healthcare system. To tackle rising complexity and fragmentation, organisations will have to collaborate across disciplines, regions, and domains. Several pointed to care pathways as a tool to support this systemic shift.

- Policies like the IZA support this direction by promoting regional planning and cooperation.
- There is growing pressure to think and act more like a connected system.
- Care pathways can be used to align roles and make complex collaborations manageable.

"You need to get very clear: who does what, when." - P11

2. Innovation & digital transformation

Innovation is no longer seen as optional, but necessary, especially to deal with rising pressure on the system. Participants mentioned that care is becoming increasingly data-driven and supported by digital technologies. Hybrid care was widely expected to become the new standard.

- Digital tools are needed to work more efficiently and improve decision-making.
- There's a growing need for user-friendly digital tools that don't increase administrative burden.

"E-health is going to be a big part of healthcare and will play a role in every care pathway." - P6

"I think hybrid is going to be the standard." - P10

3. Care pathways

Care pathways were described as essential to structure care across organisational boundaries, clarify responsibilities, and translate vision into action. Several participants linked this directly to the IZA. There is a belief that more care will be organised through standardised pathways.

- The IZA is creating a renewed urgency to (re)design care processes.
- Pathways support onboarding and knowledge sharing.

"I envision a future where 80% of care is in care pathways and 20% remains custom work" - P12

"Care pathways are also useful for onboarding. At some point, people need to see a protocol that says: this is how we care for this group." - P13

4. Patient-centeredness

A shift toward more personalised, patient-centered care is clearly underway. Patients are more informed, more involved, and expect clarity. To meet this expectation, healthcare solutions (including care pathways) must be designed to be more intuitive and adaptable to individual needs.

- Stronger involvement of patients in navigating their care journey.
- Demand for user-friendly tools, both for patients and HPCs.

"The focus on the patient will remain a central theme." - P4

5. Challenges in healthcare

Finally, many participants mentioned the structural challenges that healthcare faces: workforce shortages, growing care demands, and increasing complexity. As a result, there's strong pressure to work more efficiently. This makes clarity, efficiency, and smart digital support more important than ever. Digital tools and care pathways are only helpful if they reduce complexity and relieve pressure, not add to it.

- Need for faster, more efficient workflows due to staff shortages.
- Care pathways help define responsibilities and reduce duplication.

"You need to work more efficiently and faster. That's just the reality with the current staff shortages." - P7

Key takeaways 3.4

Based on interview insights, the future of healthcare is likely to be:

- More **collaborative** across organisations and domains
- Increasingly **hybrid** and digital
- Structured through clearly defined **care pathways**
- More **patient-centered** and personalised
- Driven by a **need for efficiency** and smart use of resources

These insights reflect many of the trends described earlier in this chapter and support the idea that the healthcare system is in transition: towards more integrated, digital, and people-centered care.

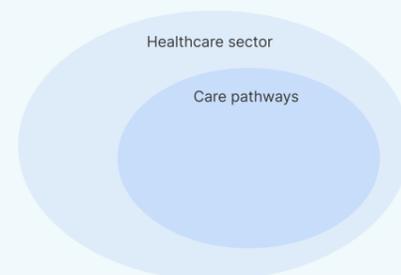
Care Pathways

04

- 4.1 Definition of a care pathway
- 4.2 Why care pathways are important
- 4.3 The process of designing care pathways
- 4.4 Types of care pathways
- 4.5 Interview insights

Metro Mapping is helpful in visualizing and optimizing care pathways, but what exactly is a care pathway? Why are care pathways important? And what are current tools and best practices? It is important to gain a deep understanding of this, which will be done through this chapter.

You might notice that care is often mentioned in terms of hospital care. This is because care pathways are mainly used within a hospital context and most literature covers this. However, I will also discuss care pathways in an outside-hospitals setting, for instance based on interviews.



4.1 Introduction to care pathways

Definition of a care pathway
In 'Het Zorgpadenboek' by Huiskes and Schrijvers (2012), the definition and characteristics of a care pathway are thoroughly discussed. In 2006, Vanhaecht et al. defined the term 'care pathway' as follows:

"A care pathway is a complex intervention for the mutual decision making and organisation of care processes for a well-defined group of patients during a well-defined period.

Characteristics of care pathways include:

- An explicit statement of the **goals and key elements of care** based on evidence, best practice, and patients' expectations and their characteristics
- The facilitation of the **communication** among the team members and with patients and families
- The coordination of the care process by **coordinating the roles and sequencing** the activities of the multidisciplinary care team, patients and their relatives;
- The documentation, monitoring, and evaluation of variances and outcomes;
- The identification of the appropriate **resources**

The aim of a care pathway is to enhance the quality of care across the continuum by improving risk-adjusted patient outcomes, promoting patient safety, increasing patient satisfaction, and optimizing the use of resources."

In my research, I will use this definition of a care pathway as a guide, as I found this definition to be used most in the literature that I have read. It is also used by the Metro Mapping Foundation.

One of the key sources for this chapter was Reinalda Schaaphok, Quality & Safety advisor at Treant, a Dutch healthcare organization that operates several hospitals and care centers. During an on-site interview and hospital visit, she shared valuable insights into how care pathways are developed and used within Treant. Her practical examples and reflections have helped shape much of the content in this chapter, and she is therefore mentioned several times throughout.

Care pathways as process innovations

Care pathways have their roots in management methodologies such as the Critical Path Method (CPM) and Lean Six Sigma. A more detailed history and theoretical background can be found in Appendix F.

According to Huiskes and Schrijvers (2012), care pathways are process innovations that focus on improving the organisation of healthcare processes. Process innovations are different from product innovations (e.g. new, scientifically proven treatments or equipment) or system innovations (e.g. changes in legislation, funding and legal responsibilities). They note that product innovations sometimes can lead to process innovations, for instance when a new medicine enables a new kind of care.

Care pathways in the 'bigger picture'

The concept of a care pathway is one of the concepts from the field of Health Operations Management (Health OM), which Vissers and Beech (2005) describe as "the analysis, design, planning and control of all the steps necessary to provide a service to a client". They describe five interconnected levels of Health OM, ranging from individual patient planning to long-term strategic decisions. Care pathways sit at level 2, focusing on patient group planning and coordination.

Understanding this layered system helps place care pathways in context and supports more integrated improvements across teams and resources. A full explanation of the five levels, including my visualisation, is included in Appendix F.

Care pathway vs. patient journey

People often confuse care pathways with patient journeys, as they both visualise a care process. It is important to make a distinction between these two, as they have different characteristics and goals (Schrijvers et al., 2012; Burke, 2023). This was also pointed out by some interviewees.

Care pathway

- Created from a HCP perspective
- Aligns members of teams
- Organizing care for a well defined group of patients
- Improve the quality of care, reduce risks, optimise patient safety and improve patient experience

Patient journey

- Created from a patient perspective
- Gives insight in emotions, barriers and dilemmas of patients
- It's not detailed enough for HCPs to work with; it's more a global overview that patients can oversee
- Room for personal care

"A care pathway is a syndrome for a defined group of patients. It's not for 100%, but about 80% of patients." - Schaaphok (Quality & Safety advisor at Treant)

What does a care pathway look like?

Care pathways can take many forms: from a report of 30 pages to one-page visuals. Flowcharts are common (Figure 17), but there is no standard format. In essence, care pathways describe who does what, when, and where in the patient's care process.

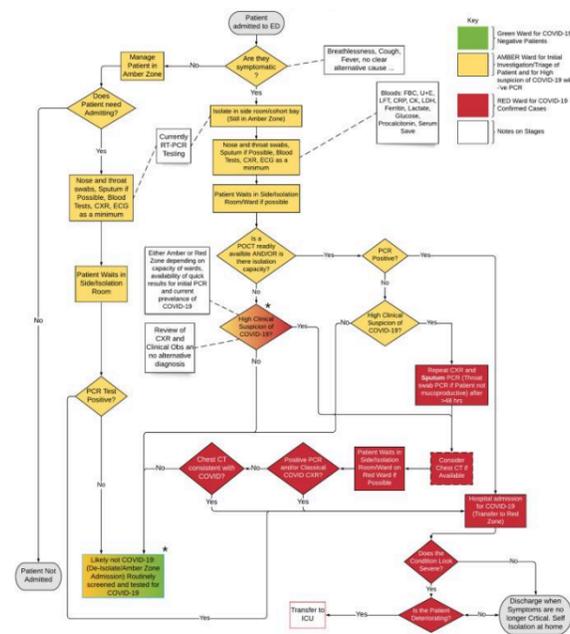


Figure 17: Example of a care pathway (Hicks et al., 2021)

Not all care can be captured in a standard pathway. As Sermeus and Rosendal (2002) note, some patients fall outside well-defined groups or timelines, especially in cases of comorbidity or rare diseases. That's why care pathways are often designed for approximately 80% of patients with a certain condition.

Some pathways follow a fixed timeline (e.g. surgery), while others are more phase-based (e.g. oncology). In this project, I use the term care pathway to refer to generalised care processes for a defined group of patients, while acknowledging individual variation.

Key takeaways 3.2

- Care pathways define who does what, when. This provides structure for healthcare professionals.
- Care pathways contribute to making care more consistent, efficient, and safer. This is important from a quality & safety perspective.

4.2 Why care pathways are important

Care pathways help tackle major challenges in modern healthcare, such as rising costs and fragmented delivery, by clarifying who does what, when, and where. This reduces variation and promotes more structured, coordinated care. Schaaphok illustrated why care pathways are important by this example:

"Imagine, someone arrives at the emergency department with chest pain. Without established care pathways, the medical team would have to make decisions on the spot, leading to a disorganised and inefficient approach. This could result in forgetting important steps, which is risky, but it could also lead to asking for the same information multiple times, which is inefficient." - Schaaphok (Quality & Safety advisor)

Theoretical advantages and disadvantages

As discussed earlier, care pathways have its roots in management theories like CPM and Lean Six Sigma. According to Schrijvers et al. (2012), these approaches show that pathways can help streamline care delivery, reduce waste, and improve coordination by clarifying roles and processes.

At the same time, they highlight potential risks, such as less freedom for HCPs to deviate from the standard path, which must be considered when applying care pathways in practice. A full overview of these advantages and disadvantages is provided in Appendix F. Although this is not the central focus of this thesis, it helps to understand the broader implications of care pathways.

Goal of care pathways

During an in-depth interview with Peter van Voorst, program manager care pathways at Radboud University Medical Center, he shared a visual illustrating the strategic goals of implementing care pathways (Appendix G). At the core lies the ambition to improve both health outcomes and the patient experience. This central goal is supported by four interconnected pillars:

- 1. Optimizing care:** Standardising and aligning workflows reduces variation, supports quality improvement, and enhances consistency across departments.
- 2. Providing more appropriate (personalised) care:** Ensures that patients receive the right care at the right time from the right professional (JZOJP, see Chapter 3.2).
- 3. Delivering more efficient care:** By streamlining processes and integrating digital tools like the EHR, care pathways help reduce administrative burden and make better use of time and resources.
- 4. Promoting more sustainable care:** This includes both workforce well-being and system sustainability, addressing topics such as prevention, value-based care, and long-term affordability.

Schaaphok summarised the main goals of care pathways as follows:

- Creating logical coherence in care and translating this into efficient and effective care processes
- Preventing duplication and/or forgetting of care actions (ensuring quality and safety)
- Describing the total care for a patient, the total process (who, what, where and when)

These insights are in line with literature, which consistently highlights the value of care pathways in improving patient outcomes, reducing risks, and supporting quality improvement efforts (e.g. Kinsman et al., 2010; Rotter et al., 2010; Vanhaecht et al., 2012; Cavlan et al., 2011).

Care pathways contribute directly to the goals of the Quadruple Aim framework (see Chapter 2.2). I have described their links below:

- 1. Improve patient experience** → through more structured and coordinated processes
- 2. Enhance health outcomes** → by aligning care and best practices
- 3. Reducing costs** → by reducing inefficiencies
- 4. Support HCPs** → by clarifying roles and responsibilities, reducing duplication, and making collaboration easier

4.3 The process of designing care pathways

There is no single, standardised method. Every healthcare organisation tends to follow its own process, shaped by internal structure, available expertise, and specific care contexts. Still, certain steps and patterns return across most cases. At Treant hospital, for example, a 7-step model that is used to guide multidisciplinary teams through the development of care pathways:

1. Preparation
2. Analysis of the current situation
3. Care pathway description
4. Risk analysis
5. Implementation
6. Evaluation
7. Continuous follow-up

Such a model for creating care pathways can have various forms: e.g. there is a visual overview of these steps (as illustrated by an old visualisation in Figure 18), but Schaaphok also showed a detailed Excel version that breaks down each phase into specific actions, including explanations, options, responsibilities, and how the outcomes should be used.

This structured approach aligns with European Pathway Association (EPA) guidelines and is further elaborated in 'Het Zorgpadenboek' (Vanhaecht et al., 2007). A more detailed explanation of the process of designing care pathways can be found in Appendix H.

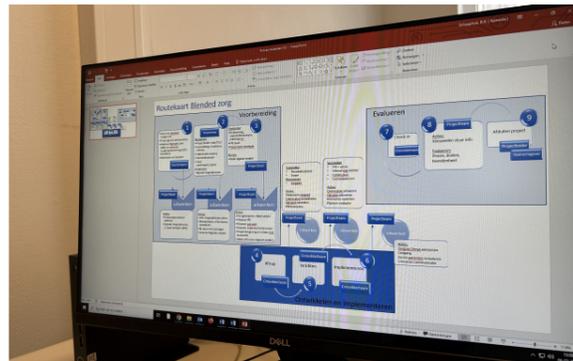


Figure 18: Example of a visualised roadmap to create a care pathway. Picture taken at the Scheper hospital of Treant.

Making the implicit explicit

Designing care pathways is not just about mapping steps: it's about making implicit knowledge explicit (see Figure 19). In multidisciplinary teams, many routines are based on assumptions or local habits. Visualizing the process helps align understanding and ensures better collaboration across disciplines.

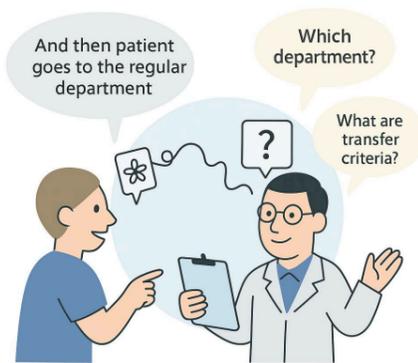


Figure 19: From words to visualisation. Illustration inspired by a visual shown by Schaaphok during the interview.

The role of the Quality & Safety department

During my research, I discovered that in many healthcare organisations a 'Quality & Safety department' plays an important role in developing care pathways. Since care pathways aim to improve the structure and consistency of care, they are considered part of the broader quality agenda. The department typically coordinates the development process, ensures alignment with evidence and policy, and monitors the impact over time.

In practice, the department often guides the process, brings the right people together, and makes sure the pathway is based on evidence and fits within existing policies and guidelines. They also help to evaluate its impact and make sure it stays up to date.

Through interviews, it became clear that there are different types of users involved in working with care pathways. For now, it is useful to distinguish between two main groups:

1. **General users:** HCPs who *interact* with the care pathway, without being responsible for creating or updating them
2. **Map builders:** Professionals who *create* and *update* care pathways (e.g. Quality & Safety advisors or service designers)

These user types are also relevant when designing the Metro Mapping tool: general users need clarity and intuitive navigation, while map builders require control and editing functionalities. This will be taken into account in the design phase.

Care pathways at Treant: a valuable reference point

To better understand how care pathways are developed and used in daily practice, I visited Treant Hospital for an interview with Reinalda Schaaphok and a system walkthrough (Figure 20 and 21). Treant uses a structured approach supported by digital tools, centered around the quality management platform Zenya. Within Zenya, a module (called 'iProcess') links to interactive Visio files that visualise the care pathway. Visio is therefore not the standalone tool, but rather the last layer in a larger, structured system.

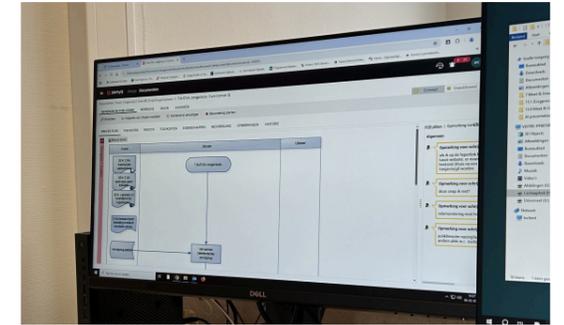


Figure 20: Process flow of a care pathway in Zenya

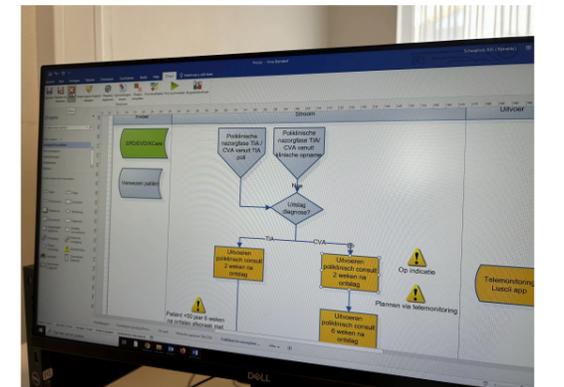


Figure 21: Process flow of a care pathway as an interactive Visio file

This setup allows Treant to go beyond static flowcharts. The care pathway acts as a flexible framework (or like Schaaphok said: 'kapstok'), to which various elements can be attached. Examples of such layered elements include:

- Working instructions and protocols
- TVB-matrixes (which specify who is responsible, authorised, or involved in each task)
- Weblinks to additional resources
- Risk indicators (soon to be added)

This layered setup allows HCPs to access relevant information per step. This improves clarity, reducing duplication, and supporting consistent care delivery.

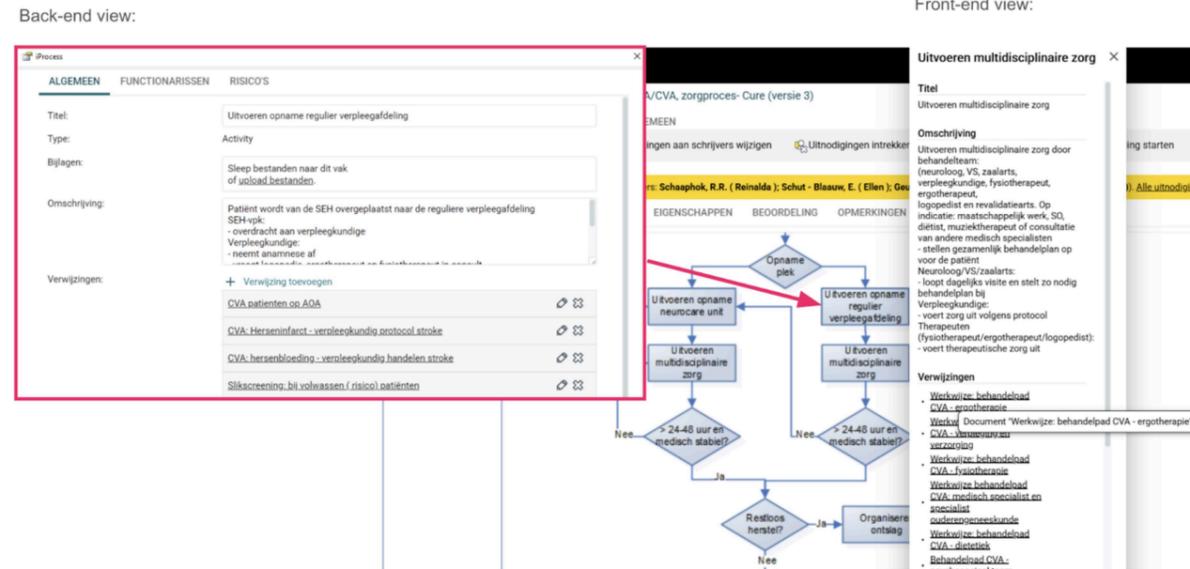


Figure 22: Example of a care pathway process flow in Zenya (front-end and back-end views)

Figure 22 shows how care pathways are managed and used within Treant's digital system. On the left, we see the back-end view in iProcess, where a map builder creates and edits a step in the care pathway. Here, users can add a description, link to relevant protocols, and assign responsibilities. On the right, we see the front-end view. In Zenya, healthcare professionals can click on each step to access a pop-up with linked protocols, role descriptions, and other relevant information. This makes the pathway a layered, interactive knowledge hub, rather than just a static visual. It's a clickable, 'three dimensional' system.

This example provides a valuable reference point when later assessing the possibilities and limitations of Metro Mapping. Understanding what care pathways need to be able to do in daily practice (such as linking to documents, or clickable layers) helps to clarify which functionalities a future digital Metro Mapping tool should ideally support.

Key takeaways 4.3

- Care pathways helps make implicit routines explicit
- Quality & Safety advisors often have a key role in designing care pathways
- Different user roles (e.g., general users vs. map builders) require different functionalities and levels of control
- A layered pathway structure (like in Zenya) supports clarity, onboarding, and access to relevant information

Involved stakeholders

Creating care pathways involves a multidisciplinary approach that includes various stakeholders. Typically, the following stakeholder groups are involved:

- HCPs (e.g. doctors, nurses, therapists)
- Quality & Safety advisors
- Program or project managers
- Service designers or innovation advisors (not always)
- Patients and/or informal caregivers

These findings were based on insights from interviews with, among others, Schaaphok (Quality & Safety advisor at Treant) and De Mul (assistant professor and researcher at Erasmus School of Health Policy & Management). In some cases, other departments such as IT, planning, or facilities may also play a supporting role. Especially when it comes to digital tooling, capacity planning, or embedding the pathway in daily operations.

4.4 Types of care pathways

Transmural care pathways

So far, this chapter has mainly focused on hospital-based care pathways. However, many patients receive care from multiple organisations over time, such as GPs, hospitals, rehab centers, and home care providers. Ensuring good care in these cases requires collaboration across organisational boundaries: this is where transmural care pathways come in. These pathways aim to improve coordination and continuity by aligning roles, responsibilities, and information flow between professionals in primary, secondary, and sometimes social or community care (Palliaweb, n.d.; Zuster Jansen, n.d.). The goal is to make care feel like a coherent whole, not a fragmented journey. This requires shared protocols, good communication, and mutual trust.

Because patients often transition between multiple care providers, it is essential that care delivery feels like a coherent whole rather than a fragmented journey. This requires shared protocols, good communication, and mutual trust between stakeholders.

Developing transmural pathways is often more complex than internal ones. Differences in systems, organisational culture, and financing can pose barriers. Yet when successful, these pathways significantly improve patient experience and reduce duplicated effort across institutions.

In my research, I spoke with professionals from organisations such as Auris audiology and Basalt rehabilitation, where transmural collaboration plays a role. Their input helped me better understand the challenges and opportunities of designing care pathways that extend beyond the walls of a single institution.

Transmural care pathways are an important area to consider, especially when designing tools like Metro Mapping. The method should not only support internal coordination, but also offer ways to involve stakeholders from different organisations

Hybrid care pathways

As mentioned earlier, another important development is the rise of hybrid care pathways: combining digital and physical care in a structured, integrated way. Instead of seeing e-health or teleconsultations as separate tools, hybrid pathways incorporate these into the full care trajectory, offering flexibility and personalisation based on what is appropriate for each patient.

This aligns closely with the Dutch policy direction "digital where possible, physical where needed" (Ministerie van VWS, 2022), and reflects a shift toward more sustainable, efficient, and accessible care models.

Designing hybrid pathways introduces new challenges: deciding which moments are suited for digital interaction, ensuring patients are digitally capable and supported, and aligning systems and workflows. But when done well, hybrid care can reduce travel, improve follow-up, and offer more flexibility for both patients and professionals.

Key takeaways 4.4

- Transmural care pathways cross organisational boundaries. They require shared roles, communication, and mutual trust
- Hybrid care combines digital and physical care
- Both types improve continuity and flexibility, but also add complexity

4.5 Interview insights

As described in Chapter 2.3, the qualitative data for this research was gathered from 14 semi-structured interviews. In this chapter, I will focus on the key insights related specifically to the current state of care pathway practices in the Dutch healthcare system. This supports answering RQ1: What are common practices in healthcare for designing and optimizing care pathways?

I have identified seven themes, which are discussed below:

1. General characteristics of current practices

Participants indicated that the design and format of care pathways vary widely between and within organisations. The use of visual tools is increasing, and design thinking is a common approach. Also, most participants really saw the value of creating care pathways.

- There is no single standard for care pathways; formats vary from text to flowcharts to visual tools like Metro Mapping.
- Visualizing care processes improves clarity and understanding.
- Design thinking is used in pathway development, including interviews, co-creation, and iteration.
- Some care pathways are seen as “living documents” that are regularly updated.

“What stood out was that we were writing a huge amount of text... there was nothing visual.” - P9

“There are too few care pathways. I don't understand how doctors can work without them.” - P8

2. Differences between healthcare settings

The use of care pathways can differ significantly between hospitals and other care settings.

- GPs and mental healthcare professionals said they don't really use explicit care pathways, as care is often determined case-by-case.
- Hospitals are more structured, often using formal, multidisciplinary developed pathways.

“In mental care, every patient is different. However, I do think we would benefit from some form of more structured documentation.” - P14

3. Multidisciplinary collaboration

Effective care pathways require diverse expertise and ownership among stakeholders.

- Multidisciplinary collaboration is essential to reflect different perspectives.
- Agreements on “who does what, when and for whom” are central to care pathway design.

“A multidisciplinary team is crucial to combine different perspectives.”- P3

4. Patients

While acknowledging the value of involving patients, patient involvement is still limited. Also, when showing care pathways to patients, a less detailed version is used.

- Methods like focus groups, mirror conversations, and value dialogues are sometimes used to collect patient insights.
- Patient-facing versions of care pathways are usually simplified and more visual than the HCP versions.

5. Tools and development process

A variety of tools are used to design and document care pathways, often guided by a structured process.

- Tools used include Miro, PowerPoint, Visio, Zenya, and flowcharts.
- Visual elements such as clickable steps linked to protocols are increasingly common.
- Implementation tools like the “implementation canvas” support uptake (shown by P7).
- Building blocks and reusable steps increase consistency across pathways (shown by P11).
- Four design phases are often followed: analysis, design, implementation, and evaluation.

“Care pathways are like a framework on which you attach documents.” - P4

“We moved from thick textual guidelines to more accessible visual tools.” - P9

6. Evaluation

Evaluation practices are becoming more structured, using both qualitative and quantitative indicators. Evaluation is not only about measurement, but also about learning and improving.

- Indicators include access time, treatment turnaround, and patient experience.
- Tools like the Clinical Compass help teams reflect on quality and collaboration (Figure 25).
- Some organisations treat care pathways as “living documents” that evolve over time.

“A set of generic indicators is sometimes applied to evaluate both quantitative and qualitative outcomes, covering metrics like access time, treatment duration, and learning outcomes.” - P11

7. Implementation challenges

While care pathways are valued in general, implementation in practice remains difficult.

- HCPs are often too busy to actively participate in design processes.
- Translating pathways from “paper to practice” is a major challenge.
- Designers play a role in bridging development and implementation.
- Evaluation methods include clinical indicators and reflection tools like the clinical compass (mentioned by P12), see Figure 23. This illustrates how different types of indicators (e.g. clinical, service, team) can help teams evaluate and improve their care process.

“HCPs often don't see the value right away... they are too busy, or not used to working like this.” - P7

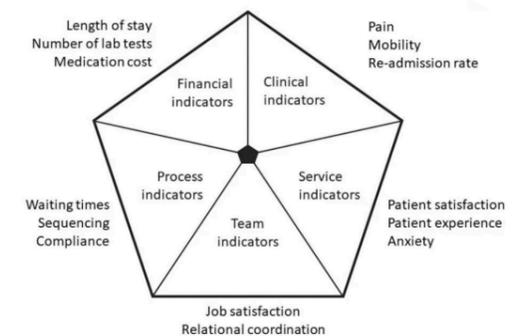


Figure 23: The Clinical Compass (Vanhaecht & Sermeus, 2003).

Key takeaways 4.5

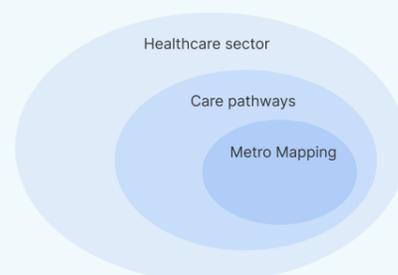
- Care pathways differ widely between settings and organisations
- Visual tools improve understanding and communication
- Evaluation methods are evolving but still underused
- Practical use is often limited by the time and capacity of HCPs

Metro Mapping

05

- 5.1 An introduction to Metro Mapping
- 5.2 Value of Metro Mapping
- 5.3 The process of Metro Mapping

Metro Mapping has already been briefly introduced in earlier chapters, but this chapter offers a more in-depth exploration of the methodology. Before proposing ways to improve its implementation, it is essential to fully understand how Metro Mapping works, what materials and processes are currently used, and who is involved. This chapter provides a first analytical step toward that understanding. Together with the next chapter, it forms the foundation for answering RQ2: *What is the current state of Metro Mapping as a methodology and what are key enablers, challenges, and barriers to its adoption?*



5.1 An introduction to Metro Mapping

Metro Mapping is a service design method developed to design and optimise care pathways in healthcare. This approach uses the metaphor and visual language of a metro system to create a clear, comprehensive overview of a care pathway (Metro Mapping, n.d.). It can be used to improve patient experience and help with clinical challenges, for example, around SDM and multidisciplinary collaboration.

By enabling co-creation among diverse stakeholders, this approach helps to create more effective and streamlined care processes, ultimately improving healthcare outcomes.

Key components

Metro Mapping consists of two main visualisation tools:

1. The Metro Net: An outline of all diagnostic and treatment options for a specific condition and their mutual relationship (Figure 24). The visualisation uses the following elements:

- Phases
- Diagnostic and treatment options
- Transfer stations
- Connecting lines

2. The Metro Map: A detailed visualisation of a specific care path within the Metro Net (Figure 25).

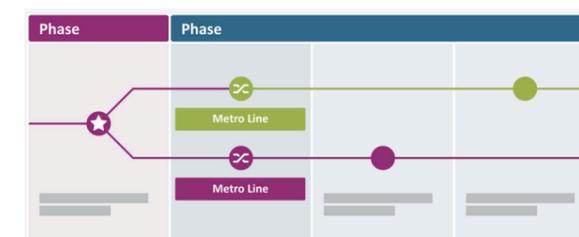


Figure 24: Structure of a Metro Net (Metro Mapping Foundation, n.d.a.)

Structure and layers

A Metro Map is composed of five layers:

- 1. Experience:** Describes patient and relative experiences
- 2. Metro Line:** Visualises phases, lines, and stations within the care path
- 3. Information:** Represents the information that is exchanged with patients and their loved ones.
- 4. Companions:** Describes caregivers and their roles in each phase
- 5. Context:** Shows where each step takes place and what medical devices are used

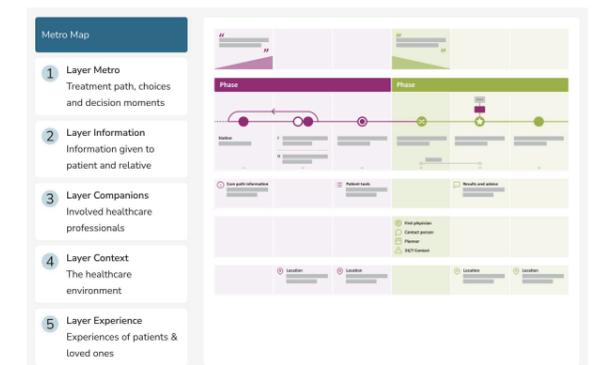


Figure 25: Structure of a Metro Map (Metro Mapping Foundation, n.d.a.)

Moreover, Online Department has been improving the Metro Mapping methodology and they have added two extra layers:

- 6. Digital:** Which software/apps/etc. is used?
- 7. Organisations:** Who is in charge in this phase?

I have seen various participants that also added different layers, such as the 'digital' one, or 'finance'. This highlights a need for more flexibility in choosing which layers to use.

History

Metro Mapping was developed by Ingeborg Griffioen as part of her PhD research at TU Delft and LUMC (Peters, 2023). The method was initially created to support shared-decision making in oncology (Griffioen et al., 2022). However, it has demonstrated potential for broader applications across healthcare. After the passing of Ingeborg Griffioen in 2022, the Metro Mapping Foundation was established. It is their mission to improve and promote healthcare and the well-being of patients, their loved ones and caregivers through this methodology (Metro Mapping, n.d.).

A patient journey is often a complex journey of events. Griffioen was a service designer and wanted to use her skills to redesign care paths, so people don't feel lost and even feel empowered. She wanted to improve shared-decision making, but she discovered that information was confusing, roles of caregivers were unclear, and so on. Why was it so difficult?

If you really want to give shared decision-making and empowerment a chance, you first need a care path that people can understand and oversee. Then, space for creating a personal care path and shared decision-making arises. In order to do so, a service design method was developed: **Metro Mapping**.

Thanks to Metro Mapping, healthcare can also enjoy the benefits of service design, such as reducing unnecessary costs.

"When care pathways are clearer for patients, relatives and their caregivers, everyone can participate and collaborate better. We see that the service design methodology Metro Mapping contributes to improving often complex care pathways."
- Metro Mapping Foundation

Quote from their website

Key takeaways 5.1

- Metro Mapping provides a structured visual method to map and improve care pathways, using the metaphor of a metro system.
- A Metro Map consists of 5 layers. However, in practice, users adapt the method by adding new layers (e.g. digital), showing the need for customisation.
- Originally developed to support shared decision-making in oncology, Metro Mapping now serves broader care contexts.

5.2 Value of Metro Mapping

Applications and benefits

According to Peters from design agency Panton (2023), Metro Mapping is used to:

1. Analyze and visualise current care pathways
2. Evaluate care pathways with all stakeholders
3. (Re)design care pathways through co-creation
4. Design solutions to implement new care pathways

Rather than offering a one-size-fits-all solution, Metro Mapping is a structured yet flexible approach that can be adapted to different types of care, organisations, and patient populations. The following benefits were repeatedly mentioned in both literature and interviews:

- **Enhanced patient experience:** By integrating patient perspectives and visualizing care from their point of view, Metro Mapping helps identifying points to improve the patient experience.
- **Support for SDM:** Originally designed to facilitate SDM in oncology (Griffioen et al., 2022), the method helps structure conversations between HCPs and patients, e.g. around key decisions.
- **Visualisation of complexity:** Metro Maps offer an intuitive way to map out complex care pathways, making them more accessible to all stakeholders involved.
- **Facilitation of multidisciplinary collaboration** Metro Mapping serves as a 'common language' that helps align professionals from different backgrounds and stimulate team reflection.
- **Identification of improvement opportunities:** The layered structure of the Metro Map makes it easier to spot inefficiencies or opportunities for improvement.
- **Flexibility and adaptability:** The method is modular and can be applied to different scenarios.
- **Co-design and stakeholder engagement** The visual format and structured sessions encourage meaningful participation from HCPs, patients, and other stakeholders.
- **Holistic and systemic view** MM goes beyond just the care process: it also takes into account the physical environment, information flow, emotional experience, and organisational context.

Improving the method

After the Metro Mapping methodology was developed, it has evolved over the years. This evolution demonstrates how Metro Mapping has grown from a specialised tool for oncology to a more adaptable methodology that is applicable across different healthcare contexts. The method is still going through refinements and research to improve its effectiveness. Contributing to such improvements is also the goal of this thesis.

The potential value of Metro Mapping

As discussed in Chapter 3.3, digitalisation in healthcare could lead to a net financial gain of at least €1.3 billion by 2028, mainly driven by productivity improvements such as hybrid care and more efficient processes using AI (SiRM, 2023). While Metro Mapping is not such a digital intervention for productivity improvements in itself, it can play an important role in enabling these types of innovations. For example, before organisations can decide which parts of care could be delivered digitally or remotely, they first need a clear understanding of the current care pathway. Mapping the pathway provides this structure: it shows who does what, when, and where, allowing stakeholders to identify logical opportunities for hybrid or digital delivery.

In that sense, **Metro Mapping offers a step back in order to move forward**. It provides a clear, visual overview of care delivery that helps teams spot inefficiencies, redundancies, and parts of the process that could potentially be redesigned. A well-designed digital Metro Mapping tool could further support this process by making it easier to collaborate, give feedback, and build shared ownership of the pathway design.

As De Mul noted during an interview, some HCPs consider Metro Mapping as a "new language" that brings energy and creativity into care process redesign. Visualizing care pathways allows HCPs to identify opportunities for improvement in a more structured and evidence-based way.

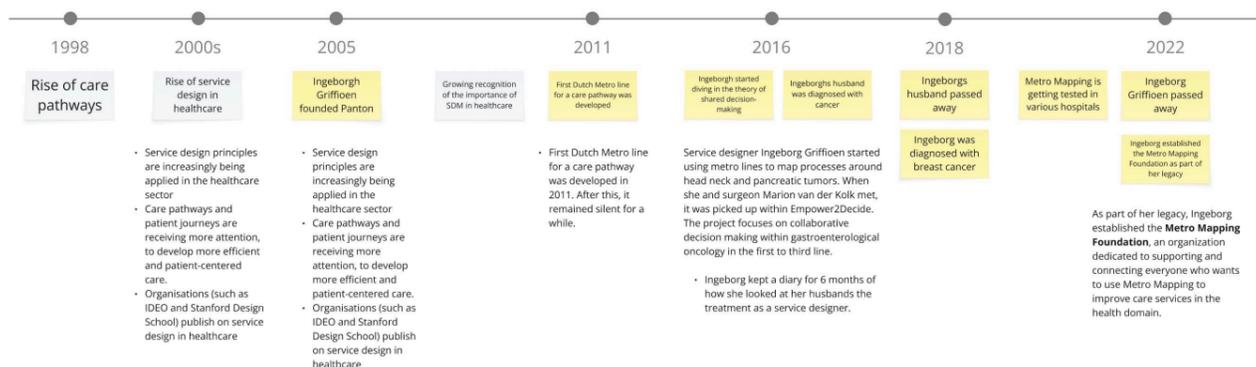


Figure 26: History of Metro Mapping and its relevant context

5.3 The process of Metro Mapping

This section describes the typical process of Metro Mapping, based on materials from the official e-learning modules (Metro Mapping Foundation, n.d.b) and supported by insights from interviews. The Metro Mapping process consists of several iterative phases that guide stakeholders from analysing the current care path toward implementing an improved, more patient-centred version.

The process results in two key outputs:

- The Metro Map 'as is', which reflects the current care path and the needs of stakeholders
- The Metro Map 'to be', a redesigned version that serves as a basis for implementation and change.

Figures 27 and 28 provide an overview of the process. Before starting your analysis, it is important to have a good preparation.



Figure 27: Overview of the Metro Mapping phases (Metro Mapping Foundation, n.d.b)

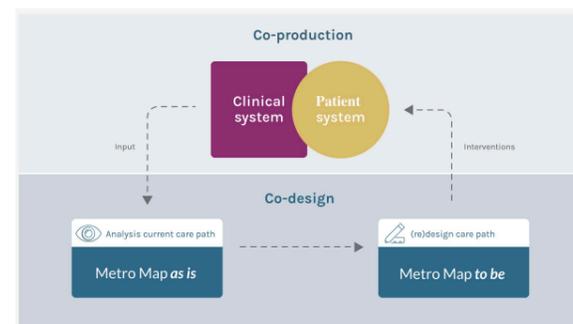


Figure 28: Visual summary of the Metro Mapping process (Metro Mapping Foundation, n.d.b)

A detailed explanation of each phase is available in Appendix I, but I will give a summary of each phase below:

1. Preparation & goal setting

Define the focus, scope, and intended impact of the project. Assemble a multidisciplinary Metro Team including healthcare professionals, project leads, and a service designer.

2. Analysis of current state ('as is')

Map the current care process using the Metro Net and Metro Map. Identify and layer patient, caregiver, and professional needs to highlight improvement areas.

3. (Re)Designing the map ('to be')

Co-design sub-solutions that respond to the identified needs. These are merged into an integrated future-state Metro Map that is tested and refined with stakeholders.

4. Implementation

The redesigned map serves as a basis for implementation. While Metro Mapping itself is not an implementation tool, it helps align improvement efforts and clarify priorities.

Current available tools and materials

It is also important to understand what tools and materials are currently available to support this process. As previously discussed, these include the official Visio template, e-learning modules, and other resources provided by the Metro Mapping Foundation. A detailed overview of these materials and their limitations in practice can be found in Appendix J.

"Visio is not very easy [...] What frustrates me is that you can't copy tabs from one file to the other." - P8

Stakeholders of Metro Mapping

During an online event hosted by the Metro Mapping Foundation (March 20, 2025), Jasper Brands shared an overview of stakeholders involved in the process (Figure 29). Since Metro Mapping is used to design care pathways, most stakeholders are the same as in care pathway development (see Chapter 4.3). A key difference is the involvement of a service designer to guide the process.

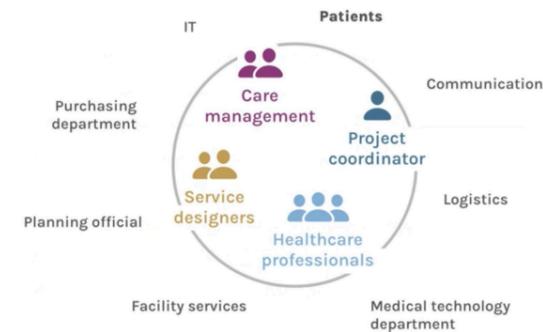


Figure 29: Stakeholders of Metro Mapping

Noa Smolenaars, a care pathway designer at the Catharina hospital, emphasised that the process should be led with HCPs, not for them. Designers play a facilitating role:

- They guide the sessions, structure input, and translate insights
- They bring continuity by staying involved throughout implementation, not just the design phase.
- Their close collaboration builds trust and helps tailor solutions to the real-world context.

"Designers shouldn't come in with a fixed idea like consultants, but work alongside HCPs to implement change from within." - Smolenaars (care pathway designer)

Different Metro Mapping processes

Although the Metro Mapping Foundation offers general steps for creating and implementing a Metro Map, the process often varies in practice. It depends on the context, available resources, and the people involved. This was also acknowledged during a Metro Mapping event in Utrecht (April 10th 2025), where Jasper Brands explained that people are encouraged to use the method that giving it your own twist is perfectly fine.

While the official template is in Visio, some prefer other tools like Miro or Figma. For example, Smolenaars developed a Miro version now used at Catharina Hospital (Figure 30).



Figure 30: MM template created in Miro (shared by Smolenaars)

Furthermore, the process may be led by an external service designer (e.g. from Online Department or Panton), or developed internally by care organisations. The number and type of sessions can also vary.

I believe this makes Metro Mapping comparable to methods like journey mapping: the basic principles are shared, but the way it is applied often varies. It is not a one-size-fits-all process, and that is part of its strength. This makes me wonder: shouldn't a Metro Mapping tool support this kind of flexibility and customisation?

Key takeaways 5.3

- The MM process consists of iterative steps: analysis, redesign, and implementation.
- There is often a service designer involved to guide the process
- The official MM template is in Microsoft Visio. In practice, however, some people prefer to create their own versions in other software (e.g. Miro or Figma).
- Flexibility is essential: the process should adapt to user needs and organisational settings.

Enablers Challenges Barriers

06

to the adoption of Metro Mapping

- 6.1 Introduction of used frameworks
- 6.2 Enablers
- 6.3 Challenges
- 6.4 Barriers
- 6.5 Suggestions for future improvements
- 6.6 Conclusion

Now that the Metro Mapping methodology has been explored in detail, this chapter focuses on understanding the conditions that influence its successful adoption in practice. Based on insights from interviews, observations, and literature, this chapter identifies what currently supports or hinders the implementation of Metro Mapping within healthcare organisations. By analysing these enablers, challenges, and barriers, the chapter provides a clearer view of the dynamics surrounding the method's uptake, and offers direction for future improvement and scaling.

6.1 Background & methodology

Data collection

To identify the enablers, challenges, and barriers to the adoption of Metro Mapping, this chapter draws on three key sources (visualised in Figure 31):

1. The conceptual model by Gartner and Côté (2023). Their study has enabled them to develop a detailed understanding of enabling factors, challenges, and barriers to the implementation of care pathways, which is a useful starting point for my research on Metro Mapping.

1. The insights from 14 semi-structured interviews. These conversations explored the current experiences with Metro Mapping, including opportunities for improvement.

1. A study by Ramaker et al. (2024), based on 21 interviews with Dutch Metro Mapping users. The study captured user experiences across a range of care domains and identified practical strengths and weaknesses in the implementation of the method.

Findings from three sources listed above were compared, clustered, and translated into key themes. Overviews of these analyses can be found in Appendix K. The resulting overview forms the basis of the next three subchapters:

- Enablers → Chapter 6.2
- Challenges → Chapter 6.3
- Barriers → Chapter 6.4

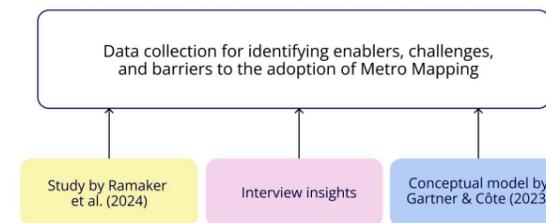


Figure 31: Overview of data collection input

Enablers, Challenges, and Barriers framework

To analyse the factors that influence the adoption of Metro Mapping in practice, this chapter builds on the model developed by Gartner and Côté (2023), as introduced in Chapter 2.2 (see Figure 32).

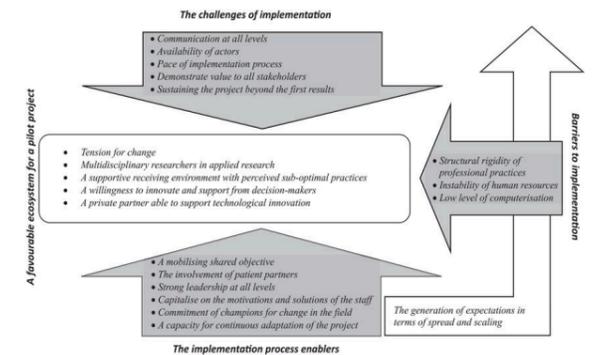


Figure 32: Conceptual model of the enablers, challenges and barriers to implementing innovations in care pathways (Gartner & Côté, 2023).

Since the introduction of care pathways, their aim was to improve healthcare outcomes by enhancing coordination, reducing fragmentation, and ultimately lowering costs. Over the years, many attempts have been made to define and refine the concept. While recent results have been promising in some cases, the overall impact of care pathway optimisation projects remains inconsistent and sometimes disappointing in relation to the invested resources (Gartner & Côté, 2023).

The aim of Gartner and Côté was to develop a conceptual model for the optimisation of care pathways which integrates enablers, challenges, and barriers to implementation. They did not create one specific innovation, but tested a mix of technological, clinical, organisational, and social improvements within existing care pathways. They explored what helps or limits the implementation of such changes.

Challenges vs. barriers

Challenges refer to obstacles that arise during the implementation process itself, such as difficulties with communication or keeping HPCs involved. These can usually be solved with good planning, leadership, and team engagement. On the other hand, barriers are more structural problems that are harder to overcome, such as staff shortages or limited digital infrastructure.

Broader context

In addition to enablers, challenges, and barriers during implementation, Gartner and Côté highlight two additional elements that are important for understanding the full picture of innovation adoption: the presence of a favourable ecosystem for starting a pilot project, and the generation of expectations for scaling and spreading the method. While these do not directly influence implementation activities, they form the broader context in which innovations like Metro Mapping can emerge and grow.

For example, a strong “**tension for change**” such as high pressure on healthcare systems or awareness of suboptimal practices, can create a momentum for testing new approaches. Similarly, when early adopters see promise and begin to imagine broader applications, this creates a foundation for future scale-up.

These contextual factors are not the focus of this chapter, but they are relevant when thinking about the long-term impact and adoption potential of Metro Mapping.

Metro Mapping

Although the model is not specific to Metro Mapping, it offers a valuable structure to analyze the current state of this methodology in context. This will directly support me in answering **RQ2: What is the current state of Metro Mapping as a methodology and what are key enablers, challenges, and barriers to its adoption?**

The conceptual model of Gartner & Côté is shown in Figure 32. In the next section, I will highlight some relevant factors with regards to Metro Mapping.

Several factors identified by Gartner and Côté (2023) are especially relevant when examining the adoption of Metro Mapping as a methodology. For example, ‘**the involvement of patient partners**’ is closely aligned with the goal of Metro Mapping to co-create care pathways together with patients and professionals. The method encourages collaboration and shared understanding, making this factor a key enabler for success.

Another important factor is ‘**capitalising on the motivations and solutions of the staff.**’ In many of the use cases of Metro Mapping so far, success depended on the willingness of healthcare staff to reflect on their current processes and improve them together. When professionals feel heard and involved in shaping the care pathway, they are more likely to embrace the method.

A third relevant point is the ‘**availability of actors.**’ Co-designing care pathways with Metro Mapping requires time and presence from various stakeholders. When key people are too busy or unavailable, the process becomes harder to carry out effectively.

Link with Tool+Team+Routine framework

To deepen the understanding of how a method like Metro Mapping can be successfully adopted, it is helpful to look at the Tool + Team + Routine framework (Shaw et al., 2018). This model shows that the introduction of a new tool in healthcare is not just about the tool itself, but about how it fits within the team using it, and how it interacts with their daily routines.

A key insight from this model is the importance of a clear value proposition for every user involved. This idea connects to the earlier point of Gartner and Côté about the need to ‘demonstrate value to all stakeholders.’ In the case of Metro Mapping, that means clearly communicating how the method adds value to the specific roles of HCPs, patients, and managers.

The model also helps to look beyond the tool itself. Metro Mapping only works when the right people are engaged and when the method supports or helps reshape existing ways of working. If there’s no fit between the tool, the people, and their routines, implementation becomes much harder.

This perspective also gives insight into why some of the identified challenges and barriers, like a lack of digital infrastructure or rigid professional structures, can stand in the way of adoption.

When routines are too fixed, or the system isn’t designed to support new ways of working, even the best tools may struggle to make a real impact. If the environment is not ready to support change, the tool may not achieve its full potential, no matter how promising it is.

Analysis process

In the next subchapters, I will discuss the enablers, challenges, and barriers to the adoption of Metro Mapping based on my research. For each of the three data sources (Ramaker et al., my own interviews, and the Gartner & Côté model) I first identified all relevant factors. I did this separately for enablers, challenges, and barriers.

After mapping out the individual factors per source, I clustered them within each category (e.g. all enablers together). Once these initial clusters were complete, I looked across the three sources to group similar factors and identify overarching themes (see Figure 33).

This final clustering formed the basis for the structure used in Chapters 6.2, 6.3, and 6.4.

While the model by Gartner and Côté (2023) was not developed specifically for Metro Mapping, I decided to include their factors in the clustering because they offer relevant insights into the implementation of care pathway innovations in general. Many of their findings showed strong parallels with my interview data and the study by Ramaker et al., which suggests that these broader enablers also apply to Metro Mapping. Nonetheless, it is important to remember that their insights were not based on the Metro Mapping methodology.

Key takeaway 6.1

This analysis combines insights from the model of Gartner & Côté (2023), interviews, and a Metro Mapping study by Ramaker et al. (2024) to identify enablers, challenges, and barriers.

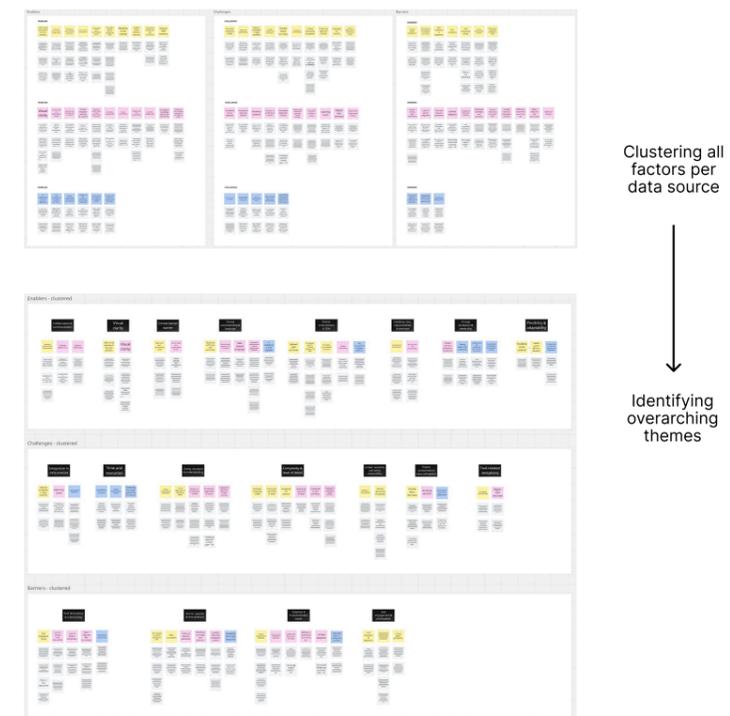


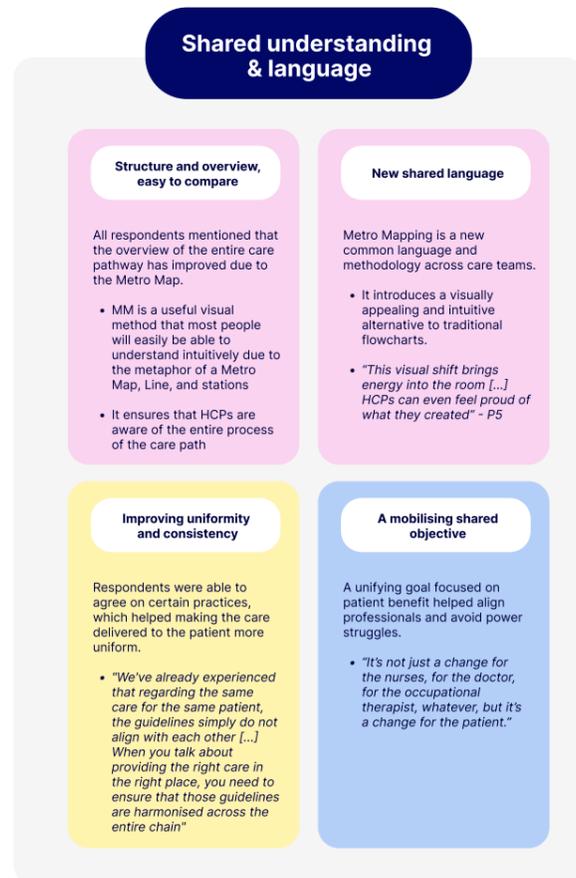
Figure 33: Analysis process

6.2 Enablers

To understand what supports the successful adoption of Metro Mapping, this section explores eight key enablers. Insights are drawn from the study by Ramaker et al. (yellow), interviews (pink), and the model by Gartner & Côté (blue). Together, they paint a picture of what makes Metro Mapping work in practice and what conditions are most promising for its growth. Each enabler is described below, supported by brief explanations and/or quotes.

Shared understanding & language

Metro Mapping contributes to shared understanding by offering a clear structure and a common language across teams. It improves consistency in care delivery and enables easier comparison between cases.



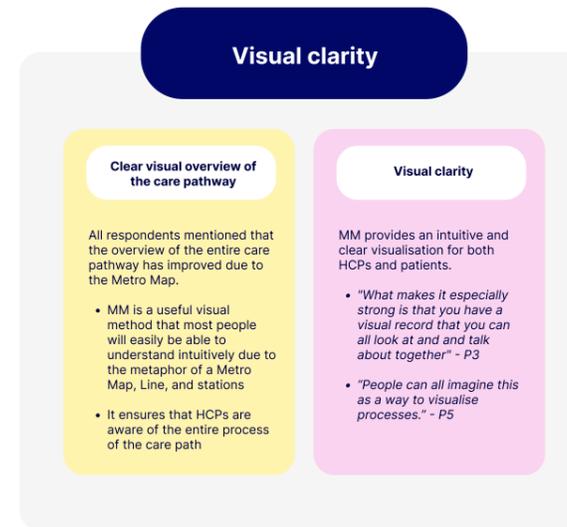
Patient-centeredness & SDM

The method helps patients play a more active role in their care. It clarifies key SDM moments, enables personalised care planning, and aligns with a patient-centered approach. Involving patient partners in decision-making also enriched project outcomes.



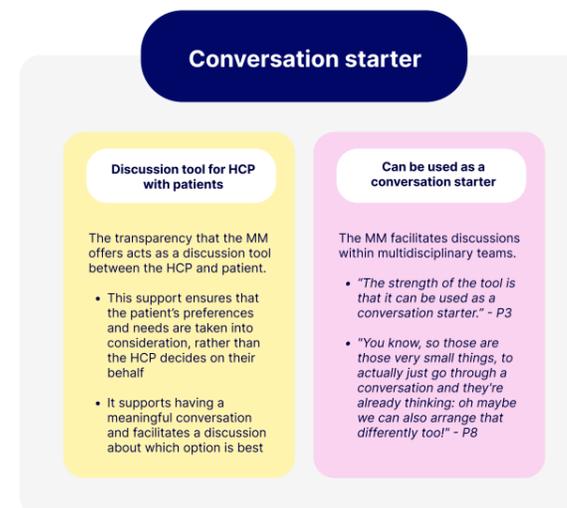
Visual clarity

One of the most frequently mentioned strengths of Metro Mapping was its ability to provide a clear and intuitive visual overview of the entire care pathway. By visualizing all steps, HCPs gained a more holistic view of the care pathway, which supported better communication, planning, and collaboration.



Conversation starter

Metro Mapping facilitates meaningful conversations, both between healthcare professionals and patients and within multidisciplinary teams. It helps clarify patient preferences and encourages open dialogue about care decisions.



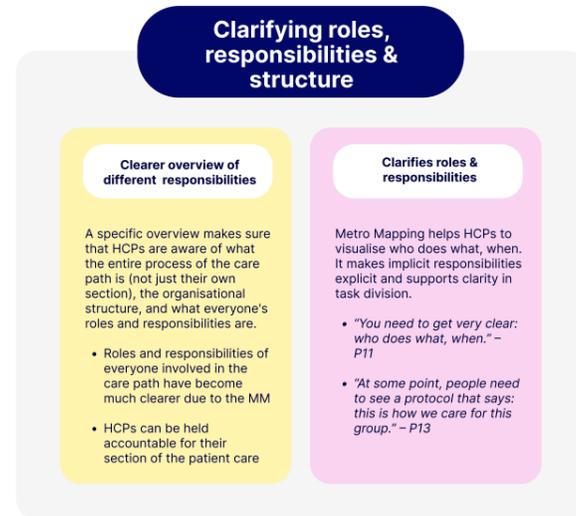
Collaboration & communication

Metro Mapping improves collaboration by aligning information, reducing duplication of work, and strengthening communication across disciplines and organisations. It supports integrated care and helps teams manage complex collaborations.



Clarifying roles, responsibilities & structure

A clearer overview of the care path helps HCPs understand both the structure and their own role within it. Making responsibilities explicit improves coordination, avoids duplication of efforts, and ensures accountability within multidisciplinary teams.



Flexibility & adaptability

The method is perceived as flexible and adaptable across care settings. Its modular setup allows teams to tailor it to their needs, and local course-correction helps ensure the method fits changing contexts.



Change facilitation & ownership

Successful implementation depends on internal leadership and ownership. Involving motivated HCPs, picking ambassadors, and providing space to contribute improves engagement and makes sure that there is continuity throughout the project



Key takeaways 6.2

The eight identified enablers to the adoption of Metro Mapping are:

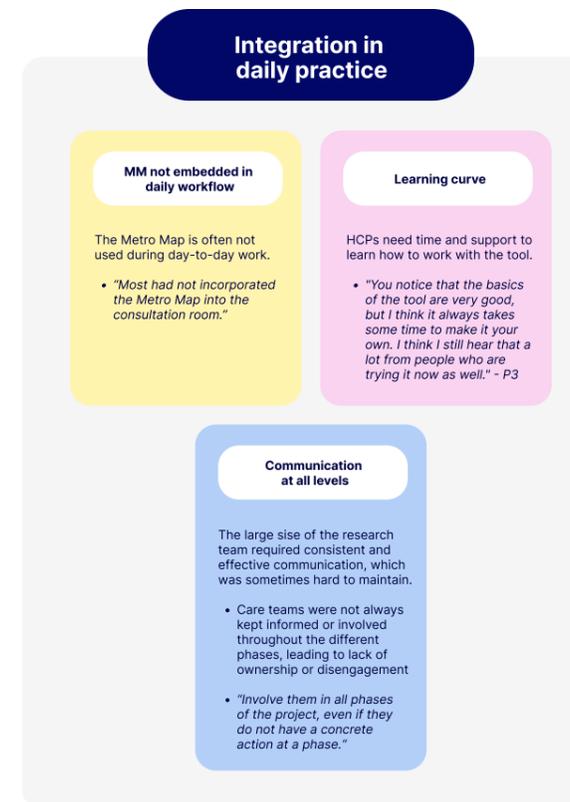
- Shared understanding & language
- Patient-centeredness & SDM
- Visual clarity
- Conversation starter
- Collaboration & communication
- Clarifying roles, responsibilities & structure
- Flexibility & adaptability
- Change facilitation & ownership

6.3 Challenges

In this section, I describe the key challenges that can arise during the implementation of Metro Mapping. These are practical difficulties that teams may encounter while using the method, such as limited time, unclear communication, or difficulties with stakeholder engagement. Unlike structural barriers, challenges are often more manageable and can be overcome with the right preparation, leadership, or team dynamics. I identified six themes that reflect these challenges.

Integration in daily practice

A challenge is the difficulty of integrating Metro Mapping into everyday routines. While the tool may be valuable, it is often not embedded in consultation workflows. In addition, professionals need time and support to learn how to use it effectively. Especially in larger projects, maintaining communication and engagement across all team members proved challenging.



Complexity & level of detail

A highlighted challenge in the use of Metro Mapping is finding the right balance between simplicity and depth. While the method introduces a new shared language and structure, users sometimes struggle with overly detailed maps that are hard to use in practice, especially in patient conversations. This highlights the tension between a clear, comprehensive design and the practical usability for HCPs.



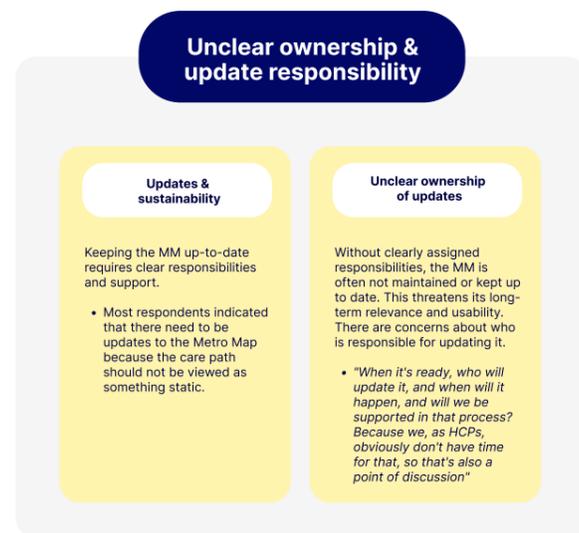
Clarity, structure & understanding

Challenges related to clarity and structure often limited the consistent use of Metro Mapping. Team members sometimes had different understandings of what was created, how it should be used, or which elements were essential. Differences in working methods, inconsistent use of layers and colours, and uncertainty about versioning further complicated alignment within and across teams.



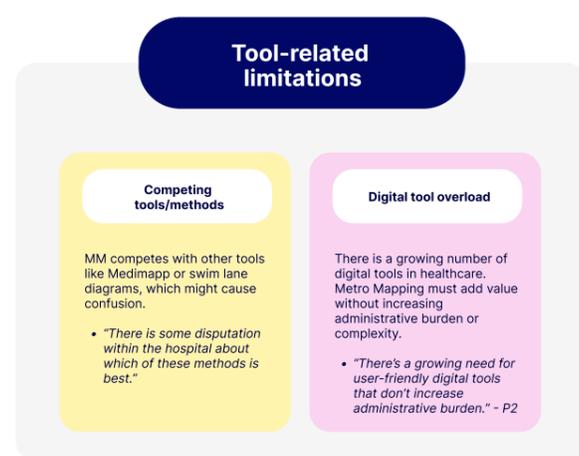
Unclear ownership and update responsibility

There can be lack of clarity around who is responsible for keeping the Metro Map up to date. While care pathways evolve, the MM is often treated as static, risking outdated content. However, without clear ownership and ongoing support, sustainability of the MM becomes difficult.



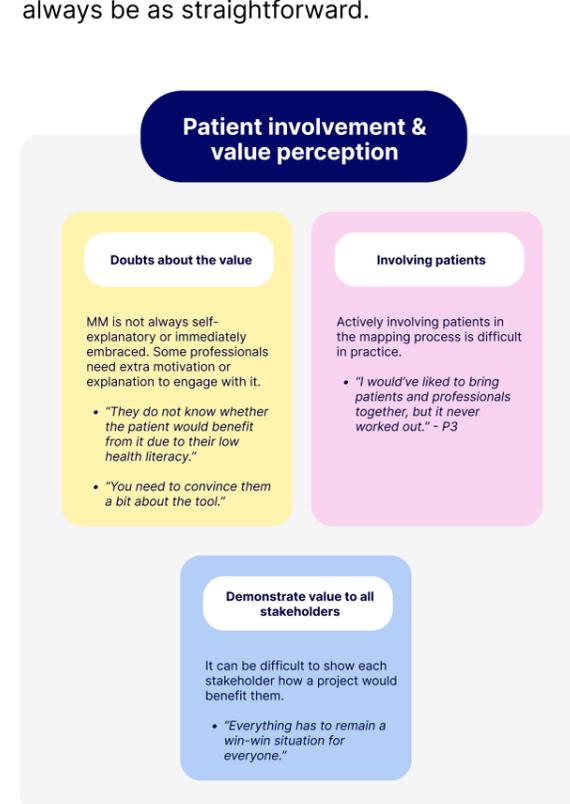
Tool-related limitations

In a digital healthcare environment filled with tools and platforms, Metro Mapping is not the only option. Some questioned whether it offers clear added value compared to existing alternatives.



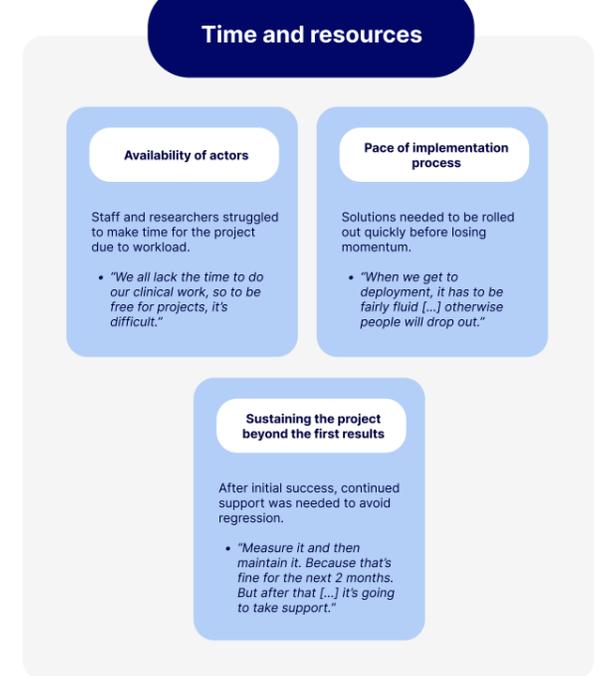
Patient involvement & value perception

Some questioned whether Metro Mapping would be valuable for patients with low health literacy or limited engagement. Actively involving patients in the mapping process also proved difficult in practice. An important challenge highlighted by Gartner & Côte (2023) is that stakeholders need to clearly understand how the method would benefit them personally in order to stay committed, which might not always be as straightforward.



Time and resources

A common challenge in creating care pathways is the limited availability of time and resources. Due to busy schedules, it is often difficult for HCPs and researchers to dedicate time to the project. Even after initial deployment, sustaining the project needs ongoing support and attention to prevent fallback into old routines.



Key takeaways 6.3

The seven identified challenges to the adoption of Metro Mapping are:

- Integration in daily practice
- Complexity & level of detail
- Clarity, structure & understanding
- Unclear ownership & update responsibility
- Tool-related limitations
- Patient involvement & value perception
- Time and resources

6.4 Barriers

While many challenges can be addressed during the implementation process, some barriers are more structural and difficult to overcome. These barriers can hinder the adoption of Metro Mapping regardless of the efforts made by teams. This section explores the four key barriers identified across sources, such as human capacity, digital infrastructure, and system limitations. They highlight deeper systemic issues that may require broader organisational or policy-level changes to allow for successful adoption.

Low engagement & participation

A lack of active participation from both HCPs and patients can hinder the effectiveness of Metro Mapping. Not all participants take the time to properly understand the method. In many cases, patients are not involved in the co-design process. These issues reflect a deeper lack of motivation, ownership, or structural support, making them harder to solve through training or planning alone.



Adoption & implementation issues

Even when teams are enthusiastic about Metro Mapping, adoption can be difficult due to unclear implementation strategies or a lack of practical guidance. Some organisations struggle to move beyond the mapping itself. As Gartner & Côte found, organisations can also face structural or professional limitations that hinder full integration of care pathways. These issues reduce long-term impact of the care pathways and Metro Maps.



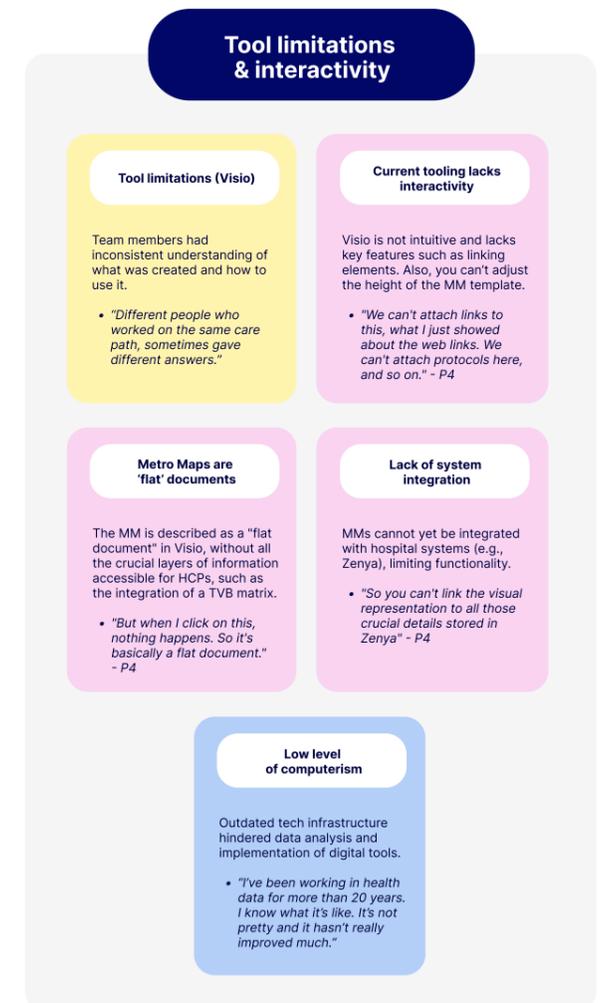
Human capacity & time pressure

This barrier may look similar to the challenge 'time and resources', but the focus is different. The challenge is about practical challenges during Metro Mapping, such as having little time, the project losing momentum, or it's hard to keep it going. These issues can often be solved with better planning or support. This barrier, however, involves more structural problems: staff shortages, high workload, or a lack of motivation or capacity. These factors can really block the use of Metro Mapping, unless something changes in the organisation or system.



Tool limitations & interactivity

Technical limitations of the current tooling, Visio, reduce the usability and interactivity of Metro Maps. Users describe the maps as "flat documents," lacking features like clickable links or system integration. This makes the tool less intuitive and harder to embed in existing digital infrastructures. This makes it hard to implement the Metro Map into daily routines.



Key takeaways 6.4

The four identified barriers to the adoption of Metro Mapping are:

- Low engagement & participation
- Adoption & implementation issues
- Human capacity & time pressure
- Tool limitations & interactivity

6.5 Suggestions for future improvements

In addition to the enablers, challenges, and barriers discussed in this chapter, I identified several suggestions for future improvements (Figure 34). These emerged from the interviews, where participants often shared ideas or needs that didn't neatly fit into the earlier categories, but are highly relevant for the future development and implementation of Metro Mapping. A full overview of the suggestions, along with the original post-it clustering, can be found in Appendix L.

The suggestions point towards both strategic and practical opportunities to make the method more usable and impactful in different healthcare contexts. They reflect a desire to make Metro Mapping more flexible and easier to adapt to local needs.

While Metro Mapping already has a strong foundation, there is significant potential to refine the method and improve its implementation in practice.

6.6 Conclusion

This chapter provided an overview of the main enablers, challenges, and barriers to the adoption of Metro Mapping. Based on insights from interviews, literature, and existing models, I identified eight enablers that help the method succeed in practice, such as collaboration, patient involvement, role clarity, and adaptability. Additionally, I identified seven practical challenges that arise during implementation, and four more structural barriers that can limit long-term adoption. Also, first ideas for future developments were listed.

Adoption & implementation issues

Even when teams are enthusiastic about Metro Mapping, adoption can be difficult due to unclear implementation strategies or a lack of practical guidance. Some organisations struggle to move beyond the mapping itself. As Gartner & Côte found, organisations can also face structural or professional limitations that hinder full integration of care pathways. These issues reduce long-term impact of the care pathways and Metro Maps.

What's next?

In the design phase, I will build on this analysis to explore how the implementation of Metro Mapping could be improved. It gives insight into what makes Metro Mapping work, what holds it back, and what conditions need to be in place for successful implementation. This understanding will help me further identify opportunities for improvement, and can be used as input for the development of my design future vision and design principles.

Broader ecosystem

Overall, this analysis shows that the success of Metro Mapping depends not only on the quality of the tool itself, but also on how it fits within the healthcare system, team dynamics, and available resources. An implementation strategy that takes these factors into account is therefore might be essential.

While this chapter has focused on concrete factors that help or hinder the implementation of Metro Mapping, it is also important to consider the broader ecosystem. As Gartner and Côte (2023) emphasise, systemic pressure for change and early signals of success can stimulate adoption and scale-up, even beyond the initial context (which was oncology for MM).



Figure 34: Suggestions for future improvements to Metro Mapping

Scoping

07

- 7.1 From insights to direction
- 7.2 Selected case
- 7.3 Ending the first diamond

7.1 From insights to direction

The first phase of this project focused on understanding the current use and limitations of Metro Mapping in healthcare. Through interviews, literature reviews, desk research, and clustering of enablers, barriers and challenges, a number of recurring patterns became clear.

Problem statement

“Despite the promising potential of Metro Mapping to improve care pathways and support shared decision-making, its adoption in practice remains limited. Metro Maps are mainly created in Microsoft Visio, but this tool is complex, lacks interactivity, and does not fit the needs of HCPs. The Metro Maps are static, hard to update, and often either too complex or too simplified. This makes them difficult to use in patient conversations throughout care processes or daily practice.

Without a more interactive and user-friendly tool, Metro Mapping risks becoming a one-time design activity instead of a method that truly improves care pathway collaboration and patient-centered care.”

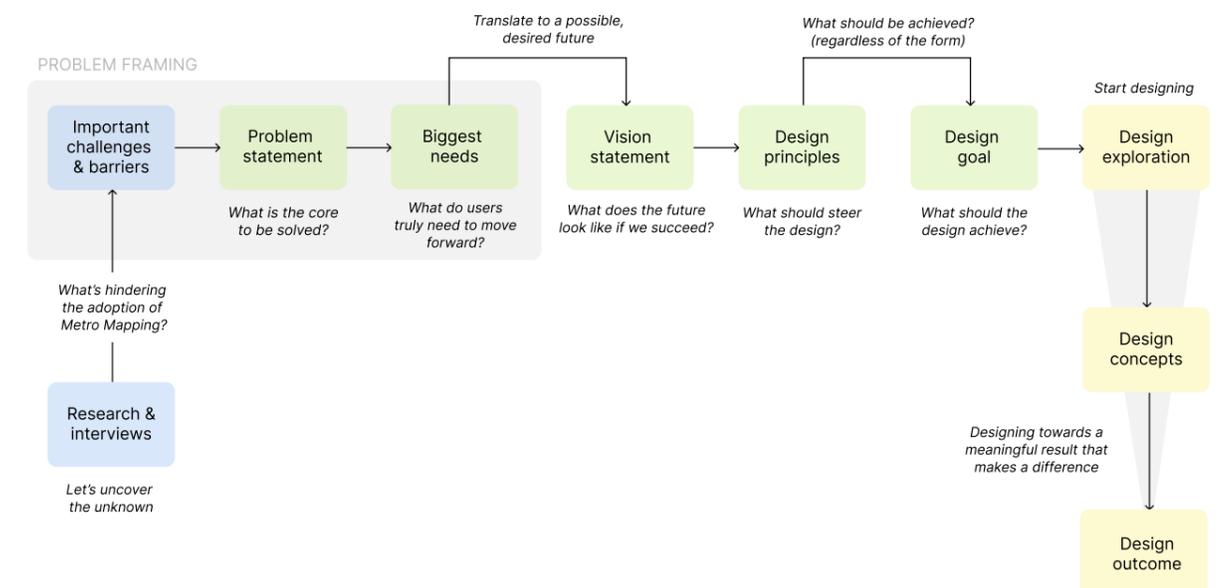
Thus, Metro Mapping has strong potential, but without a simpler and more accessible tool, the threshold to actually start and continue using it remains too high.

Translating insights

With this reframed problem in mind, I translated the insights from the research phase into a clear design direction. I used the structure as visualised in Figure 35.

First, I formulated seven main user needs: what do users truly need to move forward? These needs are based on the insights from the identified challenges and barriers (see Appendix M for a more detailed description):

1. A tool that's intuitive and easy to use
2. Support for real-time co-creation and collaboration
3. Control over the level of detail
4. Guidance to structure the mapping process
5. Flexibility to fit different care context
6. Clear added value for patients and professionals
7. Ability to attach documents and other relevant information



This chapter is the transition from the first diamond to the second diamond: from research to design. Based on the findings from the research phase, this section describes the reframed problem, the most important user needs, and the envisioned future of Metro Mapping. These insights are translated into design principles and a concrete design goal, which will guide the next phase of designing a digital Metro Mapping tool. It also introduces the selected context.

Figure 35: From insights to solution

To translate the needs into a desired future, I created a the following future vision:

Future vision

"MMs are dynamic documents that are evolving, shared visual blueprints that support coordination, communication and better patient outcomes."

Metro Maps should become '3D documents' in which you can attach information and can navigate through different levels of details, as illustrated by Figure 36.

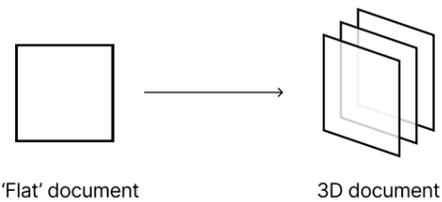


Figure 36: From 'flat' to '3D' documents

With the future vision in mind, the key needs were translated into a set of design principles, summarizing what the tool should offer. These are visualised on the right.

Finally, the vision and design principles helped define a concrete design goal:

Design goal

"Enable healthcare professionals to collaboratively create and use Metro Maps in a **clear, flexible, and dynamic** way — so the method can better support care pathway optimisation and improve patient care in daily practice."

The concept should...

- 
1. Be intuitive and easy to use
 It should reduce complexity and be easy to learn and use, even for time-pressured or digitally less experienced HCPs.
- 
2. Enable real-time co-creation and feedback
 It should allow multiple users to collaboratively build, comment on, and edit the MM.
- 
3. Support layered & filtered views
 It should let users switch between overview and detailed views using filters, layers, or clickable elements, tailored to their context and role.
- 
4. Provide guidance, structure and clarity
 It should guide users through the mapping process using templates, consistent visual elements, and clear explanations, so teams build a shared understanding.
- 
5. Adapt to different care contexts
 It should be flexible enough to support various care settings, teams, and processes, e.g. through custom elements or modular setup.

- 
6. Communicate value to all users
 It should make it clear how the MM contributes to better teamwork, patient insight, and coordination, e.g. by highlighting connections, showing updates, or visualising care goals.
- 
7. Allow attachment of relevant information
 HCPs should be able to connect documents, protocols, or links directly to specific elements in the map, so the MM becomes a rich and usable resource.

Design principles

Why, How, What

I have defined the 'Why', 'How', and 'What' of this project, based on the Golden Circle introduced by Sinek (2009), see Figure 37. This model makes sure that the design direction is grounded in insights from the first diamond and aligned with the deeper purpose of the tool.

- **Why:** Metro Mapping is a valuable method because it improves care by enhancing collaboration, facilitating better shared decision-making, and aligning HCPs.
- **How:** By fitting to the needs of HCPs, the tool enables them to collaboratively create and use Metro Maps in a clear, flexible, and dynamic way; turning static visuals into evolving, shared blueprints for care coordination and improvement.
- **What:** A user-friendly, digital Metro Mapping tool.

From the start, the 'Why' of Metro Mapping has been evident: improving collaboration and clarity in care delivery. The need for a digital version of the method ('what') was also already defined at the start of this project.

The main challenge was therefore to explore how such a tool should be designed. This 'How' is closely aligned with the future vision and design goal.

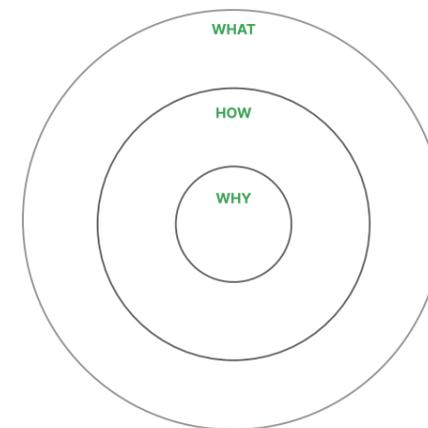


Figure 37: Golden circle (Sinek, 2009)

7.2 Selected case

The use case that was selected for the design phase is the care pathway 'palliative care' for which Online Department has created a Metro Map (Figure 38). This case was chosen based on three key criteria:

1. It represents a **transmural** care pathway, involving collaboration across different care organisations. This is an interesting new domain for Metro Mapping, as the method has so far mostly been applied within hospital settings.
2. It involves **hybrid** care, combining physical and digital interactions. This aligns with what I concluded from my research: the future of healthcare will be hybrid, and Metro Mapping should be able to support that.
3. The care pathway already has an **existing Metro Map**, since the aim of this project is not to create a MM from scratch, but to improve the way a MM is created with a tool.

This makes palliative care a valuable context to explore how a digital tool can support cross-organisational collaboration, while also allowing assumptions to be based on a real case.

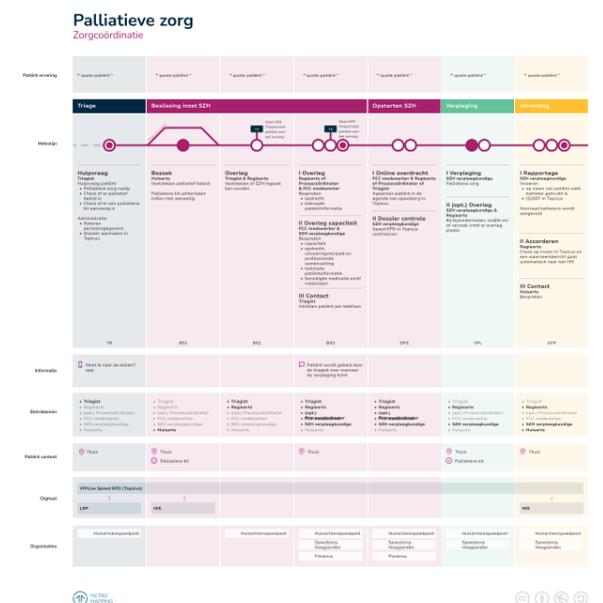


Figure 38: Metro Map for palliative care (created by Online Department)

How this MM was created

The Metro Map for palliative care was developed in 2024 at the request of Vereniging Transmurale Zorg (VTZ), who approached Online Department to help map out several care pathways and support the communication and implementation of improvements. The starting point was a completed pilot involving Spoedzorg Haaglanden, focusing on acute nursing care at home during out-of-hours shifts and improving coordination between the emergency dispatch centre and GP posts.

In response, Online Department proposed a phased, agile approach to visualising the care pathways in Metro Map format, creating communication materials, and shaping concrete improvement projects in a roadmap. The goal of the collaboration was not only to design better pathways, but to ensure shared understanding and alignment across all stakeholders involved in the care chain: from emergency care to community nursing.

The resulting Metro Map for palliative care was created through co-creation sessions facilitated by service designers at Online Department and has since been used as a tool to support coordination, communication, and evaluation across organisations. The Metro Map was visualised in Figma.

Application of the use case

The design phase will include two parts:

First, the tool will be explored in a general sense: what kind of features are needed, how flexible should it be, and what interaction patterns could support more complex or collaborative use? This will be visualised through mockups that demonstrate potential functionalities. These mockups may use abstract or fictional examples to showcase features like clickable branches or layered views, without being limited to one specific case.

Second, the tool will be applied to the existing Metro Map for palliative care to show how the design can make a difference in practice. This allows for a clear 'before and after' comparison and demonstrates what value the tool can add in a real healthcare setting.

Combining both perspectives makes it possible to show both the broader potential of the tool and its concrete value in a specific use case.

7.3 Ending the first diamond

This chapter marks the end of the first diamond, in which the focus was to explore care pathways and the broader healthcare context, understand the enablers, challenges and barriers to the adoption of Metro Mapping, and identify key opportunities for improving its adoption in practice. Based on these findings, the direction for the design phase was defined.

Scope of this project

While Metro Mapping touches on many relevant dimensions – from empowering patients to optimizing care pathways – not all of these could be addressed in this project. Therefore, it felt important to clearly define the scope. This makes sure that the design process remains focused and feasible, while still acknowledging broader opportunities. In designing a digital Metro Mapping tool, it's important to distinguish between two layers of design:

- 1. Functionalities:** What should the tool be able to do? This includes key capabilities such as attaching files or real-time collaborating.
- 2. Interactions:** How should the tool behave? This involves the detailed UX design, such as where buttons are placed, the visual hierarchy of information, and the overall look.

As illustrated in Figure 39, this project aims to define a clear 'point on the horizon': a vision for what an ideal Metro Mapping tool could look like in the future, and which functionalities are desired. This vision is grounded in research and has been validated through feedback from stakeholders. It is focused on HCPs (not patients) and creating the Metro Map 'as is'.

Out-of-scope topics, such as discussing the Metro Map in consultations, technical feasibility, and data integration, might get discussed briefly, but not explored in depth.

Approach for the design phase

Now the scope is clear, the next step is to design and prototype the digital Metro Mapping tool. First, the tool will be explored more broadly: what features and functionalities are really essential, and which are more optional?

Through working iteratively, the most valuable features will eventually be combined into an integrated prototype.

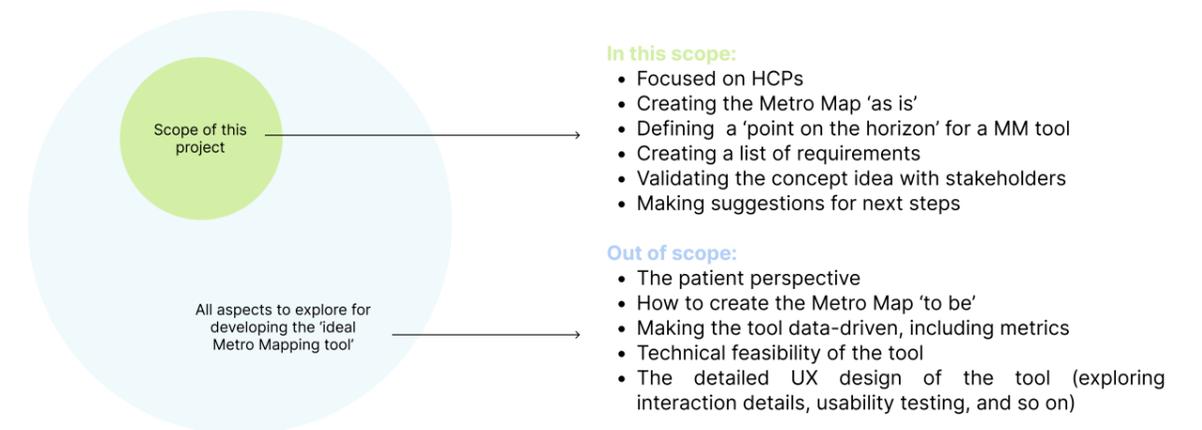


Figure 39: Defining what is in- and out-of-scope.

Key takeaways 7.2

- Palliative care is a good use case: it is transmural, hybrid, and already includes a Metro Map, making it ideal for exploring tool improvements.
- The existing Metro Map was created through co-creation and visualised in Figma.
- The design phase will explore both general improvements and a concrete before/after application to show the tool's added value.

Design Exploration

08

- 8.1 Future scenario and first ideas
- 8.2 Co-creation sessions
- 8.3 Inspiration & best practices
- 8.4 User types & top tasks
- 8.5 Feature exploration
- 8.6 Prioritisation with Kano model
- 8.7 Initial sketches
- 8.8 Summary of the design exploration

8.1 Future scenario and first ideas

Based on insights from the scoping phase, I developed a future scenario that illustrates a desirable situation in which the Metro Mapping tool is successfully integrated into daily healthcare practice (see Figure 40, or Appendix N for a bigger version). This scenario serves as a guiding vision: it helps frame the role the tool could play in the future, and what kind of experience and value it should enable.

The scenario describes seven moments along the Metro Mapping journey: from initial preparation and co-creation, to use during consultations, and ongoing refinement. Together, these steps represent a future in which the tool not only supports the technical creation of care pathways, but also enables multidisciplinary collaboration and continuity.

For every design principle, I show in which phases of the scenario they play a role, and I describe their different kinds of impact to the envisioned experience. These links help translate abstract design goals into practical needs and opportunities. It forms the starting point for the design exploration that follows: what needs to be true for this scenario to become reality? And what kind of functionalities and features are needed to facilitate this way of working?

I validated this scenario during feedback sessions. One participant pointed out that a risk analysis should take place before the MM is implemented (between step 3 and 4). While this is not shown as a separate step in the visual, it's an important consideration: potential risks and impact should be assessed before putting the MM into use.



This chapter describes the first phase of the design process, in which I explored different ideas for a digital Metro Mapping tool. The goal of this phase was not to arrive at a single solution, but to investigate what functionalities could support the needs identified during the scoping phase. Various methods were used, including creative facilitation, brainstorming, and the Kano model. I had feedback sessions with stakeholders throughout different phases of the process: during early concept ideation, when prioritising features, and during prototyping. Their insights are integrated into different sections in Chapters 8 & 9 and strengthen the overall direction of the tool.

Figure 40: Future scenario of the Metro Mapping tool

First brainstorm

The design exploration started by translating the user needs and design principles into potential features. I began with a structured brainstorm, generating functionalities that could support each principle (see Figure 41 for an illustration of this). This helped break down abstract ambitions into tangible directions for interaction and interface design.

For each principle, I explored how this could translate into tool features. For example, “intuitive and easy to use” led to ideas such as drag-and-drop building blocks, or inline explanations. I will discuss these ideas in Chapter 8.3.

In addition to this brainstorm, I had been collecting ideas throughout the research phase. During interviews, I kept a list in the back of my notebook with desired features or characteristics that participants mentioned. These included needs like interactivity, online collaboration, the ability to show different levels of detail, and the importance of keeping the goal of the map clear at all times.

All ideas were mapped and used as input for concept development. Later, some features were visualised in the form of rough sketches (Chapter 8.7). Also, quick mockups were made using AI software. I used these to test ideas and discuss them with stakeholders in short feedback sessions.

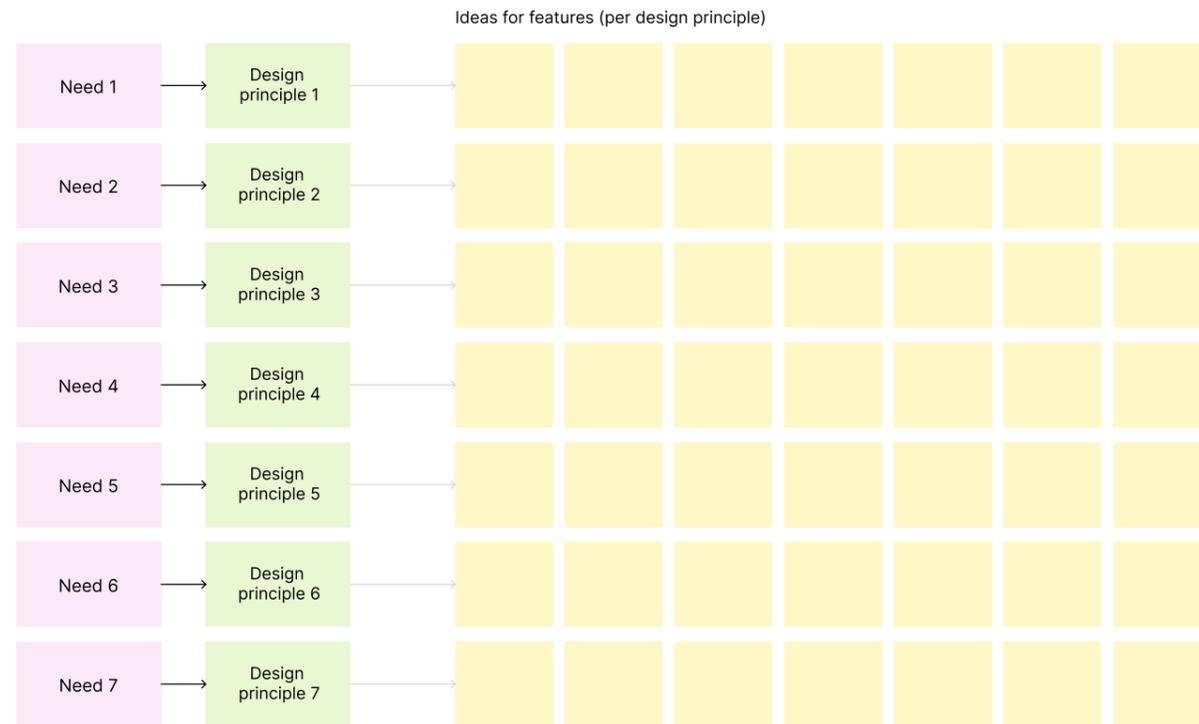


Figure 41: Brainstorming process of features per design principle

8.2 Co-creation

8.2.1 Session 1: TU Eindhoven

At the start of the design phase, I organised a co-creation session with other Industrial Design Engineering students from Eindhoven University of Technology, who were also working on Metro Mapping for their theses. We decided to meet in person for a full-day session, in which each participant hosted their own 75-minute co-creation session.

For my session, shown in Figure 42, the goal was to explore first ideas for how a digital Metro Mapping tool could support HCPs, based on the design principles and user needs identified in the scoping phase. Participants created ‘How Might We’ questions for each design principle, followed by idea generation rounds using brainsketching.

The session resulted in a range of enriched ideas per principle, a few inspiring mini-concepts, and useful insights into user needs and preferences (see Appendix O for more details).



Figure 42: Co-creation session with design students at Eindhoven University of Technology

8.2.2 Session 2: Online Department

Two weeks later, I facilitated a second co-creation session at Online Department for four UX designers (Figure 43). The aim of this session was to explore how a digital Metro Mapping tool could look like, by generating ideas together and visualising how certain functionalities might work in the interface.

After a short introduction and brainstorm based on the design principles, I presented a future scenario of how the tool might be used, followed by UI sketching rounds using prompts of top tasks (which I will explain in Chapter 8.5), where sheets were passed around and ideas were built upon collaboratively. We concluded the session by discussing the sketches and reflecting on opportunities and design directions.

This session provided valuable insights into how the tool might be structured and experienced, and helped generate several concrete interface ideas. A more detailed overview can be found in Appendix O.



Figure 43: Co-creation session with UX designers at Online Department

8.3 Inspiration from best practices

During interviews and feedback sessions, I noticed that participants often referred to features from other digital tools when imagining what a Metro Mapping tool could look like. Tools such as Miro, Figma, and Google Docs were mentioned multiple times, often with remarks like: “It would be great if you could just move things around, like in Miro,” or “You should be able to add comments, like in Google Docs.”

These references suggest that users already have certain interaction patterns in mind and that building on these familiar structures could help lower the threshold for adoption. They also show that design inspiration doesn't need to come from scratch: many relevant patterns already exist in the tools people use daily.

To translate this into design input, I analysed common features from a range of well-known digital tools (Figure 44). While these tools vary in purpose, they all offer relevant patterns and elements that align with some of the needs and design principles identified earlier in this project.



Figure 44: Used best practices

Key takeaway 8.3

Existing digital tools (like Miro, Figma, TheyDo) offer useful inspiration and familiar patterns that can lower the threshold for adoption.

In Appendix P, I analyse several of these tools more in-depth and highlight specific interface patterns with visual examples. Below is a selection of relevant features:

- **Collaborative editing:** Real-time co-editing and live cursors (e.g. Miro, Figma) support teamwork and shared ownership.
- **Commenting and suggestion modes:** Role-based interaction modes (e.g. edit, comment, view only) as in Google Docs and Figma allow safe, structured collaboration.
- **Drag-and-drop:** Intuitive placement of elements makes the tool easier and more intuitive to use, which lowers the threshold for participation. This is especially valuable for busy HCPs.
- **Modular templates:** Predefined building blocks and reusable templates (e.g. in Miro, TheyDo) help users get started faster and maintain consistency.
- **Visual layering & toggles:** Switching between overview and detail, hiding sections, or filtering views (e.g. TheyDo) supports flexibility.
- **Tabs & navigation aids:** Easy tab switching supports multitasking, navigation between versions, and reuse of elements.
- **Version history:** Tracking changes increases confidence, supports iteration, and reduces fear of making mistakes.
- **Export functionality:** Selective export of content, as seen in TheyDo, supports documentation and sharing.

These are just a few examples of best practices that inspired my design. Throughout the process, I regularly looked at how other tools handle similar challenges. TheyDo was especially useful as inspiration, because it focuses on customer journeys, which is a bit similar to Metro Maps.

8.4 User types & top tasks

To design a tool that truly supports practice, it's important to understand who will be using it and what they need.

User types & stories

In my research, I came across a range of people using Metro Mapping. For this project, I focus on users within healthcare settings: HCPs, project coordinators, service designers, and care managers. These roles are typically involved in creating or applying Metro Maps and together form the 'Metro Team' (see Chapter 5.3).

Although the individual responsibilities differ per role, these users share a common goal: to create and use a Metro Map that supports collaboration and clarity. Therefore, I treat them as one 'target group' and focus on shared patterns and needs, rather than designing separate solutions per role.

I created a user story for each user type, see Figure 45. These stories are written from the user's perspective and reflect key tasks and goals. They help translate abstract design principles and goals into more tangible use cases, and guide which features are most valuable.

A recurring insight was that Metro Maps could support onboarding. Participants noted that a clear, up-to-date Metro Map helps new team members quickly understand the care pathway and team roles. Based on this, I added "new team member" as a distinct user type.

While this project focuses on professional users, patients and family members may also interact with Metro Maps in a limited way. For this reason, I also included them as a user type.

I also created a version of the user stories in which I added values and possible relevant features per user type, which can be found in Appendix Q.

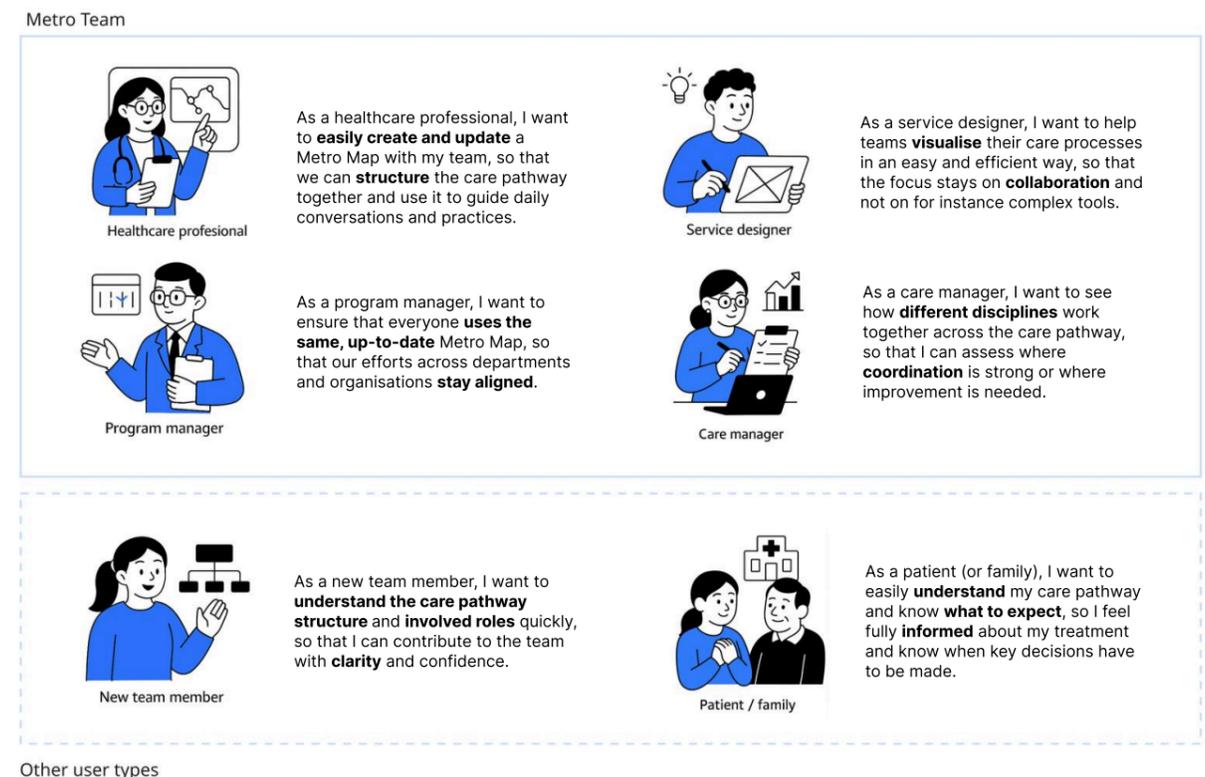


Figure 45: Different Metro Mapping user types, including user stories

Interaction roles

Not all users interact with a Metro Map in the same way. Based on my research and the structure of typical Metro Teams, I've distinguished three interaction levels:

- **Edit:** can create or change the map
- **Comment:** can give feedback or suggest changes
- **View:** can only access / use the map

Not every user needs editing rights, and sometimes this can even add risk or complexity. Roles may also shift: for example, an HCP may help build the map during a workshop, but only view it afterwards. This highlights the need for role-based permissions and flexible interaction modes. In Table 2, I created an overview of possible different interaction roles for each user type.

User type	Edit	Comment	View
Healthcare professional	✓ (some)	✓	✓
Project coordinator	✓ (some)	✓	✓
Service designer	✓	✓	✓
Care manager	✗	✓	✓
New team member	✗	✗	✓
Patient/family	✗	✗	✓ (patient-view)

Table 2: User types and interaction roles

While the previous section outlined different user types and their values, I chose to focus on 'the Metro Map user' more generally: someone who interacts with the map, regardless of their role. Therefore, the tool should support all user types. This helps maintain flexibility and avoids overfitting the design to one context, especially since many of the core challenges are not role-specific, but more task-oriented.

Key takeaways 8.4

- The Metro Team includes a variety of professional roles, but they share common goals. The Metro Mapping tool is designed with this group as a whole in mind.
- Typical users interact with the Metro Map at different levels (edit, comment, view). The tool should facilitate these differences.
- Six top tasks were identified to structure the design.

Top tasks & use cases

To guide and prioritise my design, I identified a set of top tasks that Metro Mapping users typically want to perform. These are based on recurring needs from interviews and feedback sessions, and form the basis for structuring the tool's features. By starting from these common tasks, I can design a strong foundation that supports the full Metro Team. Role-specific features can always be added later if needed.

The top tasks not only reflect what users want to do with the tool, but also translate the underlying design principles into practical goals. By clustering features under these top tasks, I make the connection between strategic design intentions and functional needs more tangible.

For each top task, I added a use case example. These were validated in feedback sessions as the most essential tasks the Metro Mapping tool should enable.

Top task	Use case
1. Create a new MM (from scratch or with templates)	A team initiates a new Metro Map, defines the goal, and selects a predefined template as a basic structure.
2. Collaborate on a MM	Two HCPs work on different sections of the map and comment on each other's updates.
3. Review or update a MM	A user checks what has changed since the last version, compares two drafts, and updates a few steps based on stakeholder feedback.
4. Navigate layers and structure	A user switches from the general Metro Line overview into more detailed information, by clicking on a specific station.
5. Use the map in daily care	A HCP wants to use the map during a multidisciplinary consultation, to guide the conversation or to explain treatment steps to colleagues or patients.
6. Link documents or additional context	The user wants to add supporting information to specific stations in the map (such as protocols or background info).

Table 3: Top tasks for the MM tool

8.5 Possible features

This section summarises a selection of possible features that emerged from the research phase, ideation, and feedback sessions. These features were inspired by user needs, design principles, interview insights, creative exploration, co-creation sessions, and expert feedback. To bring structure to these ideas, I clustered them under the six top tasks I identified earlier.

Top task 1: Create a new MM

This task includes everything involved in building a new Metro Map, from either a template or from scratch. Features that lower the barrier to start and support a flexible building experience are key here:

- Smart alignment
- Templates
- Building blocks
- Mini onboarding tour
- Drag & drop builder
- Icon library
- Choosing your own layers

Top task 2: Collaborate on a MM

Metro Mapping is a co-creative process, which the tool should support. These features help multiple users work together:

- Online collaboration
- Comment / feedback function
- Real-time cursors

Top task 3: Review or update a MM

After a map is created, it often goes through iterations. This top task focuses on managing feedback, versions, and roles:

- Approval flow, draft/final versions
- Different kinds of interaction roles
- Version history

Top task 4: Navigate layers and structure

Since Metro Maps can get complex, navigating between layers and phases in a clear way is essential:

- Clickable layers
- Collapse & expand layers/phases
- Zooming controls
- Hover-based information

Top task 5: Use the map in daily care

It's important to make the map understandable and usable for others, especially in clinical practice. Features that support clarity and contextual relevance are:

- Clearly define and display the goal of the Metro Map
- Role-based filters
- Export options
- Simplified patient view

Top task 6: Link documents

Although more of a supporting function, users highlighted the need to link relevant documents to specific steps or moments. This function is quite straightforward:

- Attachment option

Conclusion

Of course, many more features could be imagined, but this selection represents those that seem most relevant and actionable based on the project so far. An overview is shown on the next page in Figure 46. To further prioritise and validate feature desirability, I included a subset of these features in a Kano-style survey. I will explain this in more detail in Chapter 8.6.

Key takeaway 8.5

Possible features were developed based on six top tasks, combining user needs with the design principles.

8.6 Prioritisation with Kano model

To move from a broad set of possible features towards a more focused concept, I used the Kano model (Figure 45) to prioritise features based on user expectations and perceived value (Kano, 1983). The goal of this step was to understand which features are considered essential, which could deliver unexpected delight, and which are less relevant to users.

The Kano model categorises features into five types based on user feedback:

- **Must-be:** Basic expectations; if missing, users are dissatisfied.
- **Performance:** The better it works, the happier the user.
- **Attractive:** Unexpected features that generate delight if present, but are not missed if absent.
- **Indifferent:** Features that do not affect satisfaction.
- **Reverse:** Features that some users would prefer not to have.

To apply the model, I created a short online survey in which participants were shown a list of potential features. For each feature, respondents were asked two questions:

1. How would you feel if this feature were included in the tool?
2. How would you feel if this feature were not included in the tool?

Not all features were included: some, like smart alignment, are likely to be must-haves and were therefore skipped to keep the survey manageable. I tried to select a mix of expected, performance-driven, and potentially delightful features, without overwhelming respondents (see Figure 47).

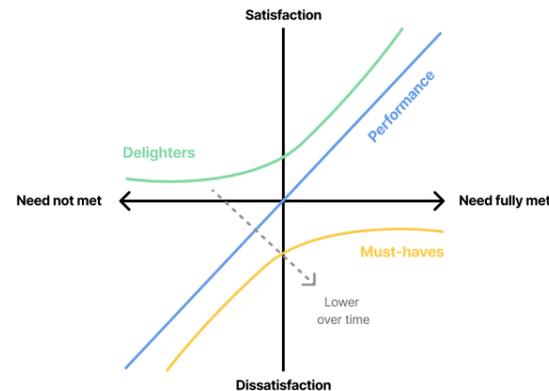


Figure 47: Kano model

Note on shifting user expectations

In the Kano model, user expectations may shift over time. Features that are now seen as attractive or new can eventually become standard, which underlines the importance of revisiting priorities regularly.

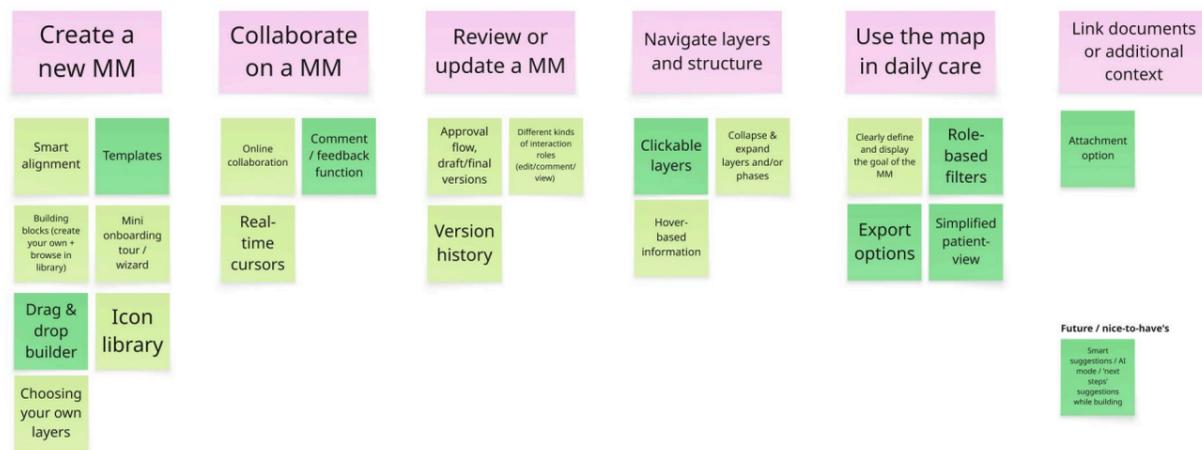


Figure 46: Features per toptask. The darker green features were chosen to be included in KANO survey.

Results

As discussed in the previous section, features can be categorised in five different categories (Figure 48). The results of the Kano survey, as shown in Figure 49, provide a valuable indication of which features are seen as essential, which ones could create added value, and which appear to have lower priority. The full results can be found in Appendix R.

	Dysfunctional (feature is absent)				
	like it	expect it	neutral	can tolerate it	dislike it
like it (feature is present)	Questionable	Attractive	Attractive	Attractive	Performance
expect it	Reverse	Questionable	Indifferent	Indifferent	Must-be
neutral	Reverse	Indifferent	Indifferent	Indifferent	Must-be
can tolerate it	Reverse	Indifferent	Indifferent	Questionable	Must-be
dislike it	Reverse	Reverse	Reverse	Reverse	Questionable

Figure 48: Categories for interpreting the Kano survey (Survalyzer AG, 2025).

Some features stood out as clear must-haves, including the drag & drop builder and export options. These are seen as basic expectations: if missing, the tool would not meet users' needs.

Other features were frequently classified as attractive and can be seen as "nice bonus features", such as templates, role-based filters, simplified patient view, and the option to attach documents. Although these features are not strictly required, the results show they are positively received and appreciated. This suggests that they have a real potential to improve the user experience and should be seriously considered for inclusion, either in the initial concept or as part of future iterations.

Only a few features received mostly neutral. For example, answers for the smart suggestions feature were mixed. One participant even felt reversed to it, indicating that users either don't need this kind of assistance or are sceptical of automated input.

Similarly, the comment/feedback feature received mixed results. I assume that the relevance for this feature differs per user group. As you can see in the results, respondents in a researcher role were mostly indifferent, while respondents in a healthcare role were mainly positive. Therefore, I decided to mark this feature as 'nice bonus feature' because the tool will primarily focus on HCPs.

Conclusion

Overall, the Kano exercise helped to identify which functionalities are considered baseline expectations, which could add surprise and delight, and which might be lower-priority or controversial. It also showed some clear appreciation for several additional functionalities. These 'bonus' features have the potential to differentiate the tool and contribute to a more engaging and satisfying experience.

These insights informed the feature selection for the list of requirements for the Metro Mapping tool, as well as for the concept prototype.

Key takeaway 8.6

The Kano survey helped prioritise the features, which informed the feature selection for the concept.

Conclusion:	Nice bonus feature	Must-have	Nice bonus feature	Must-have	Nice bonus feature	Nice bonus feature	Nice bonus feature	No priority	Must-have
Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Add attachments	Smart suggestions	Export options
Respondent 1: Researcher	Attractive	Must-be	Indifferent	Indifferent	Attractive	Attractive	Attractive	Reverse	Must-be
Respondent 2: Researcher	Indifferent	Attractive	Indifferent	Performance	Attractive	Indifferent	Attractive	Indifferent	Indifferent
Respondent 3: Service designer	Attractive	Performance	Indifferent	Performance	Indifferent	Attractive	Performance	Attractive	Performance
Respondent 4: PhD	Performance	Performance	Indifferent	Performance	Attractive	Indifferent	Indifferent	Indifferent	Performance
Respondent 5: Care pathway designer	Performance	Indifferent	Attractive	Attractive	Attractive	Attractive	Attractive	Attractive	Attractive
Respondent 6: Care pathway designer	Attractive	Performance	Performance	Attractive	Indifferent	Indifferent	Indifferent	Indifferent	Performance
Respondent 7: Quality & Safety advisor	Attractive	Attractive	Attractive	Must-be	Must-be	Must-be	Must-be	Indifferent	Must-be
Respondent 8: Quality & Safety advisor	Indifferent	Must-be	Indifferent	Must-be	Attractive	Must-be	Must-be	Attractive	Must-be
Respondent 9: Service designer	Indifferent	Attractive	Attractive	Attractive	Attractive	Attractive	Indifferent	Indifferent	Attractive

Figure 49: Results of the Kano survey

8.7 Initial sketches

Throughout the whole design exploration, I have been creating sketches: of wireframes, UI ideas, concept screens, and feature explorations. I have explored different kinds of layout options. These early sketches (see Figure 50) helped me visualise possible interfaces and interactions, while exploring how the tool could support different user flows and functionalities.

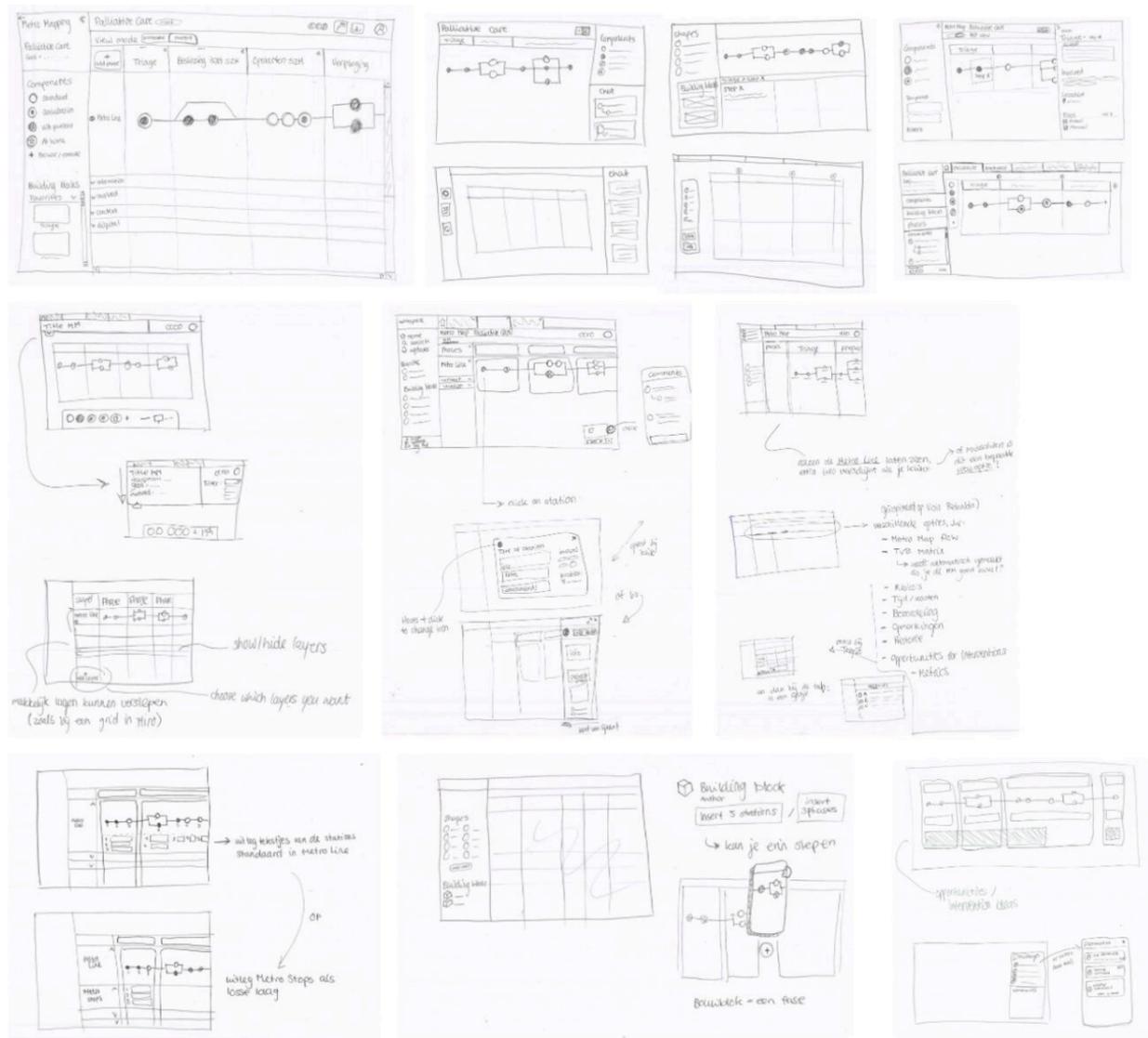


Figure 50: Some of the sketches that were made during the design process

8.8 Summary of the design exploration

This chapter explored how the Metro Mapping method could be translated into a digital tool. Through a combination of co-creation sessions, user interviews, design principles, and best practices, I gathered a broad set of ideas for useful functionalities. These were gradually refined through stakeholder feedback and prioritisation using the Kano model.

Figure 51 below summarises how the feature set was developed: from early ideation inputs, to prioritisation, to a final distinction between required features and future wishes. These outcomes form the foundation for the conceptualisation phase described in the next chapter, which will start with a list of the selected features for the tool.

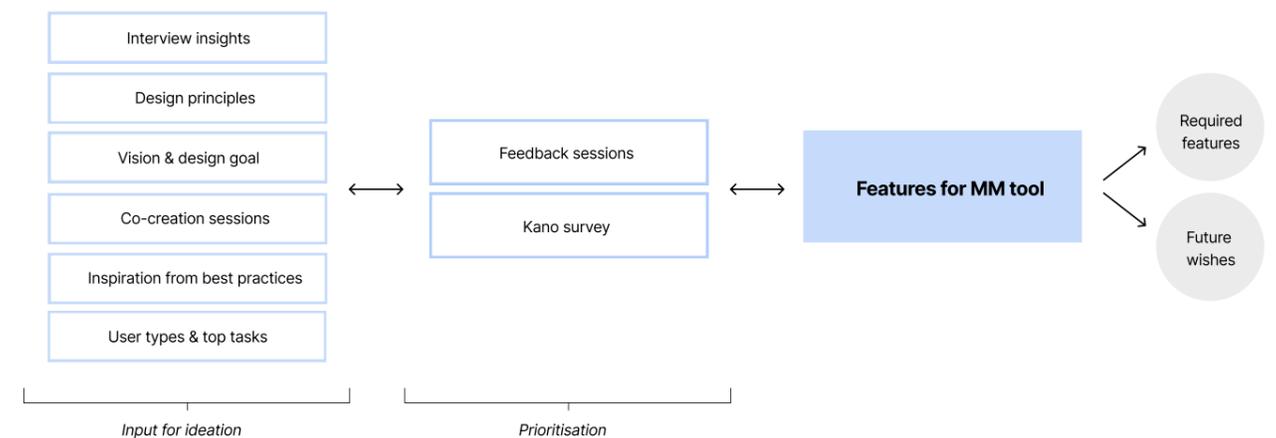


Figure 51: Process of identifying and prioritizing features for the Metro Mapping tool

Concept Design

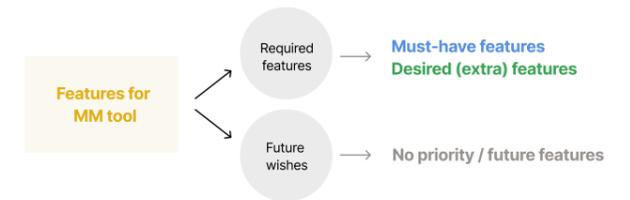
09

- 9.1 List of features
- 9.2 Prototyping
- 9.3 Concept generation

9.1 List of features

9.1.1 Features prioritization

The list of features shown in Figure 52 reflects the outcome of the design exploration, validated with stakeholders throughout the feedback sessions and Kano survey. To structure the findings, the features have been prioritized and divided into three categories:



- **Must-have features**

These are essential requirements that the tool should include to function properly. They are typically performance features: users expect them to be present, and without them the tool would not meet basic needs. Several of these have been validated through the Kano survey and stakeholder feedback.

- **Desired (extra) features**

These features were not seen as strictly essential, but were clearly mentioned by users as highly desirable. Including them will improve the user experience and increase the likelihood of adoption. They are considered part of the full product scope, but could be implemented in a second phase if needed.

- **No priority / future features**

These features are less urgent but may be valuable in the longer term. They are more exploratory, context-dependent, or rely on broader IT integration (e.g. with EPDs or Zenya). While not required for the first version, they offer opportunities for further development and scalability.

The feature list in this chapter is not meant as a strict MVP (Minimum Viable Product), but rather as a vision for a first fully functional version of the Metro Mapping tool, based on user needs. It represents a realistic yet ambitious starting point: if we want Metro Mapping to work in daily practice, these are the features it should include. I will highlight some important features in the next sections.

The prioritization is based on the six top tasks reflecting core moments in the Metro Mapping process. While some features are marked as “future wishes,” they still carry value and can be considered for development in later stages, once the core of the tool has proven itself in practice.

Category	Feature
Must-have	Drag & drop builder
Must-have	Smart alignment
Must-have	Clickable layers
Must-have	Export options
Must-have	Clearly define and display goal of Metro Map
Desired feature	Add attachments
Desired feature	Templates
Desired feature	Role-based filter
Desired feature	Simplified patient view
Desired feature	Building blocks
Desired feature	Icon library
Desired feature	Choosing your own layers
Desired feature	Collapse & expand layers or phases
Desired feature	Approval flow, draft or final version
Desired feature	Different interaction roles (edit/comment/view)
Desired feature	Version history
Desired feature	Opportunities for interventions
Desired feature	Comment / feedback function
No priority / future	Smart suggestions / AI input
No priority / future	Hover-based information
No priority / future	Mini onboarding tour / wizard
No priority / future	Adding data, costs, waiting times, etc.
No priority / future	Metrics andn analytics to demonstrate impact
No priority / future	Let users create their own view / set-up

Figure 52: List of features

This chapter describes the iterative design process that shaped the final concept. Based on the prioritised features and initial sketches, I gradually translated ideas into digital mockups and interactive prototypes. Rather than developing multiple divergent concepts, I worked from the start towards one coherent tool vision, continuously refining it based on feedback sessions with stakeholders.

9.1.2 Integration with existing systems

One item that stands somewhat apart from the other features is integration with existing systems, such as EHRs or Zenya. While this was initially placed under "future wishes," it's arguably not a feature in itself, but rather a critical condition the tool must be able to meet in the future in order to succeed in real-world healthcare settings.

According to the Tool+Team+Routine framework by Shaw et al. (2018), tools must fit into existing routines and workflows. In practice, many healthcare professionals already work primarily within platforms like the EHR or Zenya. If the Metro Mapping tool requires users to switch platforms or log into a separate environment, it creates unnecessary friction, especially in busy or time-sensitive settings.

This issue also explains why the Metro Mapping Foundation previously chose to work with Visio templates. Despite Visio's limitations in usability, it was chosen because it fits within the Microsoft ecosystem, which is commonly used in hospitals. This illustrates how IT environments in healthcare are often tightly controlled, and any new tool must align with these constraints.

Although my project does not explore the technical feasibility of integration, it is important to acknowledge this reality. Integration is not just a "nice-to-have" future feature, it is a baseline requirement for implementation. Even a lightweight form of integration, such as embedding a clickable link into the EHR or Zenya, could make a significant difference.

9.1.3 Simplified patient view

Another key feature that stood out strongly throughout my research and needs further elaboration is the simplified patient view. Since Metro Maps are created by HCPs, but also often shared with patients or families, it is important that the tool can offer a MM version that is clear, minimal, and easy to interpret. While designing the patient view is out of scope for this project, I still wanted to highlight this feature and give some suggestions.

In my research, it became clear that current Metro Maps are often perceived as too complex for patients. Several participants mentioned that patients might either don't understand the visuals or feel overwhelmed by the amount of information shown.

During an interim feedback session with Schaaphok (Quality & Safety advisor at Treant), she mentioned an example where two different Metro Maps were created for the same care path: one aimed at HCPs (Figure 53) and one aimed at patients (Figure 54). While this approach makes sense in terms of tailoring information to different users, it also challenges the original idea of Metro Mapping: to create a shared overview that can be used to streamline care processes and support SDM.

"I now see a colleague making two different Metro Maps, but that's very time-consuming. You have to constantly check: does the information match? No, not always. Then you start making mistakes. The more documents and versions you create, the more problems you'll get when copying over information." - Schaaphok (Quality & Safety advisor)

Splitting it into two versions suggests that the professional version is too detailed for patients to engage with, and yet even the patient version still appears quite complex and visually overwhelming. Schaaphok pointed out that maintaining two versions is not only time-consuming, but also **risky**:

"From a safety perspective, I worry: does the information still match? Because you basically have disconnected documents, and if you update one and forget the other. That is asking for trouble." - Schaaphok (Quality & Safety advisor)

Suggestion for future developments

These insights highlight the importance of designing a tool that supports a 'patient proof' Metro Map version, without needing separate files. Instead, the Metro Mapping tool could generate a simplified view from the same source. By applying automatic filters (based on what HCPs define as relevant for patients), the tool could hide technical language, reduce the number of visible layers, and show short, step-by-step explanations in simpler terms.

Although the scope of my project does not allow for an in-depth exploration of this, it would be a valuable direction for future research. For example, a Design for Interaction graduation student could investigate what information patients truly need and how a digital view could best support them.

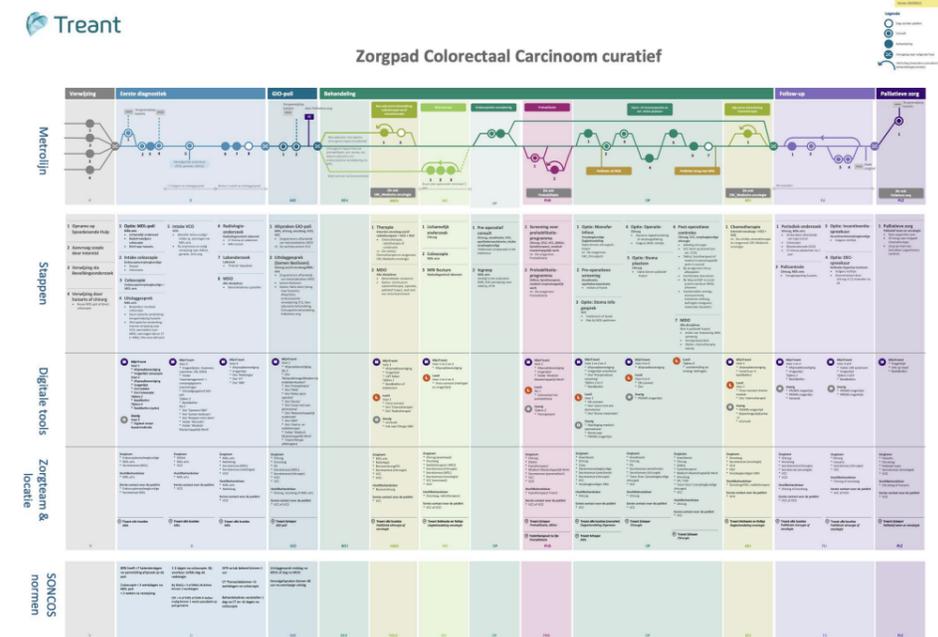


Figure 53: MM as a care pathway (for HCPs)

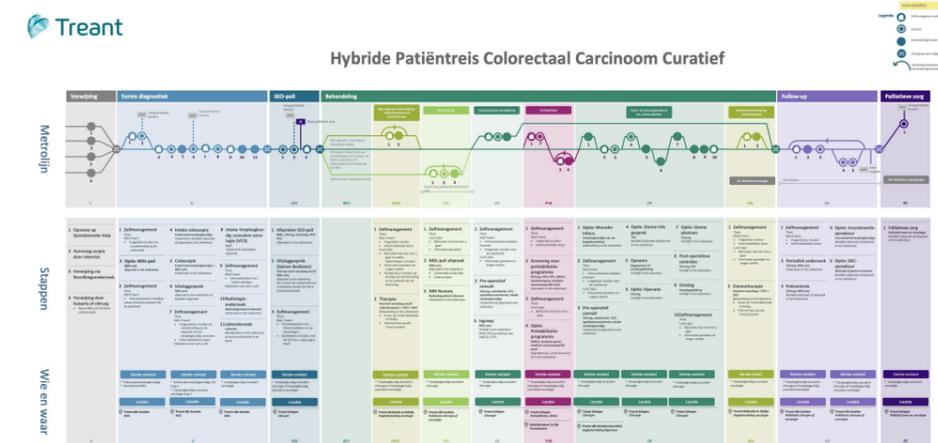


Figure 54: MM as a patient journey (for patients)

Key takeaways 9.1

- A clear distinction was made between must-have, desired, and future features.
- Integration with existing systems (e.g. EHRs) is not a core feature in this prototype but will be essential for real-world adoption.
- Maintaining separate maps for different user types is risky; the tool should generate filtered views from one source instead.
- There is a strong need for a simplified patient view. Future research could explore what patients actually need and how a digital patient view should be designed.

9.2 Prototyping

After defining the required functionalities, I began translating the concept into early prototypes, based on my initial sketches. The goal was to gradually shape the tool's layout and interaction flow, while validating my ideas through feedback sessions.

Defining the main layout

It is important to consider the current Metro Mapping tool in Visio (Figure 55), because it represents a familiar structure for many users and reflects how the method is currently applied in practice. I believe it makes sense to build on this existing mental model, to keep continuity and allow the new tool to feel recognisable, while still improving usability and flexibility.

The proposed interface layout is inspired by the current Metro Mapping setup in Visio. It consists of three main areas (Figure 56).

These three main areas are:

- a **component panel** on the left for selecting elements,
- a central **mapping canvas** for building the Metro Map,
- and a top **control bar** for navigation, settings, and additional details.



Figure 56: Main layout of the interface

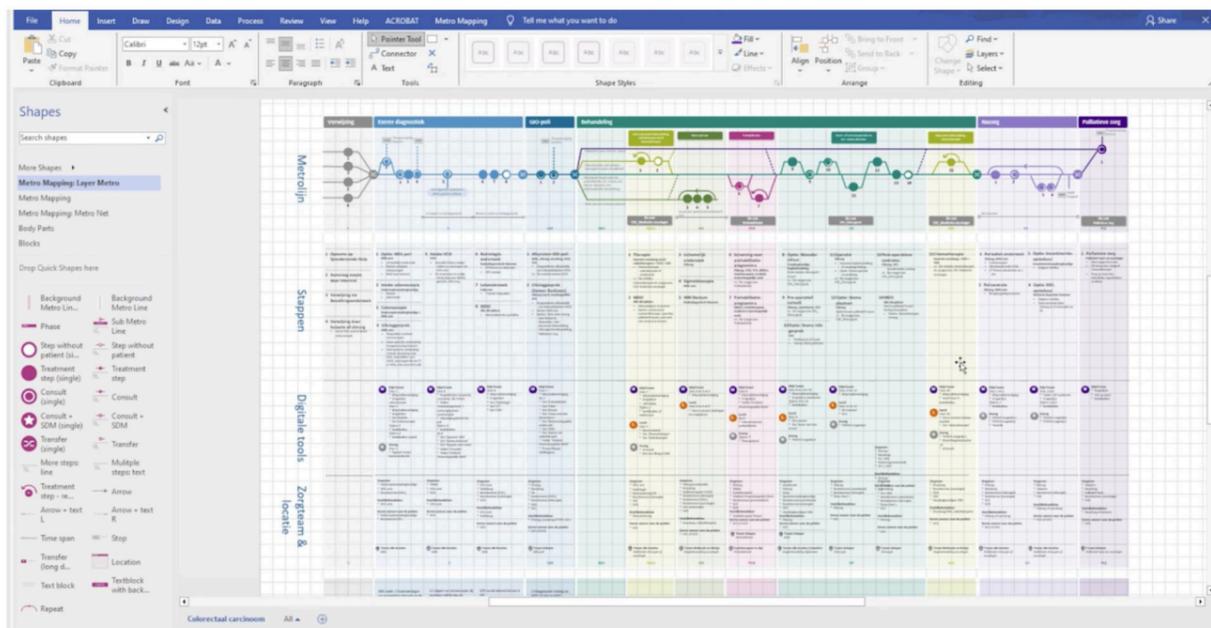


Figure 55: Metro Mapping in Visio

Experimenting with AI tools

Based on the list of features and the main layout structure, I started translating the requirements into specific interface ideas. In addition to working in Figma, I also experimented with the AI-based prototyping tool Lovable, which allows designers to generate interface layouts through prompts. This made it possible to quickly create interface ideas that were also partially interactive.

However, I noticed that designing a system like the Metro Mapping tool – which has multiple layers, a non-linear flow, and complex interactions such as drag-and-drop and collapsing phases – was significantly more challenging than prototyping, for instance, a standard website. Lovable struggled to interpret some of the more specific and dynamic elements of the tool.

Still, Lovable was valuable for exploring layouts, communicating ideas quickly, and illustrating basic interactions (such as toggling layers) during interim feedback sessions. It was also a great way to learn more about how AI can be used in UI design, especially for quickly testing ideas.

On the right, different versions of prototypes I created are shown (Figures 57, 58 & 59). As you can see, the first try did not work out really well, but later attempts were better. Prototype 2 showed some interesting features and in prototype 3, you could click on a step and a pop-up would appear with extra information. These prototypes served as an inspiration while creating my design concept.

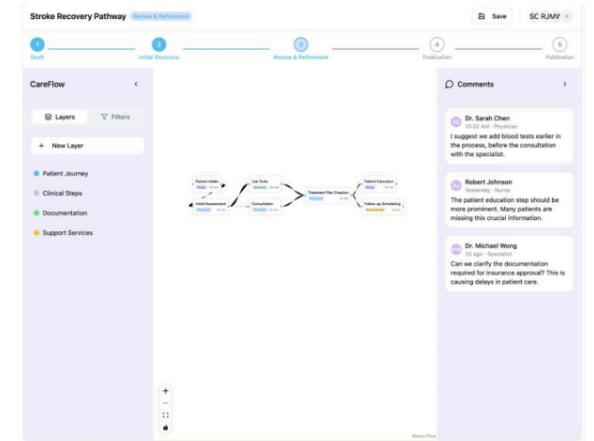


Figure 57: Lovable prototype 1

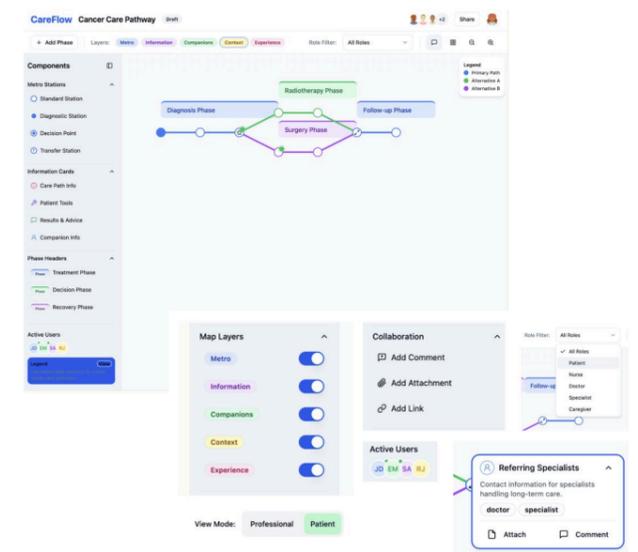


Figure 58: Lovable prototype 2 (left) and an overview of some interesting features (right)

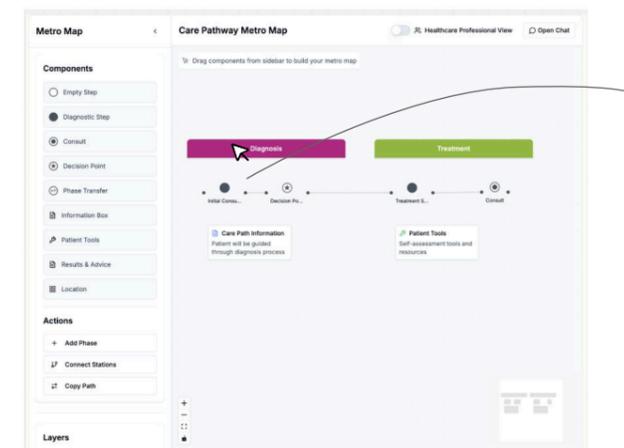


Figure 59: Lovable prototype 3

Only the Metro Line vs. more layers

During this early prototyping, I explored interface layouts where only the Metro Line was visible, and all other information (such as the context or companion layers) would open via pop-ups — similar to the care pathway system used at Treant (see Figure 22 in Chapter 4.3). This minimal version offers a clean and focused interface, but also raised practical concerns among users. However, one participant mentioned during a feedback session where I showed the Lovable prototypes:

“What I do notice is that now it's not a big visual anymore that I can easily print out. So I do have something like: how do I print this out?” - P8

during an interim feedback session

Eventually, I decided to include the layers underneath the Metro Line in the final concept (similar to the traditional Metro Mapping layout). This choice supports several goals:

- It provides visual **recognisability** for experienced users who are already familiar with the current Metro Mapping format
- It maintains the **overview** and **printability** of the map, which remains important in many practical contexts
- It offers flexibility, by allowing users to **collapse or hide** layers if they want to focus on the Metro Line only

In this way, the tool can adapt to different preferences and usage moments, whether someone is co-creating a care pathway interactively, or printing it out for a team meeting. Export options become more intuitive when the full structure is visibly present, without hiding key information behind clicks.

Color palette and standardization

Originally, the idea of Metro Mapping is to assign fixed colours to certain phases. However, as Metro Mapping is increasingly used outside of oncology, this specific colour legend no longer fully applies. The concept of using consistent colours for key phases, though, remains valuable.

Inspired by the original Metro Mapping method (Figure 60), I created a new colour palette with a slightly fresher visual style (Figure 61).

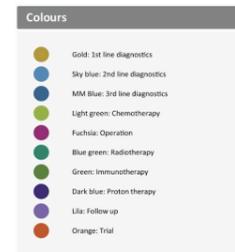


Figure 60: Original Metro Mapping colours



Figure 61: New colour palette idea

While pre-defining colours per phase make sense in specialised contexts, it also raises a challenge: the Metro Mapping tool is intended for *flexible* use across various care domains, so one fixed system may not work in all cases. A possible solution could be to:

- Define standard colours for commonly used phases (e.g. diagnosis or treatment)
- Allow colour variations per care domain or selected template
- Let teams adapt colour use if needed, while encouraging internal consistency

This way, the tool balances standardization and customizability, which are both important when designing for broad adoption in healthcare.

First set-up

Based on my initial sketches and inspired by best practices, I created a first set-up of what the tool could look like (see Figure XX and XX). The tooling bar is on the left, just like in Visio, and users can expand and collapse both the layers and phases.

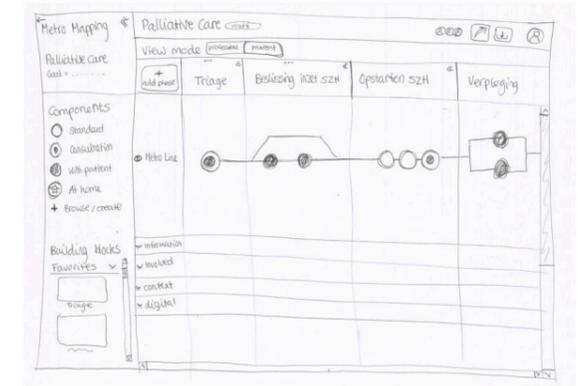


Figure 62: One of the sketches

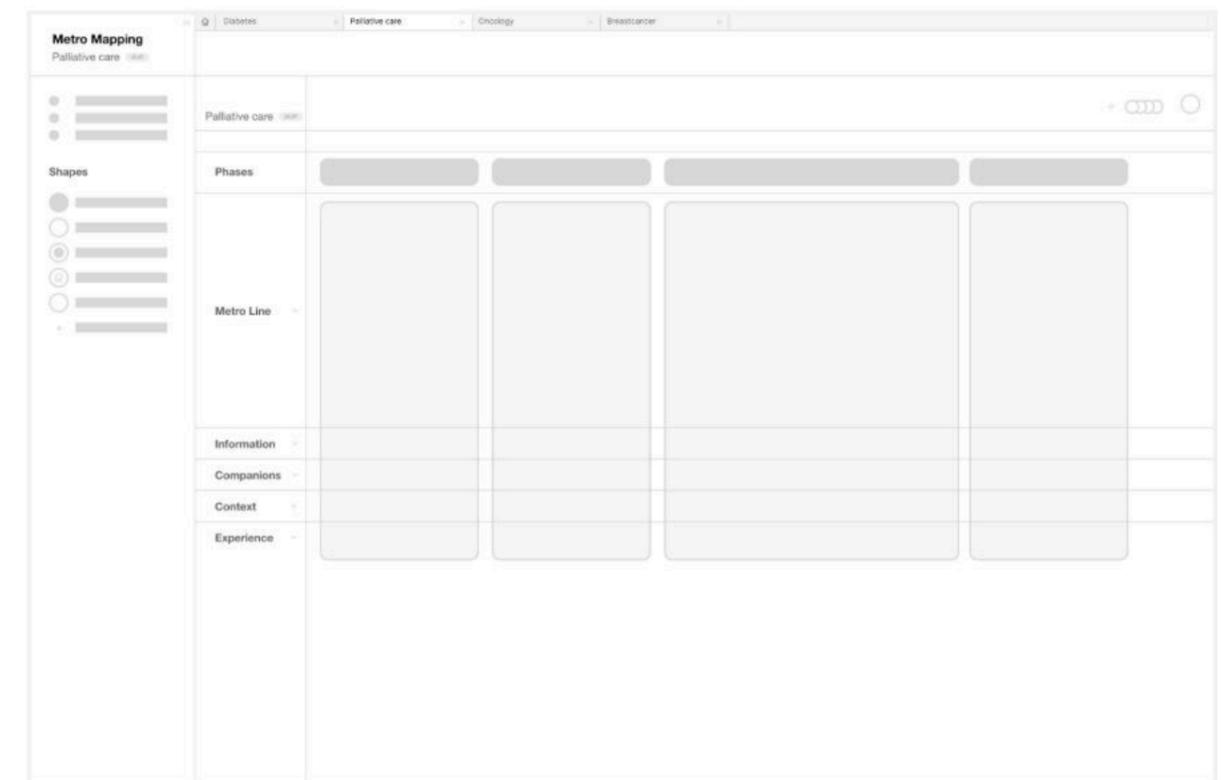


Figure 63: Basic layout idea for the tool

Key takeaways 9.2

- The prototype layout builds on the familiar Visio structure (component panel, mapping canvas, control bar), improving usability while supporting continuity.
- AI tools like Lovable offered inspiration and quick prototyping, but were limited for complex, layered systems like Metro Mapping.
- The decision to place all layers under the Metro Line improves clarity, flexibility, and printability, while keeping advanced information accessible.

9.3 Concept generation

As described in Chapter 7.3, the main focus of this project is to define which functionalities the Metro Mapping tool should offer in the future. The goal is to outline a clear vision of what the tool should ideally offer (a 'point on the horizon') and what is needed to get there. To support this, I created mock-ups that illustrate the core features and give a first impression of how they could work in practice.

Although I also experimented with some visual aspects like interaction details, layout, and colour schemes, these explorations were mainly to support usability and concept communication, since the visual styling is not the focus of this project.

The following pages present a selection of mock-ups I created. They translate the concept into possible screens and flows. The final features and mock-ups will be presented in Chapter 10, but this chapter offers a glimpse into the conceptualisation process.

Exploring map layout variations

I explored several layout variations to test what works best. I experimented with how much space is between the layers, whether or not each phase should have its own outlined block, rounded edges, and the overall spacing and visual clarity (see Figure 65). The differences may be subtle, but they influence the overall clarity and feel of the tool.

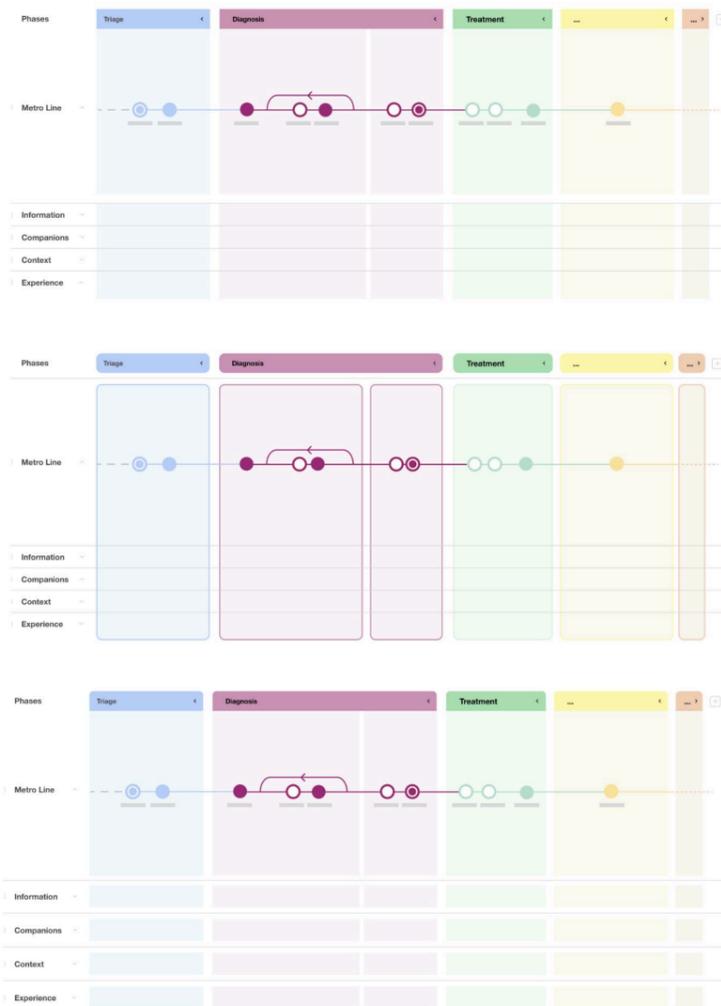


Figure 65: Layout variations

Accessibility compliance

To improve readability and inclusivity, the colour palette for the Metro Mapping tool was updated to meet the Web Content Accessibility Guidelines (WCAG) contrast requirements. These define minimum contrast ratios between text and background to make sure that content is readable for users with visual impairments and colour vision deficiencies. As of June 2025, compliance with WCAG is mandatory for all public-facing digital tools under the EU Accessibility Act (WCAG.nl, 2025).

Although the Metro Mapping tool is initially developed as a professional tool for HCPs, aligning it with WCAG makes it future-proof. This is especially relevant as a simplified patient view is planned later. By building with accessibility in mind now, the tool will support compliance not only for internal use but also for broader public-facing integration. I used a contrast checker in Figma to make sure that the WCAG standards were met (Figure 67).

In the next chapter, the final design will be presented and each feature will be explained.

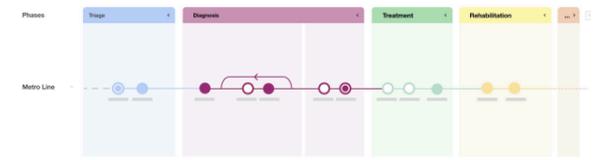


Figure 65: Initial colours

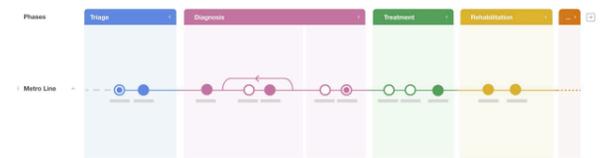


Figure 66: Colours updated to meet the WCAG standards



Figure 67: Contrast checker in Figma

Key takeaways 9.3

- Several layout and colour variations were tested.
- The colour palette was updated to comply with WCAG standards, making the tool more accessible and future-proof. This supports both internap HCP use and potential public-facing applications, such as a simplified patient view.

Final Solution

10

- 10.1 Final concept
- 10.2 Translation to use case
- 10.3 Validation
- 10.4 Value proposition
- 10.5 From a technical perspective

10.1 Final concept

This chapter presents the final design concept for the Metro Mapping tool. It highlights its key features and illustrates their potential through a clickable prototype and mock-ups. The goal of this concept is not to deliver a fully developed digital product, but to clearly communicate the core ideas behind the tool, based on the identified required and desired functionalities.

Each feature is grounded in previous research insights and was iteratively refined through stakeholder feedback. The design aims to make the method more accessible, collaborative, and suitable for use in daily practice. The concept aligns with the vision of Metro Maps evolving from static visuals to shared, dynamic blueprints that support coordination, communication, and better patient outcomes.

Digital tools can include an overwhelming number of functionalities. However, this project focused on identifying and refining the most relevant ones. The aim was to:

- Define the core requirements
- Explore how these functionalities could look and work in practice
- Validate their value and usability with users

The result is a communicative prototype: not a technical blueprint, but a visual and interactive concept that helps bring the tool to life. It serves as a conversation starter and a starting point for further development and validation.

In the next section, I will explain the features that I have selected in the previous chapter.

This chapter presents the final concept for the digital Metro Mapping tool, based on the list of requirements from Chapter 9.1. For each feature, I will discuss why this is important for the tool and illustrate what it could look like through mock-ups. The concept was validated through validation sessions with a various stakeholders. Furthermore, I completed a Value Proposition Canvas of the tool and I address the technical feasibility of the tool, based on an interview with an expert in IT in healthcare

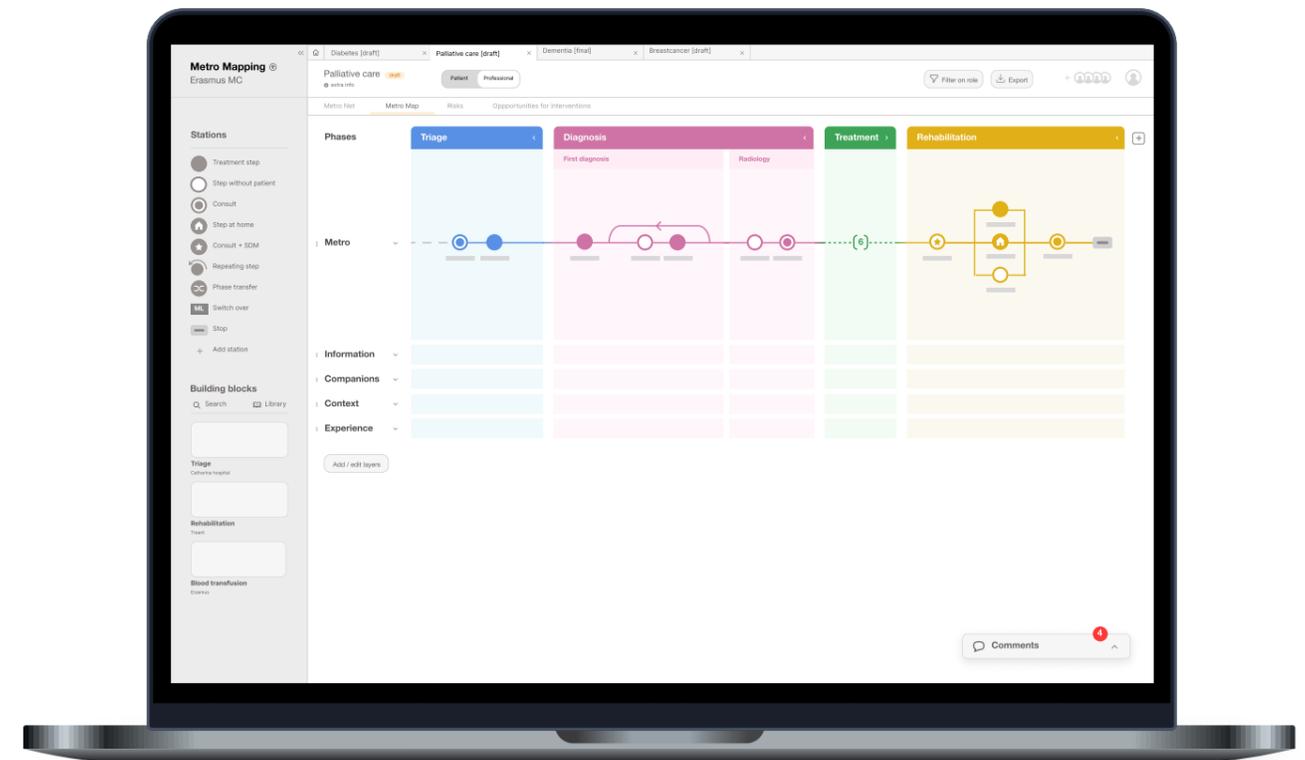


Figure 68: The main screen of the Metro Mapping tool

A first glimpse of the final concept...
 On the next pages, each feature will be explained in detail.

Export options

Selected layers:

- Metro Line
- Information
- Companions
- Context
- Experience
- Opportunities for interventions

Selected phases:

- Triage
- Diagnosis
- Treatment
- Rehabilitation

Save as PDF Save as PNG

Role-based filter

Select which roles you want to show

Patient General practitioner
 Coordinator Nurse
 Triagist Region doctor

X Clear filters

Show filtered view

The screenshot shows the Metro Mapping application interface. At the top, there are tabs for 'Diabetes [draft]', 'Palliative care [draft]', 'Dementia [final]', and 'Breastcancer [draft]'. The main workspace displays a workflow diagram for 'Palliative care' with four phases: Triage (blue), Diagnosis (pink), Treatment (green), and Rehabilitation (yellow). The 'Diagnosis' phase is expanded to show 'First diagnosis' and 'Radiology'. A 'Metro' line is shown connecting the phases. On the left, there is a 'Stations' sidebar with icons for 'Treatment step', 'Step without patient', 'Consult', 'Step at home', 'Consult + SDM', 'Repeating step', 'Phase transfer', 'Switch over', 'Stop', and 'Add station'. Below this is a 'Building blocks' section with search and library options. At the bottom right, there is a 'Comments' button with a red notification badge.

The screenshot shows the Metro Mapping application home page. At the top, it says 'Welcome back, Max!'. Below this, there is a 'Start with a template' section with five empty cards for 'Oncology', 'Palliative care', 'Mental care', 'Elderly care', and 'Pediatrics'. Below that, there is a 'Recent' section with four project cards: 'Diabetes' (last edited 7 hours ago by Max Decker), 'Palliative care' (last edited 1 day ago by Max Decker), 'Dementia' (Approved on June 2024), and 'Breastcancer' (last edited 2 weeks ago by Max Decker). On the left, there is a sidebar with 'Team' (Erasmus MC), 'Home', 'Recent', and 'Starred' options. At the bottom, there are links for 'Invite collaborators', 'Settings', and 'Logout'.

This screenshot is a zoomed-in view of the 'Treatment' phase in the workflow diagram. It shows a sequence of steps connected by arrows, with a 'Metro' line passing through them. The 'Treatment' phase is highlighted in green. The interface elements like the sidebar and top navigation are visible but slightly blurred.

Metro Line
 Information
 Companions
 Context
 Experience
 Opportunities for interventions

Add custom layer

New layer name Add

Add / edit layers

This screenshot is a zoomed-in view of the 'Opportunities for interventions' section in the workflow diagram. It shows a text input field with the placeholder 'Type here your suggestion for an intervention'. The interface elements like the sidebar and top navigation are visible but slightly blurred.

10.1.2 Chosen functionalities

As presented in Chapter 9.1, I created a list of features. I made a distinction between:

- **Required features**, consisting of must-haves and additional desired features. These features should be included in the design for the first version of the Metro Mapping tool.
- **Future wishes**, which are features that might be interesting later, but they have less priority for now. Despite this, they offer interesting opportunities and ideas for future developments.

In this section, I will further explain required features, why they are important, and illustrate ideas through mockups. Sometimes, quotes from the initial interviews or from interim feedback sessions were added.

Given the limited time of this project, not every single feature was fully prototyped. However, but a lot of features kind of speak for themselves (e.g. comments). In the end, the main goal was to define the list of required features and communicate the idea in a clear way. This goal was certainly achieved.

In chapter 10.2, I will discuss the feedback that stakeholders gave on the final prototype during five validation sessions.

Scan the QR code for a video of the prototype!



Category	Feature
Must-have	Drag & drop builder
Must-have	Smart alignment
Must-have	Clickable layers
Must-have	Export options
Must-have	Clearly define and display goal of Metro Map
Desired feature	Add attachments
Desired feature	Templates
Desired feature	Role-based filter
Desired feature	Simplified patient view
Desired feature	Building blocks
Desired feature	Icon library
Desired feature	Choosing your own layers
Desired feature	Collapse & expand layers or phases
Desired feature	Approval flow, draft or final version
Desired feature	Different interaction roles (edit/comment/view)
Desired feature	Version history
Desired feature	Opportunities for interventions
Desired feature	Comment / feedback function
No priority / future	Smart suggestions / AI input
No priority / future	Hover-based information
No priority / future	Mini onboarding tour / wizzard
No priority / future	Adding data, costs, waiting times, etc.
No priority / future	Metrics andn analytics to demonstrate impact
No priority / future	Let users create their own view / set-up

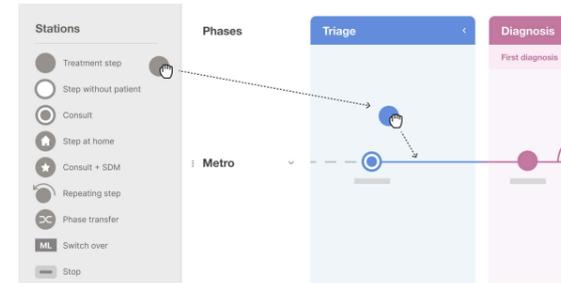
Figure 69: List of features (from Chapter 9.1)

Drag & drop builder (must-have)

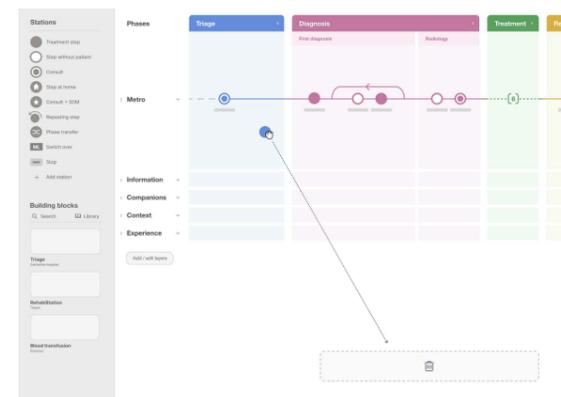
The prototype includes a drag-and-drop interface where users can move stations onto the map canvas. The colour of the station automatically changes to the colour of the phase on which it is dragged. Also, elements can be repositioned and removed freely.

Why it matters: HCPs need to be able to build and adapt care pathways without advanced design skills. Drag-and-drop interfaces lower the barrier to participation, make the tool feel more intuitive, and support co-creation.

"It would be great if you could just move things around like in Miro." - P5



If the user wants to delete a station, it can simply be dragged into the trashcan, which will appear on the bottom while dragging a station.

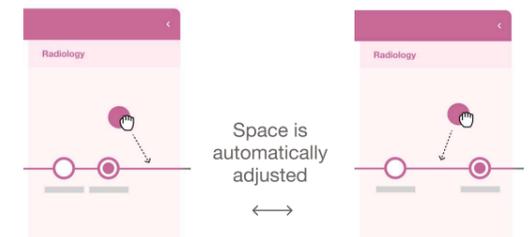


Smart alignment (must-have)

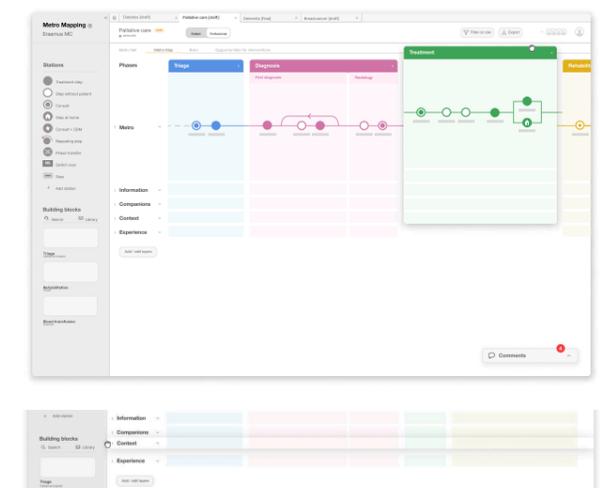
Closely linked to the drag & drop builder is the smart alignment: elements automatically snap into position along the Metro Line, and other elements will shift automatically.

Why it matters: Creating clear, readable Metro Maps requires consistent alignment of elements. Users indicated that manually aligning all stations and lines in Visio is a big frustration and time-consuming. Smart alignment supports visual structure, saves time, and improves the user-friendliness of the tool.

"When I want to add something in the middle of the Metro Map, I have to select everything manually and move it. That frustrates me a lot." - P8



Furthermore, phases and layers can easily be dragged to different positions.

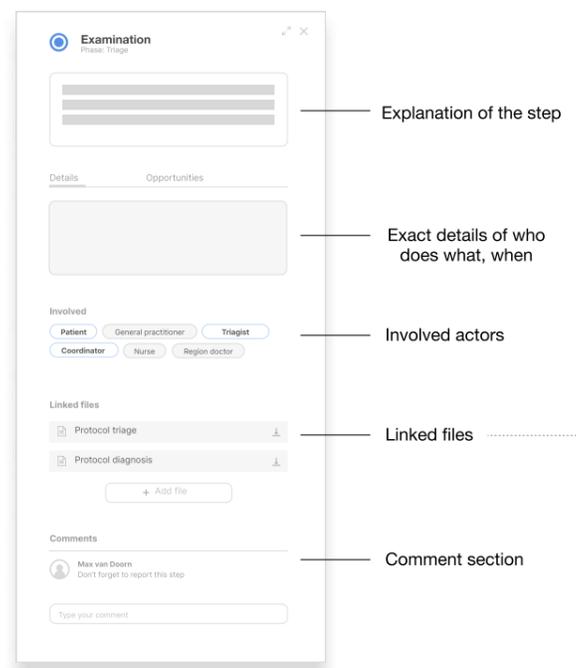
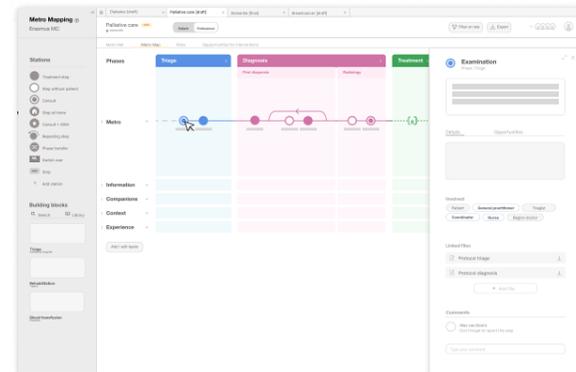


Clickable layers (must-have)

You are able to click on a station, and then a side panel appears showing extra details about the step.

Why it matters: Users don't need to see every single detail at the same time. They want to be able to have control over the level of detail. Furthermore, this is an important feature to make the tool work in daily practice. From a Quality & Safety perspective, it is crucial to have clarity about who does what, when. The information in the Metro Map layers is often not detailed enough for this.

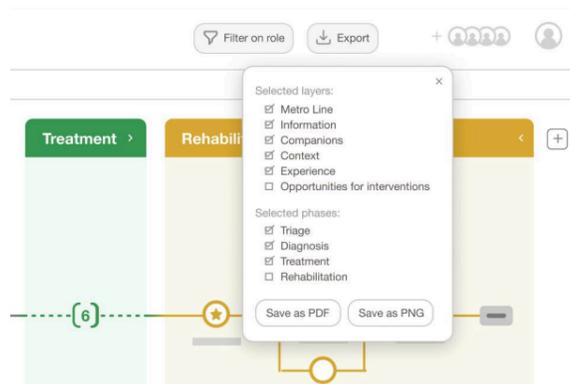
"But when I click on this, nothing happens. So it's basically a flat document."
- P4



Export options (must-have)

Users can export Metro Maps, with the option to select specific layers and phases, supporting flexible sharing. Initially, only PDF export was included, but feedback sessions revealed that PNG exports were also desired to easily insert visuals into slides or online tools.

Why it matters: Metro Maps need to be exported to align with colleagues, facilitate discussions, or include them in documentation. Also, in the Kano survey this feature turned out to be a real must-have.



Add attachments (desired feature)

Users can attach protocols, documents, or links directly to specific steps or layers in the map.

Why it matters: Several interviewees described the current Metro Map as a "flat document." By enabling attachments, the tool becomes more dynamic, layered, and practically useful. This turns the Metro Map into a central point of access for supporting materials, making it easier for HCPs to find relevant information.

"We can't attach links to this, what I just showed about the web links. We can't attach protocols here, and so on." - P4

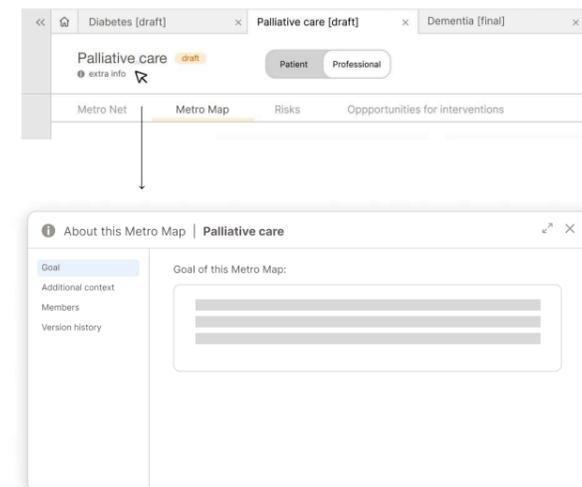


Clearly define goal of Metro Map (must-have)

When clicking on the title of the Metro Map, users can access more information, including the defined goal of the map. This goal is set during creation and can be adjusted when needed. It is automatically included in exports.

Why it matters: Metro Maps can have various purposes: from mapping financial flows to improving patient experience or optimizing care logistics. Without a clearly defined goal, there is a risk of confusion or misalignment between stakeholders.

"I notice that when I put it up and the goal is above it, people start saying: oh yeah, that's why we're doing it." - P10



This also connects to the **Common Eye model** by Kaats & Opheij (2012), as introduced in Chapter 2.2. According to this model, a shared ambition is one of the five essential conditions for successful collaboration. As emphasised by healthcare expert Dominiek Rutters during our interview, clear goals are the *starting point* for meaningful, cross-organisational collaboration.

Besides defining the goal, this pop-up screen also contains tabs for:

- **Additional context** → Users can add info or files that are relevant for the MM in general
- **Members** → Users can see a list of all members of the MM including their roles
- **Version history** → This gives an overview of recent updates and different versions

Templates (desired feature)

Templates allow users to start from a predefined structure rather than building a Metro Map from scratch. These templates could include standard building blocks, standard stations (e.g. one with a blood needle icon for diabetes), example configurations, or layouts based on specific care pathways.

Why it matters: Creating a Metro Map can feel complex, especially for teams doing it for the first time. Templates save time and improve consistency across different teams and organisations. During interviews, multiple stakeholders emphasised the desire for a clearer starting point. Also, we must not forget that HCPs have very busy schedules, so the more efficient a process can be, the better.

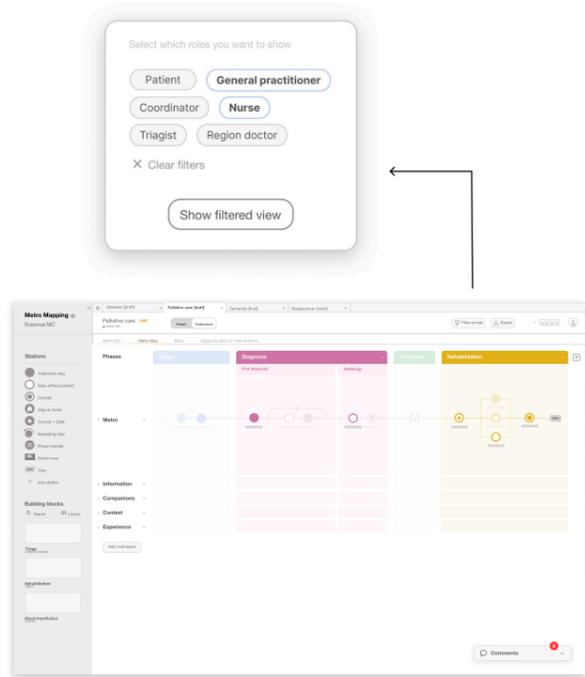


Role-based filter (desired feature)

This feature allows users to filter the Metro Map based on specific roles in the Metro Map, such as a nurse, triagist, or general practitioner. When activated, only the steps relevant to the selected role are highlighted.

Why it matters: Care pathways often involve many professionals, each responsible for a subset of tasks. Especially in complex or transmural Metro Maps, it can be difficult to quickly see what is relevant for your role. A role-based filters improves clarity, reduce cognitive overload, and make the tool more practical for daily use. This is also very valuable when onboarding new team members.

"It would be very nice to filter on different roles. For example, only relevant things for those roles have 100% opacity and the rest 20% or so, so you can still see the bigger picture." - P9

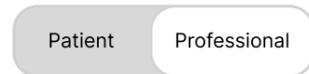


Simplified patient view (desired feature)

This is a more accessible version which is linked to the Metro Map, tailored to patients and their families. The patient view should be clear and easy to interpret. Users can easily switch from professional to patient view by clicking on the toggle.

Why it matters: Metro Mapping was initially developed to improve shared decision-making and empower patients. In practice, however, Metro Maps are perceived as too complex for patients and not detailed enough for HCPs. Therefore, there is a need to create a split: one version for patients and one for professionals.

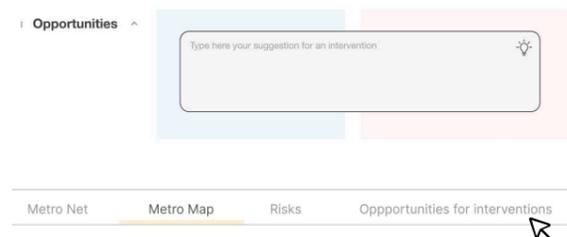
Since this feature was already discussed elaborately, I won't go into much more detail here to avoid repetition.



Opportunities for interventions (desired feature)

As described in Chapter 8.5, the layer 'Opportunities for interventions' can be added to bridge between the 'as is' and 'to be', by creating space for ideas. For example, maybe a step could be done virtually instead of physically, which can save money and time. Such ideas can be written down on 'digital post-its', potentially covering multiple phases.

Why it matters: By explicitly highlighting opportunities for improvement, users are encouraged to think critically about redesigning and optimizing care. It also helps create a clear overview of where further action or discussion is needed, supporting continuous improvement.



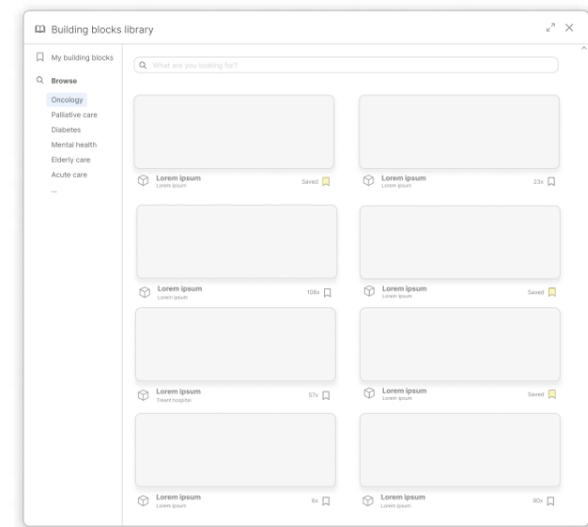
An overview of all identified opportunities within the Metro Map could be found in a separate tab.

Building blocks (desired feature)

Building blocks are reusable map elements consisting of multiple stations or phases (e.g. triage or blood transfusion processes). Users can either create their own building blocks, or browse existing ones created by others.

Why it matters: Reusable blocks support efficiency, help teams get inspired and build on existing work, and improve consistency across care pathways. It makes the process of creating a Metro Map easier, as users don't have to reinvent the wheel all the time.

"I know that they are really looking at some kind of blocks that can be reused" - P3

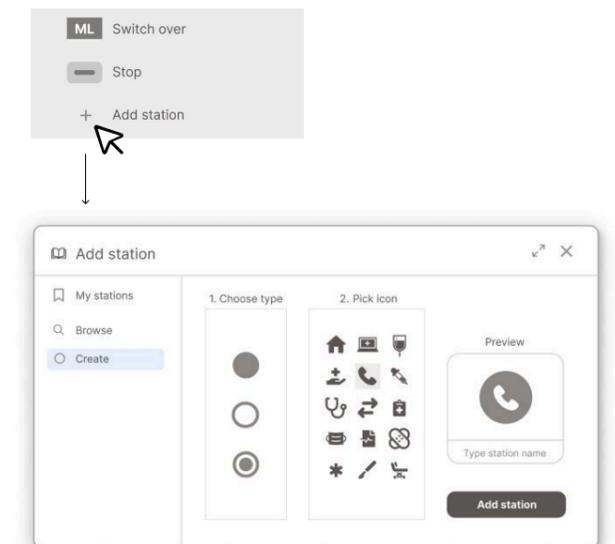


Icon library (desired feature)

Besides the standard stations, users can add more stations types through a built-in icon library.

Why it matters: Icons improve visual communication and make MMs easier to interpret. They can also help standardise visuals across teams and organisations. Several participants in my research created their own icons (e.g. a station with a house for hybrid care), highlighting a need for more flexibility. A built-in icon library addresses this need and improves usability across teams and contexts.

For example, does your MM have a lot of phone consultations? Then it's easy to display those with a phone icon in the station:



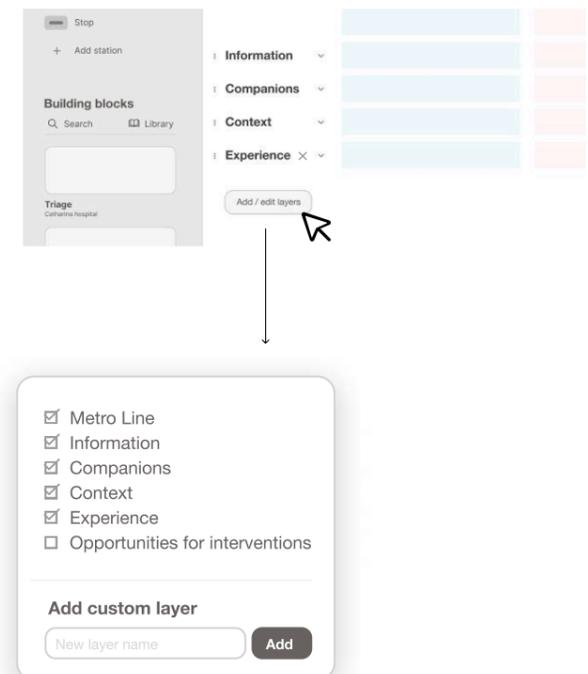
Choosing your own layers (desired feature)

Users can customise which layers they want to include in their Metro Map. Besides this, they can also add their own layers (e.g. Finance).

Why it matters: Different teams have different priorities and goals. During my research, I noticed many differences in the usage of the layers: some HCPs used all five, some used only two, and some added other type of layers. The tool should facilitate this kind of flexibility. Allowing users to define their own layers keeps the tool relevant in a wider range of settings.

"I rarely see people fill in every layer" - P3

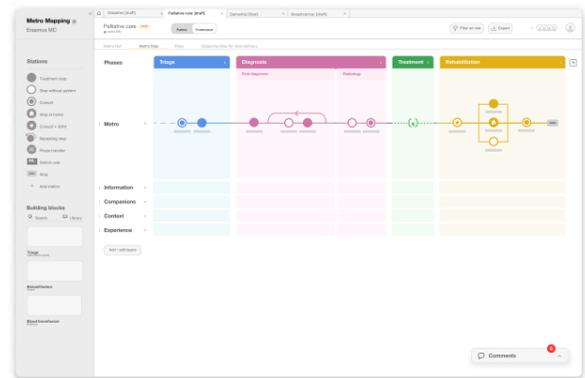
"I saw a need to map out the digital tooling that is being used, so I made a separate layer for that" - P3



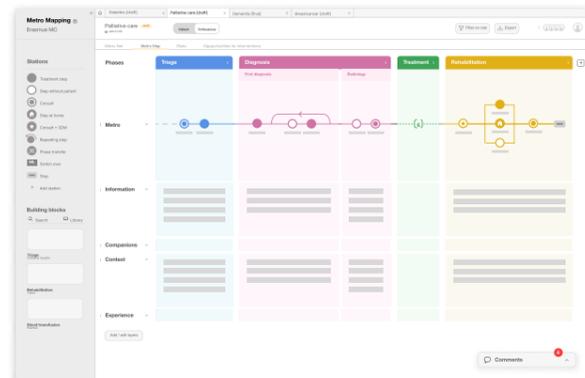
Collapse & expand layers and/or phases (desired feature)

Both layers and phases can be collapsed or expanded. This option to show or hide parts helps users tailor the map to different needs or levels of detail. It also makes it easier to navigate through.

Why it matters: Metro Maps can become very long. Digital Metro Maps have the advantage of flexibility over static, paper-based versions. Instead of always showing everything, users can focus on the parts that are most relevant to them. This improves usability, especially as maps become longer and more complex. For example, a coordinator may want to view all layers for oversight, while a nurse might only need to see a specific phase or discipline.



All layers collapsed vs some layers opened



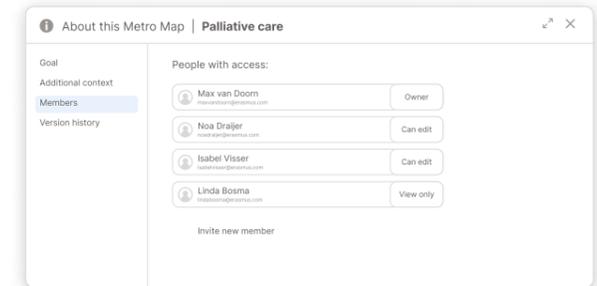
For collapsed phases, a number indicates how many stations are included in that phase:



Different interaction roles (desired feature)

Users can be assigned different interaction roles such as edit, comment, or view only.

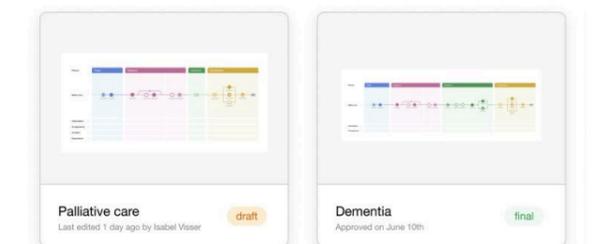
Why it matters: Not every user needs the same level of access. For example, a project lead may edit the map, a team member might only give feedback, and a nurse may simply view the map. Defining roles helps prevent errors, improves collaboration, and keeps the tool manageable for larger teams.



Approval flow (desired feature)

Metro Maps are labelled as 'draft' or 'final' versions to clearly indicate their status. Only authorised users can mark a Metro Map as 'final', making sure that appropriate checks have been performed first.

Why it matters: In healthcare, working with validated and approved content is essential. An approval flow adds structure and accountability, ensuring that the right people sign off before a map is officially used. This reduces confusion, and helps teams work with confidence.



"That's nice. Now we don't have that so specifically listed anywhere yet. So this I really like, it stands out well." - Schaaphok (Quality & Safety advisor) during an interim feedback session

Version history (desired feature)

The tool automatically saves previous versions of the Metro Map, allowing users to track changes or revert to earlier iterations.

Why it matters: Designing and updating a MM is an iterative process. A version history creates transparency, prevents data loss, and allows teams to learn from past iterations. It also helps with audits or evaluations, where understanding what changed and why is crucial.

Comment / feedback function (desired feature)

Users can leave comments on specific elements in the Metro Map to give input or ask questions.

Why it matters: Metro Maps are often created and refined collaboratively. A built-in feedback option simplifies communication, especially when working asynchronously or across organisations (transmural). It allows teams to iterate and improve together, without relying on separate tools or email threads.

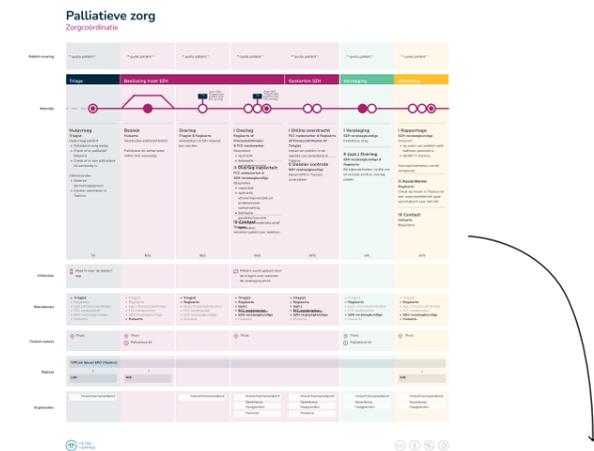
"I need to make a PDF from the MM, which I need to email to everybody. Then people need to read that, zoom in, zoom out, zoom in, zoom out: it drives them crazy. And then, they need to write an email back with their feedback" - P5



10.2 Translation to use case

To demonstrate how the Metro Mapping tool can support real-world care pathways, I applied it to an existing use case, as introduced in Chapter 7.2: the Metro Map for palliative care for the Vereniging Transmurale Zorg (VTZ).

The recreated MM shows how the tool can visualise steps, allow interaction with specific elements, and adjust the level of detail by collapsing or expanding layers. These mock-ups offer a clear picture of what the tool could look like in practice.

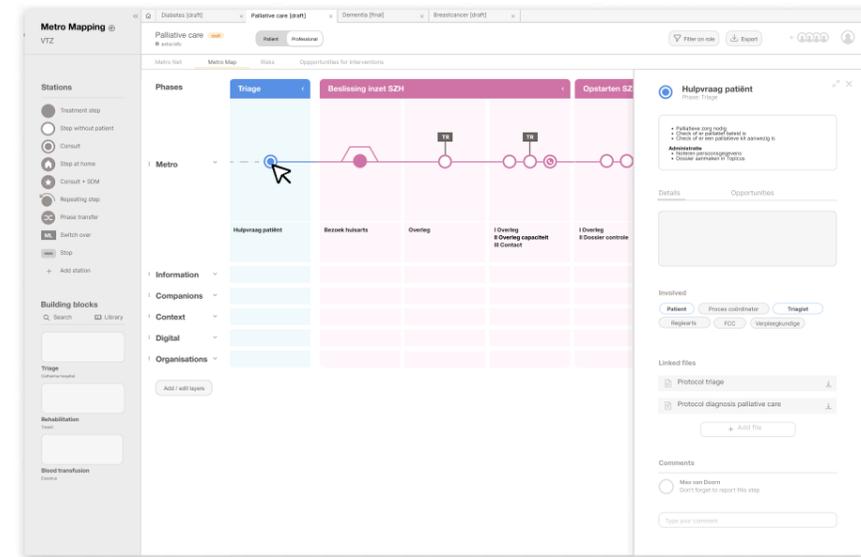


The original MM was created in Figma by a service designer. Although this offers more visual freedom than Visio, it is not a sustainable solution: Figma is not designed for healthcare teams and is too complex for non-designers. The design for this MM tool aims to be **purpose-built** for care pathway design, offering just the right level of complexity and functionality for HCPs due to its interactivity.

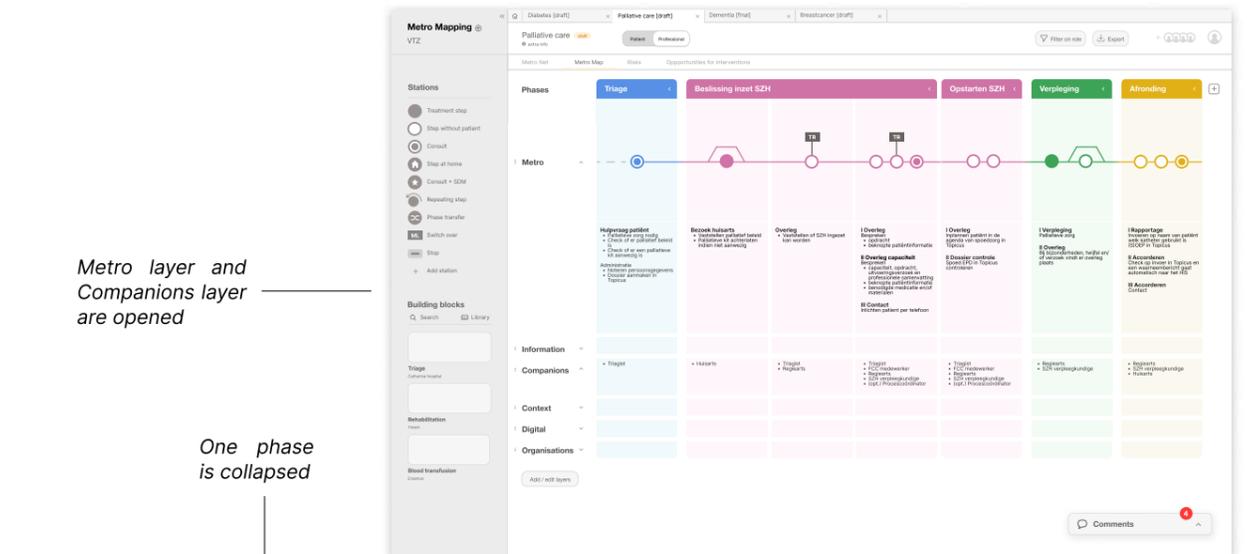
In a **transmural** context, like in this use case, collaboration is essential but often challenging. Therefore, this prototype introduces features specifically designed to support teamwork. E.g. collaborative editing, comment modes, and version tracking make it easier to co-create and review maps across different organisations.

In addition, the MM includes **hybrid care** steps, such as phone consultations or care at home. These are now visualised using simple icons (e.g., a telephone or a house). While subtle, this visual nuance was repeatedly requested in interviews and co-creation sessions.

This translation shows how the tool can turn a detailed, cross-organisational MM into a structured, interactive, collaborative resource.



When clicking on a station, more information and the roles and responsibilities appear



Metro layer and Companions layer are opened

One phase is collapsed

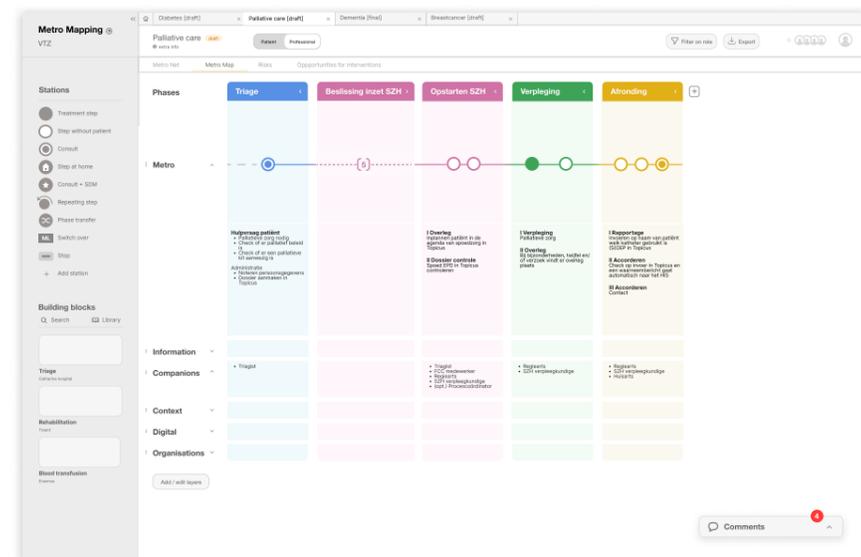
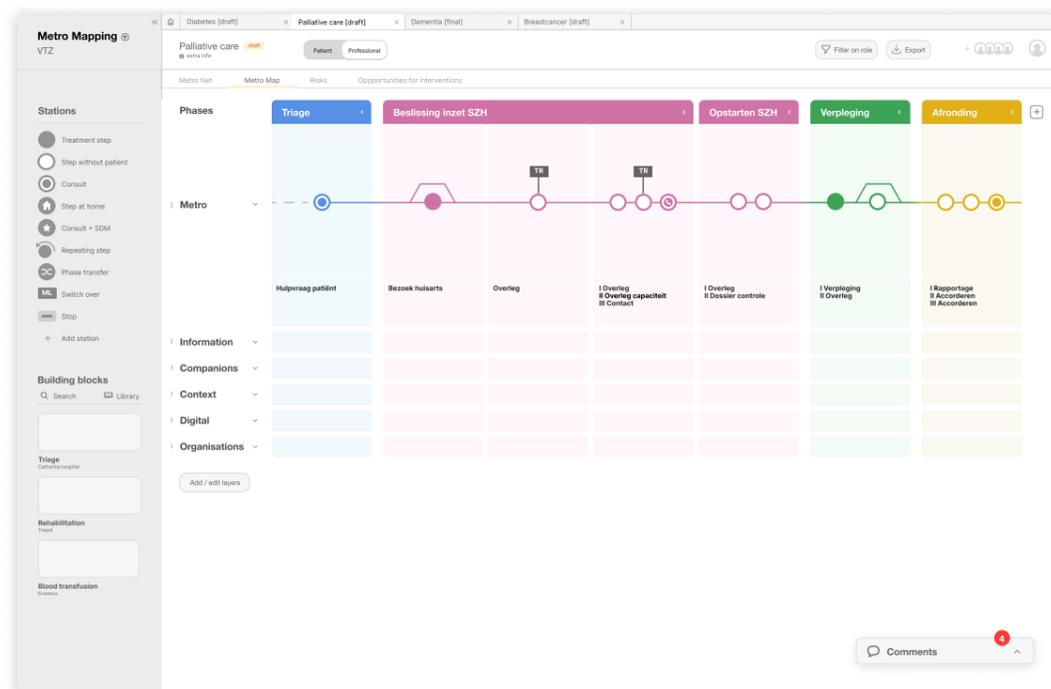


Figure 71: Examples of interactions with the Metro Map

Note: to keep the MM as similar to the original as possible, the language was kept in Dutch.

10.3 Validation

The final concept was validated through five one-on-one validation sessions with different stakeholders, who also were involved in earlier sessions in this project. All work closely with Metro Mapping in practice or research. Because some have already been mentioned repeatedly in this report, I will use their last names in this section:

- Schaaphok (Quality & Safety advisor at Treant)
- Smolenaars (Care pathway designer at Catharina Hospital)
- Van Hoorn (Postdoctoral researcher at Erasmus School of Health Policy and Management)
- De Mul (Assistant professor eHealth and researcher at Erasmus School of Health Policy and Management)
- De Haan (Service designer and board member of the Metro Mapping Foundation)

This chapter summarises the key outcomes of those sessions. Several direct quotes are included to illustrate how participants experienced the tool.

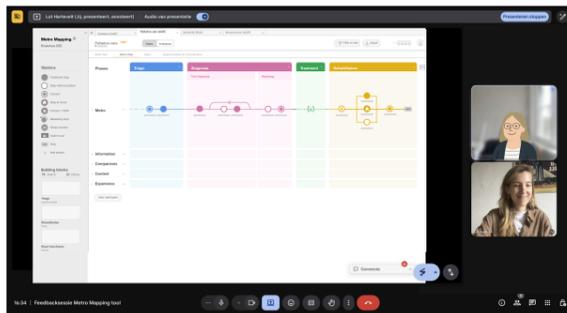


Figure 72: Showing the prototype during an online validation session

General impressions

Stakeholders responded enthusiastically to the prototype. The tool was generally perceived as a significant step forward from the current approach, particularly in terms of usability and clarity. In general, the biggest strengths of the tool are:

- It is clear and organized
- It is seen as very visually appealing
- It provides a lot flexibility and customisation
- It secures quality and safety properties

Especially the last point is crucial for the tool to work in daily practice. It is essential to know who does what when, and who is responsible. That requires an extra level of detail, assigning roles, and including important files. Those aspects are secured in the tool.

"It looks very recognizable, I think that's a big plus. I think it looks really cool... And the flexibility of adding layers and turning them on/off is something that we're also working on a lot ourselves." - Smolenaars

"First impression is good. It includes a lot of things we've talked about." - Van Hoorn

"It looks very nice and clean." - De Haan

"That is exactly that nice 3D element that was missing. Amazing." - Schaaphok

"If this really could be developed, even with a few hiccups here and there, I would immediately propose to my team: let's switch to this. [...] I would throw away my current care pathway system and fully commit to this new tool. And that is a big compliment to you!" - Schaaphok

Feature highlights

Some features were repeatedly mentioned as valuable. I will discuss some of the most important ones below:

- **Collapsing and filtering layers** helps users deal with the complexity of long or detailed care pathways. It allows HCPs to work more focused and find information easier.

"It provides so much flexibility to be able to turn some things on or off for a moment, especially because sometimes a Metro Map is just so complex." - Smolenaars

- **Approval flow** (draft vs. final version) was seen as practical, as it improves clarity. It also emphasizes the dynamic character of a Metro Map and that it is a 'work in progress'.

"I think that would really work. We currently work with boards side by side now, we put the date on it... But approving a draft to a final, that would be a really cool feature; at least a solution to problems we run into." - Smolenaars

"You often see that people find it a bit stressing to share their map, like 'now we are really presenting it as something completely finished'. Whereas it's just work in progress, you know? It's more of a tool to help you along the way [...] I think that's really nice. With such a dynamic tool, that just becomes clear." - De Haan

- **Clickable layers** and **attachments** allow users to reveal more info if necessary, providing all necessary details in one place to work with the Metro Map in daily practice.

"I also really like this! This is quite similar to what I saw within Zenya, that you can link those paths, add a comment to it [...] That's another thing that's very important in this kind of process: who owns this step, who does what? And which guidelines should not be forgotten?" - De Mul

- **Opportunities layer** allows users to register potential improvements in a structured and visible way.

"This is nice, because then it also becomes a kind of backlog actually for people to also optimise their care pathway." - De Haan

"These kinds of things are always really nice. Then it makes it a kind of living document." - De Mul

- **Drag & drop builder** with smart alignment and automatic changing colours was highly appreciated, as this is currently a big frustration in Visio.

"That's cool, we're struggling with that all the time now in Miro too [...] But if you can just drag and drop it, that would be really great of course." - Smolenaars

"Oh, I was struggling with that so much! I then had to keep dragging everything on manually and making space. That's such a hassle.... Oh, how wonderful, this makes me very happy." - Schaaphok

- **Role-based filtering** allows users to quickly filter only the steps that are relevant to them. This is also valuable when onboarding new team members.

"Such a filter is definitely nice, especially when onboarding people. So if you have an employee who has a specific role and then that you can just see which steps you are actually involved in." - De Mul

"I think that filtering is very interesting too. It already looks very cool." - Smolenaars

Some critical remarks

Although participants were enthusiastic about the prototype, the sessions also raised some valuable questions and points of discussion. Some wondered how specific features would function in practice, such as the feedback flow, or what the co-creation process would look like. This project did not aim to fully develop each feature in detail, but rather to translate the identified core requirements into one prototype that embodies the future vision. Chapter 11 will further address aspects for future development.

The fact that users were already imagining how the tool could fit into their own work context shows that the prototype triggered engagement and made the concept tangible. This ability to trigger critical reflection and concrete questions underlines both the relevance of the design and its potential for implementation.

Feedback from the Metro Mapping Foundation

During the validation session with De Haan, board member of the Metro Mapping Foundation, she responded positively to the concept. She appreciated that someone had taken the time to think the Metro Mapping tool through in detail, and felt it offered something concrete to reflect on and move forward with.

"We are currently really working on: how we can take this method a step further? [...] I think that this is something we will definitely continue with" - De Haan

De Haan highlighted that the prototype is helpful to start conversations, both within the foundation and with external partners, about how to further develop Metro Mapping.

"What we as a foundation need to do at some point is just make a good roadmap... We just need to start somewhere, and this helps a lot with that." - De Haan

This validates that my concept is that 'point on the horizon' I was aiming for to provide. Also, De Haan felt excited and motivated to start creating such a roadmap, because of this project. She wanted to further learn from my Figma prototype and explore how it could be translated into something technically feasible.

Alignment with design goal and vision

Several participants said phrases that directly reflected the original design goal and future vision of this tool: transforming the MM into a dynamic, evolving document. For example, quotes included words like 'dynamic tool' and 'living document'. The fact that these reflections so closely match the intended vision suggests that the design was successful and the goals were clearly translated into the prototype.

Conclusion of the validation

The validation sessions confirmed that the developed concept has strong potential to support healthcare professionals in designing, improving, and using Metro Maps. While each stakeholder viewed the tool from their own perspective and professional context, everybody agreed on its usability and relevance for daily practice.

Moreover, some also indicated that the tool not only offers functional improvements, but also strengthens the core value of Metro Mapping as a collaborative method. By offering more flexibility, interaction, and integration of content, the tool makes the method feel more dynamic, intuitive, and future-ready. It puts everything related to a care pathway in one central accessible place.

Although the prototype is still a conceptual version, it clearly resonated with those who are close to the practice of care pathway design. This validation provides a strong foundation for further development and implementation.

Key takeaways 10.3

- Stakeholders found the prototype clear, flexible, and visually appealing.
- The concept aligned well with the envisioned 'dynamic, living document'.
- The Metro Mapping Foundation saw it as a concrete step toward further development.

10.4 Value proposition

As introduced in the Tool+Team+Routine framework (Shaw et al., 2018), to successfully integrate a new tool into daily practice, a team must recognise its **value** and how it improves existing routines. A clear value proposition helps to understand why a tool matters. Therefore, I created a Value Proposition Canvas (Figure 73).

Addressing quality and safety in healthcare

In theory, Metro Mapping is seen as a valuable method to visualise care pathways. However, in practice, the reality can be more complex:

"As a Quality & Safety advisor, I sometimes have to play the "bad cop". MM looks nice on paper, but in practice, we can't use it very well. We have guidelines we have to comply with, and these are crucial for the safety of our patients." - Schaaphok

At Treant, a Metro Map is currently first created separately and later entered into Zenya, their care pathway system. This leads to duplication and extra work. Moreover, if information exists in two places, it can easily become inconsistent, which is a risk that they "simply can't afford."

Also, busy HCPs need to spend time on it twice: first when creating the Metro Map, and later for checking the version in Zenya. The process is time-consuming and increases staff frustration.

The Metro Mapping tool addresses these pain points by bringing everything into one place. It offers a collaborative space to design, view, and update care pathways: layered, interactive, and role-based. Protocols, responsibilities and additional context can be added directly to steps. This increases clarity, reduces double work, and enables more efficient teamwork.

The following quote from Schaaphok illustrates how clearly the value landed, and also how well the tool aligns with goals of the Quadruple Aim:

"So I actually mean to say... I immediately say full yes that I could justify this to my manager. If I were to give a business case, I would say:

- We are going to better ensure quality and safety for the patient**, because we don't have double information anymore.
- We are going to increase employee satisfaction**, because people won't be overstrained by having to do the same work again, but now for a different purpose.
- You will save money**, because you won't have to duplicate work as much as before.

So that's really a done deal." - Schaaphok

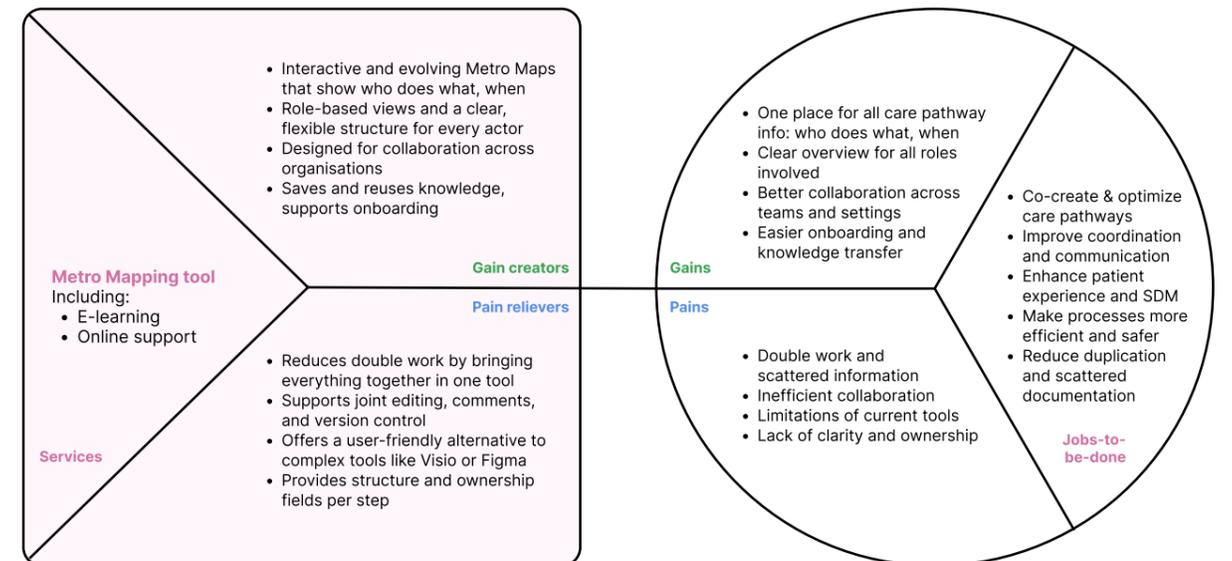


Figure 73: Value Proposition Canvas of the Metro Mapping tool

10.5 From a technical perspective

To explore the technical feasibility of the Metro Mapping tool and identify strategic directions for future development, I spoke with an expert in healthcare IT, who previously worked for organisations like ChipSoft and Topicus. According to him, the prototype is definitely technically feasible. The main challenge lies not in building the interface, but in integrating the tool into the broader healthcare IT landscape and ensuring data can be exchanged seamlessly between systems and organizations.

A key takeaway from this conversation was the importance of separating the user interface (UX) from the underlying data layer. In this architecture, the Metro Mapping tool functions as a “lens” or “viewer” that visualises data retrieved from external systems, rather than storing data itself (Figure 74). This makes the tool modular and flexible, and allows different viewers to access and display the same data in context-specific ways.

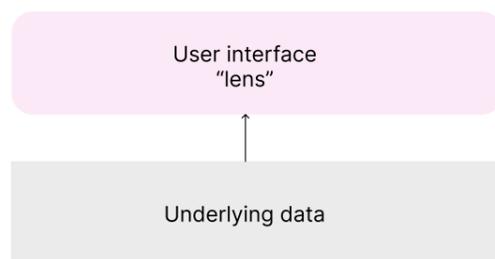


Figure 74: Interface vs. data

Vendor neutrality and open standards

Another crucial recommendation was to secure vendor neutrality by building the tool on open standards and public data models, rather than tying it to one specific EHR system or software provider. This avoids vendor lock-in, increases interoperability, and aligns with national policy directions such as the Integral Care Agreement (IZA), which advocates for open and flexible digital infrastructure in healthcare.

This aligns closely with the open-source nature of the Metro Mapping method itself. Just as the method is currently publicly available, the digital tool should also be open, interoperable, and collaborative. This would allow other developers to build on the tool and makes sure it stays relevant on the long-term in an evolving digital health landscape.

Strategic collaborations and next steps

Several strategic partnerships were suggested as possible next steps:

- **Santeon:** This network of 20 top-clinical hospitals is currently developing an open-source platform for hybrid care pathways. Their underlying data model is publicly available on GitHub and could serve as the foundation on which to build the Metro Mapping viewer. Such a collaboration would allow the tool to leverage a standardized infrastructure and focus on designing a high-quality UX layer on top of it.
- **CumuluZ:** CumuluZ is a publicly funded initiative by UMC Utrecht and other care organizations to develop a national, non-commercial data integration infrastructure. Their aim is to make health data securely and responsibly available across systems, using a ‘Landelijk Dekkend Netwerk’ (LDN). The Metro Mapping tool could connect to this infrastructure as a modular “lens,” helping care providers visualise pathway data without storing it locally. CumuluZ actively works with existing standards and building blocks, and wants to avoid commercial interests. This is a good fit with the values of the Metro Mapping Foundation.
- **DigiZorg App:** This Rotterdam-based initiative integrates data from GPs, hospitals, pharmacies, etc. into one patient-facing app. In the future, a simplified Metro Mapping viewer could be embedded in such apps to help patients better understand their current position in the care journey and what to expect next.

The Metro Mapping Foundation could also define UX guidelines and share design principles with EHR vendors such as ChipSoft. This would allow them to eventually embed Metro Mapping functionalities directly into their platforms. While this approach is less vendor-neutral, it could still be valuable in specific contexts where full integration into existing systems is required. However, the preferred direction remains building on open, vendor-independent infrastructure to keep the tool modular, scalable, and accessible across the healthcare ecosystem.

Implications for the Metro Mapping Foundation

The expert recommended that the Metro Mapping Foundation should focus on defining the design vision and interface guidelines, not on building a standalone database or back-end system. By collaborating with existing national initiatives like Santeon and CumuluZ, they can make sure that the tool integrates with broader efforts to digitise and streamline care pathways, while remaining open, future-proof, and aligned with public values.

As discussed in Chapter 9.1.2, integration with existing systems is not just a technical consideration, but a practical condition for adoption in healthcare settings. The prototype does not yet address this, but further development should at least explore lightweight and modular ways of embedding the tool into existing workflows.

Lastly, the expert has personal connections with both Santeon and CumuluZ and expressed willingness to introduce the Metro Mapping Foundation to these initiatives. This could provide a valuable stepping stone toward strategic collaboration.

Next steps, Conclusion & Discussion

11

- 11.1 Recommendations for further development
- 11.2 Ideas for additional features
- 11.3 Implementation & follow-up
- 11.4 Conclusion
- 11.5 Discussion

While this project resulted in a clear concept for a digital Metro Mapping tool, it also brought to light several areas that require further exploration before the tool could be fully developed and implemented practice. This chapter gives suggestions for further development, open questions, and strategic next steps, based on user input, validation sessions, and the boundaries of this project. Additionally, I will answer the initial research questions and discuss the limitations of the project.

11.1 Recommendations for further development

While the prototype covers the essential requirements, I also identified some promising directions that deserve further exploration and development. These suggestions build on the research, user feedback, and discussions from the previous chapters. Some were beyond the current scope, but are important to address before the tool can be implemented.

Building blocks and subprocesses

As explained in Chapter 10.1, building blocks are a desired feature that support efficiency and consistency in the Metro Mapping process. Another concept that closely relates to this is that of **subprocesses**, which emerged during a feedback session. These are reusable parts of the map, but they are linked to a separate source with a *different owner*. Some key differences between building blocks and subprocesses are shown in Table 4.

A subprocess (e.g. a colonoscopy step) may appear in multiple care pathways but is owned and maintained by a specific team. If that team updates the subprocess, the change automatically appears in all maps where the subprocess is used. This improves consistency and reduces errors caused by outdated or duplicated information.

	Building blocks	Subprocesses
Usage	Can be used and adapted across organisations	Mostly used within the same organisation
Editability	Users can adapt blocks locally; changes don't affect others	Only editable by the owner; updates are reflected in all linked maps
Ownership	Ownership transfers to user once added to the map	Maintained by a designated owner or team outside the map
Purpose	Supports flexibility and reuse of common steps	Enables dynamic updates and shared control over subprocesses

Table 4: Building blocks vs. subprocesses

This flexibility to combine standardised content (subprocesses) with local tailoring (building blocks) supports more scalable collaboration across teams and organisations. Future versions of the tool could explore how to technically implement this structure and assign ownership per subprocess.

Simplified patient view

Although this project focused on healthcare professionals, the patient perspective remains an important area for further exploration. As mentioned in Chapter 9.1.3, a simplified patient view still needs to be developed. This might include clearer icons, less clinical language, and filtered views tailored to patient needs and questions. It could also be explored how such a view could be integrated into existing digital environments, such as the DigiZorg App discussed in Chapter 10.5.

Data-driven opportunities

The idea of using the Metro Mapping tool as a lens on real-time data was also discussed in Chapter 10.5. Although this prototype does not yet include live data integration, it was suggested that the structure of the map could align with collected care data. This could unlock new use cases such as tracking patient flows or monitoring bottlenecks. Furthermore, it would be very interesting to be able to measure the potential impact of an intervention, such as cost savings or reduced waiting times, and evaluate it over time.

This direction would require careful attention to privacy, interoperability, and infrastructure, and might benefit from partnerships with initiatives like CumuluZ.

Onboarding and support materials

Another relevant topic is the onboarding of the tool. It must be further explored what would be the best way to guide new users through the Metro Mapping tool. Participants mentioned that short tutorials, example MMs, and a clear explanation of ownership logic and editing rights would be helpful. Future development should design onboarding flows that match the user's role and context. For example, This may include:

- Role-based tutorials (e.g. create a new MM' or 'make comments in a MM')
- Integrated tooltips or help functions
- An online support environment

Besides onboarding, ongoing user support will likely be needed. This could take the form of an online helpdesk, a knowledge base, or even a community forum where users can ask questions and share tips.

11.2 Future ideas

In addition to the recommendations given in the previous subchapter, several ideas for additional features came up throughout the process and during feedback sessions. These were not prioritised within the scope of this project, but they could be interesting for further discussion and creative exploration.

- **Metro Net**

The Metro Net could be integrated into the Metro Mapping tool, automatically creating a high-level overview of the Metro Map. If you click on a Metro Line in the Metro Net, you are directly navigated to that specific part in the Metro Map. This is especially valuable for very complex, long Metro Maps.



Figure 75: Navigating from the Metro Map to the Metro Net

- **Metro Mapping community**

The concept could be the foundation for a connected environment where healthcare organizations and teams can exchange building blocks, subprocesses, templates, or even full Metro Maps. In the long term, this might evolve into a community platform where users collaborate, adapt shared materials, and contribute improvements to a central repository.



Figure 76: Illustrative visual of the Metro Mapping community

- **An AI assistant: 'Mappy'**

Inspired by other digital design platforms, an virtual assistant, for example called Mappy, could support users in building, editing, or analysing Metro Maps. Mappy could suggest relevant building blocks, warn about inconsistencies, or answer questions about how to structure a Metro Map. Although speculative, such an assistant could lower the barrier to entry for new users and improve consistency across maps.



Figure 77: Example of an AI assistant

- **Branching and sub-Metro Maps**

Some care pathways involve complex decision trees or parallel scenarios, such as different routes based on diagnosis outcomes or treatment choices. In such cases, it could be useful to allow for branching within a Metro Map. One idea is to make certain steps clickable, leading to a sub-Metro Map that provides a more detailed view of that specific branch. To stay oriented, users could see a navigation trail at the top (e.g. Breast Cancer > Diagnosis B) that indicates where they are in the overall pathway. This is also a bit related to the Metro Net and subprocesses idea.

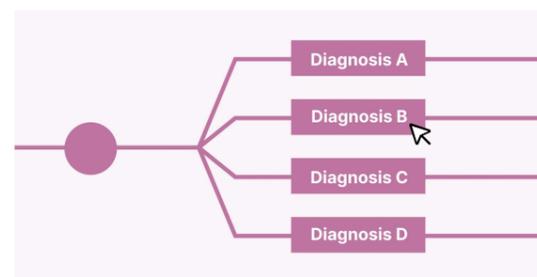


Figure 78: Splitting into sub-MMs

11.3 Implementation & follow-up

This section discusses both some important considerations for successful implementation and suggestions for follow-up actions.

Implementation considerations

If Metro Mapping were to be used in transmural collaborations, an important consideration is that implementation goes beyond simply introducing a tool. It also involves making clear agreements on how different organisations will work together. Who is involved? Who maintains the Metro Map? How are updates managed? These questions need to be discussed early in the process.

The Common Eye model (Kaats & Opheij, 2012), previously introduced in Chapter 2.2, can help support this. It offers a structured way to align on shared goals, roles and expectations. All of these factors are important when working across organisational boundaries.

Furthermore, is advisable to start with a focused pilot in a single organisation or department. This creates a manageable setting to test how the tool fits within existing routines, collect feedback, and refine the concept where needed. A small-scale start also helps to build local ownership and engagement before considering a broader rollout.

A third consideration is long-term coordination. To avoid fragmentation, there should be a clear product owner or coordinating party responsible for maintenance, updates, and user support. The Metro Mapping Foundation could take on this role, possibly in collaboration with healthcare or academic partners.

Another important aspect is the fit with existing systems and routines. As discussed in Chapter 9.1.2, many healthcare organisations work within strict IT environments.

Lastly, implementation also involves onboarding and user support. As discussed in Chapter 11.1, this is essential to make sure that the tool is not only introduced, but also actively used.

Suggestions for follow-up

Based on interviews and stakeholder sessions, the following steps are recommended to explore and prepare for further development:

→ **Explore strategic partnerships**

As discussed in Chapter 10.5, collaboration with initiatives like Santeon or CumuluZ could help align the tool with national digital health infrastructure. Exploring these collaborations should therefore be a key priority in the next development phase.

→ **Short-term collaboration with TheyDo**

The concept for this tool was partially inspired by platforms like TheyDo, which support modular journey design. A Metro Mapping plugin within such an environment could offer a more user-friendly and accessible alternative to Visio in the short term. However, this would not be a long-term solution: platforms like TheyDo are not tailored to healthcare settings and are unlikely to be supported within hospital IT infrastructures. Eventually, a purpose-built tool will be needed to match healthcare-specific requirements and offer just the right level of complexity and functionality for HCPs.

→ **Follow-up graduation project**

An Industrial Design Engineering student could take the concept further through a follow-up graduation project. This could be focused on exploring areas that were beyond the scope of this project, such as the patient perspective.

→ **Further develop the UX**

While this project focused on the core concept and functionality, the UX/UI design still needs further development. A logical next step would be to involve a design agency such as Online Department to translate the concept into a fully functional, user-friendly product.

11.4 Conclusion

The key findings and conclusions of this project have already been presented in Chapter 10. This section summarises how the research questions were answered and reflects on the design goal.

RQ1: What are common practices in healthcare for designing and optimising care pathways?

Care pathways are often developed by a small team using tools like Visio or Zenya. For care pathways, it is important to be able to attach files and assign responsibilities, such as in Zenya. Care pathways are usually time-consuming to create, not easily updated, and rarely used across teams. Collaboration tends to be limited to one-off sessions, and care pathways are often seen as static documents rather than living documents. This makes it difficult to keep them relevant in daily use.

RQ2: What's the current state of Metro Mapping as a methodology and what are key enablers, challenges, and barriers to its adoption?

Metro Mapping is a promising method to co-create and improve care pathways in a clear and structured way. Interviews and literature highlighted several enablers, challenges, and barriers to its adoption. Its strong visual language helps align teams and supports SDM, but adoption in practice is still limited. Most users rely on tools like Visio, but that does not fit the needs of HCPs. Key enablers include its adaptability and clarity, while important barriers include a lack of ownership, digital support, integration with existing systems, and practical guidance. Overall, Metro Mapping has a clear added value, but needs stronger tooling and ecosystem support to reach its full potential.

RQ3: What are important trends and developments in the healthcare sector?

Dutch healthcare is shifting toward more integrated, digital, and patient-centered care. The Integral Care Agreement (IZA) sets the direction, promoting appropriate care, regional collaboration, and digital transformation. Key developments include the rise of hybrid care, a growing demand for efficiency, and a stronger focus on value and patient outcomes. Digitalisation offers big opportunities, but only if systems can communicate, users feel supported, and privacy is secured. Care pathways are seen as essential tools to structure this shift.

RQ4: How can healthcare professionals effectively optimise care pathways and improve patient care with the support of a digital (enabled) Metro Mapping tool?

To support care pathway optimisation in daily practice, HCPs need tools that reduce complexity and promote shared understanding. A digital Metro Mapping tool can help by turning care pathways into layered, interactive overviews that clarify who does what, when, and where. For this to work in practice, the tool must be user-friendly, flexible to fit different care contexts, and fit within existing systems.

With the designed Metro Mapping tool, the MM becomes a dynamic, shared visual blueprint that supports multidisciplinary collaboration, SDM, and continuous improvement. It enables real-time co-creation and feedback, tailored navigation using filters and layers, and structured guidance throughout the mapping process. By allowing teams to attach relevant information (such as protocols or documents), and by making the implicit explicit, the tool helps improve both the quality and coordination of care. Ultimately, this supports the broader ambitions of patient-centered, appropriate, and efficient care.

Overall conclusion

This project shows that there is both a clear need and enthusiasm for a digital Metro Mapping tool. The concept was positively received by potential users who recognised its added value, indicating strong desirability. In addition, the healthcare IT expert confirmed that the tool is technically feasible.

For the tool to become viable in the longer term, the concept first needs to be further developed and tested in practice. After that, questions around ownership, maintenance and funding will need to be addressed. As described in Chapter 11.3, the Metro Mapping Foundation could take on a coordinating role, possibly in collaboration with external partners. If the tool proves valuable in practice, a subsidy or other public funding route could help support further development and implementation.

This project did not aim to deliver a finished product, but to set a clear direction for further development.

11.5 Discussion

The final concept shows what a digital Metro Mapping tool look like, but it also raises new questions about how such a tool would be used, what it should support, and what the limits are.

The purpose of the Metro Map

One of the recurring questions throughout the process was: what is the actual goal of making a Metro Map? Should it show the full care pathway with every detail from start to finish? Or just the main steps? And should it be seen as a final product, or more as a conversation starter? The answer to this depends on the context in which the tool is used: for example, whether it serves patient communication, onboarding, research, or care coordination.

It also raises the question of whether the tool is meant to be embedded in daily workflows (e.g. integrated with systems like Zenya), or whether it remains a design tool that is used occasionally: for example, to map out a care pathway during an innovation project. These choices will strongly influence the future development of the tool.

Aesthetics vs. the complex reality

Designers often try to keep things clean and simple. However, during this project it became clear that healthcare doesn't always fit that mold. As one participant said: *"Healthcare simply is complex"*. Instead of oversimplifying, the challenge lies in creating clarity within complexity. That means not reducing the amount of information, but making it easier to navigate. This highlights the importance of layered information and filtering options, so users can access relevant content without losing the bigger picture.

Standardisation vs. flexibility

A challenge for future development is finding the right balance between standardisation and local adaptability. Too much flexibility could lead to inconsistency, but a tool that is too rigid risks becoming irrelevant in practice. For example, it might be useful to always colour-code phases in the same way (e.g. blue for triage, green for treatment) to support recognition. However, in some contexts, those colours may already have a different meaning, making it necessary to adjust the standard.

The value of meeting in person

A strength of Metro Mapping lies in bringing people together physically. Sitting around a table, looking each other in the eye, and openly sharing perspectives is something that many see as valuable. While the digital tool adds clear benefits, there could also be a risk that the physical meetings fade into the background.

That doesn't mean the tool shouldn't exist. Quite the opposite: it's a great way to keep the process alive over time, but it does require careful positioning. The tool should support the conversations, not replace them. For example, by making it easier to prepare for sessions or by allowing teams to refine their map afterwards.

Limitations of this research

Several limitations must be acknowledged:

- **Use case scope:** The selected Metro Map was relatively simple. A longer and more complex use case might have better demonstrated the tool's potential. However, I was not able to find another Metro Map that met my three criteria (hybrid care, transmural, and with an existing MM available).
- **Limited number of participants:** It was difficult to find users with hands-on Metro Mapping experience, as the method is still relatively new.
- **Tool not fully built:** This project resulted in a clickable prototype, not a fully functional tool. Some technical aspects, such as integration, remain hypothetical for now.

Personal Reflection

Personal reflection

Looking back, this graduation project has been a very meaningful journey. When I started, I had just returned from a semester in Barcelona. Despite the transition, I immediately committed myself fully to this project. I knew from the start: if I'm going to do this, I want to do it well, both in depth and impact.

I didn't want to create something that would end up in a drawer. I wanted to put my time and energy into something that could actually be used or spark further development. When Metro Mapping crossed my path through Bart, it immediately felt like a meaningful opportunity to contribute to something with real impact. The story of its founder, Ingeborg Griffioen, resonated with me. I felt motivated to contribute to her mission and help to move the Metro Mapping methodology forward.

One of my personal learning goals was to deepen my understanding of healthcare and the Metro Mapping method. I have always been interested in healthcare, so this project was the perfect opportunity to gain more experience within this field. I have learned a lot from speaking with people in the field and immersing myself in real-world practice.

Another personal goal was to strengthen my stakeholder management skills. Throughout the project, I engaged with a wide variety of stakeholders and experienced these interactions as very positive. People were open to sharing their thoughts and responded enthusiastically when I reached out to them again later in the process.

A third learning goal was to grow my service and UX design skill set. A few months ago, I had never created a digital interface or interaction in Figma. Looking back, I'm proud of the progress I've made. Working on a complex service design challenge like this has deepened my understanding of translating user needs into clear, practical solutions. It confirmed my drive to keep growing in this field and strengthened my ambition to further develop myself as a service designer.

This project also taught me the value of focus. In the beginning, I wanted to explore everything, afraid to overlook important details. Over time, I learned to define and protect a clear scope. That shift brought structure, made decisions easier, and ultimately led to a stronger, more actionable outcome.

I look back on the result with satisfaction, knowing I put real care and effort into it. I hope this work contributes to the ongoing development of Metro Mapping and inspires further steps toward its adoption in healthcare. Wherever it goes from here, I'm always happy to share what I've learned with those who want to take it further.

Throughout this project, I found myself thinking about my mother quite often. She devoted her life to healthcare as a psychiatrist, and losing her to cancer several years ago has deepened my motivation to contribute to this sector. It made projects like this one feel especially meaningful. Even though this project did not focus on oncology directly, it felt rewarding to contribute, however indirectly, to improving healthcare through Metro Mapping. Reaching this graduation milestone without her is difficult, but I know she would have been proud.

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Appendices

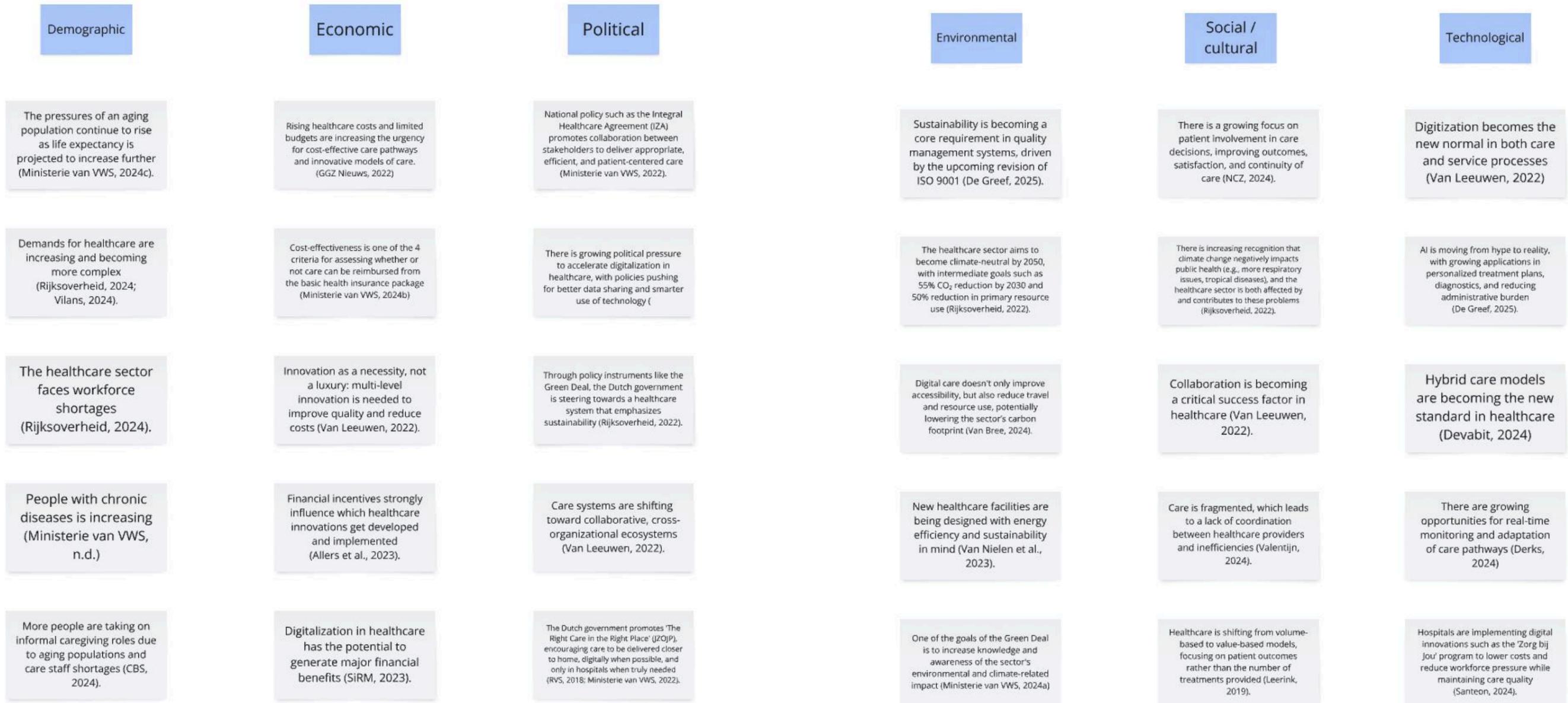
- A. Interview guide semi-structured interviews
- B. DESTEP analysis
- C. Eight themes of IZA summarized
- D. Digitalization in healthcare
- E. Key insights from interviews
- F. Theoretical foundation of care pathways
- G. Strategic goals of implementing care pathways (Radboud UMC)
- H. How care pathways are designed
- I. Metro Mapping process
- J. Current available MM tools and materials
- K. Enablers, challenges, barriers analysis
- L. Suggestions for future improvements
- M. User needs
- N. Future scenario
- O. Co-creation sessions
- P. Inspiration from best practices
- Q. User types including values and relevant features
- R. Kano survey responses per participant
- S. Project brief

A. Interview guide semi-structured interviews

Note: For each interview, an interview guide tailored to the specific participant was created, but this interview guide served as a basis.

Categorie	Vragen	Tijd
Introductie	<ul style="list-style-type: none"> • Kennismaking, ijs breken • Korte introductie van project • Uitleg opbouw & doel interview • Toestemming vragen voor het opnemen van het gesprek & het gebruiken van info uit het gesprek (-> consent form) 	5
Achtergrond	<ul style="list-style-type: none"> • Wat is je huidige functie en achtergrond? • Kan je me iets meer vertellen over je werk? 	5
Zorgpaden	<p>Algemeen:</p> <ul style="list-style-type: none"> • Op wat voor manier ben je met jouw werk bezig met zorgpaden? • Wat verstaan jullie precies onder een 'zorgpad'? <p>Gebruik:</p> <ul style="list-style-type: none"> • Hoe worden zorgpaden binnen jouw organisatie ontworpen en geoptimaliseerd? • Welke tools en methodes worden hiervoor gebruikt? • Waar loop je in de praktijk tegenaan bij het ontwerpen van zorgpaden? Wat zijn volgens jou de grootste uitdagingen? 	10
Metro Mapping	<p>Basisvragen:</p> <ul style="list-style-type: none"> • Hoe ben je in aanraking gekomen met Metro Mapping? • Hoe heb je Metro Mapping toegepast, en wat was je doel daarbij? • Hoe zag de context / setting waarin je Metro Mapping gebruikte eruit? • Welke stakeholders waren erbij betrokken? <p>Gebruik:</p> <ul style="list-style-type: none"> • Welke voordelen en beperkingen heb je ervaren bij het gebruik van Metro Mapping? • Wat voor feedback kreeg je van gebruikers (zoals klanten of colleg • Wat voor (digitale) tools heb je gebruikt? • Heb je Visio gebruikt? Waarom wel/niet? • Zijn er situaties waarin Metro Mapping minder goed werkte of niet werd gebruikt? Waarom? 	15
Toekomst en verbetering	<ul style="list-style-type: none"> • <i>Vind jij dat Metro Mapping een waardevolle tool is voor zorgpad optimalisatie / SDM / samenwerking tussen ZP's bevorderen?</i> • Hoe denk je dat Metro Mapping als tool verbeterd zou kunnen worden? • Zie je mogelijkheden om Metro Mapping breder in te zetten, bv. buiten de ziekenhuizen? 	5
Referenties	<ul style="list-style-type: none"> • Ken je andere personen die interessant zijn om te spreken voor mijn project? • Mag ik je later eventueel nog eens contacten, als ik verder in mijn onderzoek ben? En op welke manier zou je het liefst contact houden? (mail, LinkedIn, etc.) 	3
Afronding	<ul style="list-style-type: none"> • Heb je nog aanvullende punten die nuttig kunnen zijn voor mijn onderzoek? • Bedanken voor het gesprek & afronding 	5

B. DESTEP analysis



C. Eight themes of IZA summarized

Value-driven care

Care should be appropriate, effective, and based on outcomes that matter to the patient. This includes phasing out care that no longer adds value and encouraging continuous learning and improvement among professionals.

Regional collaboration

Healthcare providers, insurers, and local governments are expected to collaborate more closely in regions. This includes joint regional plans, smarter distribution of care (close to home when possible), and improved coordination of acute care.

Strengthening primary care

With more people living at home and care needs becoming more complex, strong and accessible primary care is key. Measures include giving GPs more time per patient, promoting digital self-care, and better collaboration across domains.

Better integrated care for people with complex or long-term needs

Mental healthcare, primary care, and the social domain must work together better to reduce waiting lists and improve support. Early, digital, and blended approaches are encouraged to reach people faster and more effectively.

Prevention and healthy living

A healthy lifestyle should become part of everyday life. Prevention efforts are focused both in the social domain and within healthcare insurance (for high-risk or ill individuals), aiming to support mental, physical, and social well-being.

Workforce and reducing workload

To keep healthcare an attractive place to work, the focus is on reducing administrative burden, improving development opportunities, and giving professionals more influence in policy and practice.

Digitalization and data exchange

Electronic data sharing will become the standard in care. By 2025, all Dutch citizens should have digital access to their own health data. Hybrid care (mix of digital and physical) will also be encouraged where appropriate.

Smarter contracting

While the system of individual contracts remains, insurers will be expected to focus more on rewarding appropriate care. In some cases, joint contracting may be needed to enable meaningful transformation.

D. Digitalization in healthcare

Digitalization in healthcare refers to using digital technologies and tools to improve and transform healthcare processes, services, and outcomes (Tiga Health, 2023). This includes both e-health services, such as video consultations or health apps, and broader digital transformations like system interoperability and AI support tools.

In recent years, digitalization has become a key driver of transformation in how care is organized and delivered. Digital tools are reshaping how patients and professionals interact with the healthcare system (Baelde et al., 2023).

Shift toward hybrid care

One of the most visible changes in recent years is the shift toward hybrid care: a combination of digital and physical healthcare services. Patients can now access consultations via video calls, receive digital prescriptions, and monitor their health at home through smart devices. This helps reduce the burden on healthcare facilities and gives patients more flexibility. The IZA promotes this development with the principle "digital if possible, in-person if needed" (Ministerie van VWS, 2022).

Data exchange and interoperability

Despite the growing number of digital tools, one of the biggest challenges remains the lack of interoperability between systems. While exchanging medical data between different healthcare institutions, doctors and patients is crucial for good care coordination, many healthcare providers still struggle to exchange information across organizational boundaries (Freriksen, 2023b). The Electronic Data Exchange in Healthcare Act (in Dutch: Wet elektronische gegevensuitwisseling in de zorg, 'Wegiz'), introduced in 2023, aims to make electronic data exchange mandatory by law to improve continuity and safety of care (Rijksoverheid, 2023).

Personal health environments (PGOs)

To give patients more control, the Dutch government supports the development of Personal Health Environments (PGOs). These digital platforms allow citizens to access, collect, and manage their health information from different providers in one place. PGOs are a key part of patient empowerment and are expected to become widely available by 2025 (MedMij, 2024).

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AI and decision support

Artificial intelligence is increasingly being used to support diagnostics, detect risks, and personalize treatments (Alowais et al., 2023). For example, algorithms can help identify early signs of cancer (Staff, 2025). While promising, AI in healthcare also raises questions about ethical use, transparency, and the need for human oversight (Manella et al., 2024).

Cybersecurity and privacy

As more health data is stored and exchanged digitally, cybersecurity becomes a bigger concern. Healthcare is a frequent target for ransomware attacks, which can severely disrupt services. Ensuring proper data protection, implementing multi-factor authentication, and complying with legislation are essential to ensure trust in digital systems (Google Cloud, 2025).

Digital literacy

Although digital tools offer many benefits, not every patient or HCP has the skills or resources to use them effectively. Davey (2025) highlights some barriers:

- Digital literacy: Many patients struggle with complex interfaces, making even basic healthcare management overwhelming
- Pool connectivity: In rural areas, weak internet limits virtual care
- Limited usability: Tools often meet technical standards, but still fall short for people with disabilities
- Language and culture gaps: Many platforms lack real-time translation

If we want everyone to benefit from digital innovation, we need to ensure that systems are not only available, but also usable, understandable, and supportive.

E. Key insights from interviews

Summary of all insights per research question:

RQ1: What are common practices in healthcare for designing and optimizing care pathways?	RQ2: What is the current state of Metro Mapping as a methodology, and what are key enablers, challenges, and barriers to its adoption?	RQ3: What does the healthcare landscape look like, now and in the future?	RQ4: How can healthcare professionals effectively optimize care pathways and improve patient care with the support of a digital (enabled) Metro Mapping tool?
<p>General characteristics of current practices:</p> <ul style="list-style-type: none"> Care pathways vary widely: There is no single standard; formats range from text documents and flowcharts to more visual tools like Metro Mapping. Visualizing care processes is increasingly preferred over long textual descriptions—clarity and understanding improve through visual aids. Design thinking is commonly used, often involving interviews, co-creation sessions, and iterative testing. <p>Hospitals vs. other healthcare settings:</p> <ul style="list-style-type: none"> GPs and mental care don't really use explicit care pathways, instead making decisions case-by-case with a strong emphasis on continuity and shared decision making. Hospitals tend to be more structured, with formal pathways developed by multidisciplinary teams and supported by tools like flowcharts, to guide HCPs and ensure safety, efficiency, and role clarity. In other healthcare settings, pathways are more flexible, vary in format and level of detail. <p>Multidisciplinary collaboration:</p> <ul style="list-style-type: none"> Multidisciplinary teamwork is key to creating effective pathways that reflect diverse expertise. Collaboration between managers, physicians, and care practitioners in some cases called the "triangle of ownership" is often used to co-create care pathways. Shared agreements on "who does what, when, and for whom" are central to care pathway design. <p>Tools:</p> <ul style="list-style-type: none"> Common tools: Miro, PowerPoint, Visio, Zenya, and interactive flowcharts. Implementation support tools such as the "Implementation canvas" (with 9 points of attention) are used to ensure uptake. Care pathways often include clickable elements linking to protocols, responsibilities (TVB matrix), or further details. <p>Process:</p> <ul style="list-style-type: none"> Common design phases: analysis, design, implementation, and evaluation—sometimes supported with a learning space or toolkit. Building blocks: Frequently used sub-processes are designed as reusable "blocks" to increase consistency across pathways. Care pathways are sometimes implemented iteratively, with regular validation and updates (e.g., "living documents"). <p>Implementation & challenges:</p> <ul style="list-style-type: none"> HCPs are often very busy, making it hard to engage them in care pathway development unless clear value is shown. Translating care pathways from "paper to practice" remains a key challenge. There's often a gap between development and implementation; designers can play a vital role in bridging this. Ownership is critical—assigning pathway or block "owners" improves accountability and implementation success. <p>Evaluation:</p> <ul style="list-style-type: none"> A set of generic indicators is sometimes applied to evaluate both quantitative and qualitative outcomes, covering metrics like access time, treatment duration, and learning outcomes (Participant 11). Tools like the clinical compass can be used to reflect on care quality and team functioning. Evaluation is not only used to measure performance but also to stimulate continuous improvement, reflection, and ownership within teams. <p>Patient involvement:</p> <ul style="list-style-type: none"> While shared decision-making is valued, actual patient involvement in pathway design is still limited. Methods like focus groups, mirror conversations, and value dialogues are sometimes used to collect patient insights. Patient-facing versions of care pathways are usually simplified and more visual than the HCP versions. <p>Flexibility & context sensitivity</p> <ul style="list-style-type: none"> Flexibility is essential: Care pathways need to adapt to the local context, different patient types, and available resources. Some professionals question whether standardized pathways fit well in complex or highly personalized domains (e.g. mental care), but still see value in more structured documentation. 	<p>Strengths of Metro Mapping</p> <ul style="list-style-type: none"> Visual clarity: Metro Mapping provides a clear and intuitive overview of care pathways. Conversation starter: It facilitates discussion and alignment between healthcare professionals. Creates shared understanding: Helps expose differences in practice and aligns multidisciplinary teams. Standardization and structure: Offers a consistent language and visual structure with specific building blocks. Making implicit knowledge explicit: Clarifies steps that were previously unspoken or undocumented. Supports collaboration: Especially useful in multidisciplinary or cross-organizational settings. Flexible use: Users adapt the tool to their needs—layers can be selected or left out depending on content. Tangible format: Can be printed and used in physical sessions for co-creation. Intuitive visual language: Even those without a design background quickly understand how it works. Inspiring and energizing: Described as a "new language" that motivates teams to rethink care processes. <p>Enablers for adoption</p> <ul style="list-style-type: none"> Clear structure and templates: A3 templates and predefined guidelines make it easier to use. Building on existing documentation: Allows HCPs to start from what's already there. High-level to detailed flow: Starting broad (with metro line) and zooming in is an effective approach. Physical sessions work best: In-person collaboration increases engagement and effectiveness. Tailored versions (e.g., Miro templates): Custom adaptations make it more accessible and usable in daily practice. <p>Challenges and barriers:</p> <ul style="list-style-type: none"> Complexity: Can still be overwhelming, especially for those unfamiliar or for complex/non-linear processes. Time-consuming: Creating a Metro Map takes time (interviews, input gathering, iteration), which is often a challenge with limited capacity. Not all layers are used: Some teams skip layers (e.g., companions, emotions), which may reduce the depth and value. Tool limitations: Visio is often described as unintuitive, inflexible, and difficult to maintain. Lack of interactivity: Current maps are "flat documents"; professionals miss the ability to click through or attach protocols/links. Split between HCP and patient needs: Current maps fall in-between—too complex for patients, not rich enough for professionals. Limited integration with systems: Difficulty linking Metro Maps with EHRs or internal systems (e.g., Zenya). Lack of experience: Not widely used in some settings (e.g., first-line care), leading to low familiarity and limited adoption. Need for training and support: Without proper onboarding, professionals struggle to use MM effectively. Adoption varies: Some organizations move toward other methods, indicating Metro Mapping is evolving but not always preferred. Implementation issues: Barriers such as funding, ownership, and governance affect rollout in practice. 	<p>Collaboration & systemic change:</p> <ul style="list-style-type: none"> More collaboration across healthcare organizations is expected, especially to manage complex patient journeys and streamline care. Care pathways are increasingly seen as a strategic tool to align stakeholders and responsibilities: "Who does what, when?" Multidisciplinary and transmutual collaboration will be essential in future care models. <p>Innovation & digital transformation:</p> <ul style="list-style-type: none"> Healthcare is becoming more data-driven, using insights to guide decisions and optimize processes. Digitalization and hybrid care are key trends, with digital tools expected to support every care pathway. E-health will be embedded in nearly all aspects of care, from diagnostics to follow-ups. Phased and personalized communication will become more important: providing the right information at the right time. <p>Care pathways:</p> <ul style="list-style-type: none"> There will be a big shift towards hybrid care. Care pathways are increasingly necessary, especially due to national policies like the IZA (Integraal Zorgakkoord). Care pathways help implement vision and policy, translating strategy into actionable steps. Care pathways support knowledge sharing and onboarding of new healthcare professionals. Future vision: 80% of care standardized through pathways, 20% personalized or custom work. <p>Patient-centeredness:</p> <ul style="list-style-type: none"> More patient-centered care is expected, with flexible, tailored pathways. Growing demand for tools that are intuitive and user-friendly for both professionals and patients. Patients will be more involved in understanding and navigating their care journey. <p>Challenges in healthcare</p> <ul style="list-style-type: none"> Workforce shortages are driving the need for more efficient, faster workflows. Efficiency and clarity are increasingly important—digital tools must reduce pressure, not add complexity. Hybrid care will become the new standard, balancing digital and physical care delivery. 	<p>Functionalities & design requirements:</p> <ul style="list-style-type: none"> Interactivity is key: Users want to click on elements to quickly access underlying modules, criteria, or steps. Role-based views: Showing only the relevant parts of the care pathway per user (e.g. nurse, physician) increases clarity and usability. Customizable levels of detail: Users should be able to hide or collapse layers that are not relevant to them. Dual views: Separate visualizations for healthcare professionals and patients help tailor communication. <p>Integration & implementation:</p> <ul style="list-style-type: none"> Integration into EHRs (EPD): Embedding pathways into existing systems makes them actionable and part of daily routines. Data-driven use: Linking the tool to real-time data from EHRs or care systems (e.g., EPCs, ECDs) supports continuous optimization. Training is essential: Adoption depends on preparing and educating professionals on how to use the tool effectively. Visual templates (e.g. Miro, Figma): Flexible platforms support co-creation and easier onboarding. <p>Collaboration & adoption:</p> <ul style="list-style-type: none"> Involving users in co-creation builds ownership and increases likelihood of long-term use. An internal ambassador or 'champion' helps drive adoption within the organization. Common goals and governance structures are crucial for effective multidisciplinary collaboration. Preconditions matter: Without aligned funding, shared culture, and clear responsibilities, even the best tool may fail (Common Eye model). <p>Opportunities & challenges</p> <ul style="list-style-type: none"> Potential for real-time monitoring: Professionals want to immediately see how changes affect capacity, wait times, or costs. From mapping to action: Many organizations stop at visualization—designers can help translate insights into interventions. Metro Mapping can support transmutual care by clarifying roles and transitions between organizations. Tools should support—not dictate—care: Digitalization must enhance, not complicate, patient care.

Insights per participant (P1-P7)

Participant	Product manager, Visionary thinker within healthcare	General practitioner	Service designer & Metro Mapping practitioner	Advisor Quality & Safety	Assistant Professor Digital Innovation, Action researcher	Executive director, Driving force behind regional healthcare collaboration	Chair of Quality & Safety department		
Participant 1									
Participant 2		<ul style="list-style-type: none"> GPs don't work with explicit care pathways, but define what's necessary per individual patient Most care is given within the GP (90%) Continuity is important in GP care SDM is crucial in their work GP is often a 'spider in the web' 							
Participant 3			<p>Strengths:</p> <ul style="list-style-type: none"> Nice to have a common language in healthcare Visually very strong Conversation starter People react very positive to it, especially to the visual metro line Makes care pathways easy to compare with each other Nice to have specific building principles and guidelines Identifying differences in working approaches <p>Basics of the tool are very good, but takes some time to really make it your own and work with it.</p> <p>Challenges:</p> <ul style="list-style-type: none"> Not always flexible enough Not all layers are used Dynamics of the tool can be improved 				<ul style="list-style-type: none"> Suggests adding a separate digital tooling layer in Metro Mapping. Having an internal ambassador to lead and advocate for the tool is important. A modular system like a (EOD set) helps professionals compare and build pathways. Recommends linking Metro Mapping with real-time data from EHR/EPD systems. Many organizations struggle to move from mapping to action; designers can help drive that change. 		
Participant 4				<ul style="list-style-type: none"> Care pathways are important to ensure quality and safety Care pathways are like a "coat rack" on which you can hang things, such as working instructions, links, and responsibilities (TVB matrix) They work with a 7 step model (prepare, analyse current situation, define care pathway, risk analysis, implementation, evaluation, continue evaluation) <p>Strength: visually very clear</p> <p>Critical issue: Metro Mapping files are "flat documents". Not able to click through it or to attach files to it (like a coat rack)</p> <p>Current Metro Maps are too detailed for patients, but too limited for HCPs to actually work with it. How is a bit in-between, and neither of both. There should be a clear split.</p>			<ul style="list-style-type: none"> Digitalization and hybrid care More patient centered care <ul style="list-style-type: none"> Interactivity is essential for adoption by healthcare professionals. Digital systems should support patient care, not dictate it. Uses care paths for HCPs as a base in Zenya; patient journeys can be added via the EHR. Believes integrating a patient-specific care path into the EHR is technically very doable. 		
Participant 5			<ul style="list-style-type: none"> Multidisciplinary collaboration is important A multidisciplinary team is crucial to combine different perspectives and expertise Care pathways provide structure and clarity <p>Strengths:</p> <ul style="list-style-type: none"> A new visual language, which can bring new 'positive energy' within multidisciplinary teams to rethink care Intuitive. "Everyone can understand that this is a way to visualize processes" Decision moments <p>Challenges:</p> <ul style="list-style-type: none"> Complexity: "The feedback I often get is: it's pretty complex" Limits of the software Important to integrate it with existing systems 				<ul style="list-style-type: none"> Need for care pathways because of IZA <ul style="list-style-type: none"> Integrating care pathways into the EHR Uses care paths for HCPs as a base in Zenya; patient journeys can be added via the EHR. 		
Participant 6					<ul style="list-style-type: none"> When developing care pathways, HCP make agreements on who does what, when. "In detail, we define who does what, to which patient, at which moment" Care pathways used to be in Excel, but currently a flowchart is more often used From a director's perspective, she was mostly creating the right preconditions: bringing together all parties, making sure the right governance structure is used. Creating the care pathway is done by the HCPs. Multidisciplinary collaboration "There is a big shift to developing multidisciplinary care pathways" <p>Strengths:</p> <ul style="list-style-type: none"> Making processes insightful. "Metro Mapping is really a method for making it insightful." Supporting multidisciplinary collaboration: It promotes collaboration between different healthcare providers, which is essential for effective care pathways. 			<ul style="list-style-type: none"> Multidisciplinary care pathways Hybrid care pathways: "Health is going to be a big part of healthcare and will play a role in every care pathway" <ul style="list-style-type: none"> Preconditions such as a strong collaboration culture, governance, and aligned funding models are crucial. Refers to the "Common Eye" model by Kaats & Ophrij for effective collaboration. Training and implementation support are key for successful adoption of the tool. 	
Participant 7							<ul style="list-style-type: none"> Care pathways can have different forms: text, visual, often in flowcharts, but there is no uniform method They have stopped using thick, textual guidelines. They strive for more accessible and dynamic forms of care pathways. They use tools like Powerpoint and Miro An implementation canvas with 9 points of attention is used to facilitate the implementation of a care pathway HCPs are busy people and don't immediately see the added value of explicitly defining care pathways in an uniform way "We also see that it is just difficult. They have little time, it is something completely different from what they normally do. So they are also used to other things and sometimes have no desire to do care pathway innovation." <p>Metro Mapping is not really used yet within this rehabilitation center</p>		<ul style="list-style-type: none"> Shift towards hybrid care Increasing demands in care <ul style="list-style-type: none"> There is a need for more accessible and interactive digital tools. Users should be able to click on parts of the care path to quickly access relevant content.

Insights per participant (P8-P14)

Participant 8	Postdoctoral researcher Metro Mapping PhD within VBHC	<ul style="list-style-type: none"> Strong need for explicit care pathways "I think there are too few of them right now, where I really don't understand how doctors can do their jobs well without care pathways." Goal is defining who does what when Actually, the goal has always been to have the care pathway clear. What happens when and by whom?" She uses Metro Mapping for creating care pathways. Process is: <ul style="list-style-type: none"> First collecting documentation and input of HCPs Creating a rough sketch of the Metro Map Further define it in iterative sessions with HCPs Often, the map is shared digitally (e.g. as PDF) so HCPs can give direct feedback 	Strengths: <ul style="list-style-type: none"> Making implicit knowledge explicit Clear visual representation Making care concrete and showing all steps of the process, improving better understanding of care Identifying inefficiencies Discussion starter Challenges: <ul style="list-style-type: none"> Visual is not intuitive and user-friendly Problems with downloading and installing templates Specific visual related issues (such as changing the height of the map is impossible) Difficult to accurately map complex and often non-linear processes. Can be hard to integrate every variation in a visualization <p>In practice, the theoretical structure of Metro Mapping is not always used very strictly. They change it to their own preferences and needs, e.g. using different layers.</p>	<ul style="list-style-type: none"> Need for care pathways Workforce shortages Care pathways could be helpful in knowledge sharing and educating new workforce 	<ul style="list-style-type: none"> Users should be able to choose their preferred level of detail. The current format can feel too long and overwhelming. There should be different views for healthcare professionals and patients. Interactive features like collapsible layers or clickable modules would make the tool more engaging. Role-specific filtering (e.g. showing only relevant steps per function) would improve usability.
Participant 9	Innovation advisor	<ul style="list-style-type: none"> Strong need to visualize care processes rather than just textual descriptions. "What stood out was that we were writing a huge amount of text. We only come across descriptions of the process, very long ones. There was no arrow in it, nothing visual." They use design thinking as a method for creating care pathways 	Strengths: <ul style="list-style-type: none"> Conversation starter Gives the patient a focus Identifying differences between different ways of working Having specific phases Standardization Streamlining processes Identifying points of improvements Clear communication through visualizing processes 	<ul style="list-style-type: none"> Workforce shortages You need to work more efficiently and faster Growing need for accessibility and user-friendliness 	<ul style="list-style-type: none"> Patients should be involved in the Metro Map process. Smart input assistant could help users convert text into visuals. Filtering by detail level or user role would increase clarity and usefulness. Actively involving staff in building the map fosters ownership and buy-in.
Participant 10	Service designer hybrid care pathways	<ul style="list-style-type: none"> Important to visualize processes to increase understanding and improve collaboration Power of designers in healthcare is persevering after you have made a care path visual. As a service designer within healthcare, you have the time to actually go implement it and build a relationship with the HCPs." Collecting input can be very time consuming Previously, care pathways were visualized in flowcharts with little context They use a Miro version of Metro Mapping to visualize care pathways. HCPs are very busy → "I had a project where I then knew with a neurologist exactly that he was going to get a case at 11 o'clock. Well, those were exactly my few minutes to then ask a few questions and move on again." 	Strengths: <ul style="list-style-type: none"> Visual clarity Facilitates collaboration Tangible tool (you can print it) Standardized methods Flexible. Teams can adapt it to their own context and use the layers they want Challenges: <ul style="list-style-type: none"> Not all layers are used Time-consuming collecting input, interviews, ... Limited capacity <p>Created their own customized version in Miro</p>	<ul style="list-style-type: none"> More data driven More hybrid care "I think hybrid is going to be the standard" A trend is to provide information in a more phased manner at the right time 	<ul style="list-style-type: none"> Tools like Miro are helpful for collaborative design. Visual is less suited. Flexibility is important—HCPs should be able to tailor the tool to their needs.
Participant 11	Programmanager care pathways	<ul style="list-style-type: none"> Has a human-process-system approach to care pathways. Process steps are interactive and can be linked to more information. Building blocks are reusable process steps that occur in multiple care paths. Building stones are smaller monodisciplinary processes within building blocks. Learning space developed with tools for teams to create care pathways. Four phases in care path development: analysis, design, implementation and evaluation Set of generic indicators → both qualitative and quantitative: <ol style="list-style-type: none"> Access time, 2. Turnaround time diagnostics, 3. Waiting time to treatment, 4. Number of patients in phase intake/diagnostics, 5. Number of patients in phase Treatment, 6. Turnaround time (up through) treatment, 7. Learning and improving based on patient experiences in the care pathway, 8. Learning and improving regarding collaboration in care pathways (too much about the team) 	<p>Although Metro Mapping is still in use at Radboud UMC, there is a shift toward alternative methods, indicating its evolution rather than being the sole or preferred approach.</p>	<ul style="list-style-type: none"> ZZA Care pathways as a tool: "So I really see care pathways as a tool to soon enable a lot of things that people think in terms of vision, for instance: "getting very clear: who does what when?" 	<ul style="list-style-type: none"> Metro Mapping has strong potential for cross-organizational (transmural) care coordination. Emphasizes a mindset of continuous improvement—care pathways are never truly "done". Crucial factors for a successful implementation of care pathways are: <ul style="list-style-type: none"> Governance Involving HCPs from the "work floor" A clear need from medical perspective Good coordination within the program on what is and is not within the scope
Participant 12	Advisor Quality & Safety	<ul style="list-style-type: none"> Triangle of collaboration with a manager, physician, and practitioner (charette) to set goals and design the care pathway Evaluation and adaptation: Care pathways should be considered living documents that are regularly evaluated and adapted based on new insights and feedback from both patients and providers. Challenge: translation from paper to practice Clinical compass is used for evaluation care pathways 	<ul style="list-style-type: none"> Clear overview Lack of experience with Metro Mapping in practice, which can limit adoption. Maybe HCPs need more training and support. 	<ul style="list-style-type: none"> Digitalisation Focus on efficiency Personalization of care Expects more care pathways in the future Drives for 80% in care pathways and 20% custom work 	<ul style="list-style-type: none"> Recommends real-time analytics to track effects of care pathway changes on capacity, waitlist, and costs. Emphasizes the importance of training and support to ensure successful implementation. A visual, layered, interactive tool is preferred.
Participant 13	Programmanager elderly care	<p>About the dementia care pathway in which she has been involved:</p> <ul style="list-style-type: none"> Bottom-up approach Multidisciplinary collaboration "Truly cross-domain and multidisciplinary" Flexibility and adaptation: Care pathways must be flexible and adaptable to the specific context and needs of patients Need for structure in care pathways 	<ul style="list-style-type: none"> Complexity of implementation Currently not broadly used in the first line 	<ul style="list-style-type: none"> Hybrid care Responsibilities and governance 	<ul style="list-style-type: none"> A structured and visual digital tool would be highly valuable. Expresses clear interest in using such a solution in her work.
Participant 14	Psychologist	<p>There are no clearly defined care pathways in mental health care. Mostly general rules and working instructions. The approach is mostly individual per patient.</p> <p>Also, she is not sure whether care pathways can be used within mental care, because every patient has their own (sometimes very specific and personal) case. However, she would appreciate more structured documentation of their workflows.</p>	-	-	-

F. Theoretical foundation of care pathways

A bit of history

In the 1950s, the 'critical path method' (CPM) became popular, which is a project modeling technique developed by Kelley and Walker (1959). In later years, visual representation of care pathways became a profession in its own right. The term care pathway has its roots in management theories like CPM, Lean Six Sigma, Business Process Redesign (BPR), and the theory of constraints. For care pathways, appropriate guidelines and information technology have only been available since 2005 (Huiskes & Schrijvers, 2012).

From the 2000s, care pathways got a huge boost because of the creation of multidisciplinary guidelines. Over the past two decades, hospitals have been developing many new care pathways. Besides hospitals, care pathways are also increasingly used in non-hospital settings. I have conducted various interviews with such organizations, such as an audiology center and two rehabilitation centers.

The bigger picture: Health OM

The concept of a care pathway is one of the concepts from the field of Health Operations Management (Health OM), which Vissers and Beech (2005) describe as "the analysis, design, planning and control of all the steps necessary to provide a service to a client".

They distinguish five levels of Health OM:

1. A care plan for each individual patient (patient planning and protocol).
2. **The planning of care in care pathways (patient group planning and control)**
3. The capacity planning of professionals, equipment and space (resource planning and control)
4. The planning of the number of patients to be treated and care activities to be performed (patient volume planning and control)
5. The long-term policy of the healthcare institution (strategic planning)

Vissers and Beech (2005) emphasize that the five levels of Health Operations Management are closely connected. Implementing care pathways (level 2) without adjusting related aspects — such as individual scheduling (level 1) or capacity planning for staff and equipment (level 3) — can lead to problems.

If care pathways influence patient volumes, strategic decisions at levels 4 and 5 also become relevant. Understanding this broader system helps to place care pathways in context and supports more integrated, sustainable improvements.

Advantages & disadvantages of care pathways from a theoretical perspective

As discussed earlier, care pathways have its roots in management theories like CPM, Lean Six Sigma, BPR, and the Theory of Constraints. In an article by Schrijvers et al. (2012), they identified several key advantages:

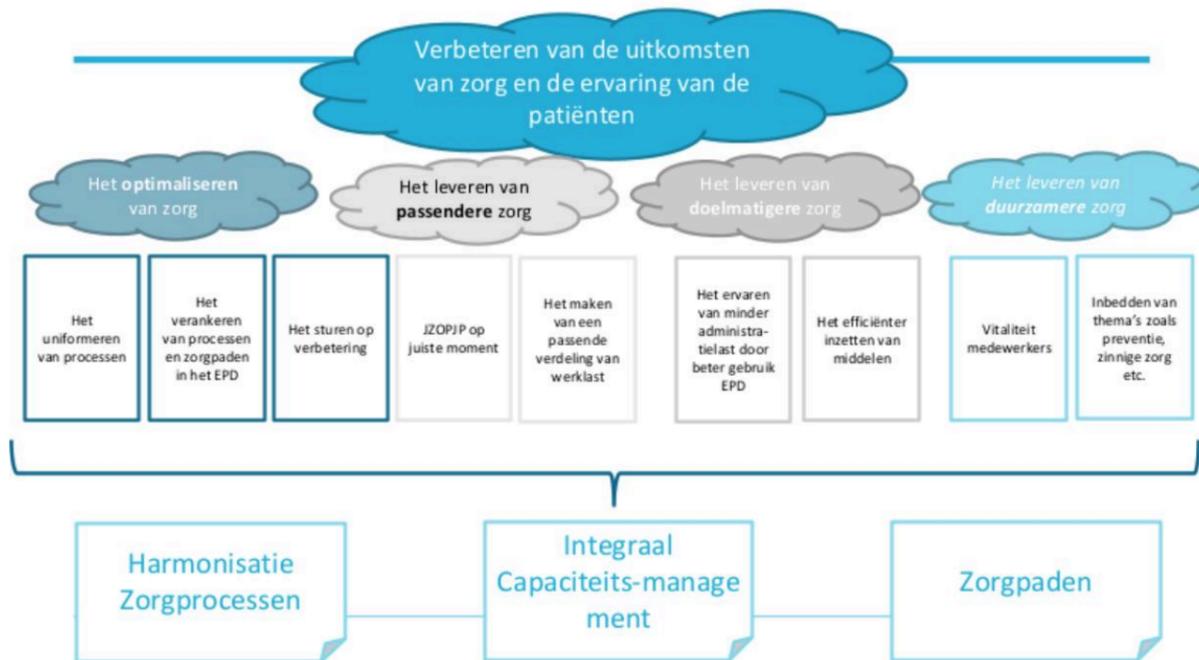
- Shorter process times by carrying out sub-processes parallel instead of in sequence (especially BPR and Theory of Constraints)
- Better coordination between departments due to explicit analysis of how different parts of the process interact (especially BPR)
- Reducing the risk of errors by standardisation and streamlining of processes (especially Lean Six Sigma)
- Reducing costs through standardization, by avoiding inefficiencies like unused capacity, unnecessary duplication, or underutilized equipment (all theories)
- Increasing the job satisfaction as roles and responsibilities become more clear (especially BPR)

However, there are some disadvantages that need to be considered too:

- A risk of dehumanising care: when there's little room for professionals to use their own judgment, the care process may feel less personal, and patient choice may be limited. Fixed time slots can also pressure professionals to rush, possibly affecting quality.
- Increased costs for control and checking: extensive monitoring of quality and errors requires extra resources, and can create a feeling of mistrust among staff.
- Decreased job satisfaction: when professionals have little time for their tasks or their work lacks variety, this can cause stress and reduce motivation.
- Less creativity and flexibility: rigid pathways may limit professionals in finding the best solution for each unique case.

G. Strategic goals of implementing care pathways (Radboud UMC)

This slide was shared by Peter van Voorst (Radboud UMC), with permission to use it in this thesis.



H. How care pathways are designed

At the core of this approach is a multidisciplinary project team, typically coordinated by the Quality & Safety department. This team includes key stakeholders such as physicians, nurses, therapists, and sometimes patients or informal caregivers.

The process starts by exploring how care is currently delivered: existing workflows, protocols, and documents are gathered to create a clear picture of the starting point. These insights are visualized and used as input for co-creation sessions, where team members discuss what could be improved and how.

From there, the pathway is gradually shaped, validated, and eventually implemented. After implementation, the pathway is regularly evaluated and updated to reflect new insights, policy changes, or shifts in care delivery.

I. Metro Mapping process

Phase 1: Preparation and goal setting

A Metro Mapping project starts by defining the goal and scope of the desired improvement. This includes practical questions such as:

- What is the reason for improvement?
- Which patient group and condition are we focusing on?
- Which departments or organisations are involved?
- What are the constraints in terms of budget, lead time or infrastructure?

A 'Metro Team' is assembled, typically consisting of a service designer, one or more healthcare professionals, a project coordinator, and a representative from care management. Additional expertise (e.g., IT, quality, patient representatives) can be involved when needed.

Phase 2: Analysis and visualisation of the current state ('as is')

In this phase, the current care pathway is mapped out and visualised, often starting with the Metro Net: a high-level overview of all treatment and diagnostic options for a condition. This is followed by a more detailed Metro Map, which visualises the concrete steps, touchpoints, actors, and environments involved in a specific care journey.

Stakeholders' needs (patients, relatives, HCPs) are gathered through interviews, focus groups or questionnaires. These needs are layered on top of the Metro Map, creating a structured insight into how people experience the current system.

The goal of the project determines the level of detail and which steps are included. This also ensures that only relevant information is added to the Metro Map, making it focused and practical.

Phase 3: (Re)designing the Map ('to be')

In this phase, stakeholders work together to design sub-solutions for the identified needs. These can range from adjusting care steps or communication methods, to changes in physical spaces or routing. These ideas are then combined into an integrated solution that forms the Metro Map 'to be', which can be tested and validated with stakeholders.

Co-designing solutions with the people who experience and deliver the care has two main benefits:

- It ensures the solutions are relevant and feasible.
- It increases ownership and engagement, which is crucial for successful implementation.

Phase 4: Implementation

The Metro Map 'to be' serves as the starting point for implementation. Each sub-solution may require a separate realisation process. The Metro Team ensures that developments remain aligned with the overall goal. While implementation is not the main focus of the Metro Mapping method, it is considered an integral part of the process.

J. Current available MM tools and materials

To support the application of the Metro Mapping method, the Metro Mapping Foundation provides a set of tools, templates, and learning materials. These resources help to apply the methodology in a structured and user-friendly way. Below is an overview of the main tools and materials currently available.

It is valuable to have a clear overview of the currently available tools and materials. This also helps to identify where additions or improvements may still be needed.

Visio template

Microsoft Visio is the standard software used to create Metro Maps. It was chosen because Microsoft is often used within hospitals. The Metro Mapping Foundation offers a ready-made Metro Mapping template for Visio, which includes all necessary layers, building blocks, and visual elements.

While powerful, Visio is also known for being relatively unintuitive and sometimes restrictive. Several participants mentioned limitations during interviews, such as:

- Limited 'undo' functionality
- Difficulty copying elements between tabs
- Lack of interactivity or linking options
- Fixed layer heights, which restrict layout flexibility

E-learning modules

As mentioned in the previous sub-chapter, the Metro Mapping Foundation has developed a set of online e-learning modules to guide users through the methodology, including instruction videos. The modules include:

1. Getting started with MM
2. Metro Net and Metro Map
3. Mapping in Visio

Metro Mapping website

The official Metro Mapping website serves as a central platform where users can:

- Access e-learning materials and manuals
- Download templates and example maps
- Find practical tips for facilitation and stakeholder engagement
- Read case studies from other healthcare institutions

This platform makes sure that the methodology is openly accessible and continuously updated.

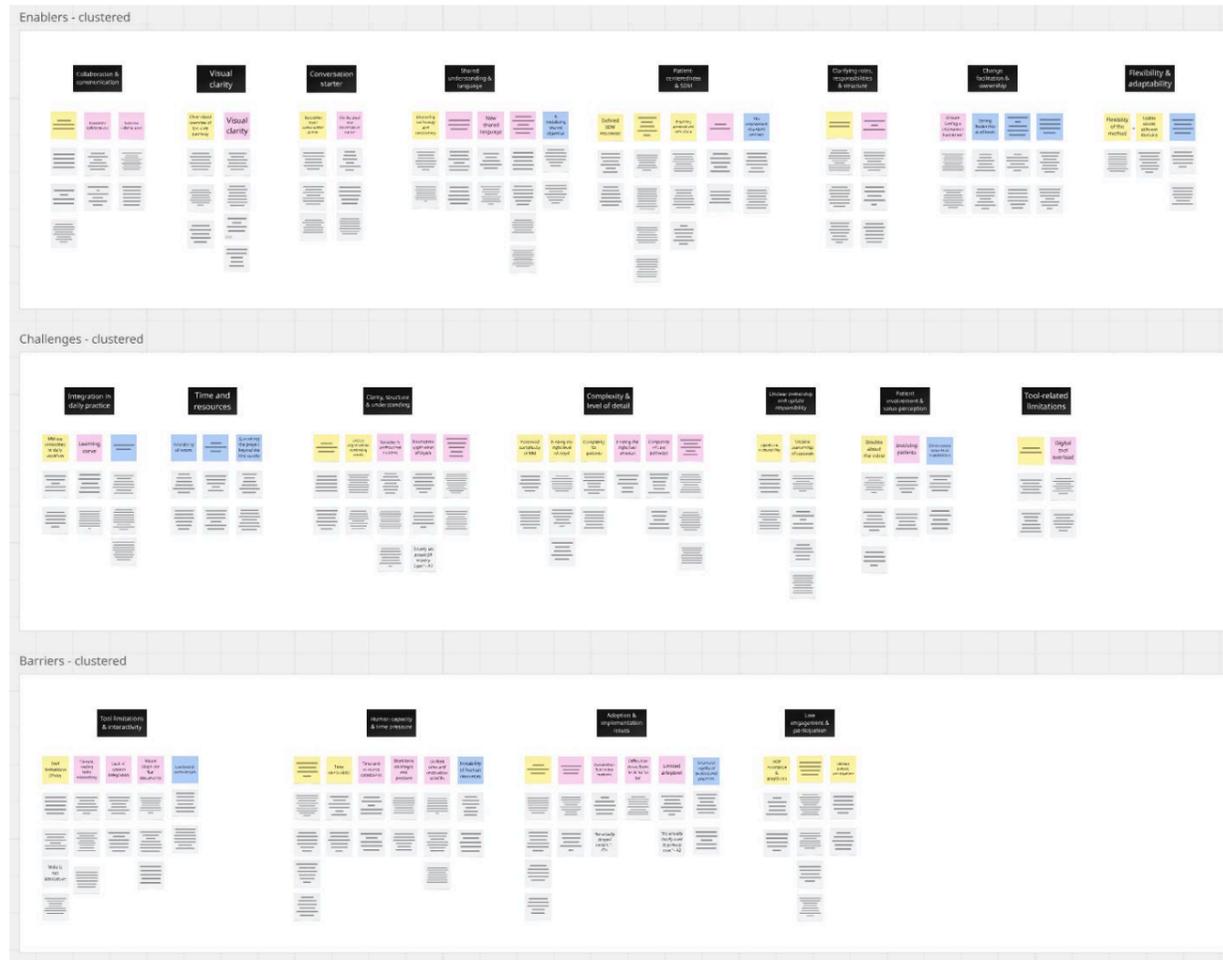
Other tools used in practice

Although Visio is the recommended tool, I learned from interviews that people can adapt the method, depending on what works best for them. Common alternatives include:

- Miro, for online collaboration and early sketches
- PowerPoint, for presenting simplified versions of the map
- PDF exports, to distribute and annotate maps with HCPs
- Paper prints, for co-creation sessions or onboarding purposes.

K. Enablers, challenges, barriers analysis

Full overview of the clustered themes:



The next three pages provide the clusters of each individual factor:

- Enablers
- Challenges
- Barriers

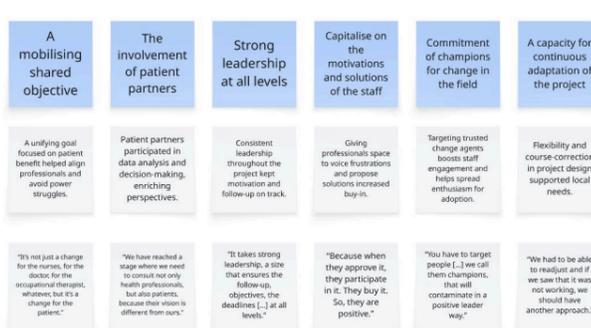
ENABLERS



ENABLERS



ENABLERS



CHALLENGES

Perceived complexity of MM	Updates & sustainability	MM not embedded in daily workflow	Variable understanding across team	Doubts about the value	Competing tools/methods	Unclear ownership of updates	Finding the right level of detail	Complexity for patients	Lack of alignment on versioning needs
Some HCPs felt the Metro Map was too complex, especially for patients.	Keeping the map up to date requires clear responsibilities and support.	The Metro Map is often not used during consultations or day-to-day work.	Team members had inconsistent understanding of what was created and how to use it.	MM is not always self-explanatory or immediately understood. Some professionals need extra educational material to understand what to do with it.	MM competes with other tools like Medimap or swim lane diagrams, causing confusion.	Without clearly assigned responsibilities, the Metro Map is often not maintained or kept up to date. This has led to long-term relevance and usability.	The Metro Map sometimes becomes too long or detailed, making it hard to use or maintain. Respondents had trouble determining how much detail is needed.	While the MM may be a good tool for HCPs, it is often too complex for patients to understand or use effectively.	There is no consensus on whether the HCP and patient versions should be different. Some say a simplified patient version is needed, others believe even the HCP version is unnecessarily complex.
"Some indicated that the Metro Map is a good overview for HCPs, but that it is much too complex for patients."	"Most respondents indicated that there need to be updates to the Metro Map because the care path should not be viewed as something static."	"Most had not incorporated the Metro Map into the consultation room."	"Different people who worked on the same care path, sometimes gave different answers."	"They do not know whether the patient would benefit from it due to their low health literacy."	"There is some dispute within the hospital about which of these methods is best."	There are concerns about who is responsible for updating it	"Some respondents had trouble with the amount of detail that the MM sometimes goes into."	"Some indicated that the MM is a good overview for HCPs, but that it is much too complex for patients to look at."	"Other respondents disagreed and argued whether there really is a need for the MM to be as detailed as it is." "There's no need for the HCP version to be as complete as it is."
				"You need to convince them a bit about the tool."		"This is not something that can be organized by the HCPs themselves."	"The Metro Map documents become very long (sometimes 13 pages)."		"When it's ready, who will update it, and when will it happen, and will it be supported in that process? Because we, as HCPs, obviously don't have time for that, so that's kind of a point of discussion". MS3

CHALLENGES

Complexity of care pathways	Finding the right level of detail	Involving patients	Variation in professional routines	Incomplete application of layers	Original color scheme not applicable outside oncology	Limited usability of complex visualizations in patient interactions	Learning curve	Digital tool overload	Takes time to get used to Visio
Care processes are often non-linear and difficult to visualize comprehensively.	Too much detail overwhelms; too little detail reduces usability.	Actively involving patients in the mapping process is difficult in practice.	Significant differences in working methods complicate establishing a shared 'as-is' situation.	Not all layers (e.g., experiential or companion layers) are used, which limits depth.	The original color scheme of Metro Mapping was designed for oncology, but as the method is applied to other domains, professionals often struggle to establish a shared 'as-is' situation.	Extremely detailed or large Metro Maps may be difficult to use in practice, especially when trying to discuss them with patients. This creates friction between design and practical application.	Professionals need time and support to learn how to work the tool.	There is a growing number of digital tools in healthcare. Metro Mapping must add value without increasing administrative burden or complexity.	There is a growing number of digital tools in healthcare. Metro Mapping must add value without increasing administrative burden or complexity.
"It's hard to include all possible variations and decision points."	"I would've liked to bring patients and professionals together, but it never worked out."	"What I really wanted, which I also know happens in other organizations, is that for different people there is a different level of detail in the Metro Map. It's a challenge to get to one size fits all." - P2	"We don't really use all layers, like the companion layer for example." - P10	"Like here, for example you have colors that they give, those also come from Metro Mapping itself. Well, you don't use those either. They give you the colors, to here you also apply your own colors." - P8	"It is challenging to determine how much detail to include in a Metro Map. If you include it, it becomes hard to read, explain, or use in practice — especially in patient communication."	"You notice that the basics of the tool are very good, but I think it's always taken some time to still make it your own. I think I still have that a lot from people who are trying to use it well." - P3	"There's a growing need for user-friendly digital tools that don't increase administrative burden."	"There's a growing need for user-friendly digital tools that don't increase administrative burden."	"I had some it printed — it was in big on that screen. How are you going to discuss that with a patient? So that's another thing you can think. Oh, no, here it now, but what now?" - P8
		"So you see that the difference in methods between different HCPs is so great that it is quite a challenge to arrive at one size fits all." - P3	"I rarely see people fill in every layer" - P3						

Communication at all levels	Availability of actors	Pace of implementation process	Demonstrate value to all stakeholders	Sustaining the project beyond the first results
The large size of the research team required consistent and effective internal communication, which was sometimes difficult to maintain.	Staff and researchers struggled to make time for the project due to workload.	Solutions needed to be rolled out quickly before losing momentum.	It was difficult to show each stakeholder how the project would benefit them.	After initial success, continued support was needed to avoid regression.
Care teams were not always kept informed or involved throughout the different project phases, even when no immediate action was required from them. This led to	"We all lack the time to do our clinical work, so to be free for projects, it's	"When we get to deployment, it has to be fairly fluid [...] otherwise people	"Everything has to remain a win-win situation for	"Measure it and then maintain it. Because that's fine for the next 2 months. But after

BARRIERS

Limited patient participation	Lack of method knowledge (due to incomplete preparation)	HCP reluctance & skepticism	Time constraints	Tool limitations (Visio)	Unclear implementation in practice	Time pressure and limited availability of HCPs
In most cases, patients were not involved in the co-design process.	Not all participants considered the required learning before the MM workshop. This led to very low levels of understanding, confusion about the method, and slower progress in collaborative sessions.	Some professionals resist being guided by a visual template.	Time pressure and other priorities pushed the MM process to the background.	Microsoft Visio was sometimes difficult to use and had limited functionality.	There is a lack of guidance on how to use MM in day-to-day clinical settings. As a result, HCPs are unsure how to apply the tool in their daily work, which limits its impact.	HCPs are often involved in many different projects or tasks, which makes it difficult to involve them in the Metro Mapping process. As a result, their time is not always prioritized or embedded in daily routines.
"There is a distinct lack in collective patient participation during MM."	Many users did not fully understand the flow, scope, or how to apply them. Many respondents were confused when asked about the number of layers they created."	"They will not be led or influenced by what a Metro Map tells them to do."	"The creation of the Metro Map was a long process and was often pushed to the back."	Most indicated that it was a useful tool to template to have, but there were some difficulties and frustrations using it.	"There is little to no guidance on how HCPs can effectively use this Metro Map in daily practice."	"HCPs are very busy people often involved in many different projects or research groups."
	"Most respondents seemingly did not take the time to properly study the method"			Visio is not interactive	"Respondents were still left with the question what to do with it once completed."	"It was difficult for people in MM 'leadership roles' to contact the appropriate HCPs."
	"The e-learning that had to be completed prior to the workshop was not completed by all participants. [...] The trainer noticed and allowed extra time for the workshop."			"Some respondents used Visio as a template for their personal patient care plans and integrated it into the Metro Map, then they were no longer 'in the method'."	"More guidance must be provided and clear manuals have to be developed."	"Some are concerned that using the MM in daily practice would take up too much time."

BARRIERS

Current tooling lacks interactivity	Lack of system integration	Time and resource constraints	Limited adoption	Competition from other methods	Workforce shortages and pressure	Lack of interactivity in current MM	Limited time and motivation of HCPs	Difficult to move from 'as is' to 'to be'	Metro Maps are 'flat' documents	Implementation steps are not always clear
Visio is not intuitive and lacks key features such as linking elements or adjusting the map height.	Metro Maps cannot yet be integrated with hospital systems (e.g., Zenya), which limits functionality.	Developing Metro Maps is time-consuming and labor-intensive.	In many settings, especially in primary care, Metro Mapping is not yet widely used.	Some organizations have moved on to alternative approaches.	Workforce shortages put pressure on teams to work faster and more efficiently. If Metro Mapping is seen as time-consuming or difficult to implement, it risks being deprioritized.	Metro Maps are currently seen as "flat documents" (i.e., in Visio, which prevents interactivity). From linking paragraphs or resources to specific data, this limits the depth of information that can be shared.	"I had a project where I knew that a methodology would get a little bit of change over time and the questions and then more etc."	"In the end, many organizations will probably in response, but it is quite hard to move from 'as is' to 'to be'."	The MM is described as a "flat document" in Visio, which prevents interactivity and makes it difficult for HCPs, such as the integration of a TSB matrix.	Successful adoption of Metro Mapping requires detailed planning, without a clear implementation strategy, the methodology being misunderstood.
"Visio-based Metro Maps are flat and lack interactivity features like a linking paragraphs, which limits their functionality and usefulness in practice."	"So you can't link the visual representation to all those crucial details stored in Zenya." - P4	"We simply don't have the capacity to build elaborate Metro Maps." - P10	"It's actually hardly used in primary care." - P2	"We actually stopped using it." - P11	"You need to work more efficiently and faster. That's just the reality with the current staff shortages." - P9	"Metro Mapping files in Visio were 'flat documents' without the interactive capabilities we relied on in our current system." - P4	"Ideally, I would have liked to get patients and doctors all together. But that never worked out. And I also know that's a big challenge." - P3	It is not possible to attach links or relevant documents, work instructions, etc. to the visual elements of the Metro Map.	"It's important to really think through the implementation" - P6	
"We can't attach links to the, what I just showed about the web links. We can't attach web pages here, we can't attach protocols here." - P4								"But when I click on this, nothing happens. So it's basically a flat document." - P4		

BARRIERS

Structural rigidity of professional practices	Instability of human resources	Low level of computerism
Role boundaries and 'reserved acts' led to tensions about interdisciplinary collaboration.	High staff turnover and management changes hindered continuity.	Outdated tech infrastructure hindered data analysis and implementation of digital tools.
"What defines a professional or medical discipline is its reserved acts."	"An issue will be human resources and continuity for the project."	"I've been working in health data for more than 20 years. I know what it's like. It's not pretty and it hasn't really improved much."

L. Suggestions for future improvements

SUGGESTIONS FOR THE FUTURE

<p>Having a champion / 'kartrekker'</p> <p>Having a dedicated ambassador or 'kartrekker' within the organization can make a big difference in the successful adoption of Metro Mapping. This person serves as an internal marketing coordinator, offers support and expertise, and helps to build momentum and buy-in from stakeholders.</p> <p>"It's very nice in any case when you have an ambassador who really believes in it. Internally, within the organization of course, who is like the driver ('kartrekker') of the process." - P2</p>	<p>Create an additional layer for digital tooling</p> <p>Several participants want the digital tooling to be more dynamic and interactive. They suggest adding a special layer for digital tooling that can be used to attach documents and have different layers.</p> <p>"I saw a need to pull out the digital tooling being used, and make a special layer for that." - P3</p>	<p>Making the Metro Map dynamic and interactive</p> <p>There is a need to make the Metro Map a clickable document in which you can attach documents and have different layers.</p> <p>To make the Metro Map dynamic, users should be able to expand or collapse parts of it. This would help take the view depending on the situation (overview vs. details). For instance, you could add triggers to the already detailed information.</p>	<p>Creating reusable 'building blocks'</p> <p>To make the Metro Mapping process more efficient and reusable, participants suggest creating reusable building blocks. These could be templates for common elements like patient journeys, care pathways, and clinical routines. These blocks could be used to create different versions of the Metro Map for different users and contexts.</p> <p>"I know they are very much looking at some kind of cubes that can be reused" - P3</p>	<p>Different views for different users</p> <p>Participants recognize that different users have different needs (e.g., HCPs, patients). A light approach is suggested, just a clear view of the journey for patients, and a detailed version for HCPs.</p> <p>The ability to view only the relevant things for your role (e.g., as a nurse, physician, or patient) would help focus the information. This could be achieved through visibility or toggle functions.</p> <p>"For example, that only the relevant things for you have 100% opacity and the rest 20% or so, so you can still see the bigger picture." - P9</p>	<p>Supporting users to adapt the method to their needs</p> <p>The method can be tailored to different user needs and contexts.</p> <p>"We just adapted it to our own style." - P10</p>	<p>Making it an interactive document with clickable layers</p> <p>Several participants expressed the need for an interactive document. They want to be able to click on different parts of the Metro Map to see more details or to go back to an overview. This would help focus the information and make it easier to use in daily clinical routines.</p> <p>"When I could, for example, just click on a patient population, for example here is a list of it, I would then just click that split, that I would have further split on the different possibilities. They would be great, because now I have all these splits in one, so that also makes the Metro Map such a messy thing." - P8</p>	<p>Focus on usability and system integration</p> <p>Future development should focus on better usability, integration with existing systems, and adding real value in daily clinical routines.</p> <p>"User-friendliness and integration with current systems plays an important role" - P3</p>	<p>Clearly define and display the goal the Metro Map</p> <p>Clarifying the overarching goal of the care pathway or Metro Mapping project at the top of the map helps participants understand the context and mission behind the project. It improves engagement and shared decision-making among HCPs.</p> <p>"I notice that when I put it up and the goal is above it, people start saying, oh yeah, that's why we're doing it." - P10</p> <p>For example, in bariatrics, the goal of mapping the care pathway is to choose a new obesity app, and we want to pilot with another app" - P10</p> <p>"The goal basically always has been to make the care pathway clear. What happens when, by whom." - P8</p>	<p>Smart input support when building the map</p> <p>For some users, especially those who are not familiar with digital tooling, it might be helpful to have a digital tooling guide that can be used while filling out the Metro Map. This could be achieved by having prompting questions, showing examples, or offering templates per role or phase.</p> <p>"Some of the steps in the map can be very extensive, and that I have if you're doing it for the first time and you don't have knowledge of the software, that you're really making a mess... a input support or something could be very helpful." - P9</p>
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M. User needs

Key user needs in more detail:

- 1. A tool that is intuitive and easy to use**

HCPs need a clear, simple interface that lowers the threshold to start and continue working with Metro Maps (even under time pressure).
- 2. Support for real-time co-creation and collaboration**

The tool should allow multiple users to view, comment, or edit the map, making collaboration smoother, instead of working in isolated documents.
- 3. Control over the level of detail**

Users need the ability to toggle between overview and detail, so the MM stays clear and relevant for different users and moments.
- 4. Guidance to structure the mapping process**

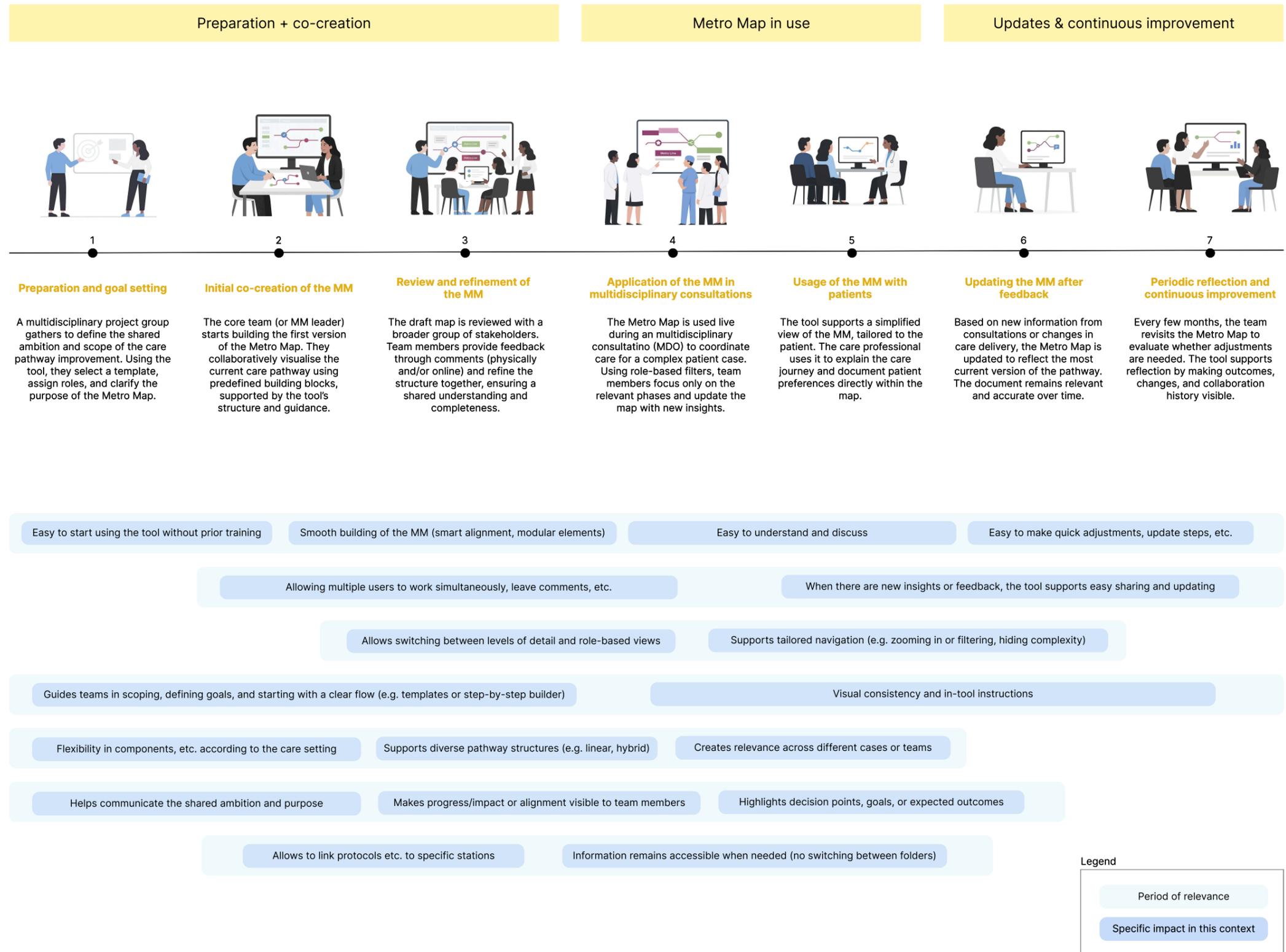
Users need support or built-in templates to guide them through creating and refining a Metro Map, without confusion or inconsistency.
- 5. Flexibility to fit different care context**

The tool must support different (non-oncologic) care contexts, such as transmural and/or hybrid care.
- 6. Clear added value for patients and professionals**

Users need to understand what MM brings (for themselves and for the patient) to stay motivated to use it
- 7. Ability to attach documents and other relevant information**

Users need to attach documents, links, notes, or other relevant data directly to elements in the Metro Map, so that the map becomes a connected, layered, and actionable tool (instead of a 'flat document').

N. Future scenario



O. Co-creation sessions

Plan session 1

For my session, the goal was to explore first ideas for how a digital Metro Mapping tool could support HCPs, based on the design principles and user needs identified in the scoping phase.

After briefly presenting my project and scoping results, including the seven design principles, I invited the participants to generate 'How Might We' questions for each principle. Together, we selected one key question per principle. For each question, we held a short idea generation round using "brainsketching": participants drew ideas on an A3 sheet and passed it around, allowing others to build on their suggestions.

After several rounds, we discussed and clustered the most promising ideas and features. A few of these were further developed into quick mini-concepts and shared with the group for feedback. This session helped to expand the initial solution space and revealed which ideas resonated most, both in terms of practicality and user value.

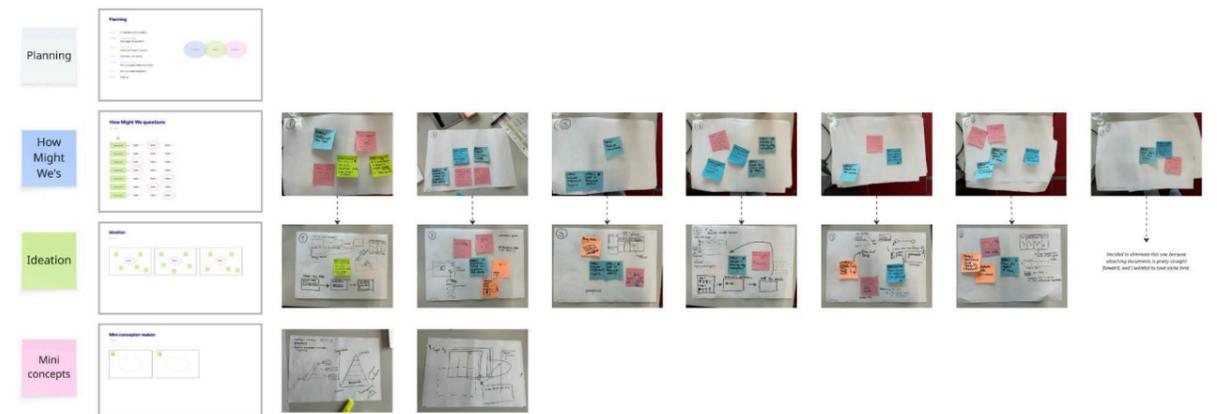
Plan session 2

The aim of this session was to explore how a digital Metro Mapping tool could look and feel, by generating ideas together and visualising how certain functionalities might work in the interface.

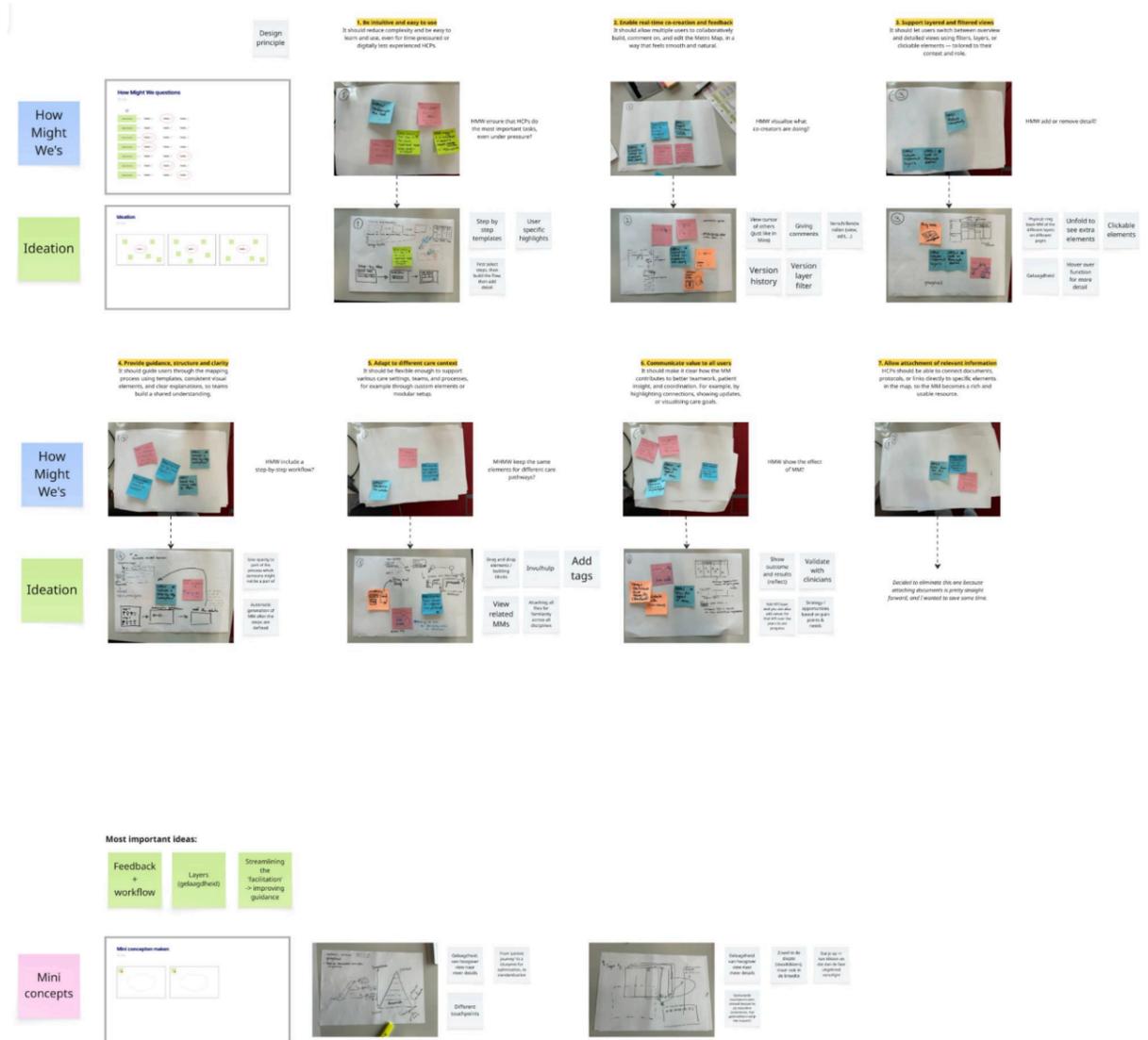
After a short introduction, we started with a brainstorm based on the design principles as a warm-up exercise. I then presented a future scenario sketch of how the tool might be used in practice. In the next part of the session, we moved into UI sketching rounds using prompts. Participants sketched their ideas, passed their sheet to the next person, and built upon each other's concepts across multiple rounds. We concluded the session by discussing the sketches and reflecting on opportunities, preferences, and design directions.

This session provided valuable insights into how the tool might be structured and experienced, and helped generate several concrete interface ideas.

Output co-creation session 1



Processing the results:



Q. User types including values and relevant features

Metro Team



Healthcare professional

As a healthcare professional, I want to **easily create and use** a Metro Map with my team, so that we can **structure** the care pathway together and use it to **guide daily practices** and conversations.

→ **Values:** Clarity, ease of use, shared ownership

→ **Relevant features:**

- Role-based filtering
- Drag-and-drop builder
- Clean and intuitive interface
- Real-time collaboration



Service designer

As a service designer, I want to help teams **structure and visualise** their care pathways in a **simple, accessible** way, so that sessions stay focused, collaborative, and productive.

→ **Values:** Flexibility in facilitation, visual clarity, ease of use

→ **Relevant features:**

- Templates and reusable components
- Real-time collaboration
- Printable or exportable views



Program manager

As a care pathway coordinator, I want to ensure that everyone **uses the same, up-to-date** Metro Map, so that our efforts across departments and organisations stay **aligned**.

→ **Values:** Consistency, overview, cross-organisational coordination

→ **Relevant features:**

- Version history and change tracking
- Printable summary view for presentations
- Dashboard with status indicators per Metro Map
- Access to all Metro Maps in one place
- Role-based permissions
- Overview or "summary mode" of the map



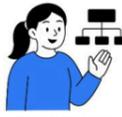
Care manager

As a care manager, I want to see how **different disciplines** work together across the care pathway, so that I can assess where **coordination** is strong or where improvement is needed.

→ **Values:** Strategic overview, insights into team coordination

→ **Relevant features:**

- KPI indicators linked to map elements (e.g. bottlenecks)
- Clarity in responsibilities across phases
- Map comparisons



New team member

As a new team member, I want to **understand the care pathway structure and involved roles** quickly, so that I can contribute to the team with **clarity** and confidence.

→ **Values:** Understanding their role quickly, clarity

→ **Relevant features:**

- Visual timeline or pathway viewer
- Clickable roles and phases with pop-up explanations
- Highlighted care steps and responsibilities
- Embedded links to protocols or learning materials



Patient / family

As a patient, I want to easily **understand** my care pathway and know **what to expect**, so I feel fully **informed** about my treatment and know when key decisions have to be made.

→ **Values:** Transparency, reassurance, understanding the process

→ **Relevant features:**

- Simplified patient view with only key steps
- Visual explanation of roles (e.g. icons or avatars)
- Timeline with "what to expect" moments
- Glossary tooltips for non-medical terms

R. Kano survey responses per participant

Respondent 1 - Researcher (Experience level: 8)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Blij	Verwacht	Maakt niet uit	Verwacht	Blij	Blij	Blij	Vervelend	Verwacht
Niet	Jammer	Vervelend	Maakt niet uit	Jammer	Jammer	Jammer	Maakt niet uit	Blij	Vervelend
Conclusie	Attractive	Must-be	Indifferent	Indifferent	Attractive	Attractive	Attractive	Reverse	Must-be

Respondent 2 - Researcher (Experience level: 6)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Verwacht	Blij	Verwacht	Blij	Blij	Verwacht	Blij	Maakt niet uit	Verwacht
Niet	Maakt niet uit	Jammer	Jammer	Vervelend	Jammer	Maakt niet uit	Jammer	Maakt niet uit	Jammer
Conclusie	Indifferent	Attractive	Indifferent	Performance	Attractive	Indifferent	Attractive	Indifferent	Indifferent

Respondent 3 - Service designer (Experience level: 9)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Blij	Blij	Verwacht	Blij	Verwacht	Blij	Blij	Blij	Blij
Niet	Jammer	Vervelend	Jammer	Vervelend	Jammer	Maakt niet uit	Vervelend	Maakt niet uit	Vervelend
Conclusie	Attractive	Performance	Indifferent	Performance	Indifferent	Attractive	Performance	Attractive	Performance

Respondent 4 - PhD (Experience level: 8)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Blij	Blij	Verwacht	Maakt niet uit	Blij	Verwacht	Maakt niet uit	Maakt niet uit	Blij
Niet	Vervelend	Vervelend	Jammer	Maakt niet uit	Jammer	Maakt niet uit	Maakt niet uit	Maakt niet uit	Jammer
Conclusie	Performance	Performance	Indifferent	Performance	Attractive	Indifferent	Indifferent	Indifferent	Performance

Respondent 5 - Care pathway designer (Experience level: 9)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Verwacht	Verwacht	Blij	Blij	Blij	Blij	Blij	Blij	Blij
Niet	Vervelend	Jammer	Jammer	Maakt niet uit	Jammer	Jammer	Jammer	Maakt niet uit	Maakt niet uit
Conclusie	Performance	Indifferent	Attractive	Attractive	Attractive	Attractive	Attractive	Attractive	Attractive

Respondent 6 - Care pathway designer (Experience level: 9)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Blij	Blij	Blij	Blij	Maakt niet uit	Maakt niet uit	Verwacht	Maakt niet uit	Blij
Niet	Jammer	Vervelend	Vervelend	Jammer	Maakt niet uit	Maakt niet uit	Jammer	Maakt niet uit	Vervelend
Conclusie	Attractive	Performance	Performance	Attractive	Indifferent	Indifferent	Indifferent	Indifferent	Performance

Respondent 7 - Quality & Safety advisor (Experience level: 8)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Blij	Blij	Blij	Verwacht	Verwacht	Verwacht	Verwacht	Maakt niet uit	Verwacht
Niet	Verwacht	Verwacht	Maakt niet uit	Vervelend	Vervelend	Vervelend	Vervelend	Maakt niet uit	Vervelend
Conclusie	Attractive	Attractive	Attractive	Must-be	Must-be	Must-be	Must-be	Indifferent	Must-be

Respondent 8 - Quality & Safety advisor (Experience level: 3)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Verwacht	Verwacht	Verwacht	Verwacht	Blij	Verwacht	Verwacht	Blij	Verwacht
Niet	Jammer	Vervelend	Jammer	Vervelend	Jammer	Vervelend	Vervelend	Maakt niet uit	Vervelend
Conclusie	Indifferent	Must-be	Indifferent	Must-be	Attractive	Must-be	Must-be	Attractive	Must-be

Respondent 9 - Service designer (Experience level: 7)

Feature	Templates	Drag & drop builder	Comments & feedback	Clickable layers	Role-based filters	Simplified patient-view	Bijlagen toevoegen	Smart suggestions	Export options
Wel	Maakt me niet uit	Blij	Blij	Blij	Blij	Blij	Maakt me niet uit	Jammer	Blij
Niet	Maakt me niet uit	Jammer	Jammer	Maakt me niet uit	Maakt me niet uit	Maakt me niet uit	Maakt me niet uit	Verwacht	Jammer
Conclusie	Indifferent	Attractive	Attractive	Attractive	Attractive	Attractive	Indifferent	Indifferent	Attractive

S. Project brief



Personal Project Brief – IDE Master Graduation Project

Name student Lot Hartevelt

Student number 4,852,818

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Designing a digital Metro Mapping tool

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)

The healthcare sector in the Netherlands is under pressure. The Dutch coalition agreement acknowledges the challenges within this sector, such as the increasing demand and the workforce shortage (Rijksoverheid, 2024). In 2022, the government established the Integral Care Agreement (IZA). It was signed by a wide range of parties in the healthcare sector, such as umbrella organizations of hospitals, mental health care, and elderly care. The goal of IZA is to improve Dutch healthcare and prepare it for the future, emphasizing on aspects such as regional cooperation, digitalization, and data sharing (Ministerie van Volksgezondheid, Welzijn en Sport, 2022). Delivering patient-centered care across fragmented systems is complex, leading to inefficiencies and hindering collaboration (Bahle et al., 2023). One important challenge is the lack of governance and proper documentation in designing care pathways. Metro Mapping presents a promising solution to improve this situation.

Metro Mapping is a relatively new service design method by which care pathways can be designed and optimized in a visual way (Figure 1). It can be used to improve patient experience and help with clinical challenges, for example, around shared decision making and multidisciplinary collaboration. By enabling co-creation among diverse stakeholders, this approach helps to create more effective and streamlined care processes, ultimately improving healthcare outcomes. While Metro Mapping was originally developed to support shared decision-making in oncology (Griffioen et al., 2022), it has demonstrated potential for broader applications across healthcare. The Metro Mapping Foundation's mission is to improve and promote healthcare and the well-being of patients, their loved ones and caregivers through this methodology (Metro Mapping Foundation, n.d.). However, the lack of a scalable, digital Metro Mapping tool hinders its widespread adoption and limits its ability to enhance collaboration within and across health organizations.

The healthcare sector faces limitations, such as diverse stakeholder needs, resistance to change, and the challenges of implementing e-health innovations within existing systems (Talwar et al., 2023). Important stakeholders include healthcare professionals, organizations, and innovators.

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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)

The current implementation of Metro Mapping faces barriers to adoption and scalability. Despite its potential to collaboratively visualize and optimize care pathways, its practical application remains limited. This is partly due to the lack of a scalable, user-friendly, digital tool that meets the needs of healthcare professionals, who often lack design expertise. Currently, the only tool used for Metro Mapping is Microsoft Visio, which is complex, unsuitable for collaboration across multiple institutions (transmural care), and limited in functionality. As a result, Metro Mapping has yet to realize its full potential within healthcare innovation. Also, the added value of optimizations and interventions cannot be measured yet.

This project aims to address these challenges by developing a user-friendly, digital Metro Mapping tool. The opportunity lies in creating a scalable solution that not only supports healthcare professionals in co-creating improved care pathways, but also demonstrates the added value of these interventions to healthcare institutions, policymakers, and other stakeholders. The tool will ultimately contribute to better, more efficient, and patient-centered healthcare. The focus of this project is to design and validate a prototype for this tool. The validated concept should act as a concrete use case for further development in Dutch healthcare, aligning with the goals of the Integral Care Agreement (IZA).

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 and validate a prototype for a scalable, user-friendly, digital Metro Mapping tool to improve the implementation of the methodology for healthcare professionals, enabling more efficient collaboration within and between healthcare institutions, while demonstrating its value in optimizing care pathways.

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)

I will use the Double Diamond framework to structure my graduation project. In the **Discover** phase, I will conduct research through interviews, desk research, stakeholder analysis, and a review of existing tools and methods to identify user needs, challenges, and measurable KPI's. I will explore various healthcare contexts, such as mental health, elderly, or regional care, to determine the most relevant focus area for my project. In the **Define** phase, I will narrow down the final scope and establish clear design principles. By organizing focus groups or expert panels, I will cluster insights and co-create a shared vision.

During the **Develop** phase, I will ideate and iterate multiple concept ideas, involving healthcare professionals to ensure the tool meets their needs. Finally, I will create a prototype of the tool and validate the concept with stakeholders during the **Deliver** phase. This phase will also include creating an implementation plan for further development of the tool.

A more detailed, visual overview of my project approach can be found in Appendix A.

