EMPOWERED TO Care

Exploring how design can contribute to balancing care demand and capacity in rheumatology

Master Thesis - Kim Nouwen

Master Thesis
Delft University of Technology
Faculty of Industrial Design Engineering
MSc Design for Interaction
Medisign Specialisation

Graduate student
Kim Nouwen
Student number: 5030579

Graduation Committee
Chair:
Dr. Ir. Armagan Albayrak
Department of Human-Centred Design
Applied Ergonomics and Design

Mentor:
Ir. Brechtje Krijvenaar
Department of Design, Organisation and Strategy
Designing value in ecosystems

Client Mentor:
Dr. Petra Kok
Reinier de Graaf Gasthuis
Rheumatologist and CMIO

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Acknowledgements

Dear reader,

Writing this master thesis has been an exciting and sometimes vulnerable journey. As a young designer in a healthcare context, I was surrounded by people with deep knowledge and experience. At times, this made me feel small. During this process, however, I learned that I did not have to compete with this expertise, but could embrace it. I was greatly supported in this by my graduation committee, whom I would like to thank first.

I am very grateful to my chair, Armagan Albayrak, for her warm guidance, trust, and support throughout this project. She made me feel safe and reminded me that my insights and perspective as a designer were valuable. Especially in moments when I felt uncertain or overwhelmed, her support helped me regain confidence and continue with clarity.

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In addition, I would like to thank my client mentor, Petra Kok. Petra, thank you for your support, enthusiasm, and the freedom you gave me to explore the directions I considered valuable as a designer. I am grateful for the people you connected me with, the space you created for me within the hospital, and the platform you gave both me and this project.

A special thank you goes to all participants who contributed to this research. I am grateful to everyone who took the time to share their experiences, participate in interviews, or allow me to observe their work. Their openness, interest, and trust have been essential to this project and gave depth and direction to my work.

Finally, I would like to thank my family and friends for their support throughout this process. Whether by listening, thinking along with me, offering a fresh perspective, or simply being there when I needed it, they helped me keep going.

With this thesis, my time as a student comes to an end. I look back on this journey with gratitude and pride.

Kind regards,

Kim Nouwen

Nouwen

Summary

The Dutch healthcare system is under increasing pressure from demographic ageing, rising care demand, and limited specialist capacity. In rheumatology, this pressure is particularly visible: a growing share of patients referred to specialist care do not necessarily require specialist treatment, contributing to long waiting times and high workloads. Understanding why this happens requires looking at the system as a whole, rather than at isolated steps in the care pathway.

This project explored how design can contribute to balancing the inflow of patients with joint complaints and the capacity of rheumatology care, using the rheumatology department of Reinier de Graaf Gasthuis as its primary context. The research combined observations at four hospital settings, eighteen semi-structured interviews with patients, primary care professionals, secondary care professionals, and a systemic stakeholder, thematic analysis, and future visioning.

The research revealed four interconnected opportunities in the system: 'Bridging the gap between patient expectations and what care can offer', 'Primary care as a powerful filter for the right care at the right place', 'The patient as the most powerful factor in their own recovery', and 'Working smarter within the boundaries of a financially constrained system'. The design direction was focused on the opportunity where design could intervene most directly: supporting patients in taking a more active role in their own recovery in relation to lifestyle factors.

This led to the development of Jointly, a mobile application for people with non-inflammatory joint complaints in primary care. Jointly helps users reflect on their complaints, recognise the role of lifestyle factors, and translate these insights into small, feasible actions in daily life. The app uses an AI coach named Skelly to guide users through daily check-ins, personal insights, and concrete next steps, structured around the six domains of 'Het Leefstijlroer'. An optional community function allows users to connect with others in similar situations.

Jointly is positioned after the GP consultation and before referral to secondary care is considered, offering patients guidance and a sense of agency during a phase in which they are often expected to manage their complaints independently. Initial validation with a patient and two general practitioners confirmed the relevance of the concept, while also highlighting the importance of scientific credibility, continuity of support, and careful implementation. If successfully implemented, Jointly has the potential to contribute to fewer unnecessary referrals to rheumatology and a more active role for patients in their own recovery, though these effects require further longitudinal research to evaluate.

Reader Guide

This report follows the phases of the Double Diamond design process. Each phase contains one or more chapters that build towards the final design response. The overall structure and the methods used are visualised in Figure 1 and further explained throughout the report.

Several chapters end with Design Implications. These sections translate key insights into starting points for the design and are marked in orange to make them easy to identify.

Some visuals contain many details and may be difficult to read at page size. The QR codes on this page provide access to supporting materials, including a Canva whiteboard where the main visuals can be viewed and zoomed in on. Due to the length of the report and the size of the Appendix materials, the appendices are provided separately and can also be consulted through the QR code.

Visual Overview

Appendices

On the use of artificial intelligence

During the writing of this report, several AI tools were used as support. These tools were used to refine text written by the researcher and to generate visual illustrations. They were not used to generate ideas, arguments, or conclusions. All content was independently developed and critically reviewed by the researcher. A full account of which tools were used, for what purposes, and how they were applied responsibly can be found in Appendix B.

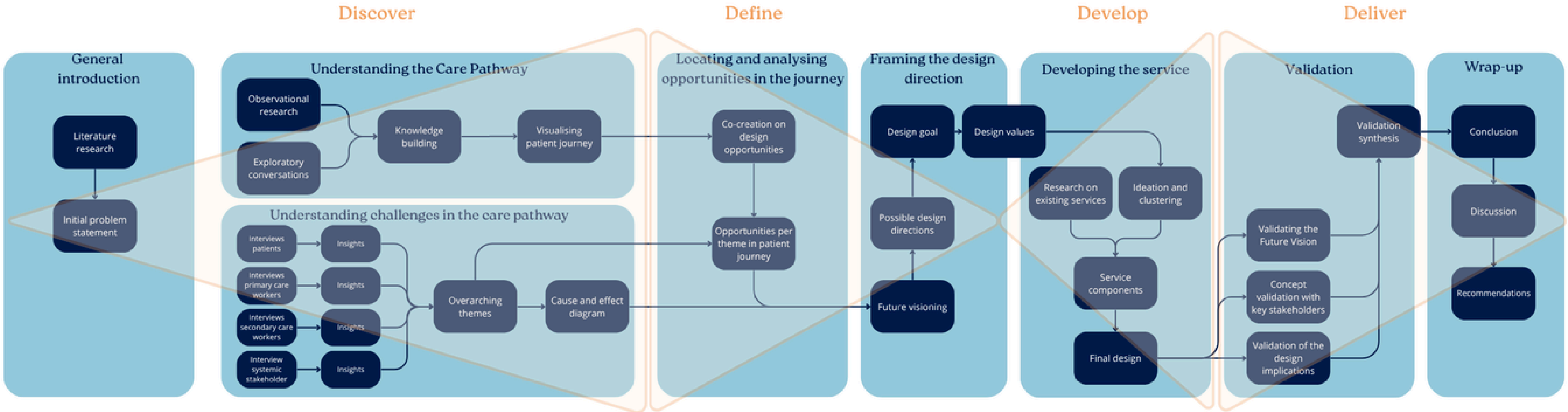

Figure 1: Process overview of this research

List of Abbreviations

DBC	Diagnosis-Treatment Combination *Diagnose-behandelcombinatie*
FMS	Federation of Medical Specialists *Federatie Medisch Specialisten*
GDPR	General Data Protection Regulation
GP	General Practitioner *Huisarts*
H&W	General practitioners and science Huisarts en Wetenschap
IGj	Health and Youth Care Inspectorate *Inspectie Gezondheidszorg en jeugd*
METC	Medical Ethics Review Committee *Medisch Ethische Toetsingscommissie*
NHG	Dutch College of General Practitioners *Nederlands Huisartsen Genootschap*
NVR	Dutch Society for Rheumatology *Nederlandse Vereniging voor Reumatologie*
NVZ	Dutch Hospital Association *Nederlandse Vereniging Ziekenhuizen*
NZa	Dutch Healthcare Authority *Nederlandse Zorgautoriteit*
OA	Osteoarthritis Artrose
RA	Rheumatoid Arthritis Reumatoïde artritis
RdGG	Reinier de Graaf Hospital Reinier de Graaf Gasthuis
SDT	Self-Determination Theory *Zelfdeterminatietheorie*
VWS	Ministry of Health, Welfare and Sport *Ministerie van Volksgezondheid, Welzijn en Sport*
Wlz	Long-term Care Act *Wet langdurige zorg*
Wmo	Social Support Act *Wet maatschappelijke ondersteuning*
ZN	Health insurers Netherlands *Zorgverzekeraars Nederland*
Zvw	Health Insurance Act *Zorgverzekeringswet*

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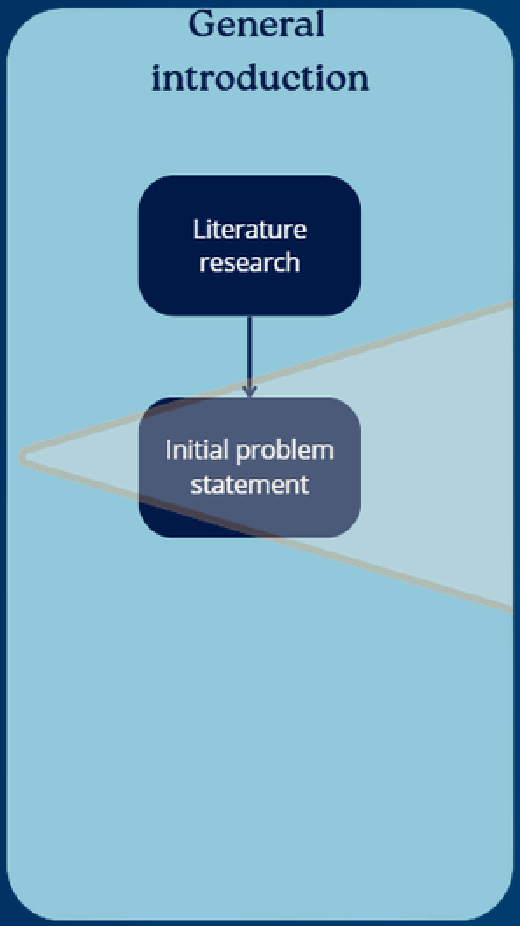
Chapter 1

INTRODUCTION

This chapter introduces the context in which this graduation project takes place. It explains how the Dutch healthcare system is organised, why the growing number of people with joint complaints creates pressure on rheumatology care, and why this calls for a different way of thinking about care pathways. The chapter also introduces the specific context of Reinier de Graaf Gasthuis and describes how the project is positioned within the broader healthcare system.

The chapter concludes by defining the scope of the project, introducing the stakeholder landscape, presenting the main research question and subquestions, and explaining the overall project approach and methods. Together, this chapter provides the foundation for understanding why this project is relevant and how the research and design process is structured.



The Dutch healthcare system is widely regarded as one of the better-organised systems in the world. It is built on a foundation of universal access, a strong primary care structure, and clear coordination between care levels (Kroneman et al., 2016). Yet despite this solid foundation, the system is facing serious challenges. Healthcare costs are rising, and the demand for care is growing faster than capacity can keep up (VWS, 2016).

The causes of this growing pressure are varied. Economic fluctuations and shifting government budgets affect the ability of organisations to deliver affordable care. However, the more structural driver is demographic ageing. This increases both the number of people requiring care and the complexity of care needs, as older adults are more likely to live with multiple chronic conditions simultaneously, also referred to as multimorbidity (Dekker et al., 2024). At the same time, a large part of the current healthcare workforce is approaching retirement age, resulting in staff shortages, more patients per professional, and increased workload across the care system (VWS, 2024).

These pressures are felt across all medical specialties, including rheumatology. Within this field, osteoarthritis (OA) is the most prominent example of the challenge ahead. Nearly 1.5 million people in the Netherlands currently live with the condition, and this number is expected to double to approximately 3 million by 2050 (RIVM, 2024). The rheumatology department of the Reinier de Graaf Gasthuis (RdGG) is already seeing the early effects of this trend, with a growing influx of patients putting pressure on the available specialist capacity.

To anticipate this growing demand, the RdGG has partnered with Delft University of Technology (TU Delft). In this project, the process and journey around the care for joint complaints is mapped out, opportunities within the journey and system are explored, and the potential contribution of design is investigated.

1.1 BACKGROUND INFORMATION

1.1.1 The Dutch Healthcare system

Since this project takes place within the Dutch healthcare system, it is important to understand how this system works. Without this understanding, it can be difficult to fully grasp the context of this research.

The Dutch healthcare system is designed to ensure that high quality healthcare remains accessible and affordable for the entire population. The organisation of the system is based on three central principles, as shown in Figure 2.

Figure 2: Core principles of the Dutch healthcare system
(Image generated using the prompt "Create an image of the core principles of the Dutch healthcare system" by Google Gemini, 2025 (https://gemini.google.com))

The system operates as a regulated market model, in which the government combines public regulation with elements of market competition. The government establishes the legal framework and supervises accessibility and quality of care, while health insurers and healthcare providers operate within these boundaries and compete with each other on price and quality (Hagenaars et al., 2018).

The organisation and financing of healthcare in the Netherlands are regulated through four key laws (see Figure 3). The Health Insurance Act (Zvw) regulates the financing of curative healthcare, such as general practitioner care, hospital care, and specialist medical care.

The Long-term Care Act (Wlz) covers individuals who require permanent and intensive care. The Social Support Act (Wmo) supports individuals in maintaining independence and participation in society. Finally, the Youth Act (Jeugdwet) regulates care and support for children and adolescents. Together, these four laws form the foundation of the Dutch healthcare system (VWS, 2016). Within the context of this research, the Zvw is most relevant, as it covers both general practitioner care and hospital care, the two care settings most involved in the care for joint complaints.

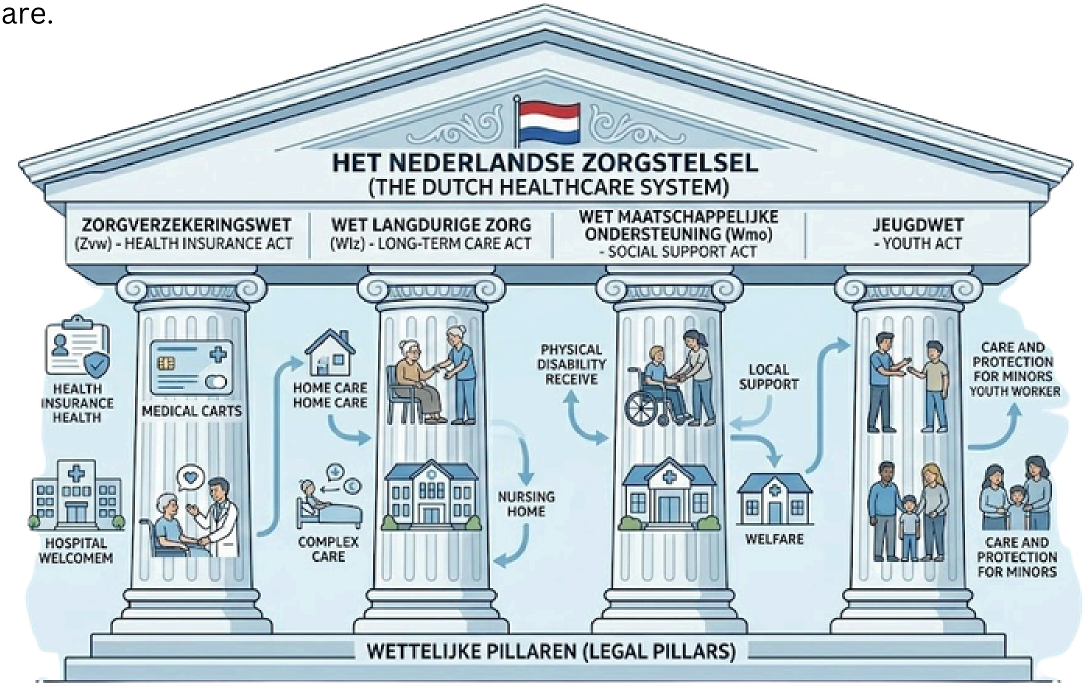
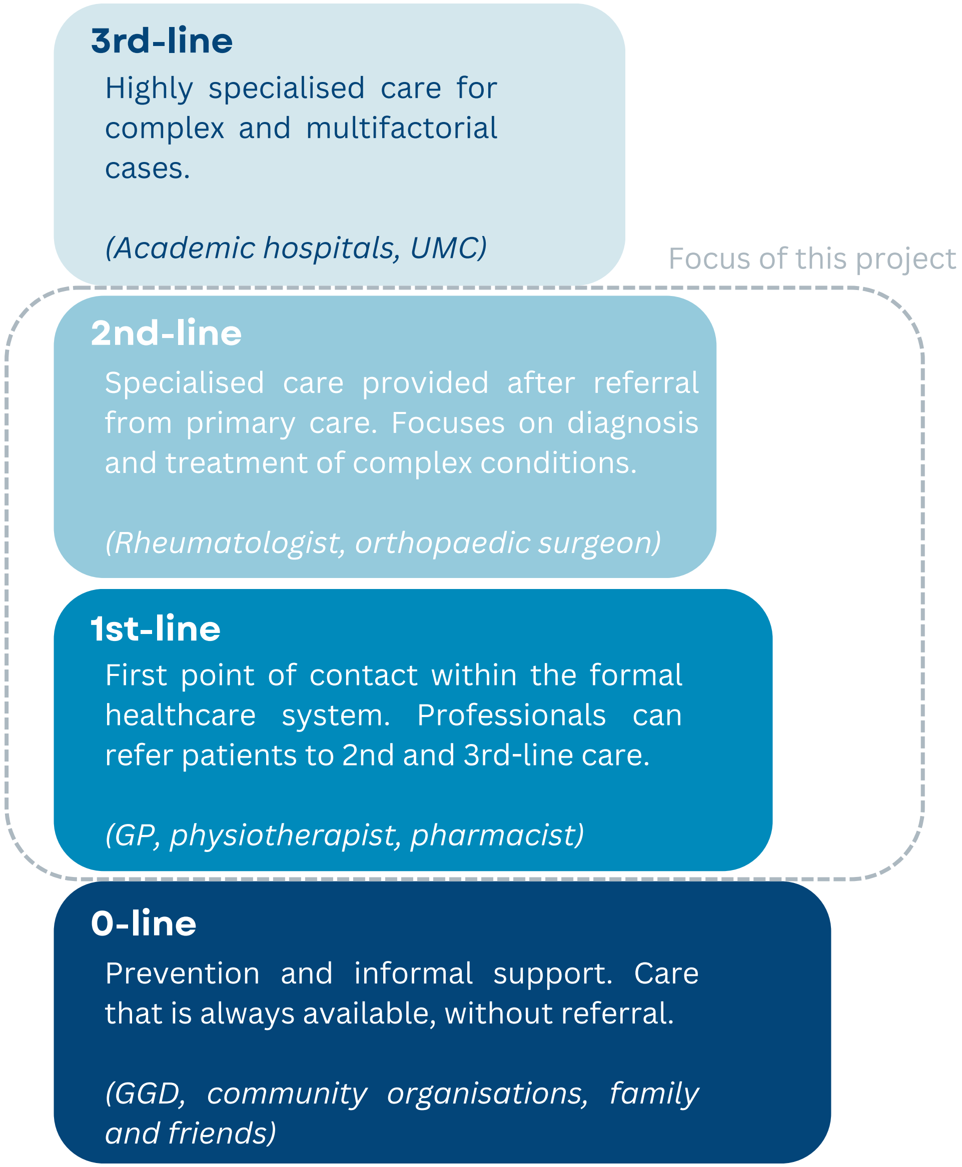


Figure 3: Four legal pillars of the Dutch healthcare system
(Image generated using the prompt "Create an image of the four legal pillars of the Dutch healthcare system" by Google Gemini, 2025 (https://gemini.google.com))

Within this system, healthcare is organised in different levels, as shown in Figure 4. Zero-line care refers to preventive activities and informal support outside the formal healthcare system. Primary care forms the first point of contact and includes general practitioners, physiotherapists and other paramedical professionals. Secondary care is delivered by medical specialists in hospitals or specialised clinics, such as rheumatology departments. Tertiary care refers to highly specialised care in academic hospitals for complex or rare conditions. Within this research, the focus lies primarily on primary and secondary care and the transition between them.

A key characteristic of the Dutch system is the gatekeeping role of the general practitioner (GP). Patients cannot directly access specialist care without a referral from their GP. This model contributes to an efficient organisation of healthcare and helps to distribute demand more effectively across different levels of care, thereby preventing unnecessary pressure on specialist services (Olthof et al., 2018; VWS, 2016). Within the context of this research, the GP is often the first person a patient encounters and plays a key role in shaping the patient journey from that point onwards.

Understanding how patients move through the different levels of care also requires some insight into the financial structures behind healthcare delivery. In practice, the organisation of care is not only shaped by financing, but strongly driven by patient inflow, external care demand, and available capacity. Financial outcomes are often evaluated afterwards, while day-to-day care is mainly affected by how many patients enter the system and how complex their needs are. Two overviews of the financial structures within primary and secondary care can be found in Appendix C.



3rd-line
Highly specialised care for complex and multifactorial cases.

(Academic hospitals, UMC)

Focus of this project

2nd-line
Specialised care provided after referral from primary care. Focuses on diagnosis and treatment of complex conditions.

(Rheumatologist, orthopaedic surgeon)

1st-line
First point of contact within the formal healthcare system. Professionals can refer patients to 2nd and 3rd-line care.

(GP, physiotherapist, pharmacist)

0-line
Prevention and informal support. Care that is always available, without referral.

(GGD, community organisations, family and friends)

Figure 4: Four healthcare lines in the Dutch healthcare system

1.1.2 The spectrum of joint complaints and their care needs

In this research, joint complaints refer to musculoskeletal symptoms related to the joints and surrounding structures, such as pain, stiffness, reduced mobility, and functional limitations. These complaints can differ strongly in severity, duration, and underlying cause. Some are temporary and self-limiting, while others are persistent, progressive, or related to chronic conditions.

Because of this variation, joint complaints do not represent one single condition, but a broad spectrum of problems with different care needs. Some complaints can be managed within primary care through advice, reassurance, lifestyle support, or physiotherapy, while others may indicate more complex or progressive conditions that require referral to secondary care. This distinction is relevant because musculoskeletal complaints form the second largest diagnostic cluster in terms of consultations per 1,000 registered patients, as shown in Figure 5. Moreover, the number of patients consulting the GP with musculoskeletal complaints has increased over recent years, driven by demographic ageing, chronic conditions, and increased healthcare utilisation (Terpstra et al., 2025).

Understanding this spectrum helps clarify where patients come from, what type of support they need, and where they should be guided next. Table 1 provides an overview of the five main categories relevant to this research, including their description, examples, and appropriate level of care.

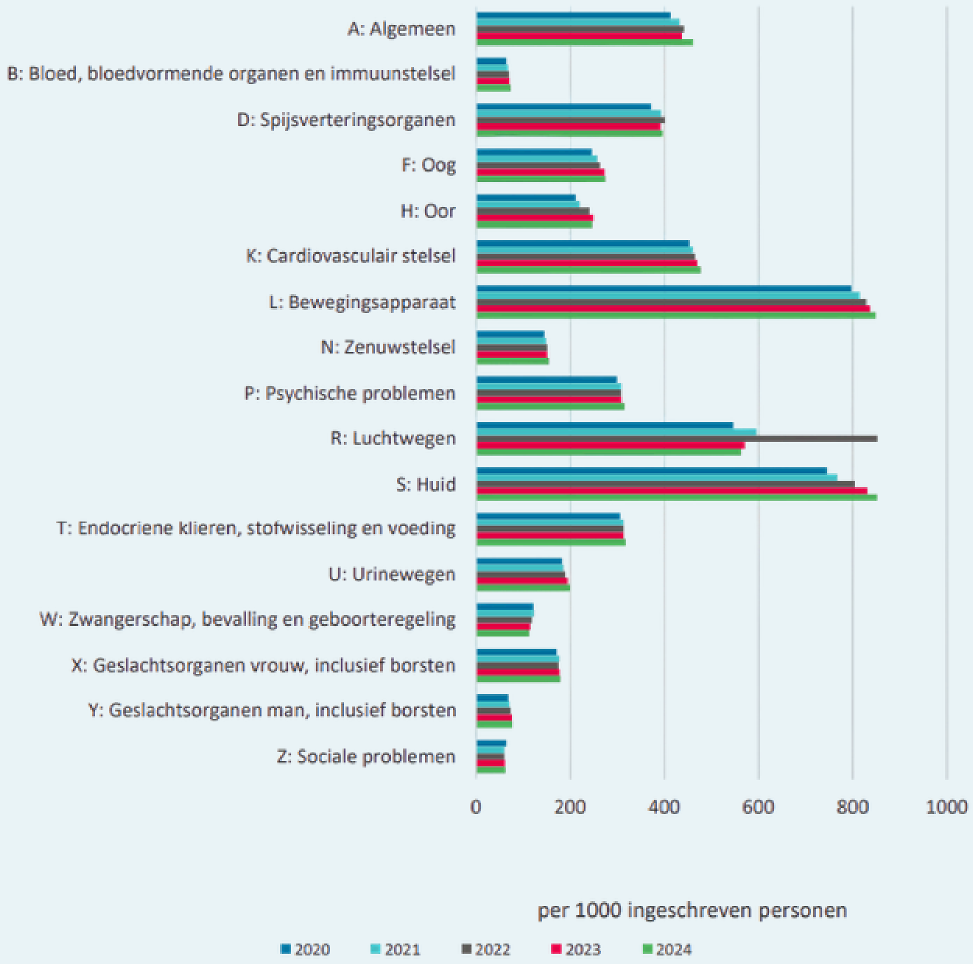


Figure 5: Number of health problems per 1,000 registered persons (Terpstra et al., 2025)

	Description	Examples	Primary care	Treatment
Osteoarthritis	Degenerative condition in which cartilage gradually wears down, causing pain and stiffness. Affects weight-bearing joints such as knees and hips (Thuisarts, z.d.-a).	Knee OA, hip OA, hand OA	Yes	GP or physiotherapist; pain management and lifestyle advice (Geenen et al., 2018)
Soft tissue rheumatism	Pain located in muscles, tendons or connective tissue rather than the joint itself (Thuisarts, z.d.-b). Often multifactorial and without clear structural damage.	Fibromyalgia, tendinitis, bursitis	Yes	GP, physiotherapist or pain specialist; multidisciplinary approach (Thuisarts, z.d.)
Crystal arthropathies	Inflammatory joint conditions caused by crystal deposits in or around the joint. Often presents as sudden episodes of severe pain and swelling (Thuisarts, z.d.-c).	Gout, pseudogout	Partial	Acute episodes often managed by GP; chronic cases may require specialist follow-up (Thuisarts, z.d.-c)
Inflammatory rheumatic diseases	Conditions caused by ongoing joint inflammation, often due to an autoimmune process (Poudel & Lappin, 2023). Can lead to permanent joint damage if left untreated.	Rheumatoid arthritis, psoriatic arthritis, axial or peripheral spondyloarthritis, systemic autoimmune diseases such as SLE and vasculitis	No	Requires referral to rheumatologist for diagnosis and treatment (FMS, 2026)
Infectious causes	Joint complaints resulting from bacterial or viral infection of the joint. Requires urgent medical attention as it can cause rapid joint damage (Janssens et al., 2017).	Septic arthritis, reactive arthritis	No	Requires urgent referral or hospitalisation for treatment (Janssens et al., 2017)

Table 1: Overview of main joint complaint categories and appropriate level of care

The way joint complaints are assessed and treated in primary care is largely shaped by clinical guidelines. In the Netherlands, the Dutch College of General Practitioners (NHG) has developed specific guidelines for a range of musculoskeletal conditions, including knee complaints, shoulder complaints, hand and wrist complaints, and suspected inflammatory arthritis, among others. These guidelines support GPs in structuring their diagnostic reasoning, determining initial treatment, and deciding when and how urgently to refer a patient to secondary care.

Within the scope of this research, these guidelines are particularly relevant at three points:

1. Recognising warning signs and distinguishing between inflammatory and non-inflammatory complaints
2. Determining initial treatment and any necessary monitoring
3. Determining the timing and urgency of referral to a rheumatologist.

At the same time, practice does not always match guideline intent. Stepped care is underused and referral patterns vary (NZa, 2025). Understanding why this gap exists, what causes it, and why certain choices are made in practice, forms an important starting point for this research.

1.1.3 Patient population

To understand the system surrounding the care for joint complaints, it is important to know who the patients are that move through it. The patient population presenting with joint complaints is not a homogeneous group. Patients differ in age, health status, digital skills, and expectations of care. Understanding these characteristics helps to map the complexity of the current system and anticipate the challenges that lie ahead. This section looks at both the current and the future patient population and compares them across a number of key dimensions.

Table 2 provides an overview of the key differences between the current and future patient population across four dimensions, based on available literature.

Dimension	Current patient population	Upcoming patient population
Age and complexity	OA is already common in older adults, while RA can also affect working-age patients (US, 2020; Nielen et al., 2017).	The population will age further, with a strong increase in people aged 65+ and 80+ (Stoeldraijer et al., 2020). Multimorbidity is expected to become more common (RIVM, 2024).
Lifestyle and comorbidities	Overweight, hypertension and diabetes are common among patients with OA and can affect symptoms and treatment options (Arslan et al., 2022).	Overweight is expected to increase further, making mobility, treatment and self-management more challenging (CBS, 2026).
Digital and health literacy	Digital skills and health literacy vary, which affects access to information and the ability to follow self-management advice (Allan & Cilia, 2024).	Digital care will become more common, but older adults and people with limited health literacy may need additional support (Zorg Innovatie Forum & Platform Pouwer, 2020).
Role in care	Patients increasingly want clear information, guidance and practical advice to manage their condition (Erwin et al., 2020; Papandony et al., 2017).	Future care expects patients to take a more active role, but self-management cannot be assumed to happen automatically (NZa, 2025; Hutting et al., 2021).

Table 2: Key differences between current and future patient population

1.2 ABOUT THIS PROJECT

This project is situated within the rheumatology department of Reinier de Graaf Gasthuis (RdGG), a hospital serving Delft and the surrounding region. The department faces a growing challenge in the years ahead. The number of people living with osteoarthritis is expected to nearly double by 2050, rising from 1.6 million to approximately 3 million (NZa, 2025). A large share of these patients currently end up at the rheumatology department, even though not all of them require specialist care. Research shows that approximately 70% of all patients referred to rheumatology have a non-inflammatory condition (Van Delft et al., 2022). This places considerable pressure on the capacity of rheumatologists, and with expected patient numbers continuing to rise, this pressure is likely to increase.

Understanding why this happens requires looking at the broader system. Joint complaints cover a broad spectrum of conditions with different causes, severities, and care needs. Not all conditions require specialist care, yet referral patterns vary and stepped care is underused (NZa, 2025). The guidelines that structure this process provide a clear framework on paper, but the gap between guideline and practice remains a relevant challenge.

The patient population adds a further layer of complexity. Patients differ widely in age, comorbidities, health literacy, digital skills, and expectations of care. Many conditions have a chronic character and require ongoing coordination between multiple professionals across different levels of care.

This makes care for patients with joint complaints a complex adaptive system, in which outcomes emerge not from a single intervention, but from the interaction between patients, professionals, organisations, and the wider healthcare context (E Plsek & Greenhalgh, 2001). Improvement should therefore not be sought only in isolated steps of the care pathway, but in understanding and addressing the relationships and dynamics of the system as a whole.

1.2.1 Context of Reinier de Graaf Gasthuis

Reinier de Graaf Gasthuis (RdGG) is one of the oldest hospitals in the Netherlands and provides care to more than 500,000 people in the Delft and surrounding region. The hospital has locations in Delft, Voorburg, and Naaldwijk and employs over 3,000 staff members (Reinier de Graaf, n.d.). In addition to delivering general hospital care, RdGG is affiliated with the Samenwerkende Topklinische Ziekenhuizen (STZ), which means that, alongside patient care, it also focuses on specialised care, education, research, and innovation. This broader organisational context is relevant to the present project, as it reflects a healthcare setting in which quality of care, efficiency, and innovation must be continuously balanced.

Within this organisation, the project is specifically situated in the rheumatology department. The department focuses on the diagnosis, treatment, and monitoring of patients with rheumatic and musculoskeletal conditions. The department is characterised by a substantial and continuous care demand, with approximately 500 new referrals and 2,500 follow-up consultations per quarter.

The direct care team consists of five rheumatologists, two rheumatology nurses, and one nurse specialist in training. Together, the rheumatologists account for 3.2 FTE, meaning that this specialist capacity must provide care for the entire patient population. In addition to outpatient consultations, the department is also responsible for clinical consultations, emergency department consultations, prescription requests, questions from outpatient clinic staff, e-consultations, reviewing test results, and requesting additional diagnostic tests. Alongside these clinical tasks, rheumatologists also contribute to education, training, research, organisational tasks, and committee work.

The rheumatologists are organised in a cooperative partnership model, in which they jointly carry responsibility for the delivery of medical specialist care. In this structure, the hospital makes internal production agreements with the specialists, while the specialists collectively provide the agreed care in practice. They also operate as a department, or '*vakgroep*', within which internal agreements are made regarding task division, scheduling, and working procedures. At the time of this project, the waiting time for a first consultation at the rheumatology department was approximately 20 weeks, reflecting the considerable pressure on available capacity.

1.2.2 Scope and focus of this project

This project focuses on the complex system that shapes the inflow of patients with joint complaints to the rheumatology department. In view of the expected influx of patients with joint complaints, it is important to understand and map out this system properly. Rather than focusing on a single hospital or predefined region, this project engaged with multiple hospitals in the broader area. This was a deliberate choice: by including multiple settings, it can be validated that the challenges identified are not unique to one department, but reflect a broader pattern. It also allows for a richer understanding of the system, drawing on the perspectives and experiences of professionals across different contexts. The following hospitals participated in this research: Albert Schweitzer Ziekenhuis (Dordrecht), Maasstad Ziekenhuis (Rotterdam), Groene Hart Ziekenhuis (Gouda), and Franciscus Gasthuis & Vlietland (Rotterdam). Together, these hospitals provide a representative view of how rheumatology care is organised across different settings in the South Holland region. This broader system perspective formed the basis for the original design statement of this project:

Create a future-proof design to optimize the inflow of patients to the rheumatology department through a system analysis, in order to improve patient experience and support a sustainable workflow for healthcare professionals within osteoarthritis care.

To work towards this design statement, this project takes a systems perspective on the challenges described above. Rather than optimising individual components in isolation, it first maps the system as a whole to identify key themes and opportunities for improvement. Based on this analysis, a future vision was developed that describes how care could ideally be organised across all identified themes, sketching a direction in which the system could develop.

1.2.3 Stakeholder landscape of joint complaint care

Understanding who is involved in the care for patients with joint complaints is essential for mapping the complexity of this field. As shown in Figure 6, many different parties are connected to this care, each operating at a different level. Being aware of these layers helps to understand why decisions in this field are rarely straightforward, and why improving care requires insight into the broader network of actors involved.

The first ring consists of the patient's social environment, including family, friends, colleagues, and the work-related context. These actors may influence how symptoms are experienced, how support is provided, and how easily patients are able to engage with care.

The second ring comprises the direct care providers, being the professionals involved in diagnosis, treatment, and follow-up. Their clinical decision-making, mutual collaboration, and referral behaviour shape the course of the care pathway and directly influence access, quality, and continuity of care.

The third ring consists of organisational and regional actors, including parties that influence capacity, waiting times, contracting, and regional positioning. The outer ring represents the system and policy level, consisting of regulators, policymakers, and guideline developers who shape the broader context of care through legislation, financing structures, and professional standards.

Together, these layers show that the care pathway is shaped by ongoing interactions between social, clinical, organisational, and policy-related actors, which illustrates that joint complaint care is inherently complex and shaped by a network of interdependent relationships.

To make this complexity more explicit, a second stakeholder map was developed that visualises the relationships between the different actors in the system (Figure 7). Whereas the first map provides an overview of the main stakeholders and their position across the micro, meso and macro levels, this additional map shows how these stakeholders are connected and influence one another. The map was based on desk research using publicly available information from the websites of the included organisations. Their described roles, responsibilities and collaborations were used to identify direct and indirect relationships between actors involved in the care for people with joint complaints. Although this broader system perspective is important for understanding the full context, this research focuses specifically on the micro and meso levels, as these are most closely connected to the patient journey and the organisation of care in daily practice.

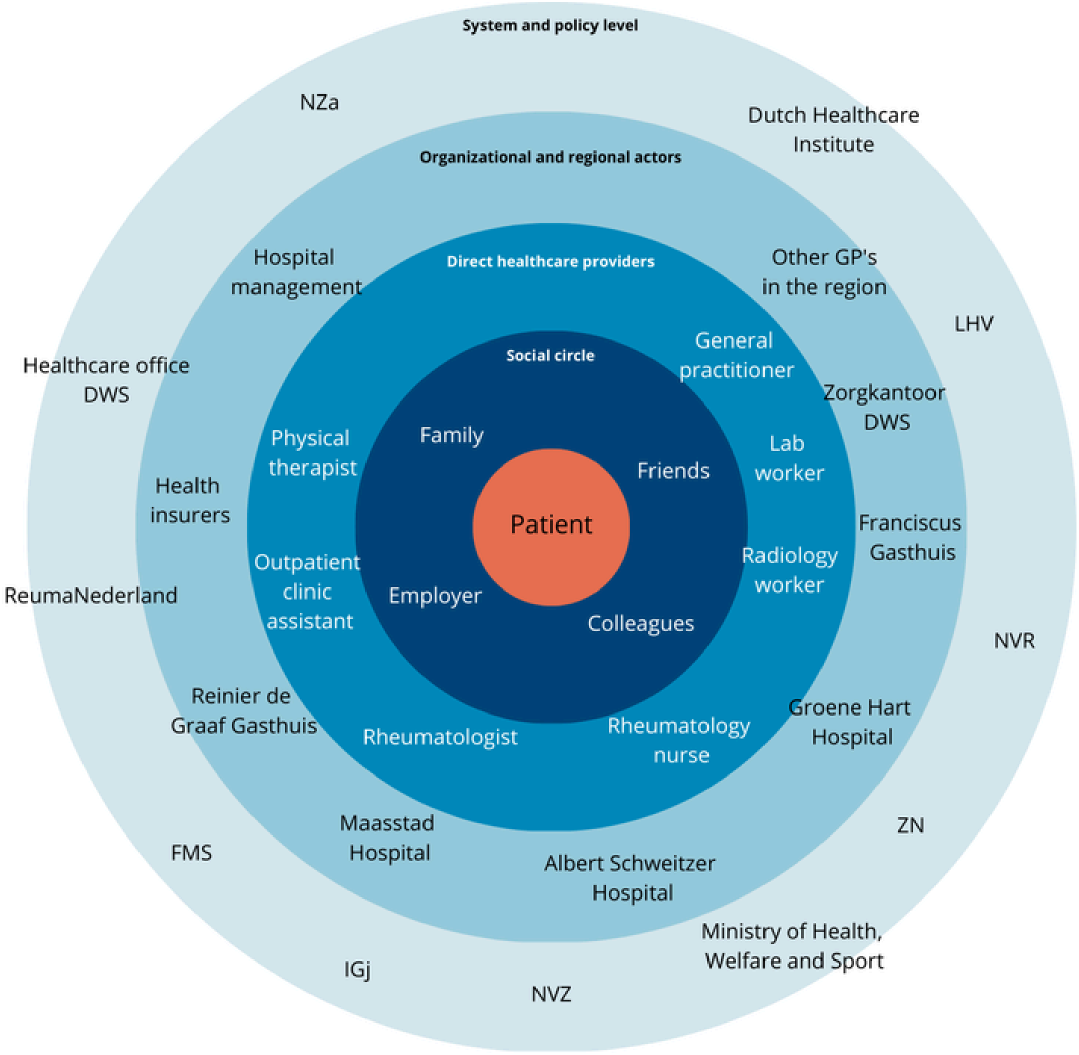


Figure 6: Stakeholder ring map of the context

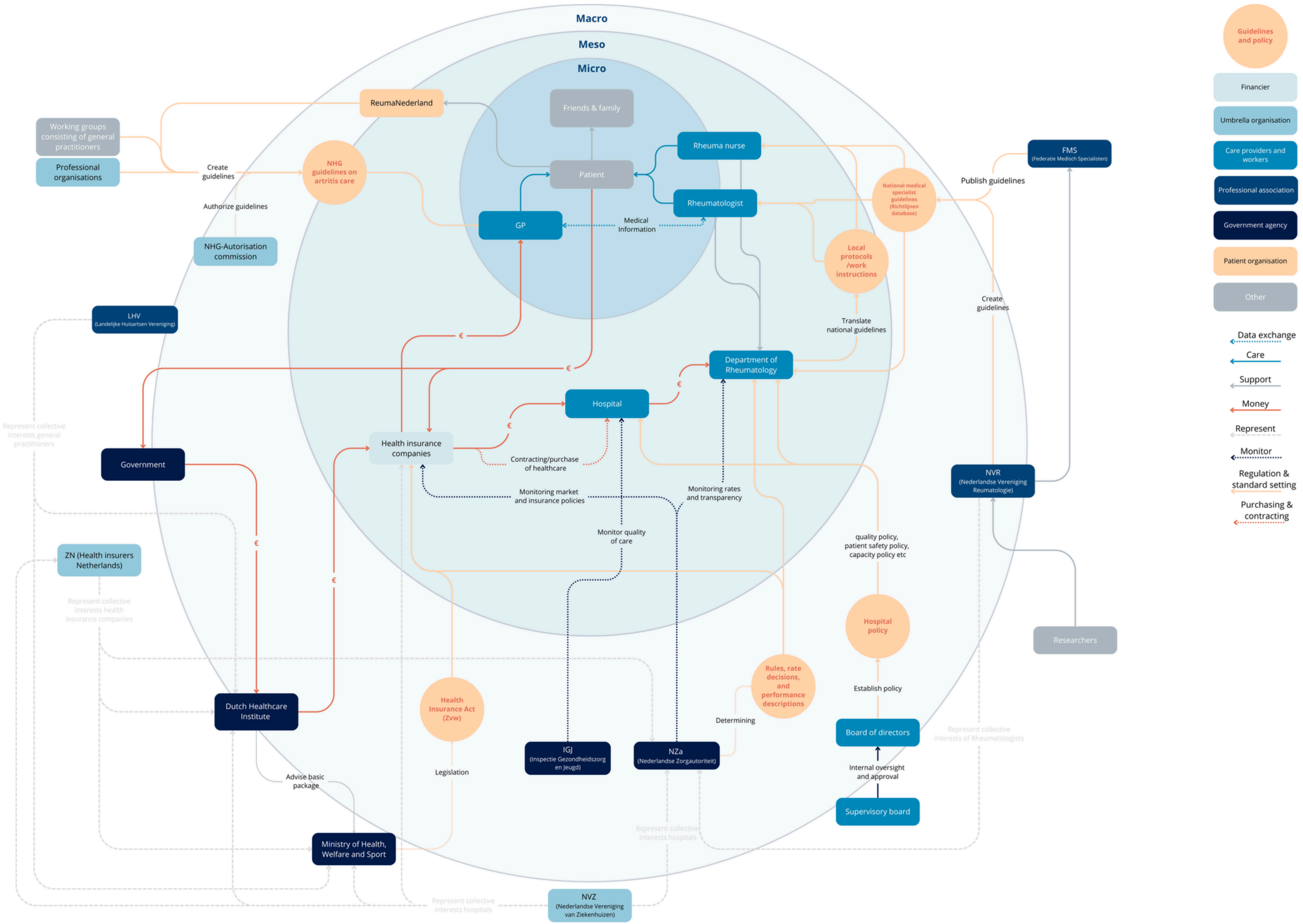


Figure 7: Stakeholder map with relations of the current context

1.2.4 Research questions

To give direction and structure to this project, a main research question was formulated. This question defines the central focus of the study and guides the exploration of the problem, the care pathway, and the role that design can play within this context.

How can design contribute to balancing the inflow of patients with joint complaints and the capacity of rheumatology care?

To answer this question, four sub-questions were formulated. Together, these questions explore the system from multiple angles and bring in the perspectives of different people involved in the care pathway.

1. What does the patient journey look like, from first complaints to a diagnosis by a specialist?
2. How do patients, primary care professionals, secondary care professionals and systemic stakeholders experience the current inflow process of patients with joint complaints to rheumatology?
3. Which factors influence the balance between care demand and care capacity within rheumatology?
4. Where do design opportunities lie that can make a positive contribution for both patients and healthcare professionals?

1.2.5 Ethical considerations

The research conducted for this thesis involved interviews with both healthcare professionals and patients, which required careful ethical consideration throughout the research process. Prior to data collection, an application was submitted to the Medical Ethics Review Committee (METC), which determined that the study did not fall under the scope of the Medical Research Involving Human Subjects Act (WMO), resulting in a non-WMO declaration. Although formal WMO approval was not required, this did not diminish the ethical obligations associated with conducting research involving human participants.

Following the METC assessment, local approval was obtained from the Board of Directors of RdGG, ensuring that the study complied with the internal governance requirements of the institution before any data collection took place.

All participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any point without consequence. Informed consent was obtained prior to each interview, and all data was anonymised during analysis to protect the privacy of both patients and healthcare professionals. Particular attention was given to the potentially vulnerable position of patients who were approached for participation, and all participants were treated with respect and care throughout the process.

1.3 PROJECT APPROACH AND METHODS

Given the complexity of the healthcare context, this project adopted the Double Diamond framework to guide the design process. The Double Diamond structures the process into four phases: Discover, Define, Develop, and Deliver (Design Council, 2005). This structure was relevant for this project because the challenge involved both understanding a complex care system and translating these insights into a concrete design response.

The system surrounding patients with joint complaints is shaped by multiple interacting levels, including patients and their social context, healthcare professionals, organisational structures, and the wider context of regulations and financing. Therefore, the project required an approach that allowed the problem to be explored broadly before moving towards a focused design direction.

The Double Diamond supports this by alternating between divergent phases, in which different perspectives and parts of the system are explored, and convergent phases, in which insights are synthesised and translated into design decisions.

As shown in Figure 8, the first diamond focused on understanding and defining the current care system. During the Discover phase, the care pathway, stakeholder landscape, patient journey, and system challenges were explored through qualitative research methods. During the Define phase, these insights were brought together to identify opportunities for improvement and to frame the design direction. The second diamond focused on developing and delivering a design response. In the Develop phase, design values, possible directions, and service components were explored and iterated. In the Deliver phase, the final concept was validated from three perspectives. These validations formed the basis for the final conclusions and recommendations.

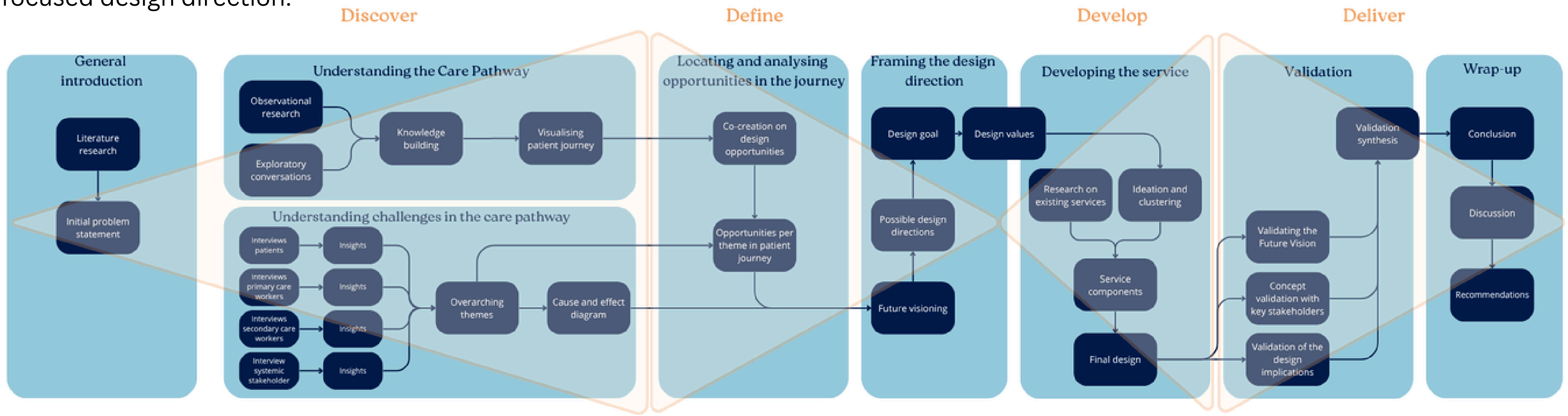


Figure 8: Process overview of this research

This approach was selected because it provided both structure and flexibility. It made it possible to move from a broad understanding of the healthcare system towards a concrete service concept, while keeping the design grounded in the experiences of patients, professionals, and other stakeholders involved in joint complaint care.

To answer the main research question, several methods were used. To structure this, the methods are explained per subquestion.

To answer Research Question 1 — *What does the patient journey look like, from first complaints to a diagnosis by a specialist?* — observational research, exploratory conversations and patient journey mapping were used.

The project started with a broad exploration of the current context through observations and exploratory conversations across multiple hospital settings. These activities were used to gain an initial understanding of the care pathway, daily work practices and interactions between patients, healthcare professionals and the wider system. As healthcare can be characterised as a complex socio-technical system, understanding relationships, interdependencies and organisational structures was essential before defining a design direction. System design builds on systems thinking principles, which emphasise interconnections, feedback loops and structural constraints within complex environments (Jones, 2014).

A patient journey map was then developed to synthesise these insights into a visual representation of the pathway from first complaints and primary care to referral and specialist diagnosis. A patient journey is defined as a structured representation of a healthcare service from the patient's perspective, including interactions, touchpoints and experiences (Simonsen, Ablyak, & Starre, 2019). By visualising the entire pathway rather than isolated touchpoints, the map helped build a more holistic understanding of where important experiences, transitions and bottlenecks occur.

To answer Research Question 2 — *How do patients, primary care professionals, secondary care professionals and systemic stakeholders experience the current inflow process of patients with joint complaints to rheumatology?* — semi-structured interviews and thematic analysis were used.

To capture the lived experiences of different stakeholder groups, semi-structured interviews were conducted. This approach provides both structure and flexibility (Ahmed et al., 2025), and is particularly suitable for exploring complex healthcare systems, as it allows participants to discuss contextual factors, motivations, and experiences that are difficult to capture through quantitative methods.

The interview transcripts were analysed using thematic analysis, a widely used method for identifying, analysing, and reporting patterns within qualitative data (Braun & Clarke, 2006). Themes were iteratively refined to ensure they accurately represented the data and provided a structured way to interpret qualitative insights while remaining sensitive to contextual complexity.

To answer Research Question 3 — *Which factors influence the balance between care demand and care capacity within rheumatology?* — the following methods were used: thematic analysis and a cause and effect diagram.

The insights from the thematic analysis, combined with findings from the observations and literature, were then synthesised into a cause and effect diagram. This method helps reveal causal relationships, feedback loops, and broader system dynamics within a complex adaptive system, showing how patient behaviour, care expectations, referral processes, and organisational constraints influence one another (Kiekens et al., 2022). This helped identify structural tensions and recurring dynamics within the system.

To answer Research Question 4 — *Where do design opportunities lie that can make a positive contribution for both patients and healthcare professionals?* — future visioning was used.

Future visioning is rooted in speculative and participatory design traditions and is used to create shared images of a preferred future, which can serve as a reference point for identifying concrete steps towards change (Candy & Dunagan, 2017). In this project, the insights gathered during the research phases formed the starting point for a future scenario describing how the care pathway for patients with joint complaints could be organised differently. The scenario was not intended to be a prediction, but rather a directional and inspirational tool to guide the development of a design solution.

1.4 SUMMARY

This chapter introduced the context of the project. The Dutch healthcare system is under increasing pressure due to ageing, growing care demand and limited capacity, while joint complaints remain one of the most common reasons for GP consultations. These complaints range from conditions that can be managed within primary care to conditions requiring specialist assessment, yet referral patterns vary, stepped care is underused and many patients referred to rheumatology do not require specialist care. At the same time, patients differ in age, health literacy, digital skills and expectations of care, making the pathway more complex. This project therefore takes a systemic perspective on the inflow of patients with joint complaints to rheumatology, using the Double Diamond process to move from broad exploration towards a focused design response.

1.4.1 Design implications

Any design response must fit within the Dutch healthcare system as it currently functions, respecting the GP's gatekeeping role and the distinction between primary and secondary care. Because not all joint complaints require the same type of care, the design should support better differentiation between care needs and help reduce unnecessary specialist referrals. It should also account for differences in health literacy, digital skills, age and care expectations. Finally, as care for joint complaints is a complex adaptive system, the design should support both patients and professionals in making appropriate care decisions.

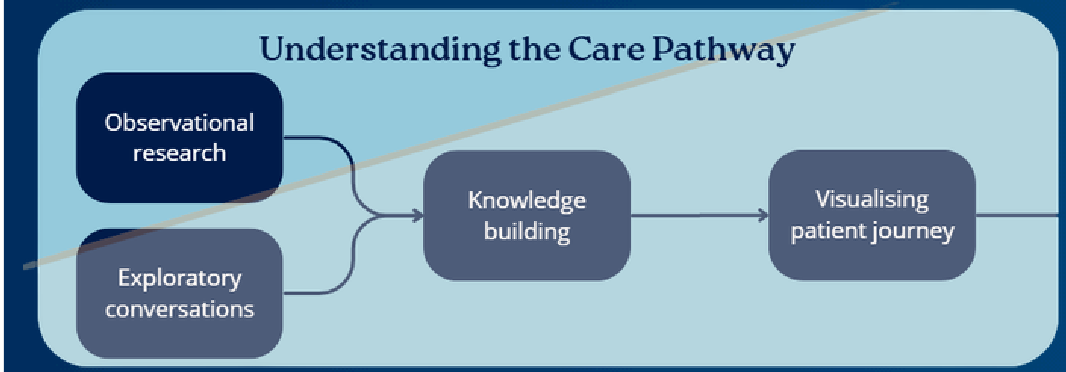
Chapter 2

UNDERSTANDING THE CARE PATHWAY

This chapter maps the current care pathway for people with joint complaints as it works in practice. Through observations and informal discussions at rheumatology outpatient clinics, the chapter provides insight into how patients move from first complaints through primary care to referral and diagnosis. The results are translated into a set of patient profiles that captures the diversity of care needs, and a patient journey that visualises the route patients follow through the system.

This chapter contributes to answering the following subquestion:

SQ1: What does the patient journey look like, from first complaints to a diagnosis by a specialist?



2.1 DATA COLLECTION THROUGH OBSERVATIONS AND EXPLORATORY CONVERSATIONS

2.1.1 Method

To better understand how rheumatology care works in practice, exploratory observations were conducted at four hospitals in the South Holland region. This method was chosen as an early step in the research because the care pathway for patients with joint complaints was still relatively unfamiliar at the start of the project. There was not yet enough contextual knowledge to define strict observation categories or checklists in advance. An exploratory approach was therefore more appropriate, as it allowed the researcher to enter the context with an open perspective, notice unexpected patterns, and understand what happened in practice before narrowing the focus of the research.

The observations also prepared the later interview phase. By first observing consultations and workflow patterns in practice, relevant topics, moments of uncertainty and parts of the care pathway that required further exploration could be identified. This helped to formulate more focused and context-sensitive interview questions for patients and healthcare professionals.

The observations focused on moments of patient care within rheumatology practice, including triage of newly referred patients, first consultations and follow-up consultations with rheumatology professionals.

An overview of the visited hospitals, observation types and session durations is shown in Table 3.

During the observations, attention was given to four aspects: the types of patients and complaints seen during consultations, the structure and workflow of the consultation, the communication between healthcare professionals and patients, and, where possible, the reasoning behind diagnostic, treatment and referral decisions.

During the observations, short field notes were taken where possible. These focused on concrete observations, recurring consultation steps, notable patient questions, professional explanations and questions that emerged during the session. Directly after each observation session, the notes were expanded into fuller reflection notes to capture contextual details while they were still fresh. These notes can be found in Appendix D.

Hospital	Observation	Duration
Albert Schweitzer Hospital	Triage of new patients	2 hours
Reinier de Graaf Gasthuis	Consultations with rheumatologist	4 hours
Maasstad Hospital	Consultations with rheumatologist	6 hours
Groene Hart Hospital	Consultations with rheumatologist	5 hours

Table 3: Overview of hospitals visited and what was observed during each session

After each observation session, exploratory conversations with healthcare professionals took place. These conversations were used to clarify what had been observed and to better understand the reasoning behind certain decisions and workflow patterns. They were unstructured and emerged from the observations themselves. Therefore, they were not treated as formal interview data, but as contextual clarification that helped interpret the observed care process.

After all sessions were completed, the observation notes and contextual clarifications were reviewed per hospital and compared across settings. Recurring observations were identified when similar situations, consultation steps or workflow patterns appeared in multiple settings. These recurring observations were then grouped into three outputs: patient profiles, consultation characteristics and a patient journey map.

2.1.2 Results

The observations and exploratory conversations provided insight into how patients end up at the rheumatology outpatient clinic, the steps they take along the way, and how consultations unfold within the hospital.

Although some differences were observed between hospital settings, the findings were combined into one general picture that reflects the overall pattern across settings. This resulted in three outputs: a set of patient profiles that captures the diversity of care needs, insights into how the rheumatology consultation works in practice, and a patient journey that maps the route from first complaints to diagnosis.

Patient profiles

The observations and exploratory conversations made clear that not all patients who visit the rheumatology outpatient clinic are there for the same reason. A wide variety of patients was seen across the different hospital settings, each arriving with their own complaints, expectations and backgrounds. To capture this variety, a set of patient profiles was developed based on patterns that were observed consistently across settings (see Figure 9).

The profiles distinguish between patients whose referral to secondary care is medically justified, for example because a specialist assessment is needed to rule out or confirm an inflammatory condition, and patients for whom the added value of secondary care is less straightforward. Within this second group, several recurring types were identified, ranging from patients who seek reassurance or a second opinion, to patients who struggle to accept that their complaints may be related to lifestyle factors. The profiles are not meant to represent fixed categories, but rather to illustrate the diversity of reasons why patients end up in secondary care.

Justified referral

Suspected inflammatory condition

Characteristics
- Suspected autoimmune disorder
- Requires specialist assessment
- Referral medically justified
- Needs treatment or monitoring

Difficult acceptance

Seeks medical cause, avoids lifestyle change

Characteristics
- Struggles to accept complaints
- Unaware of lifestyle factors
- Unwilling to change behaviour
- Prefers medical explanation

Persintent complaints

No clear cause found in primary care

Characteristics
- Ongoing joint complaints
- No improvement over time
- GP has no further options
- Referral as next step

Fixed self-diagnosis

Strong personal belief about condition

Characteristics
- Convinced of own diagnosis
- Dismisses GP assessment
- Resistant to alternative views
- Seeks specialist validation

Diagnostic uncertainty

GP unable to give clear diagnosis

Characteristics
- Unclear clinical picture
- GP seeks specialist input
- Condition needs ruling out
- Referral for clarification

Higher treatment expectations

Hopes for more options in secondary care

Characteristics
- Dissatisfied with primary care
- Expects more treatment options
- May request specific medication
- High expectations of specialist

Seeking confirmation

Doubts GP or wants reassurance

Characteristics
- Low trust in GP judgment
- Wants second opinion
- Seeking reassurance
- Driven by need for certainty

Figure 9: Patient profiles of different referral types identified through interviews with healthcare professionals

The rheumatology consultation in practice

The observations also provided insight into how consultations at the rheumatology outpatient clinic are structured and experienced in practice. Three recurring aspects stood out across the different hospital settings.

Structure and workflow

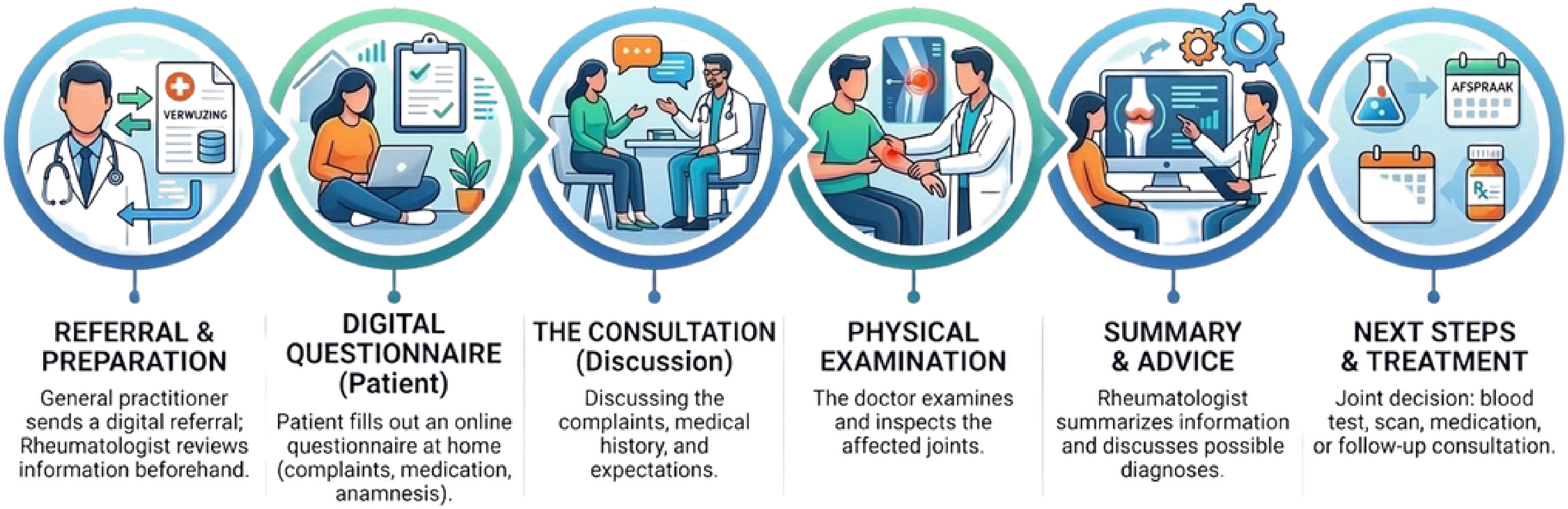
A consultation generally follows a number of recurring steps, as shown in Figure 10. The structure varies depending on whether it is an initial or a follow-up appointment.

Time constraints

Time pressure is a recurring factor during consultations. Rheumatologists often work with relatively short consultation slots, within which they must review the patient's history, conduct the consultation and document the outcomes. This can sometimes cause consultations to run longer than planned, particularly when patients present with complex questions or when additional explanation is needed.

Communication and shared decision-making

A significant part of each consultation is dedicated to providing clarity, addressing concerns and aligning expectations. Decision-making is not based on clinical reasoning alone. Treatment options are discussed and decided together with the patient, which means that the outcome of a consultation often reflects a combination of medical judgement and patient preferences.



REFERRAL & PREPARATION
General practitioner sends a digital referral; Rheumatologist reviews information beforehand.

DIGITAL QUESTIONNAIRE (Patient)
Patient fills out an online questionnaire at home (complaints, medication, anamnesis).

THE CONSULTATION (Discussion)
Discussing the complaints, medical history, and expectations.

PHYSICAL EXAMINATION
The doctor examines and inspects the affected joints.

SUMMARY & ADVICE
Rheumatologist summarizes information and discusses possible diagnoses.

NEXT STEPS & TREATMENT
Joint decision: blood test, scan, medication, or follow-up consultation.

Figure 10: Steps in a consult with rheumatologist
(Image generated using the prompt "Create an image of the following steps in a consult with rheumatologist" by Google Gemini, 2025 (https://gemini.google.com))

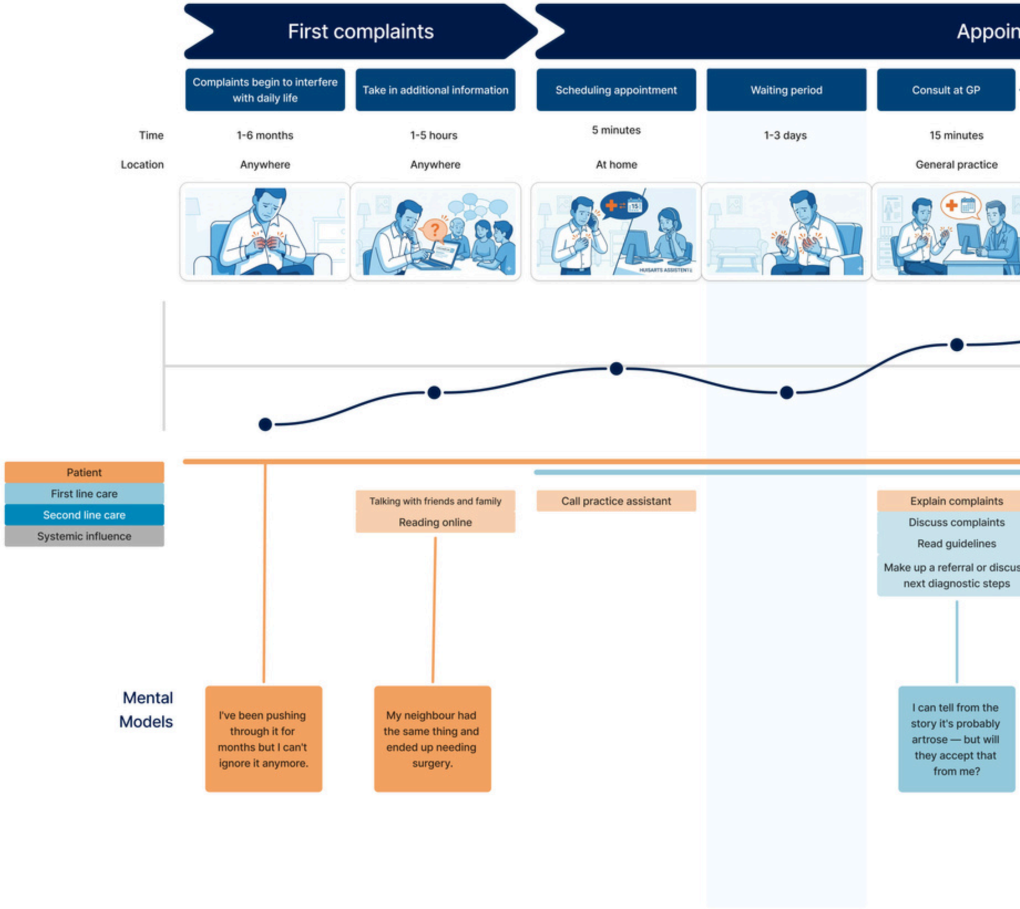
The patient journey

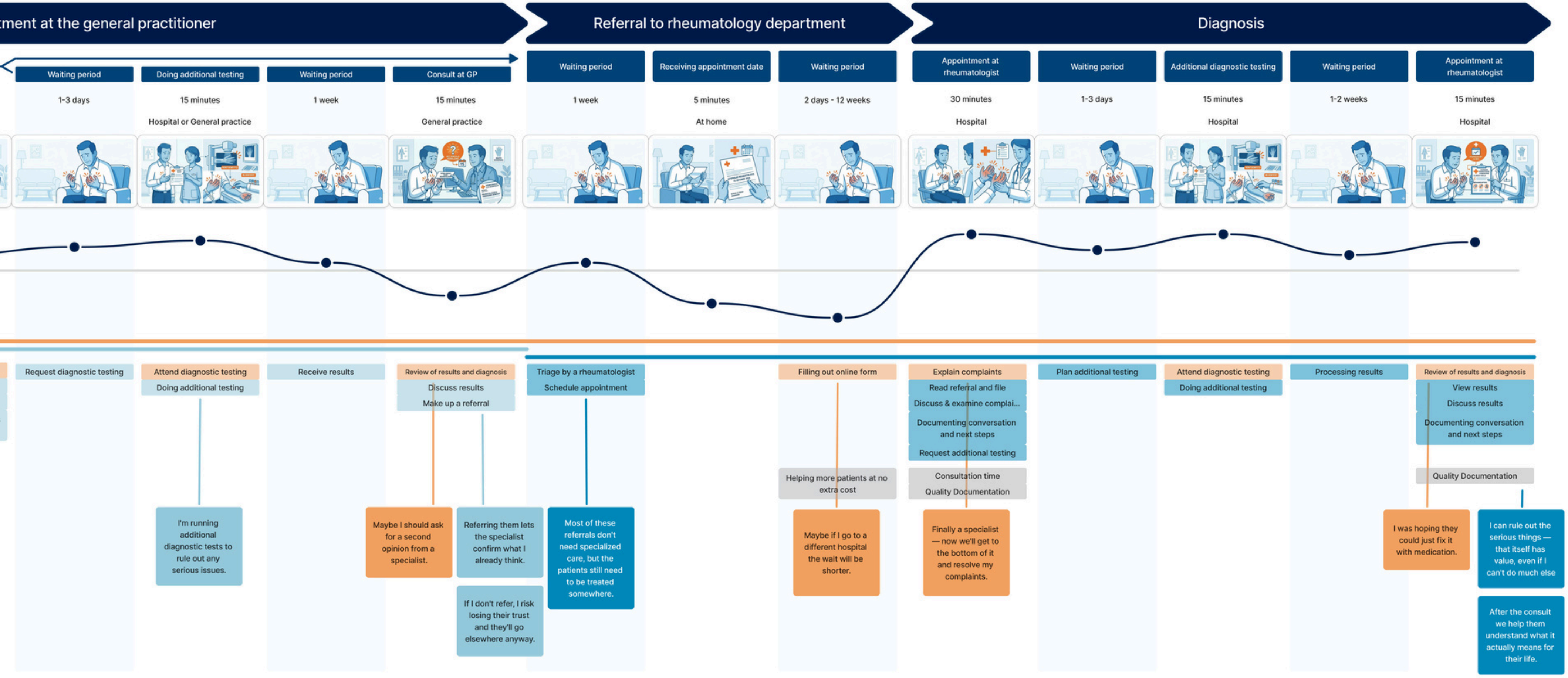
The observations and exploratory conversations provided insight into the full journey a patient goes through from first complaints to diagnosis by a rheumatologist. To bring these separate insights together, a patient journey map was created. This method was chosen because the subquestion focuses on the full route through the care pathway, rather than on isolated consultation moments. By visualising the journey, it became possible to show how actions, waiting periods, decisions and stakeholder interactions are connected over time.

The journey is divided into four main phases: first complaints, appointment at the general practitioner, referral to the rheumatology department, and diagnosis. Each phase contains sub-steps, indicative timeframes and locations, giving a realistic sense of how the process unfolds in practice.

To show who is involved at each moment, the journey includes touchpoints per stakeholder group: the patient, first line care professionals, second line care professionals and systemic stakeholders. These are colour coded, making it possible to see which stakeholder is active at which point and how their actions relate to one another.

Mental models were added throughout the journey to provide more context around why certain actions are taken. These short quotes and thoughts reflect how different stakeholders experience and reason about specific moments in the pathway. Together, the touchpoints and mental models create a grounded overview of the care pathway and provide a basis for identifying vulnerable moments and design opportunities later in the project.





ment at the general practitioner

Waiting period
1-3 days
Request diagnostic testing

Doing additional testing
15 minutes
Hospital or General practice
Attend diagnostic testing
Doing additional testing
I'm running additional diagnostic tests to rule out any serious issues.

Waiting period
1 week
Receive results

Consult at GP
15 minutes
General practice
Review of results and diagnosis
Discuss results
Make up a referral
Maybe I should ask for a second opinion from a specialist.
Referring them lets the specialist confirm what I already think.
If I don't refer, I risk losing their trust and they'll go elsewhere anyway.

Referral to rheumatology department

Waiting period
1 week
Triage by a rheumatologist
Schedule appointment
Most of these referrals don't need specialized care, but the patients still need to be treated somewhere.

Receiving appointment date
5 minutes
At home

Waiting period
2 days - 12 weeks
Filling out online form
Helping more patients at no extra cost
Maybe if I go to a different hospital the wait will be shorter.

Diagnosis

Appointment at rheumatologist
30 minutes
Hospital
Explain complaints
Read referral and file
Discuss & examine complai...
Documenting conversation and next steps
Request additional testing
Consultation time
Quality Documentation
Finally a specialist — now we'll get to the bottom of it and resolve my complaints.

Waiting period
1-3 days
Plan additional testing

Additional diagnostic testing
15 minutes
Hospital
Attend diagnostic testing
Doing additional testing

Waiting period
1-2 weeks
Processing results

Appointment at rheumatologist
15 minutes
Hospital
Review of results and diagnosis
View results
Discuss results
Documenting conversation and next steps
Quality Documentation
I was hoping they could just fix it with medication.
I can rule out the serious things — that itself has value, even if I can't do much else
After the consult we help them understand what it actually means for their life.

2.1.3 Discussion

The results presented in this section are based on observations and exploratory conversations conducted across four hospital settings. Although consistent patterns emerged, the insights were gathered through observation and contextual clarification rather than through systematic data collection. This means that the patient profiles and patient journey reflect an exploratory picture of the care pathway, rather than a definitive or exhaustive overview.

The patient profiles capture recurring types that were observed across settings, but they are not exhaustive. Other patient types may exist that were not encountered during the observation sessions. Similarly, the patient journey provides a general overview of the care pathway, but individual routes can differ considerably from the picture presented here.

These limitations also point to an opportunity. The insights gathered through observations and exploratory conversations provide a useful starting point, but they need to be further deepened and validated. The semi-structured interviews conducted later in this research offer a more systematic way to explore the experiences of patients and healthcare professionals, and will help to confirm, nuance or expand the picture that has emerged here.

2.1.4 Conclusion

The observations and exploratory conversations contributed to answering subquestion 1 by providing a first insight into what the patient journey looks like from first complaints to a specialist diagnosis.

The journey shows that the route involves multiple steps across different care settings and is accompanied by significant waiting periods. These waiting moments represent periods during which patients have little guidance or support, while their need for clarity and pain relief remains unmet.

The patient profiles show that the patient population arriving at the rheumatology outpatient clinic is diverse. Not all observed patients appeared to require specialist treatment at that point in their care journey, and the reason for referral varied widely. A considerable share of patients appeared to have care needs that could potentially be addressed elsewhere, which raises questions about how the care pathway is currently organised.

Together, these findings provide a first answer to RQ1, showing that the patient journey is complex, variable and marked by several vulnerable moments. The insights gathered here will be further deepened and validated through the interviews and thematic analysis in the following chapter.

2.1.5 Design implications

The findings from the observations and exploratory conversations point to two implications for the design direction of this project.

The patient journey shows that waiting periods are a recurring and difficult moment for patients. During these periods, patients have little guidance or support while their need for clarity and pain relief remains unmet. A design intervention could offer patients something to hold on to during these moments, for example by providing accessible information or a sense of progress and control.

The patient profiles suggest that some patients referred to the rheumatology outpatient clinic may not require specialist treatment at that point in their care journey. These patients may still have genuine care needs, but those needs might be better addressed elsewhere in the care pathway. A design intervention could therefore explore how patients can receive accessible and appropriate support within primary care, before or instead of referral to secondary care.

Chapter 3

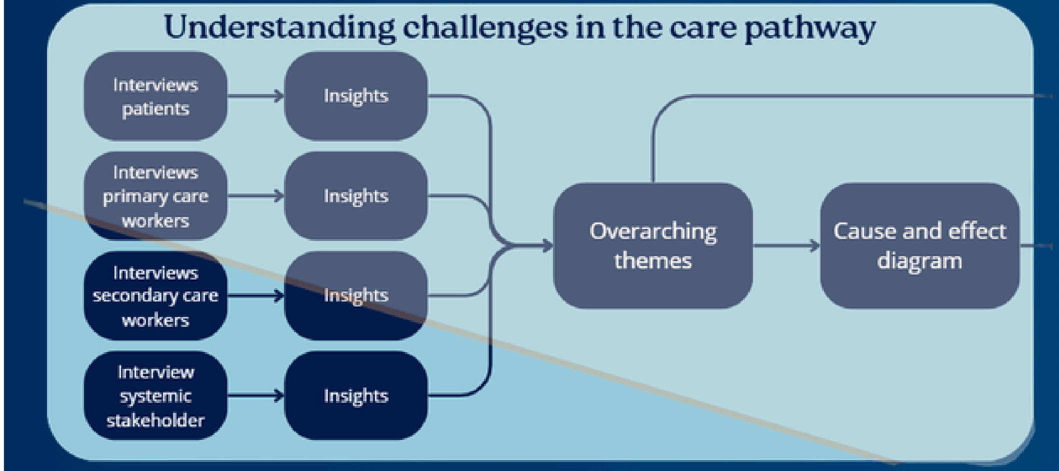
UNDERSTANDING CHALLENGES IN THE CARE PATHWAY

This chapter analyses why the current care pathway creates pressure on rheumatology care. Semi-structured interviews were conducted with patients, primary care professionals, secondary care professionals and a systemic stakeholder. The findings are examined through thematic analysis, revealing how each stakeholder group experiences the care pathway from their own perspective.

The chapter then brings these perspectives together by identifying shared patterns across stakeholder groups, visualised in a cause and effect diagram that shows how different factors reinforce one another.

This chapter contributes to answering the following subquestions:

SQ2: How do patients, primary care professionals, secondary care professionals and systemic stakeholders experience the current inflow process of patients with joint complaints to rheumatology?
SQ3: Which factors influence the balance between care demand and care capacity within rheumatology?



3.1 DATA COLLECTION THROUGH QUALITATIVE METHODS

3.1.1 Method

To gain a deeper understanding of how different stakeholders experience the current inflow process of patients with joint complaints, a series of semi-structured interviews was conducted. This method was chosen because it provides both structure and flexibility, allowing participants to elaborate on their own experiences and perspectives while still addressing the key topics relevant to the research questions.

Four participant groups were included in this study: primary care professionals, rheumatology department professionals, patients and a system stakeholder. An overview of the participant groups, the number of participants per group and a short description is shown in Table 4.

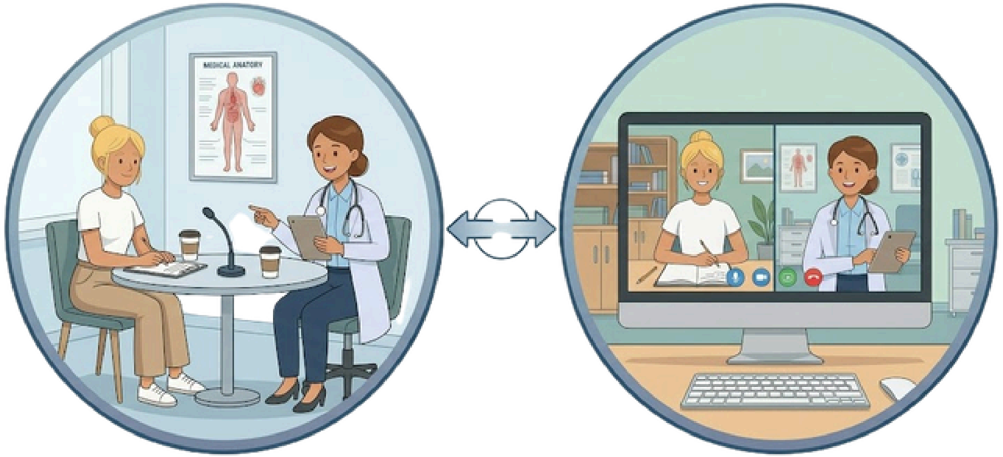


Figure 11: Interview setup
(Image generated using the prompt "Create an image of the following interview setup" by Google Gemini, 2025 (https://gemini.google.com))

Participant group	N	Participants
Patients	5	3 patients newly referred to the rheumatology outpatient clinic at Reinier de Graaf Gasthuis 2 patients previously referred to a rheumatology department at another hospital in the region
Primary care worker	4	1 physiotherapist 2 general practitioners 1 general practitioner (also GP trainer and framework GP musculoskeletal system)
Secondary care worker	8	Reinier de Graaf Gasthuis – 1 rheumatology nurse Maasstad Ziekenhuis – 1 rheumatologist Albert Schweitzer Ziekenhuis – 1 rheumatologist Groene Hart Ziekenhuis – 3 rheumatologists Franciscus – 1 rheumatologist, 1 doctor's assistant
Systemic stakeholder	1	Manager healthcare purchasing at DSW health insurer

Table 4: Overview of participant groups included in the interview study

Interview guides were developed for each participant group to ensure that the relevant topics were covered during each conversation. The interview guides can be found in Appendix E. Before the interviews took place, all participants received information about the study and signed an informed consent form. This form can be found in Appendix F.

The interviews were conducted either in person at the hospital or digitally, as illustrated in Figure 11. Each session lasted approximately 15 to 30 minutes. With permission of the participants, all interviews were audio recorded. The recordings were then transcribed to create a written basis for analysis. The transcripts of these interviews can be found in Appendix G, H, I and J.

To analyse the interview transcripts, a thematic analysis was conducted following the six-step approach described by Braun and Clarke (2006), as shown in Figure 12. This method was used to systematically identify recurring patterns and themes within the qualitative data, and is particularly suitable for exploring complex qualitative datasets in a structured yet flexible way. The analysis was conducted using NVivo, a qualitative data analysis software that supports the organisation and coding of large sets of textual data.

Relevant fragments were coded through an open coding process, allowing key ideas and recurring patterns to emerge from the material. Codes that addressed similar topics were subsequently grouped into broader categories and eventually synthesised into overarching themes. To better understand differences and similarities between stakeholder groups, the thematic analysis was conducted separately for each interview target group. A full overview of the codes and categories identified during the analysis can be found in Appendix K.

After the themes were identified, Self-Determination Theory (SDT) was used as an interpretative lens to give the themes a stronger explanatory foundation. Thematic analysis helped identify what participants experienced in the care pathway, while SDT helped interpret why these experiences mattered. This was relevant because many themes related to feeling in control, feeling capable of acting, and feeling heard or supported by others. These dimensions closely relate to the three basic psychological needs described in SDT: autonomy, competence and relatedness (Ryan & Deci, 2000).

In this study, SDT was not used to measure individual motivation or wellbeing, but as a sensitising framework to interpret where the current care system supports or limits the needs of the people involved. This made the framework suitable for understanding both patient and professional experiences within the joint complaints pathway.

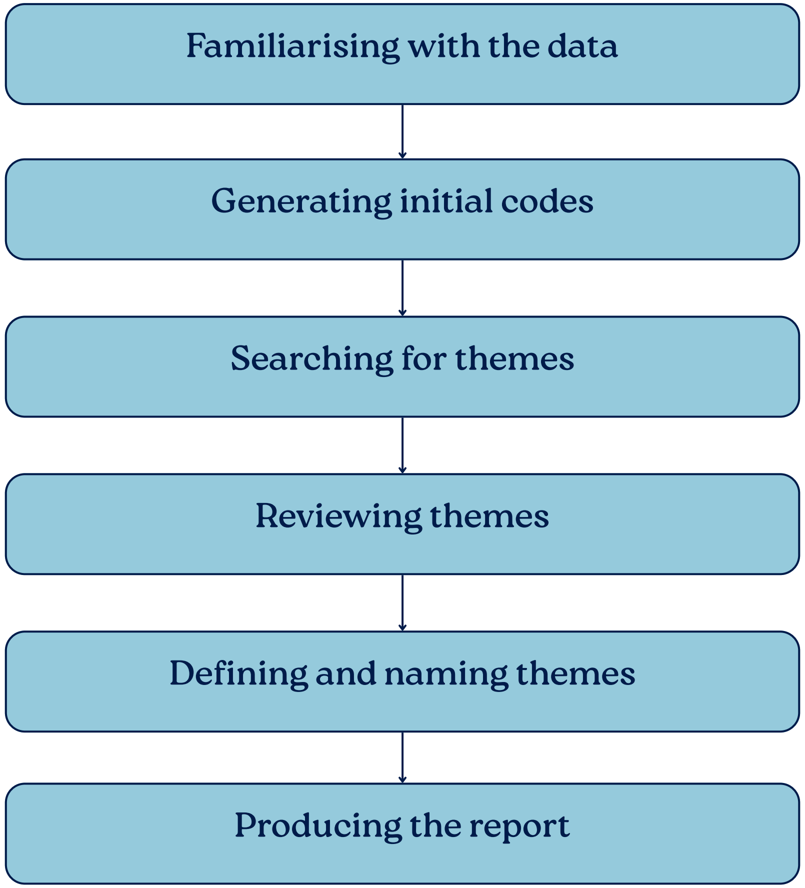


Figure 12: Steps taken in the thematic analysis (Braun & Clarke, 2006)

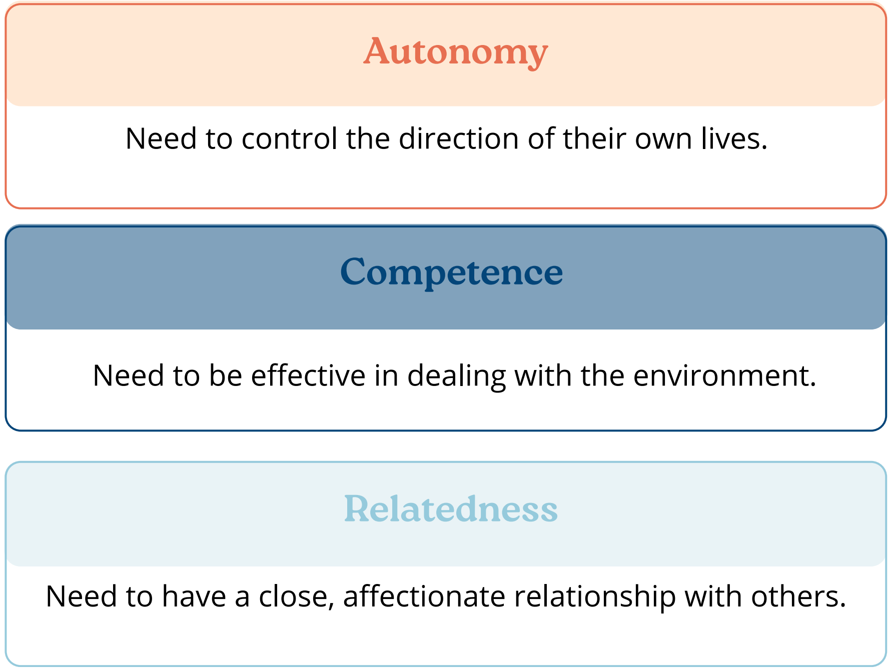


Figure 13: Three basic psychological needs of the SDT

3.1.2 Results

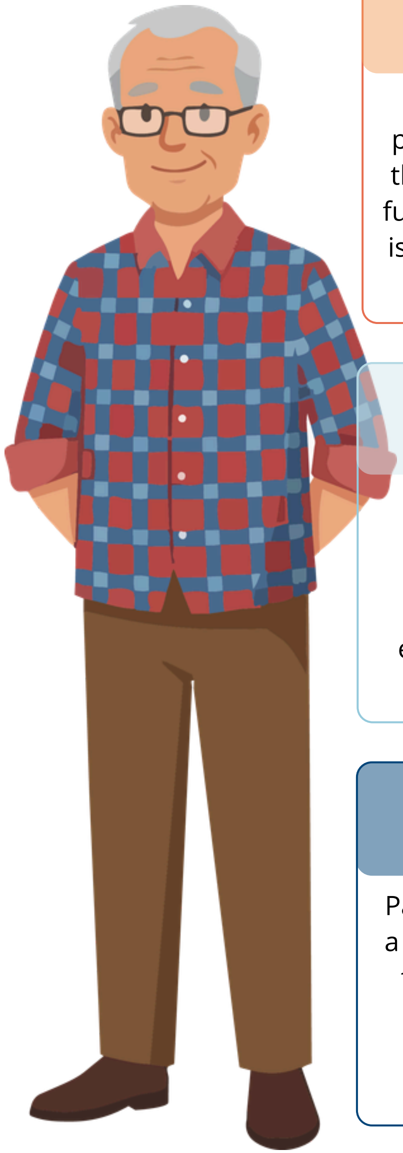
The thematic analysis of the interviews led to a set of themes per stakeholder group, showing how the current care pathway is experienced from different perspectives.

Each theme was interpreted through Self-Determination Theory (SDT), which distinguishes between three basic psychological needs: autonomy, competence and relatedness (Ryan & Deci, 2000). Autonomy refers to the experience of choice and ownership over one’s actions, competence refers to feeling capable and effective, and relatedness refers to feeling connected to and understood by others.

For each theme, one SDT component was selected to capture the underlying mechanism that explains why a particular stakeholder experiences the care pathway in a certain way. The themes are colour coded according to the SDT component they relate to, as shown in Figure 13. The themes identified for each stakeholder group are presented below and are further supported with quotes from the interviews in Appendix L.

Patient perspective

The following five themes emerged from the interviews with patients who were recently referred to a rheumatology outpatient clinic, reflecting the factors that shape how patients experience the joint complaints care process and their psychological needs.



Theme 1: Patients delay seeking help until symptoms become undeniable

Patients often live with joint complaints for a prolonged period before visiting a GP. They normalise symptoms, hope they will resolve on their own, and only seek help when daily functioning is significantly impaired. The decision to seek care is experienced as a loss of control, an acknowledgement that self-management is no longer sufficient.

Theme 2: Diagnostic uncertainty creates a strong need for clarity and reassurance

Not knowing what is wrong is a major source of distress. Patients search online, struggle to interpret test results, and encounter conflicting diagnoses across providers. They feel most capable and settled when a professional offers a clear, honest explanation, even when certainty is not yet possible.

Theme 3: Feeling heard and taken seriously is central to a positive care experience

Patients consistently describe feeling listened to and respected as the most important quality of a good consultation. When professionals take time, ask open questions, and respond with genuine attention, trust is established. When consultations feel rushed or dismissive, patients disengage and are reluctant to return.

Theme 4: Waiting times can reduce patients’ sense of control

Long waiting periods, sometimes exceeding six months, leave patients with ongoing symptoms and no guidance or communication in between. This suspension of agency is particularly burdensome when medication or monitoring is time-critical, and contributes to prolonged uncertainty and helplessness.

Theme 5: Patients value transparent explanation of what is happening and why

Patients want to understand not just what is wrong, but how a professional reaches that conclusion and what they can do themselves. Receiving step-by-step explanations, practical self-management advice, and proactive follow-up communication strongly increases patients' sense of understanding and confidence in their care.

Primary care worker perspective

The following five themes emerged from the interviews with general practitioners and a physiotherapist, reflecting the structural factors that contribute to the imbalance between care capacity and demand within the joint complaints pathway.

Theme 1: Primary care professionals frequently assess joint complaints with varied underlying causes

Joint complaints are common in primary care, but true inflammatory rheumatic disease is rare. The core challenge is that professionals must reliably tell them apart, often without the clinical experience or physical examination skills to do so confidently.

Theme 2: Patient expectations can influence referral decisions alongside clinical judgement

Referrals are frequently made not because a specialist is truly needed, but because the GP feels unable to convince the patient otherwise. A combination of clinical uncertainty and limited consultation skills makes it easier to refer than to stand firm.

Theme 3: Patients often enter consultations with existing ideas and expectations

Patients often arrive with a fixed idea of their diagnosis or the care they expect, making it difficult to establish trust and have an open clinical conversation. When the professional cannot credibly challenge that picture, the patient's preconception tends to win.

Theme 4: Acceptance of chronic complaints plays an important role in treatment progress

Many patients struggle to accept that their complaints are chronic and that lifestyle change is the most effective response. This is reinforced by professionals who do not consistently guide patients through the available non-medical treatment options.

Theme 5: Support around lifestyle factors is available in fragments across the care pathway

The factors that influence joint complaints extend well beyond what any single discipline addresses. Integrated care is emerging but not yet widely available, leaving patients without a coherent support structure that treats them as a whole person.

Secondary care worker perspective

The following six themes emerged from the interviews with rheumatologists, reflecting the structural factors that contribute to the imbalance between care capacity and demand within the joint complaints pathway.

Theme 1: Consultation duration is structured at department level, which can limit flexibility

Rheumatology departments use collectively agreed consultation durations to organise planning and distribute available specialist capacity across the patient population. While this creates structure in the outpatient schedule, it can limit flexibility when individual patients require more time due to complex questions, uncertainty, or additional support needs.

Theme 2: GPs may have limited support in confidently assessing which referrals are needed

Referring patients with possible rheumatic conditions is a complex decision, particularly because GPs are not always equipped to rule out inflammatory disease with confidence. This uncertainty leads to referrals being made as a precaution, which contributes to higher demand in secondary care.

Theme 3: There can be a mismatch between specialist expertise and patients' support needs

A significant share of patients referred to rheumatology would benefit more from lifestyle guidance and acceptance support than from specialist medical intervention. When this mismatch occurs, the consultation has limited added value for the patient, which can result in them seeking help elsewhere.

Theme 4: Building trust with patients requires more time and continuity than the system allows

For patients with non-inflammatory complaints, feeling genuinely heard is often a prerequisite for accepting a diagnosis or making lifestyle changes. The current system, with its time pressure and limited continuity, makes it difficult to build that relational foundation, which can slow down the care process.

Theme 5: Lifestyle-related complaints often enter the healthcare system as medical questions

A recurring pattern is that patients seek medical solutions for complaints that are closely connected to lifestyle factors such as stress, weight or physical inactivity. This places healthcare professionals in a difficult position, as the most effective solutions often fall outside the clinical domain.

Theme 6: Current referral structures leave limited space for intermediate forms of consultation

The current referral structure offers GPs limited intermediate options between referring and not referring. Greater flexibility, such as the ability to briefly consult a specialist without a full referral, could support more tailored decision-making. At the same time, short hospital waiting times can unintentionally lower the threshold for referral.

Systemic perspective

The following four themes emerged from the interview with a healthcare procurement manager at a health insurance company, reflecting the broader systemic factors that shape the conditions within which the joint complaints pathway operates.

Theme 1: The volume of specialist care cannot grow at a national level

Healthcare insurers operate within a national macro framework that restricts the growth of specialist care volume. Even when demand rises, simply financing more care is not an option. This structurally limits what hospitals and insurers can agree on together.

Theme 2: Growing demand is driven by ageing, lifestyle and rising treatment possibilities

The demand for specialist care is rising due to an ageing population, the growth of lifestyle-related diseases, and the fact that conditions that were once fatal are now chronic. The system lacks the tools and capacity to adequately respond to this structural growth.

Theme 3: Part of the care demand is a social problem, not a medical one

A significant part of what enters the healthcare system as a care question originates from social issues such as loneliness, individualisation, and the erosion of informal social networks. Healthcare cannot and should not solve these problems alone, but the current system absorbs them regardless.

Theme 4: Digitalisation offers capacity relief but only if implemented thoughtfully

Digital care pathways have the potential to free up capacity for patients who genuinely need physical contact. However, digitalisation currently still places a heavy burden on care providers. The potential will only be realised when digital tools truly reduce administrative load rather than adding to it.

3.1.3 Discussion

The insights gathered through the semi-structured interviews and thematic analysis provide a rich and layered understanding of how different stakeholders experience the care pathway for patients with joint complaints. Because the method is qualitative in nature, it allows for depth and nuance that would be difficult to capture through quantitative approaches. The themes that emerged reflect the lived experiences and perspectives of the people involved, making the findings particularly relevant for understanding the human side of the system.

At the same time, the qualitative nature of this study also means that the findings are based on a relatively small and specific group of participants. The perspectives gathered represent a particular set of experiences across four hospital settings in the South Holland region, and may not fully reflect the diversity of experiences across other settings or regions. It is therefore possible that certain dynamics were not captured or were underrepresented in the analysis.

Despite these limitations, the consistency of the themes across different stakeholder groups and hospital settings suggests that the findings reflect broader patterns rather than isolated experiences. The insights provide a solid foundation for the next step, in which the relationships between these themes will be further explored through the cause and effect diagram.

3.1.4 Conclusion

The thematic analysis provided a layered understanding of how different stakeholders experience the current inflow process of patients with joint complaints to rheumatology, thereby answering subquestion 2. The findings confirm and further deepen the initial picture that emerged from the observations and informal discussions in the previous chapter.

From the patient perspective, the analysis shows that patients often delay seeking help and enter the system with fixed expectations and a strong need for clarity. Diagnostic uncertainty is a major source of distress, and feeling heard and taken seriously is central to a positive care experience. Long waiting times further reduce patients' sense of control, leaving them feeling uncertain and helpless.

From the primary care perspective, GPs frequently assess joint complaints with varied underlying causes, making it difficult to distinguish between conditions that do and do not require specialist care. Patient expectations can influence referral decisions alongside clinical judgement, and many patients enter consultations with existing ideas about their diagnosis that are hard to address within the limited time available.

From the secondary care perspective, rheumatologists experience a recurring mismatch between their specialist expertise and the support needs of many patients they see.

Building sufficient trust with patients to support acceptance and lifestyle change requires more time and continuity than the current system allows. GPs also have limited intermediate options between referring and not referring, which contributes to unnecessary inflow.

From the systemic perspective, the volume of specialist care cannot grow at a national level, while demand continues to rise due to ageing, lifestyle factors and increasing treatment possibilities. A significant part of what enters the healthcare system as a care question originates from social or lifestyle related issues rather than medical ones.

Together, these perspectives confirm and expand on the findings from chapter 2, showing that the inflow process is shaped by dynamics at every level of the system, and that each stakeholder group experiences a different but interconnected part of the same problem.

3.1.5 Design implications

The findings from the thematic analysis point to several implications for the design direction of this project.

Patients frequently lack the knowledge and confidence to take an active role in managing their complaints. A design intervention should therefore help patients better understand their situation before or between consultations.

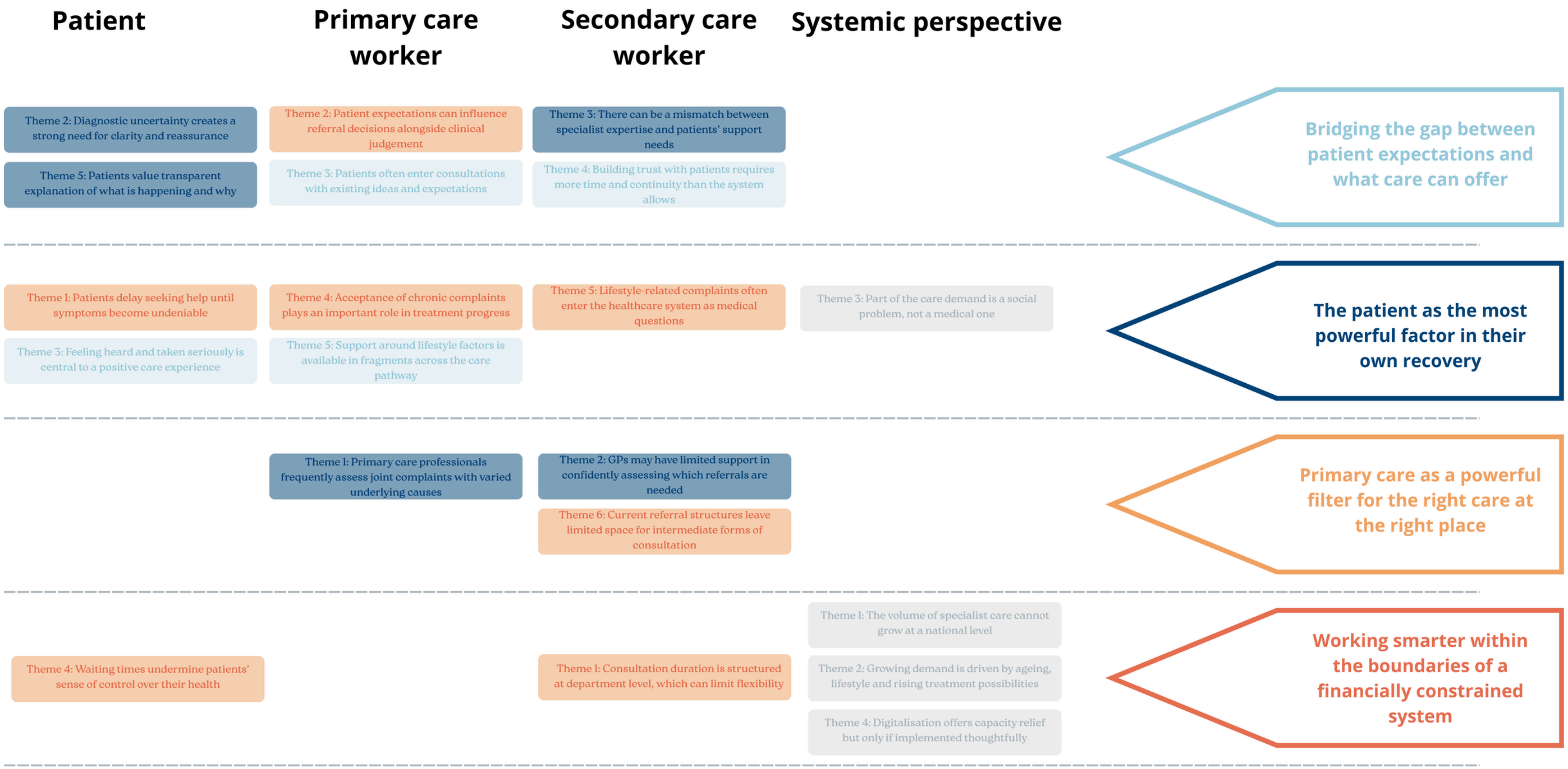
A recurring mismatch exists between what rheumatologists can offer and what many patients actually need. This suggests that a design intervention should offer an accessible alternative for patients whose complaints do not require specialist care.

Finally, a growing part of care demand can be influenced by lifestyle-related factors. A design intervention should therefore address the role of lifestyle in joint complaints, helping patients recognise what they can influence themselves.

3.2 IDENTIFYING SHARED PATTERNS ACROSS STAKEHOLDER GROUPS

After analysing each stakeholder group separately, the next step was to compare the findings across groups.

This was necessary because the interviews showed that patients, primary care professionals, secondary care professionals and the systemic stakeholder often described related problems from different positions in the care pathway. By placing these perspectives next to each other, it became possible to identify shared mechanisms that were not visible when looking at each group in isolation, as shown in Figure 14.



Patient	Primary care worker	Secondary care worker	Systemic perspective	
Theme 2: Diagnostic uncertainty creates a strong need for clarity and reassurance Theme 5: Patients value transparent explanation of what is happening and why	Theme 2: Patient expectations can influence referral decisions alongside clinical judgement Theme 3: Patients often enter consultations with existing ideas and expectations	Theme 3: There can be a mismatch between specialist expertise and patients' support needs Theme 4: Building trust with patients requires more time and continuity than the system allows		Bridging the gap between patient expectations and what care can offer
Theme 1: Patients delay seeking help until symptoms become undeniable Theme 3: Feeling heard and taken seriously is central to a positive care experience	Theme 4: Acceptance of chronic complaints plays an important role in treatment progress Theme 5: Support around lifestyle factors is available in fragments across the care pathway	Theme 5: Lifestyle-related complaints often enter the healthcare system as medical questions	Theme 3: Part of the care demand is a social problem, not a medical one	The patient as the most powerful factor in their own recovery
	Theme 1: Primary care professionals frequently assess joint complaints with varied underlying causes	Theme 2: GPs may have limited support in confidently assessing which referrals are needed Theme 6: Current referral structures leave limited space for intermediate forms of consultation		Primary care as a powerful filter for the right care at the right place
Theme 4: Waiting times undermine patients' sense of control over their health		Theme 1: Consultation duration is structured at department level, which can limit flexibility	Theme 1: The volume of specialist care cannot grow at a national level Theme 2: Growing demand is driven by ageing, lifestyle and rising treatment possibilities Theme 4: Digitalisation offers capacity relief but only if implemented thoughtfully	Working smarter within the boundaries of a financially constrained system

Figure 14: Themes mapped across stakeholder groups into four overarching themes

3.2.1 Method

To move from the thematic analysis towards a more systemic understanding of the problem, a cause-and-effect diagram was developed. This method was chosen because subquestion 3 focuses on the factors that influence the balance between care demand and care capacity within rheumatology. While the thematic analysis showed which themes were important across stakeholder groups, it did not yet fully explain how these factors influence and reinforce one another. The cause-and-effect diagram was therefore used as an analytical synthesis tool to make relationships, feedback loops and system dynamics visible.

To develop the diagram, the interview transcripts were revisited with a focus on relationships between factors. Relevant fragments were analysed to identify possible underlying causes and consequences within the system. These findings were combined with insights from the observations and targeted literature research, which was used to support and contextualise the identified dynamics.

The diagram was developed iteratively, with several versions being created and refined over time. Two earlier versions can be found in Appendix M. Throughout this process, the diagram was regularly presented to a rheumatologist to validate whether the relationships and dynamics depicted were recognisable in practice. This helped ensure that the final diagram was analytically grounded and practically credible. The diagram should be understood as a visual synthesis of possible system dynamics, rather than as a definitive causal model.

3.2.2 Results

The cause and effect diagram is shown in Figure 15. The diagram contains four overarching themes, each represented as a cluster that groups the underlying factors and dynamics that together characterise that theme. The arrows between elements show how one factor leads to or reinforces another, making it possible to trace how issues in one part of the system create or amplify problems elsewhere.

At the centre of the diagram lies the core problem that was identified earlier: a significant share of patients referred to rheumatology do not necessarily require specialist care in secondary care. Three of the four surrounding themes explain what drives this situation: 'Bridging the gap between patient expectations and what care can offer', *'Primary care as a powerful filter for the right care at the right place*', and *'The patient as the most powerful factor in their recovery'*. Together, these three themes describe the factors that cause patients to be referred to secondary care who do not always require specialist treatment. The fourth theme describes what happens as a result of this: growing pressure on rheumatology departments, where capacity is already constrained and workload continues to rise.

The four themes are also interconnected with one another. A development within one theme can trigger or amplify dynamics in another, which means that the system as a whole is self-reinforcing and difficult to change by addressing only one part of it. The four overarching themes are described in the following sections.

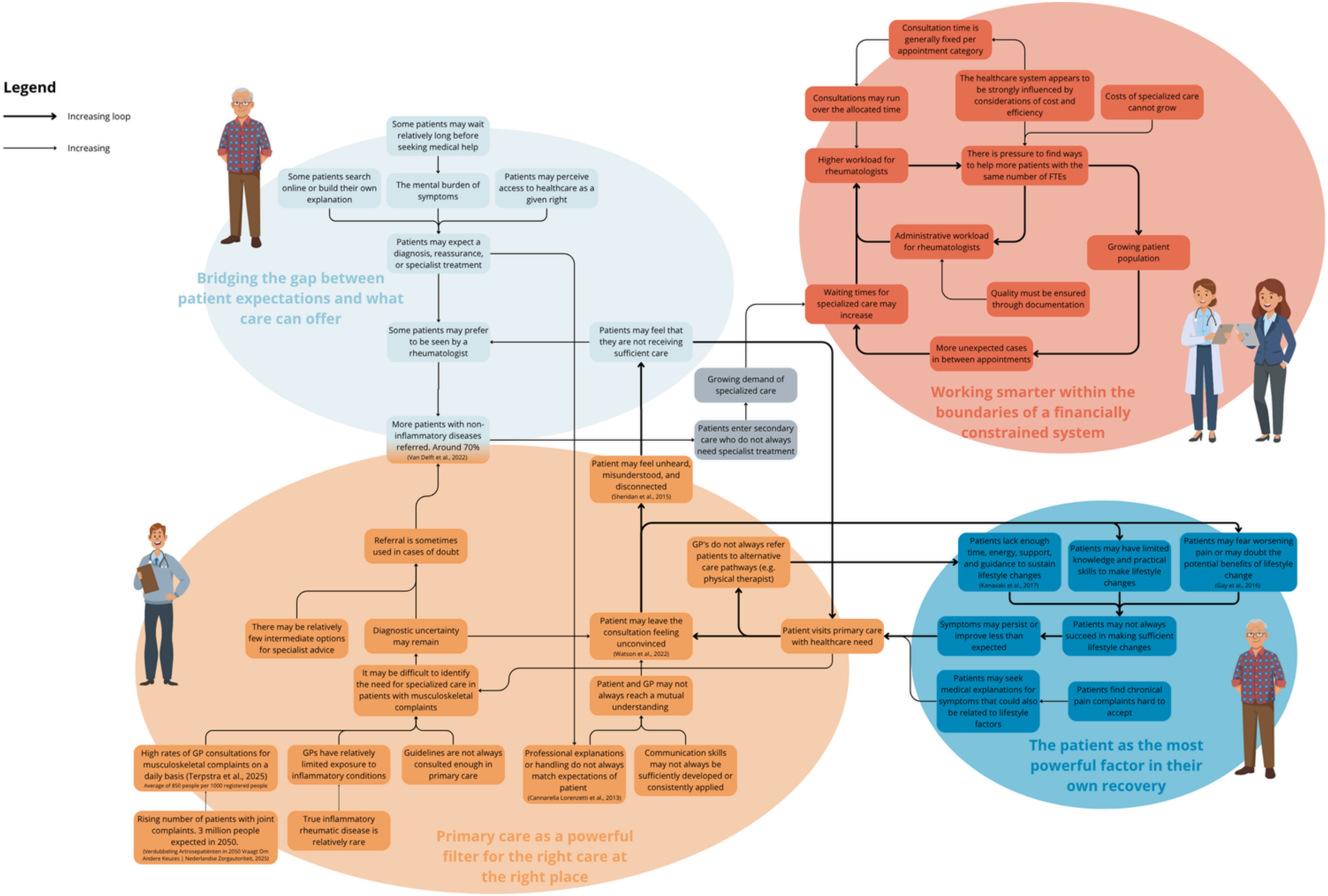


Figure 15: Cause and effect diagram explaining why patients enter secondary care who do not always need specialist treatment

Theme 1: *Bridging the gap between patient expectations and what care can offer*

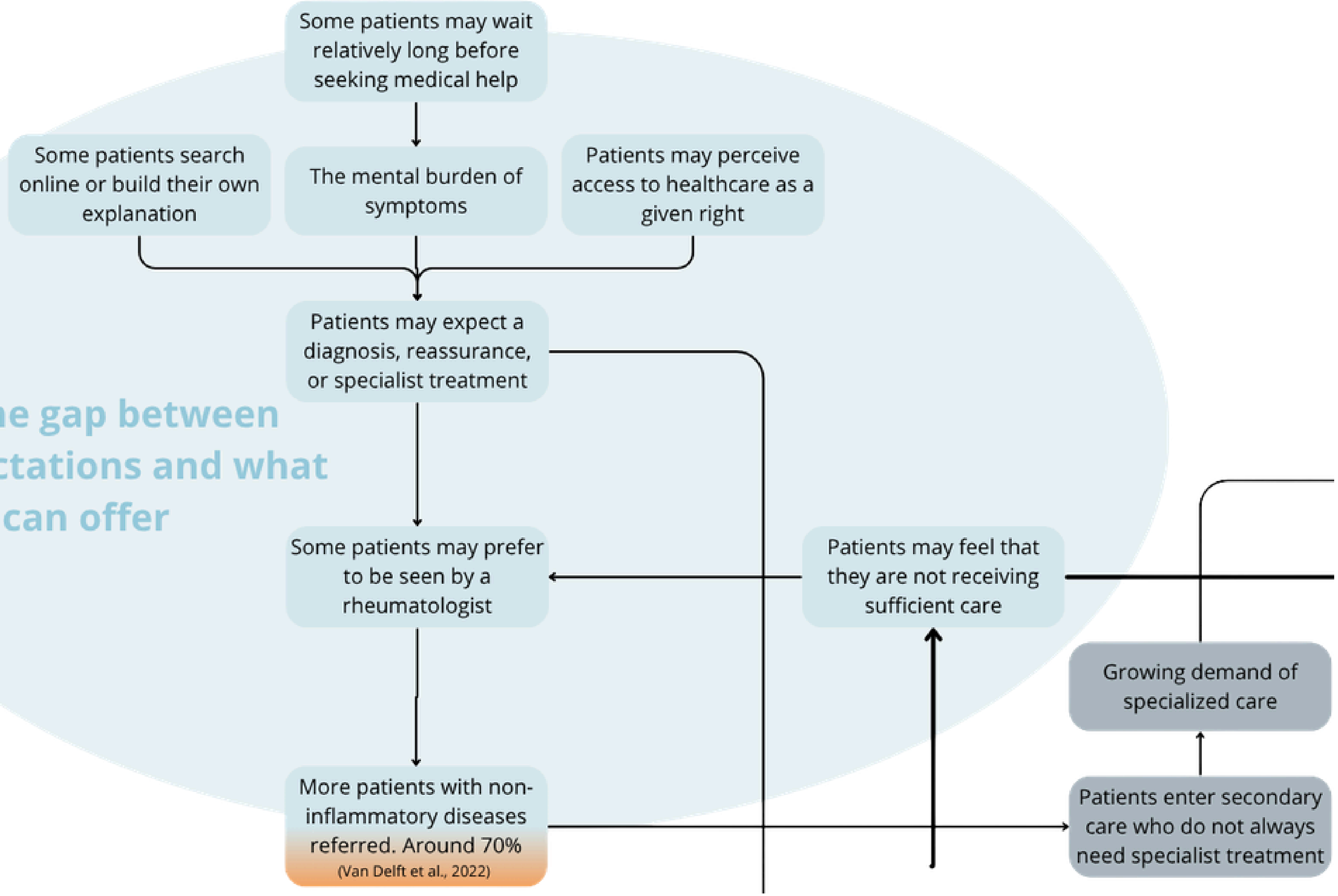
Patients with joint complaints may sometimes wait a relatively long time before seeking medical help. During this period, they may search online or develop their own explanations for their symptoms, while the mental burden of their complaints can increase. When they eventually enter care, they may do so with relatively fixed expectations about what they have and what they need, often hoping for a clear diagnosis, reassurance, or specialist treatment. This may be reinforced by the perception that healthcare in the Netherlands is a right, which could strengthen the expectation that specialist care should be accessible when needed.

When these expectations are not fully met during the consultation, some patients may feel that they are not receiving sufficient care. This feeling of being insufficiently helped may contribute to a preference for being seen by a rheumatologist, even in cases where specialist care may add limited clinical value. As a result, patients with non-inflammatory conditions may also be referred to secondary care. In this context, Van Delft et al. (2022) reported that around 70% of referred patients did not have an inflammatory rheumatic disease.

This theme appears to connect closely to the theme 'Primary care as a powerful filter for the right care at the right place', where diagnostic uncertainty and limited consultation skills may make it more difficult for GPs to manage these expectations effectively and guide patients toward the most appropriate care pathway.

It also seems to relate to the central grey loop, in which unmet expectations may contribute to patients feeling unheard, which could in turn increase the likelihood of requesting specialist referral and thereby add to the demand for specialised care.

Bridging the gap between patient expectations and what care can offer



Some patients may wait relatively long before seeking medical help

Some patients search online or build their own explanation

The mental burden of symptoms

Patients may perceive access to healthcare as a given right

Patients may expect a diagnosis, reassurance, or specialist treatment

Some patients may prefer to be seen by a rheumatologist

Patients may feel that they are not receiving sufficient care

Growing demand of specialized care

More patients with non-inflammatory diseases referred. Around 70% (Van Delft et al., 2022)

Patients enter secondary care who do not always need specialist treatment

Figure 16: Theme 1 (Bridging the gap between patient expectations and what care can offer) of the cause and effect diagram

Theme 2: *Primary care as a powerful filter for the right care at the right place*

The gateway between primary and secondary care holds potential for improvement. General practitioners encounter a high volume of musculoskeletal complaints on a daily basis, with an average of 850 consultations per 1000 registered patients (Terpstra et al., 2025), while true inflammatory rheumatic disease remains relatively rare. At the same time, the number of patients with joint complaints is expected to rise to 3 million by 2050 (NZa, 2025). This may place GPs in an increasingly important position in filtering and guiding patients, provided they have sufficient tools, knowledge, and confidence to do so effectively.

Several factors may make this filtering role more challenging. Because GPs may have relatively limited exposure to true inflammatory conditions, it may not always be straightforward to determine when specialist care is genuinely needed. In addition, guidelines may not always be consulted consistently in primary care, and professional explanations or approaches may not always align with patient expectations. Communication skills may also not always be sufficiently developed, embedded, or applied in practice (Cannarella Lorenzetti et al., 2013), which may make it more difficult for the patient and GP to reach a mutual understanding. In such situations, the patient may leave the consultation feeling unconvinced (Watson et al., 2022). When few intermediate options for specialist advice are available, diagnostic uncertainty may persist, and referral may sometimes be used in situations of doubt rather than solely on the basis of a clear clinical indication.

This theme connects directly to the central loop in the diagram. When the GP consultation does not sufficiently address the patient’s concerns, and alternative care pathways such as physical therapy are not discussed or suggested clearly enough, patients may be more likely to feel unheard or misunderstood (Sheridan et al., 2015). This may contribute to an increased preference for specialist referral and, in turn, add to the demand for specialised care. In addition, this theme appears closely connected to the dark blue theme of patient ownership. When patients are not sufficiently informed during the consultation about the possible role of lifestyle factors in their complaints, and are not referred to alternative care pathways that may address these factors, they may leave without the knowledge, skills, or motivation needed to make meaningful lifestyle changes. As a result, underlying contributing factors may remain insufficiently addressed, symptoms may persist or improve less than expected, and some patients may continue returning to the healthcare system without experiencing a lasting solution.

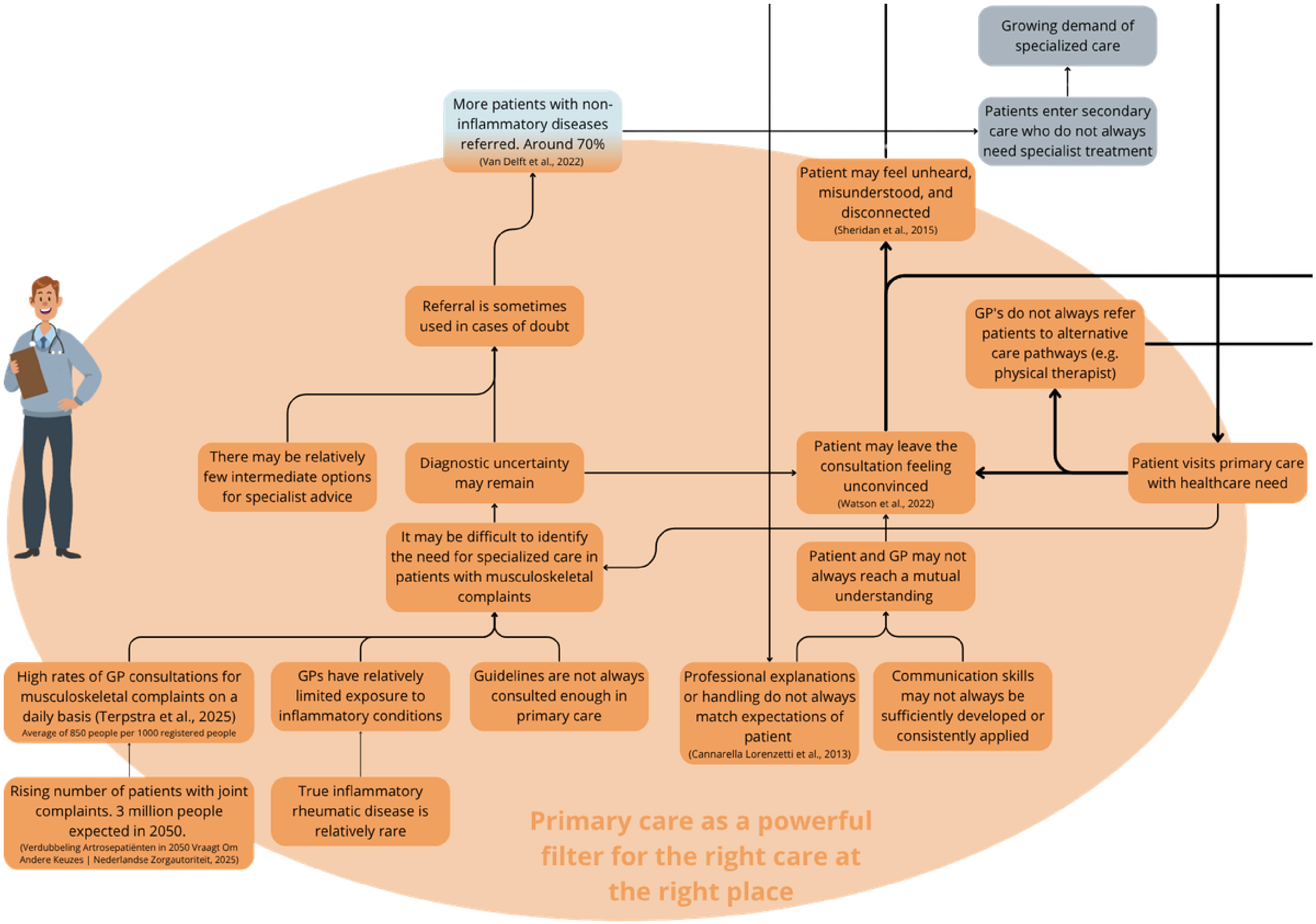


Figure 17: Theme 2 (Primary care as a powerful filter for the right care at the right place) of the cause and effect diagram

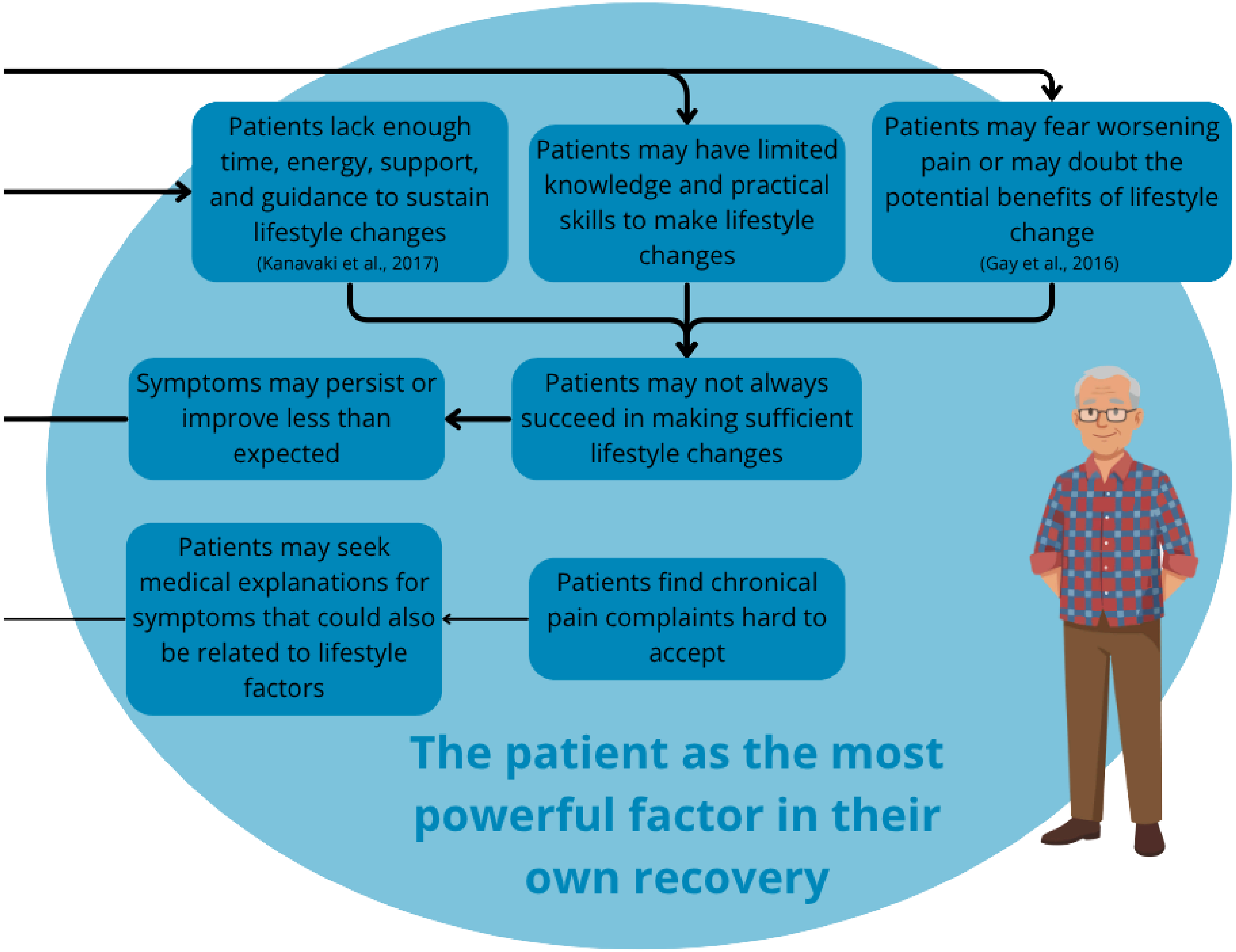
Theme 3: ***The patient as the most powerful factor in their own recovery***

A substantial proportion of patients who visit primary care with joint complaints may experience symptoms that can be related to lifestyle factors. At the same time, making lifestyle changes is often complex and may be influenced by several interacting factors. First, some patients may have limited knowledge and practical skills to make lifestyle changes. Second, they may lack the time, energy, support, or guidance needed to sustain such changes in daily life (Kanavaki et al., 2017). Third, patients may fear worsening pain or may doubt the potential benefits of lifestyle change (Gay et al., 2016). Together, these factors may reduce the likelihood that patients make sufficient lifestyle adjustments.

As a result, patients may be more likely to seek medical explanations for symptoms that could also be related to lifestyle factors, rather than recognizing the possible connection between how they live and how they feel. In addition, patients with chronic pain complaints may find these symptoms difficult to accept. When lifestyle-related drivers remain insufficiently addressed, symptoms may persist or improve less than expected.

This may create a self-reinforcing pattern within the theme. When symptoms persist, some patients may return to primary care with the same healthcare need, hoping for a different answer or a medical solution. When knowledge, support, or motivation for lifestyle change remains limited, this pattern may continue over time.

This theme connects directly to the orange theme of primary care gatekeeping. When consultations do not sufficiently address the possible role of lifestyle factors, and when patients are not guided toward alternative care pathways that may support behavioural change, they may leave without the knowledge, tools, or support needed to take greater ownership of their recovery. As a result, the potential role of the patient in influencing recovery may remain underused, while underlying drivers of the complaints may remain insufficiently addressed and continue to contribute to demand across the wider healthcare system.



Patients lack enough time, energy, support, and guidance to sustain lifestyle changes
(Kanavaki et al., 2017)

Patients may have limited knowledge and practical skills to make lifestyle changes

Patients may fear worsening pain or may doubt the potential benefits of lifestyle change
(Gay et al., 2016)

Patients may not always succeed in making sufficient lifestyle changes

Symptoms may persist or improve less than expected

Patients find chronical pain complaints hard to accept

Patients may seek medical explanations for symptoms that could also be related to lifestyle factors

The patient as the most powerful factor in their own recovery

Figure 18: Theme 3 (The patient as the most powerful factor in their own recovery) of the cause and effect diagram

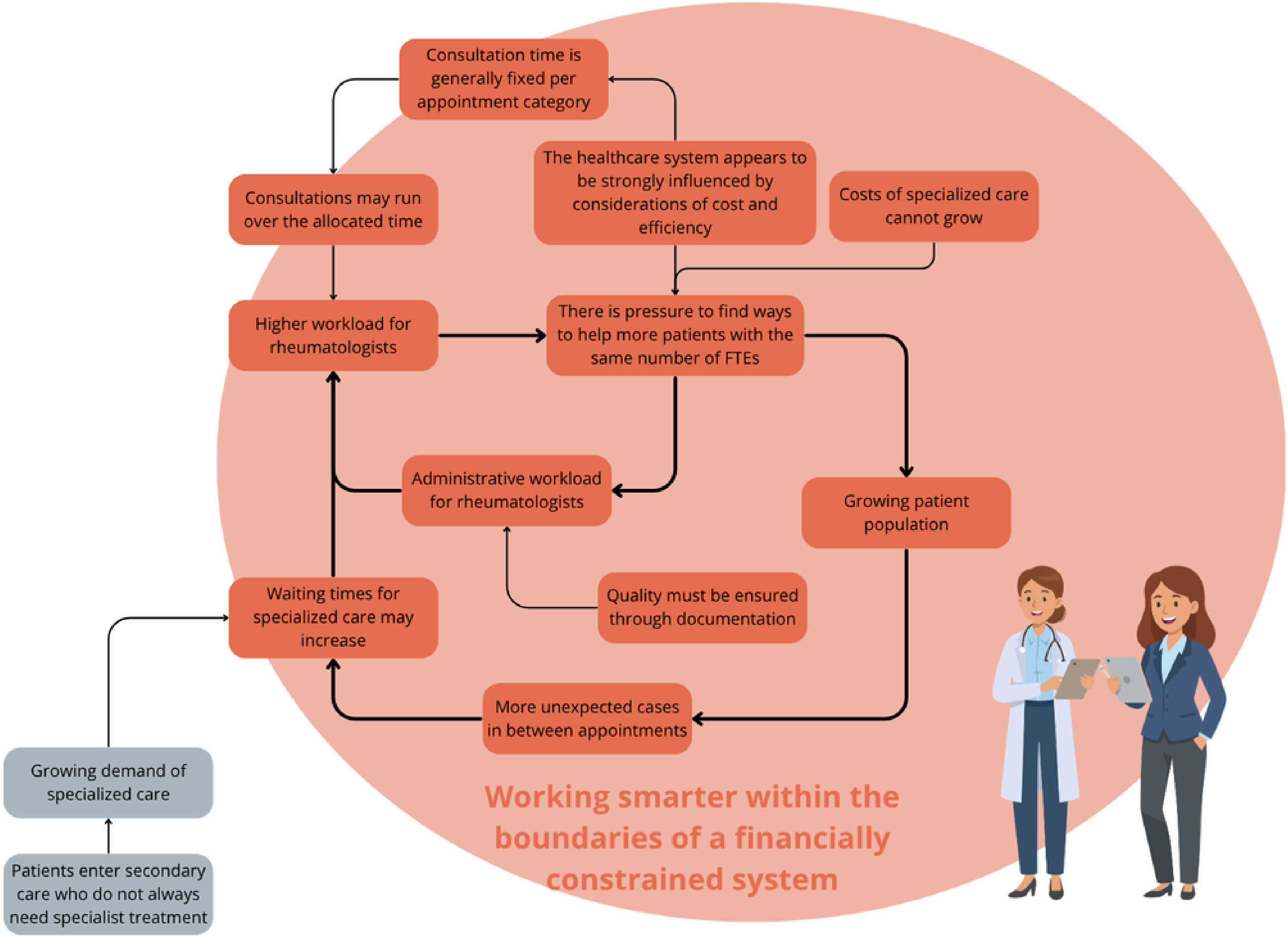
Theme 4: *Working smarter within the boundaries of a financially constrained system*

The capacity of the healthcare system to respond to rising demand appears to be structurally limited. At the national level, growth in the costs of specialised care is constrained, while the healthcare system seems to be strongly shaped by considerations of cost and efficiency. As a result, even when demand increases, expanding capacity by simply adding more FTEs may not always be a feasible option.

Within rheumatology departments, these structural constraints may translate into fixed consultation times per appointment category, often determined by departmental agreements rather than individual clinical needs. When patients require more time than is formally allocated, consultations may run over time. In combination with a growing patient population, this may contribute to a higher workload for rheumatologists and to longer waiting times for specialised care.

The pressure associated with this workload may encourage the search for solutions that enable rheumatologists to help more patients within the same number of FTEs. At the same time, such solutions may also have unintended effects. For example, they may lead to more unexpected cases being handled between scheduled appointments, while quality assurance through documentation may add further administrative burden. In this way, a reinforcing dynamic may emerge, in which attempts to relieve pressure also risk contributing to the same cycle of workload and waiting times, making the situation increasingly difficult to change without structural intervention.

This theme appears to connect directly to the central loop in the diagram. The demand for specialised care may increase partly as a result of referrals from primary care that are not always clinically necessary, and this may further intensify the pressure already experienced within rheumatology departments. From this perspective, addressing the dynamics described in the other three themes, such as better aligning patient expectations with what care can offer, strengthening the filtering role of primary care, and supporting patients in taking greater ownership of their health, may not only benefit patients but could also help reduce structural pressure on the specialist setting.



Working smarter within the boundaries of a financially constrained system

Figure 19: Theme 4 (Working smarter within the boundaries of a financially constrained system) of the cause and effect diagram

3.2.3 Discussion

The cause and effect diagram makes visible what the thematic analysis alone could not easily show: that the four overarching themes are deeply interconnected and continuously feed into one another. When one factor changes, the others remain in place and continue to reinforce each other, which means that addressing only one theme is unlikely to resolve the broader problem. Improving one part of the system without considering the others risks leaving the underlying dynamics intact.

This also means that the problem cannot be attributed to a single cause or a single stakeholder. The diagram shows that different actors across different levels of the system each make their own decisions for their own reasons, and that it is precisely the combination of these decisions that sustains the current situation. The problem is therefore not located in one place, but is distributed across the system as a whole.

Because of this interconnectedness, a single intervention that solves everything at once is unlikely to exist. Instead, it may be more productive to look at where in the system meaningful contributions can be made, keeping in mind that changes in one area may have effects elsewhere.

Limitations

This mapping is based on the insights gathered through eighteen interviews conducted across four stakeholder groups. While this provided a broad range of perspectives, it is possible that certain dynamics were missed or not fully captured.

In addition, the diagram was validated with one rheumatologist. Validating with multiple professionals across different roles and settings would have been preferable to ensure that all findings were interpreted correctly and that the relationships depicted accurately reflect the complexity of the system.

3.2.4 Conclusion

The cause and effect diagram contributes to answering subquestion 3 by identifying the key factors that may influence the balance between care demand and care capacity within rheumatology.

The analysis suggests that this balance is shaped by four interconnected themes. First, a gap may exist between what patients expect from care and what care can realistically offer. Patients sometimes enter the system with fixed ideas about their diagnosis and a preference for specialist reassurance, which can contribute to referrals that are not always clinically necessary.

Second, primary care plays an important filtering role, but this role is not always easy to fulfil. GPs face diagnostic uncertainty, limited consultation time, and varying patient expectations, which can make it challenging to consistently guide patients toward the most appropriate level of care.

Third, the patient's own role in their recovery is not always sufficiently supported. Lifestyle related factors can contribute to joint complaints, yet patients do not always have the knowledge, motivation or support needed to act on this.

Fourth, the healthcare system operates within structural financial constraints that limit the growth of specialist capacity, making it difficult to respond to rising demand through additional resources alone.

Together, these four themes suggest that the imbalance between care demand and capacity is not caused by one single factor, but may emerge from the interaction of dynamics at different levels of the system.

3.2.5 Design implications

The four themes identified in the cause and effect diagram each represent a possible direction for design intervention. Together, they suggest that meaningful improvement requires attention to all four areas rather than one isolated solution.

A first direction lies in bridging the gap between patient expectations and what care can offer. A second direction lies in strengthening the filtering role of primary care, so that patients are guided toward the most appropriate level of support. A third direction lies in supporting patients in taking a more active role in their own recovery, particularly in relation to lifestyle factors. A fourth direction lies in finding smarter ways to organise care within the boundaries of a financially constrained system.

Because these four themes are deeply interconnected, addressing only one of them is unlikely to resolve the broader challenge. This insight calls for a broader perspective: rather than designing one solution that fixes one problem, it may be more valuable to first imagine how the ideal system could function across all four directions, and then identify where design can make a meaningful contribution to that future.

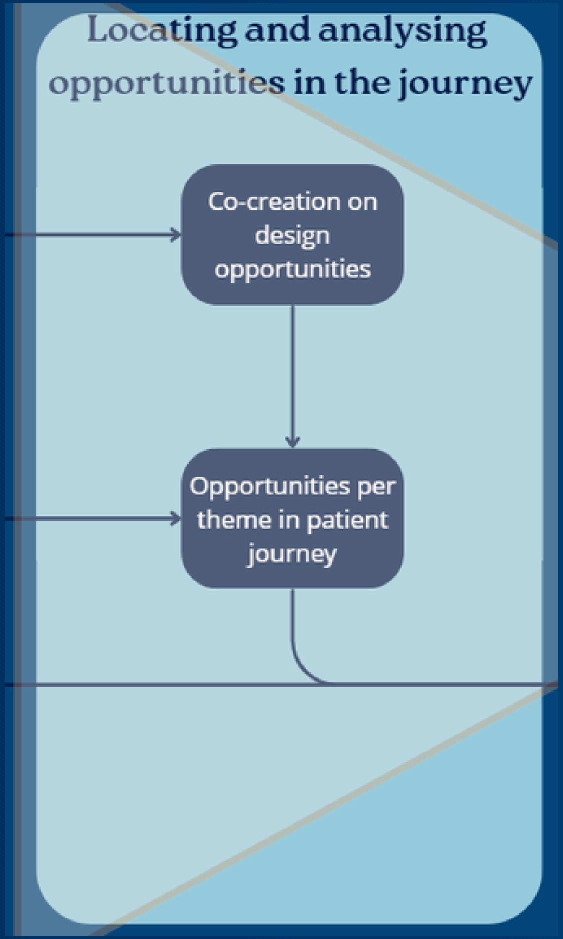
Chapter 4

LOCATING AND ANALYSING OPPORTUNITIES IN THE JOURNEY

This chapter moves from understanding the current system towards identifying where design could make a meaningful contribution. Based on the challenges identified in the previous chapter, a broad range of ideas is generated through a structured brainstorming session. These ideas are clustered into opportunity areas and mapped onto the patient journey, making visible at which moments patients, general practitioners and other stakeholders could be supported differently.

This chapter contributes to answering the following subquestion:

SQ4: Where do design opportunities lie that can make a positive contribution for both patients and healthcare professionals?



4.1 EXPLORING IDEAS IN THE DESIGN DIRECTIONS

To move from research insights to concrete design directions, the first step was to generate a broad range of initial ideas. Rather than immediately narrowing down to one solution, the goal at this stage was to explore as many different directions as possible across the four identified themes.

4.1.1 Method

To identify where there is potential for improvement within the care pathway, a brainstorming session was organised with fellow students from the Faculty of Industrial Design Engineering. The decision to involve peers from outside the project was deliberate. After an extensive period of research, a certain familiarity with the themes had built up, which can narrow the scope of ideas generated. Involving others helped to introduce fresh perspectives and reduce the risk of fixation on directions already explored.

For the session, eight "How might we" questions were formulated, each addressing one of the key themes identified in the earlier analysis, as shown in Figure 20. The full session plan, including the setup, can be found in Appendix N.

The session was based on the 6-3-5 method, a structured brainwriting technique in which participants sketch ideas in response to a prompt and then pass their sheet to the next person, who builds on or is inspired by what they see (Wodehouse & Ion, 2011).

Bridging the gap between patient expectations and what care can offer

How might we align patients’ expectations with what primary care can offer?

How might we help patients feel heard and connected in or after a GP consult?

Primary care as a powerful filter for the right care at the right place

How might we help GPs feel more confident when assessing joint complaints?

How might we make alternative care pathways clearer to both GPs and patients?

How might we help GPs and patients leave the consultation with the same understanding of the problem and next step?

The patient as the most powerful factor in their own recovery

How might we help patients accept chronic joint complaints?

How might we help patients recognise the strong influence of lifestyle factors on their joint complaints?

How might we help patients take small steps in changing habits that affect their joint complaints?

Figure 20: 'How might we' questions used in the session

This approach avoids the session being dominated by louder personalities and ensures that all participants contribute equally throughout. The method is well suited to generating a high volume of ideas across a short timeframe, which was the main goal at this stage of the process. Because the session included eight questions rather than one, and given the time available, the format was adapted to an 8-3-3 structure: eight questions, three ideas per round, and three minutes per round instead of the original five. This kept the pace high and ensured that all questions were covered within the session time. An impression of this method during the session is shown in Figure 21.

After all rounds were completed, the generated ideas were clustered during the session itself. Participants grouped similar ideas together and gave each cluster a title, making it possible to identify recurring directions across the different "How might we" questions.

Figure 21: '8-3-3 method during the session

4.1.2 Results

The brainstorm session resulted in a large number of ideas spread across the eight "How might we" questions. The ideas from the session were clustered into themes based on recurring directions and similarities between ideas. An impression of the clustering during the session is shown in Figure 22, and the full results of the brainstorm session can be found in Appendix O. Together, the ideas pointed towards six distinct clusters, each representing a different angle from which the problem can be approached.

Figure 22: clustering during the session

Peer support – Ideas in this cluster focused on connecting patients with others who have similar experiences. This includes buddy systems, support groups and community platforms where patients can share tips, stories and advice with one another.

Tracking – This cluster contains ideas around monitoring complaints and progress over time. Examples include dashboards, apps or tools that help patients keep track of their symptoms, lifestyle habits and steps taken, making their situation more visible to both themselves and their care provider.

Education – Ideas here focused on improving patient knowledge about joint complaints, lifestyle factors and alternative care pathways. The goal is to help patients better understand their situation so they can make more informed decisions about their own health.

Pre-primary care – This cluster grouped ideas that take place before or during the first contact with a general practitioner. Examples include pre-consultation questionnaires, AI tools that help patients prepare for their appointment and tools that help set expectations before entering the healthcare system.

Follow-up education and tracking – Ideas in this cluster focused on what happens after a consultation. This includes follow-up questionnaires, checklists and micro-interventions that help patients stay informed and take small steps towards improvement after leaving the care setting.

Human-digital support – This cluster brought together ideas that combine human and digital elements to support patients. Examples include AI chat tools, digital buddies and automated summaries that help patients understand their complaints and navigate the system more confidently.

4.1.3 Discussion

One deliberate choice in the setup of the brainstorm session was to exclude the theme "Working smarter within the boundaries of a financially constrained system" from the session. This decision was made because this theme is deeply embedded in the broader context of the healthcare system, including financial structures, insurer agreements and organisational constraints that are difficult to understand without extensive background knowledge. For participants who are not familiar with this context, it would be very difficult to generate useful and grounded ideas on this theme. Including it would likely have resulted in ideas that are too abstract or disconnected from the reality of the system to be of practical value.

This theme will not be left out of the process entirely. It will be taken into account when mapping opportunities onto the patient journey in the next step, where the broader systemic context can be considered more carefully alongside the other themes.

4.2 MAPPING IDEAS ONTO THE PATIENT JOURNEY

To answer subquestion 4, the ideas generated during the brainstorm session were translated into concrete design opportunities and mapped onto the patient journey. By connecting the ideas to specific moments in the journey, it becomes possible to identify where design can make a meaningful contribution for both patients and healthcare professionals.

4.2.1 Method

To translate the ideas and clusters into concrete opportunities, they were linked to the four design directions identified in the cause and effect diagram. The clusters were reviewed and matched to the direction they relate to most closely. In addition, ideas gathered earlier during the research process were also included, ensuring that relevant insights that emerged outside of the brainstorm session were not lost. The theme that was left out of the brainstorm session, "Working smarter within the boundaries of a financially constrained system", was revisited at this stage based on insights from the earlier research phases. For each opportunity, a moment in the patient journey was identified where it could play a role. This resulted in a patient journey map filled with opportunity areas, colour coded per theme, as shown in Figure 23.

4.2.2 Results

The opportunities are discussed per phase of the patient journey below.

First complaints

In the earliest phase of the journey, before a patient has visited a general practitioner, the main opportunity lies in helping patients understand the connection between their lifestyle and their complaints. At this stage, patients are still forming their own picture of what might be wrong, making it a valuable moment to influence how they think about their situation.

Appointment at the general practitioner

This phase contains the largest concentration of opportunities. Before the consultation, there is an opportunity to better prepare patients for what to expect when seeing their GP. During and after the consultation, opportunities include giving patients a clearer picture of what care can offer, providing GPs with better tools to evaluate and monitor complaints over time, connecting patients with others who share similar experiences, giving patients concrete guidance on what they can do themselves and using digital tools to support both patients and care workers. There is also an opportunity to better align patient expectations about what secondary care can offer, creating a more meaningful distinction between referrals that are necessary and those that are not. Together, these opportunities focus on improving the quality and outcome of the primary care consultation for all parties involved.

Referral to the rheumatology department

In this phase, the key opportunities lie in supporting patient engagement and self-management during what is often a long waiting period, and giving patients a greater sense of progress and control. These opportunities recognise that the waiting period is not an empty pause, but a moment where patients can be actively supported even when no clinical contact is taking place.

Diagnosis

In the final phase, the opportunity focuses on using digital tools to better support and inform both patients and care workers throughout the diagnostic process, helping patients leave with a clearer understanding of their situation and next steps.

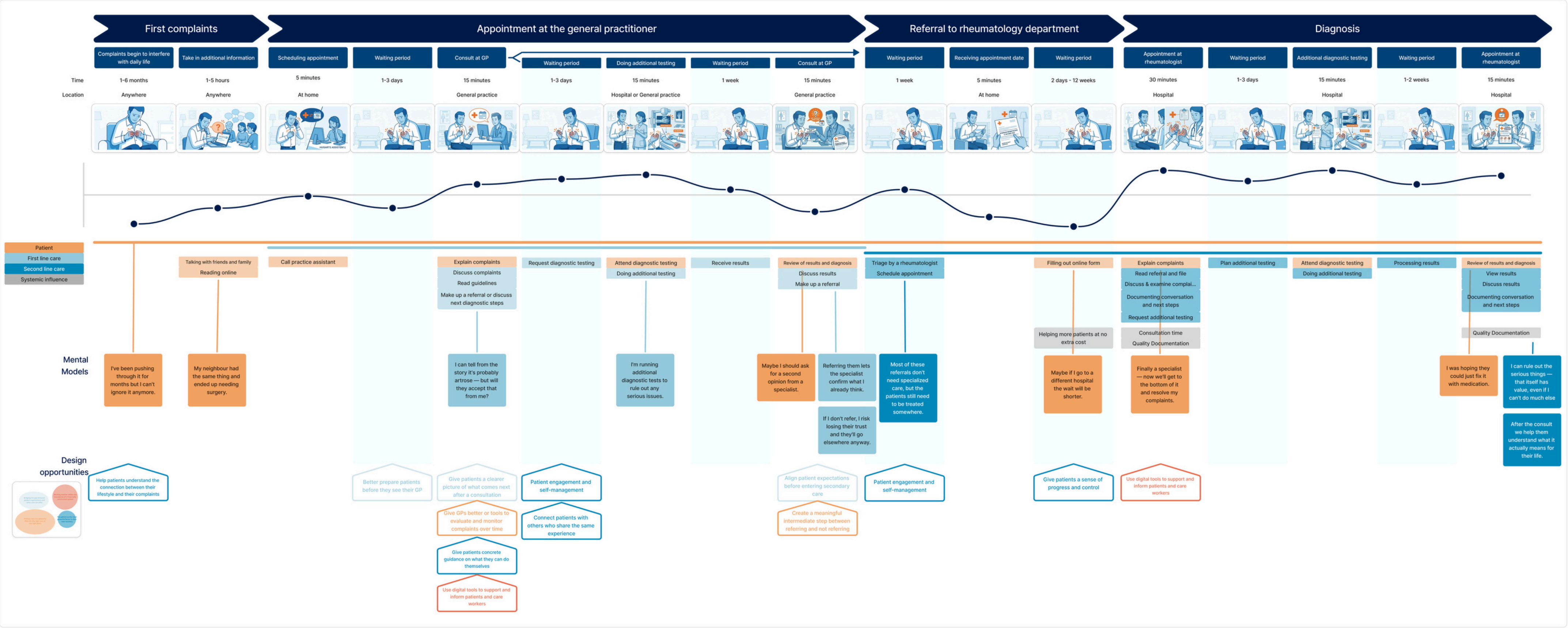


Figure 23: Patient journey map with opportunity areas, colour coded per overarching theme

4.2.3 Conclusion

The mapping of ideas onto the patient journey contributes to answering subquestion 4 by identifying where design opportunities lie across the care pathway. Opportunities exist at every phase of the journey, from the moment patients first notice their complaints to the point of diagnosis. The largest concentration of opportunities lies around the GP consultation, where better preparation, clearer communication and more targeted support could improve the experience for both patients and healthcare professionals. During the waiting period and at the moment of diagnosis, opportunities exist to keep patients better informed and engaged. Together, these opportunities point towards a design direction that will be further elaborated upon in the next chapter.

4.2.4 Design implications

The opportunity mapping shows that the largest concentration of design opportunities lies around the GP consultation. A design response should therefore focus on this phase of the journey, where better preparation, clearer communication and targeted support can improve outcomes for both patients and healthcare professionals.

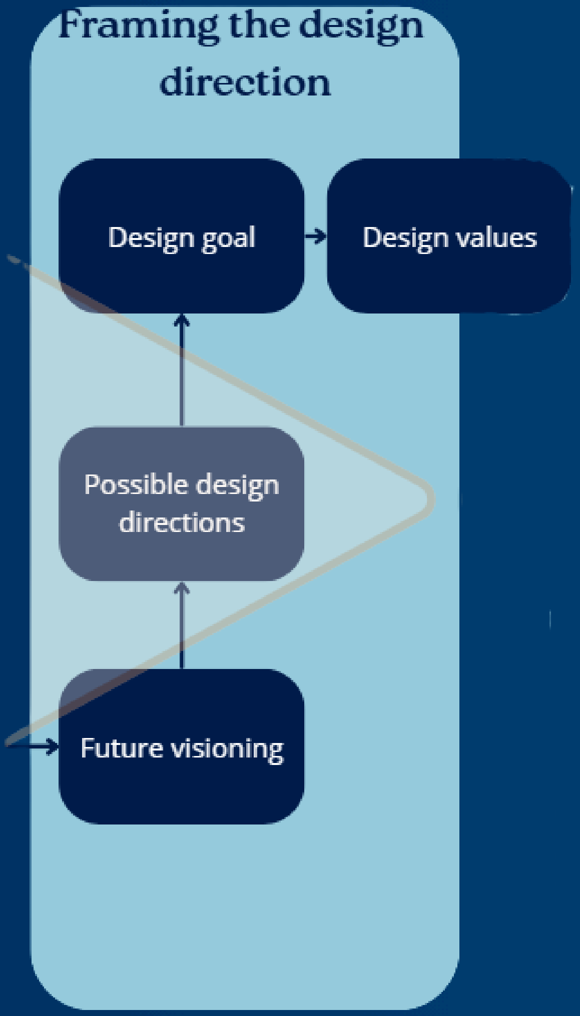
The waiting period between referral and diagnosis also presents an opportunity that is often overlooked. Rather than treating this as an empty pause, a design can use this time to keep patients informed, engaged, and actively supported.

Finally, the identified opportunities span multiple phases of the patient journey, which reinforces that a single intervention is unlikely to be sufficient. A design that supports patients across different moments in the journey is better positioned to create meaningful change.

Chapter 5

FRAMING THE DESIGN DIRECTION

This chapter translates the opportunity areas into a focused design direction. First, a future vision is developed to imagine how the care pathway for people with joint complaints could function differently if the system supported patients, general practitioners and rheumatology departments in a more balanced way. The chapter then narrows the design focus to the role of the patient in their own recovery, defines the target group and context of use, and establishes the design values that the service should fulfil using the COM-B model.



Framing the design direction

Design goal

Design values

Possible design directions

Future visioning

Earlier in this research, it became clear that a single intervention will not be enough to create lasting change within the system. Because the four themes are interconnected and mutually reinforcing, meaningful improvement requires a broader perspective on how the system as a whole could function differently. Before narrowing down to a specific design direction, it is therefore important to first establish a shared picture of what the ideal system could look like.

5.1 CREATING A FUTURE VISION

5.1.1 Method

To move from the identified opportunities towards a concrete design direction, future visioning was used. Future visioning is a future-oriented design method that helps explore desirable future states and translate them into design directions. It is especially useful in participatory and human-centred design processes, because it allows stakeholders to reflect on what a preferred future could look like before defining concrete solutions (Ollenburg, 2019).

To develop the future vision, the elements identified in the cause and effect diagram were used as a starting point. For each of the four themes, it was explored what would need to change or improve in order to create a more desirable care pathway for patients with joint complaints. These insights were then combined with input from a validation conversation with a rheumatologist from RdGG.

This conversation lasted approximately 30 minutes and focused on translating practical insights from rheumatology care into a future state. The aim was to understand how a desired future could look from the perspective of someone working within the field, while also using the conversation to reflect on and validate the emerging ideas. The rheumatologist’s input helped to check whether the future vision was recognisable, relevant and realistic in relation to daily practice, professional priorities and developments within rheumatology care.

The insights from both the cause and effect diagram and the validation conversation were translated into a future state. This future state was written as a narrative describing how a patient with joint complaints might experience the care pathway in 2035. The narrative is followed by an overview of the conditions that would need to be in place across the four themes for this future to become possible.

5.1.2 Results

Future state

It is 2035. The number of people with osteoarthritis and joint complaints has risen sharply over the past years. At the same time, the number of available rheumatologists has not kept pace. The system has had to adapt, and it has.

Someone notices that their knees have been feeling stiff for a few weeks and that moving around has become more painful. They have already looked things up online and arrive at the GP with a head full of questions and expectations. They suspect something serious is going on.

The GP takes her time. The technology beside her is no longer a distraction, but a tool that supports her. The system has already summarised the relevant information from the patient's file before the consultation, so she can be fully present for the patient. She listens to his story, asks further questions about his concerns, and deliberately responds to what he has already read.

Together they reach a shared understanding of what is going on. The GP can confirm with sufficient certainty that there is no inflammatory condition that requires treatment in secondary care. That clarity alone is a relief for the patient. He now knows where he stands.

But the GP does not stop there. She explains how joint complaints are often connected to lifestyle factors such as physical activity, sleep, weight, and stress. She makes clear what the patient can do himself and how a healthier lifestyle can reduce his complaints. The patient leaves with concrete guidance and understands what the next steps are.

The consultation does not feel like a standard procedure, but like a real encounter between two people, supported by technology that thinks along in the background.

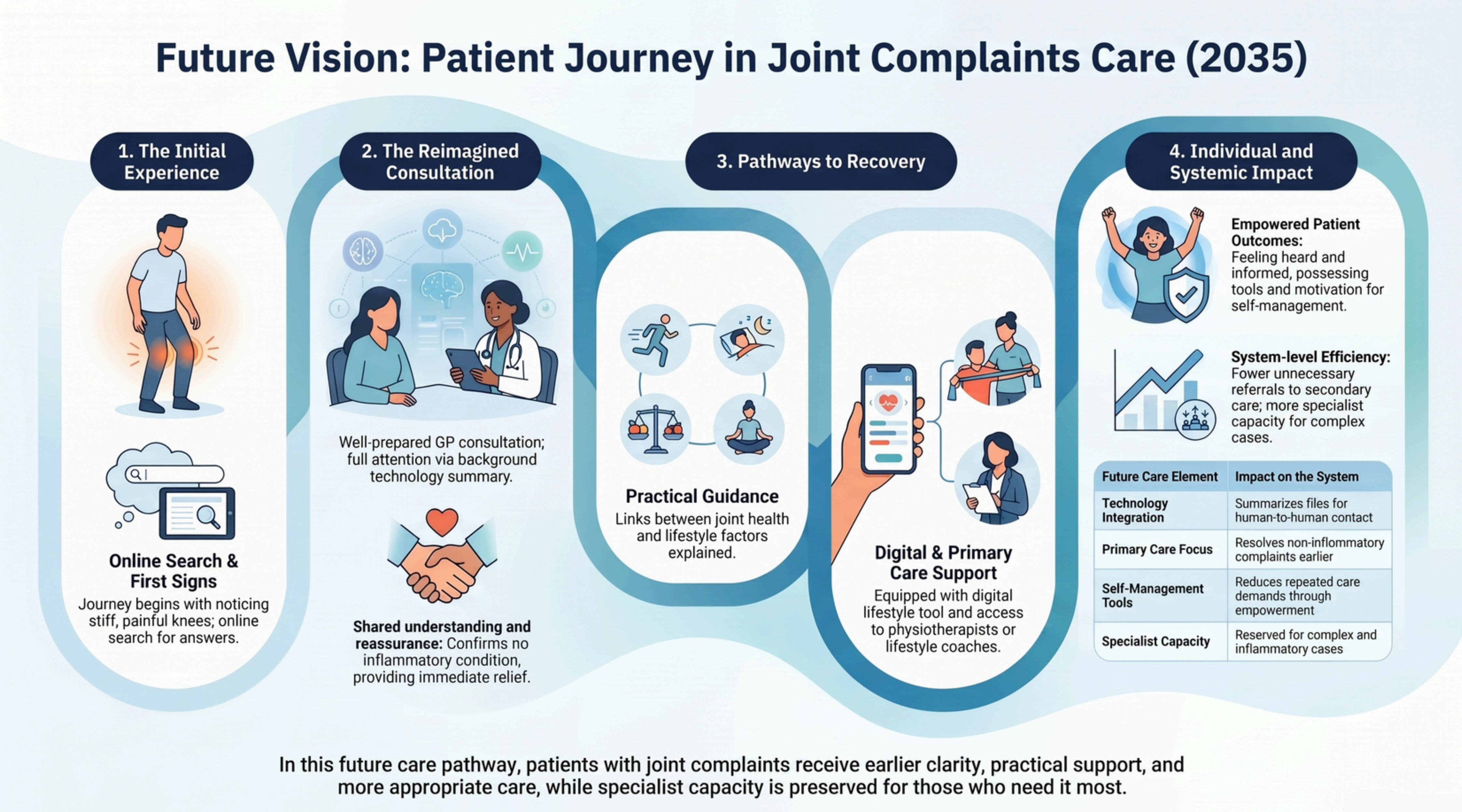
On the advice of the GP, the patient starts using a digital lifestyle tool. This tool helps him better understand his complaints, supports him in making lifestyle changes, and gives him the feeling that he can actually do something himself. He has the knowledge, the means, and the motivation to get started.

When he needs additional support, suitable care providers in primary care are available, such as a physiotherapist or a lifestyle coach, who can guide him further.

The patient leaves the practice differently than he arrived. He feels heard and taken seriously. He did not receive the answer he perhaps expected, but he did receive an answer he understands and can accept. And more importantly, he knows what he can do himself and has the tools to act on it.

At the system level, this has an effect. Patients who do not need specialist care are no longer referred out of uncertainty or because the consultation got stuck on mismatched expectations. Secondary care receives fewer patients with non-inflammatory complaints, allowing capacity to be used more effectively for those who truly need it. Technology has taken on a supportive role in this, not as a replacement for the care provider, but as a tool that creates space for what truly matters: the contact between one human being and another. The reinforcing cycle of repeated care demands and unnecessary referrals is broken earlier in the system, not after the fact, but already during the first conversation with the GP.

To make the future state more tangible and accessible, the narrative is accompanied by a visual representation of the key elements of the future vision, as shown in Figure 24. This visual summarises the most important steps and changes within the future care pathway and provides an overview of how different elements of the system work together in the ideal situation.



Future Vision: Patient Journey in Joint Complaints Care (2035)

1. The Initial Experience

Online Search & First Signs

Journey begins with noticing stiff, painful knees; online search for answers.

2. The Reimagined Consultation

Well-prepared GP consultation; full attention via background technology summary.

Shared understanding and reassurance: Confirms no inflammatory condition, providing immediate relief.

3. Pathways to Recovery

Practical Guidance

Links between joint health and lifestyle factors explained.

Digital & Primary Care Support

Equipped with digital lifestyle tool and access to physiotherapists or lifestyle coaches.

4. Individual and Systemic Impact

Empowered Patient Outcomes: Feeling heard and informed, possessing tools and motivation for self-management.

System-level Efficiency: Fower unnecessary referrals to secondary care; more specialist capacity for complex cases.

Future Care Element	Impact on the System
Technology Integration	Summarizes files for human-to-human contact
Primary Care Focus	Resolves non-inflommatory complaints earlier
Self-Management Tools	Reduces repeated care demands through empowerment
Specialist Capacity	Reserved for complex and inflammatory cases

In this future care pathway, patients with joint complaints receive earlier clarity, practical support, and more appropriate care, while specialist capacity is preserved for those who need it most.

Figure 24: Visualisation of the future state

Conditions for reaching the future state

The future state described is not something that will emerge on its own. It requires a number of conditions to be in place across the system. These conditions are not design solutions in themselves, but rather the prerequisites that need to be met for the future scenario to become possible. They are organised according to the four themes that were identified earlier in this project.

Bridging the gap between patient expectations and what care can offer

- GPs actively explore patient expectations, fears, and prior knowledge during the consultation.
- Consultations are structured in a way that allows for a tailored conversation.
- Patients and GPs reach a mutual understanding by the end of the consultation, so that patients leave with clarity.
- Patients feel heard and taken seriously, so that they accept the diagnosis and engage with the proposed treatment path.

Primary care as a powerful filter for the right care at the right place

- GPs have sufficient diagnostic certainty to confidently confirm whether or not a complaint requires specialist treatment in secondary care.
- Intermediate options exist between referring and not referring.
- Guidelines are consistently used in daily practice as a foundation for clinical-decision making.

The patient as the most powerful factor in their own recovery

- Patients have sufficient knowledge about the relationship between their complaints and lifestyle factors to understand what they can do themselves.
- Patients have access to a tool or resource that gives them concrete guidance and builds their sense of competence and control.
- Patients feel motivated and supported enough to actually engage with lifestyle change, not just informed about it.
- Where self-management is not enough, suitable support is available in primary care to guide patients further.

Working smarter within the boundaries of a financially constrained system

- Unnecessary referrals to secondary care are reduced, so that specialist capacity is used for patients who truly need it.
- Administrative workload is reduced so that care providers can focus their time and energy on patient contact.
- Technology is integrated as a supporting tool that strengthens the relationship between patient and care provider.
- The system creates space for experimentation and innovation, so that there is room to work differently.

5.2 FRAMING THE DESIGN DIRECTION

The future vision described in the previous section paints a picture of how the care pathway for patients with joint complaints could function differently. However, to move from a broad vision to a concrete design, one direction must be chosen as the primary focus. This choice is informed by the cause and effect diagram developed earlier in this research.

5.2.1 Framing the problem

What makes the four overarching themes particularly relevant is not only what they describe individually, but also the way they are connected through a central reinforcing loop (see Figure 25). This loop can be understood as the dynamic that links the themes together and allows them to strengthen one another over time. Rather than functioning as separate issues, patient expectations, primary care gatekeeping, the patient's own role in recovery, and the structural pressure within specialised care appear to interact as part of one broader system.

At the centre of this system is a pattern in which patients may remain in primary care with the same healthcare need when their complaints are not sufficiently resolved. This may happen when consultations leave room for uncertainty, when explanations do not fully align with patient expectations, or when underlying factors related to lifestyle remain insufficiently addressed. As a result, patients may return to primary care repeatedly with a similar care demand.

When this continues over time without a satisfactory solution, patients may increasingly prefer to be seen by a rheumatologist. This in turn may contribute to referrals to secondary care for complaints that do not always require specialist rheumatology treatment.

These referrals add to the demand placed on rheumatology departments, where capacity is already constrained. This can contribute to longer waiting times, higher workload, and increasing pressure to organise care more efficiently within fixed resources. In that way, the pressure in specialised care is not separate from what happens in primary care, but is partly sustained by the same reinforcing dynamic. At the same time, these patients do still need support, even if specialist care is not always the most appropriate setting in which to provide it.

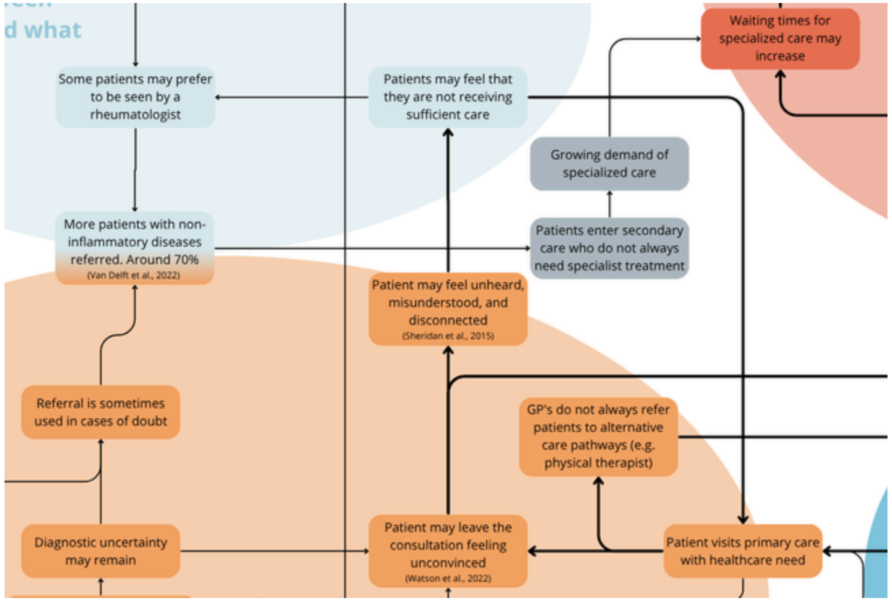


Figure 25: Central reinforcing loop of the cause and effect diagram

5.2.2 Choosing a direction

Based on the central reinforcing loop, this project focuses on the theme *'the patient as the most powerful factor in their own recovery'*. This does not mean that the other themes are less important. However, within the scope of this graduation project, this theme offered the most direct and actionable point for design intervention.

The other themes also represent relevant opportunities, but were less suitable as the primary focus for this project. Bridging the gap between patient expectations and what care can offer is strongly connected to the GP consultation itself, including communication skills, trust-building and the relationship between patient and professional. Strengthening primary care as a filter would likely require changes in clinical decision-making, guideline use, diagnostic support or collaboration between GPs and specialists.

Working smarter within a financially constrained system is important, but closely tied to financing structures, capacity planning and organisational agreements. These directions are therefore valuable, but less directly designable within the scope of this project.

The patient-focused direction was selected because it addresses a moment before repeated care-seeking and referral to secondary care become more likely. When patients leave the GP consultation without sufficient understanding, guidance or support to act on lifestyle-related factors, their complaints may remain unresolved and the same care need may return. By supporting patients after or between consultations in primary care, design can contribute to strengthening what patients are able to do themselves, without immediately depending on large system-level changes.

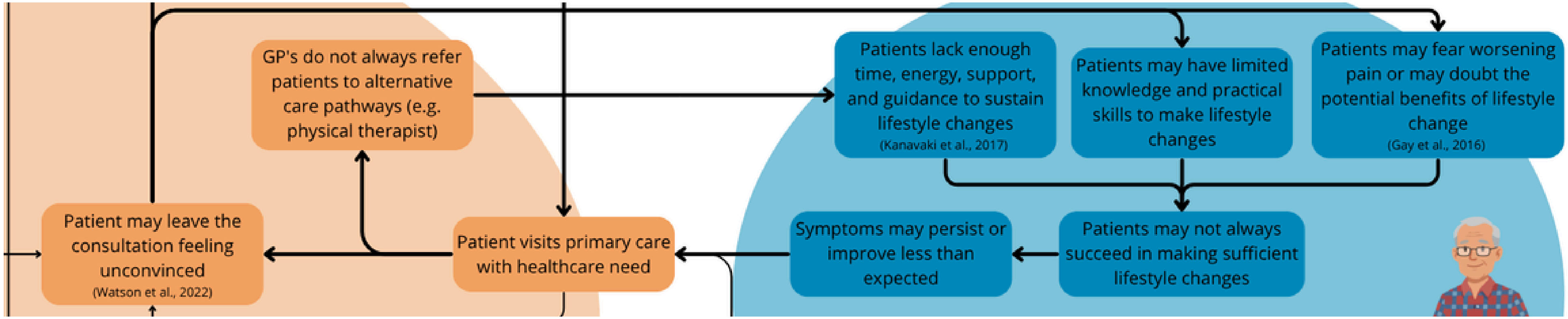


Figure 26: Reinforcing loop of the chosen design direction

Design a service that supports people with non-inflammatory joint complaints in primary care in understanding and managing their complaints by providing accessible guidance on joint complaints and related lifestyle factors, so that they are better able to take an active role in their recovery and may receive appropriate support before referral to second line care is considered.

At the same time, this direction remains connected to the wider system. The focus of this project is therefore not to solve the full imbalance between care demand and rheumatology capacity, but to explore how design can contribute meaningfully within one specific part of the care pathway. Based on this focus, the design statement shown alongside this text was formulated.

This design statement positions the intervention at an early stage in the care pathway, within the context of primary care. It emphasises the importance of accessible guidance, not as a replacement for professional care, but as a way to support patients in better understanding their situation and translating this understanding into feasible actions in daily life. By doing so, the intervention aims to strengthen the support available within primary care before referral to secondary care becomes the most likely next step.

Looking back at the patient journey developed earlier in this research, the intervention is positioned after the consultation with the general practitioner and before referral to secondary care is considered, as shown in Figure 27. This is a critical moment in the care pathway. The patient has received an initial explanation or advice, but may still need support in translating this into daily life. By intervening at this point, the service aims to provide guidance during a period in which patients are often expected to manage their complaints independently, while the underlying lifestyle-related factors may not yet be sufficiently understood or addressed.

This positioning also reflects the systemic ambition of the project. The intervention is not placed in secondary care, where pressure is already high, but earlier in the pathway, where support may help patients develop greater understanding, confidence, and ownership before specialist referral becomes necessary or desirable.

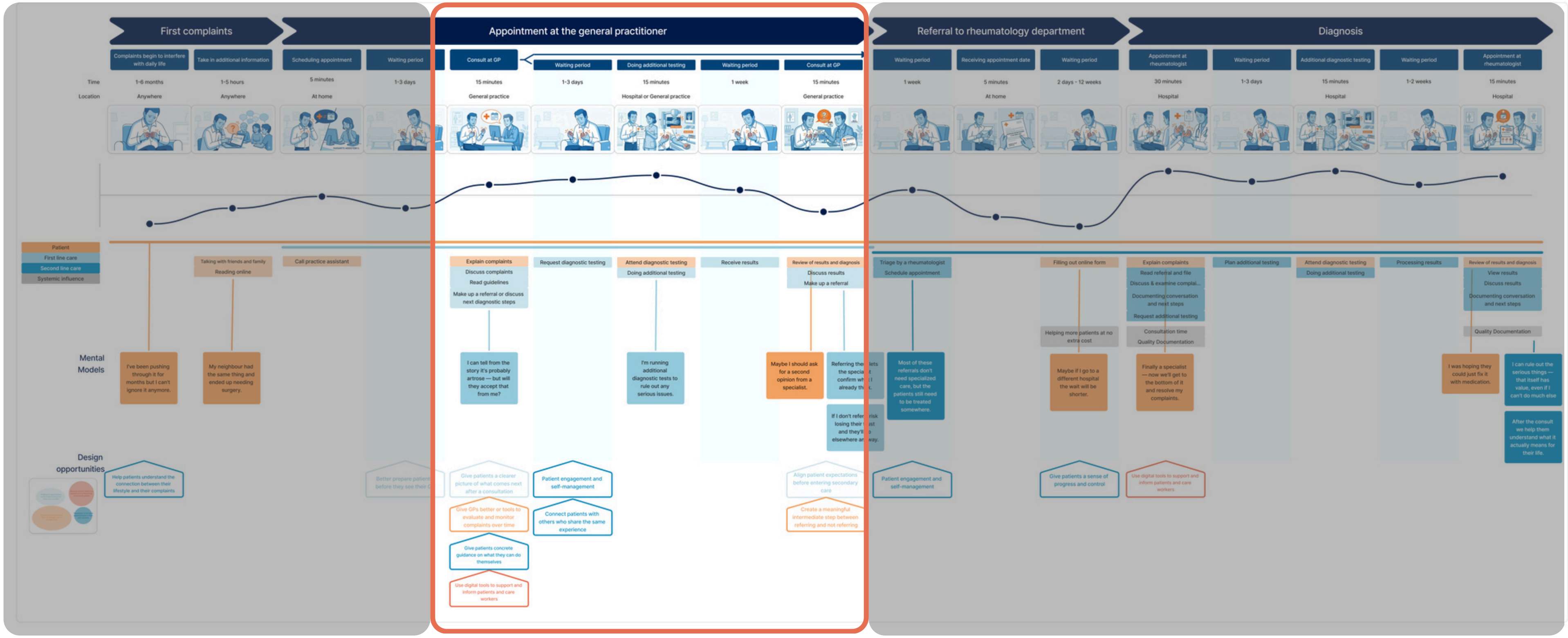


Figure 27: Positioning of the design direction in patient journey map

5.2.3 Grounding the design direction in interview insights

The choice to focus on the patient as an active factor in their own recovery is supported by what was shared across multiple interviews. A recurring pattern emerged in which patients do not always have the knowledge, motivation, or practical tools needed to actively engage with the lifestyle factors that may contribute to their complaints. This suggests that patients may benefit from more accessible guidance and support that helps them understand what they can influence and how to take meaningful steps in daily life.

A rheumatologist pointed to the structural consequence of this pattern: *"Als je deze patiënten steeds blijft opvangen binnen het medische systeem, hoe goed bedoeld ook, dan houd je die instroom in stand... De echte verandering zit volgens mij in een maatschappelijke omslag: meer verantwoordelijkheid voor leefstijl."* This perspective suggests that as long as patients are not supported in taking greater ownership of their health, the demand for specialist care will continue to grow regardless of how care is organised.

The support needed to enable this shift is currently insufficient. A physiotherapist confirmed that patients often lack the resources to sustain lifestyle changes: *"Er zijn gewoon te weinig leefstijl coaches en het wordt ook niet zomaar aangereikt."* Even when patients are aware that lifestyle factors play a role, this awareness does not automatically lead to action: *"Sommige patiënten missen het wel, maar ze weten niet wat ze missen."*

The physiotherapist also pointed to the physical stakes involved: *"Als je bijvoorbeeld niet goed eet en je hebt bijvoorbeeld overgewicht, dat artrose echt wel een grote belemmering gaat zijn in de toekomst, omdat het gewricht gewoon meer moet dragen."*

This gap is also felt within primary care. A general practitioner acknowledged that the knowledge needed to guide patients on lifestyle factors is not always available at this level: *"Ik heb zelf te weinig kennis om daar goede informatie over te geven."* At the same time, patients who do not receive sufficient guidance tend to return with the same unresolved need: *"Ze komen vaak terug. Zeker mensen met veel onbegrepen gewrichtsklachten. Die zie ik toch wel weer terug omdat ze er last van blijven houden."*

The underlying reason is often that patients find it easier to seek a medical answer than to engage with what they can do themselves: *"Het is natuurlijk veel fijner als iemand zegt: je hebt reumatische artritis en ik geef een prik en het gaat beter, in plaats van dat je er zelf wat aan moet doen."*

This points to a clear gap in the system. One general practitioner described what a more appropriate alternative could look like: *"Wat je eigenlijk zou moeten hebben is gewricht consulenten. Dan een gedeelte van de mensen zou ik denk ik dan daarheen sturen en niet naar de reumatoloog."* This suggests that for a significant share of patients, a more accessible and targeted form of support would be both sufficient and more appropriate than a referral to secondary care.

Together, these perspectives confirm that helping patients become more aware of, and better equipped to act on, the lifestyle factors that influence their complaints is a central but underused opportunity in the care pathway. Intervening at this level, before referral to secondary care becomes the default next step, has the potential to reduce unnecessary demand and provide patients with more meaningful and lasting support.

5.3 FRAMING WHAT THE DESIGN SHOULD DO

After defining the design direction, the next step was to determine what the design should do in order to support the desired change. The chosen direction focuses on helping people with non-inflammatory joint complaints become more active in understanding and managing the lifestyle factors that may influence their complaints. This means that the design should not only provide information, but also support behaviour change in daily life.

Earlier in this research, Self-Determination Theory was used to interpret stakeholder experiences and understand where the current care pathway does or does not support people's psychological needs. For the development of the design, however, a more action-oriented behavioural framework was needed. The COM-B model was therefore used to translate the design direction into concrete design values. Whereas SDT helped to understand experiences, COM-B helped to define what users need in order to act.

The COM-B model describes behaviour as the result of three interacting components: Capability, Opportunity and Motivation (Michie et al., 2011), as shown in Figure 28. Capability refers to whether a person has the knowledge and skills needed to perform a behaviour. Opportunity refers to whether the physical and social environment makes the behaviour possible. Motivation refers to the mental processes that direct and sustain behaviour. For behaviour change to occur, all three components need to be sufficiently supported.

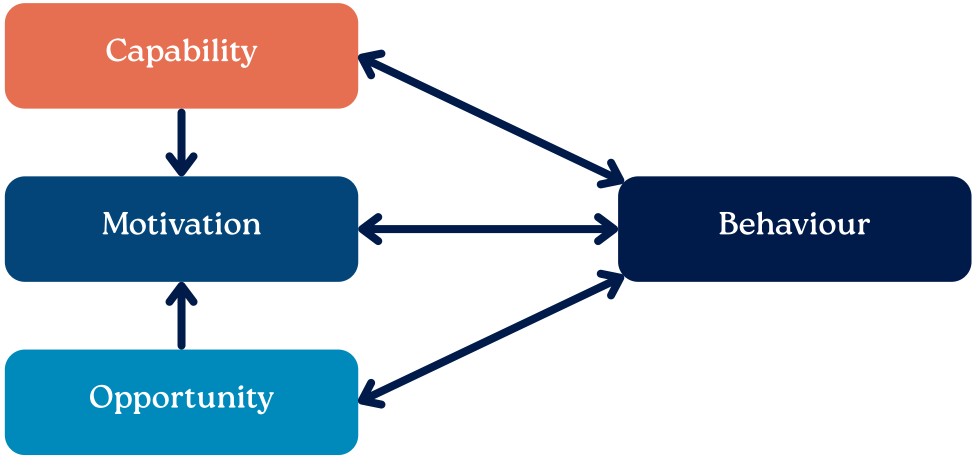


Figure 28: COM-B model (Michie et al., 2011)

This model was relevant for this project because the cause-and-effect diagram showed that patients often struggle to engage with lifestyle change for multiple reasons. Some patients lack the knowledge or practical skills to understand what influences their complaints. Others lack the time, energy, support or guidance to apply lifestyle advice in daily life. In addition, patients may fear worsening pain, doubt whether lifestyle change will help, or feel insufficiently capable of influencing their symptoms. These three causes map directly onto the three components of the COM-B model.

Using COM-B therefore helped ensure that the design would not focus on only one part of the behavioural challenge. A design that only provides information may increase awareness, but does not necessarily help users take action. A design that only motivates users may not provide enough practical guidance. A design that only suggests actions may fail if users do not understand why these actions matter. For this reason, the design values were structured across all three COM-B components.

Based on this, six design values were defined, two for each COM-B component, as shown in Figure 29. These values describe what the service should offer in order to support users in actively engaging with lifestyle factors related to their joint complaints.

Capability

The first two values address the user's ability to understand and act on information about their complaints. Awareness focuses on helping users recognise that lifestyle factors can influence joint complaints. Understanding goes a step further by helping users understand their own complaints and which lifestyle factors may be relevant to their personal situation.

Motivation

The next two values address the user's drive to engage with behaviour change. Self-efficacy focuses on helping users feel capable of influencing their symptoms through their own actions. Engagement focuses on helping users stay involved over time, rather than only interacting with the service once or dropping off after initial use.

Opportunity

The final two values address the conditions that make behaviour change possible in daily life. Actionability focuses on helping users translate insight into concrete, feasible next steps that fit their situation. Social support focuses on helping users feel supported and connected to peers and the people around them, reducing the sense of having to manage chronic or persistent complaints alone.

Together, these six values form the foundation for the development of the service. They ensure that the concept supports users not only in becoming aware of lifestyle factors, but also in understanding their relevance, feeling capable of acting on them, staying engaged over time, translating insights into feasible actions and feeling supported in the process.

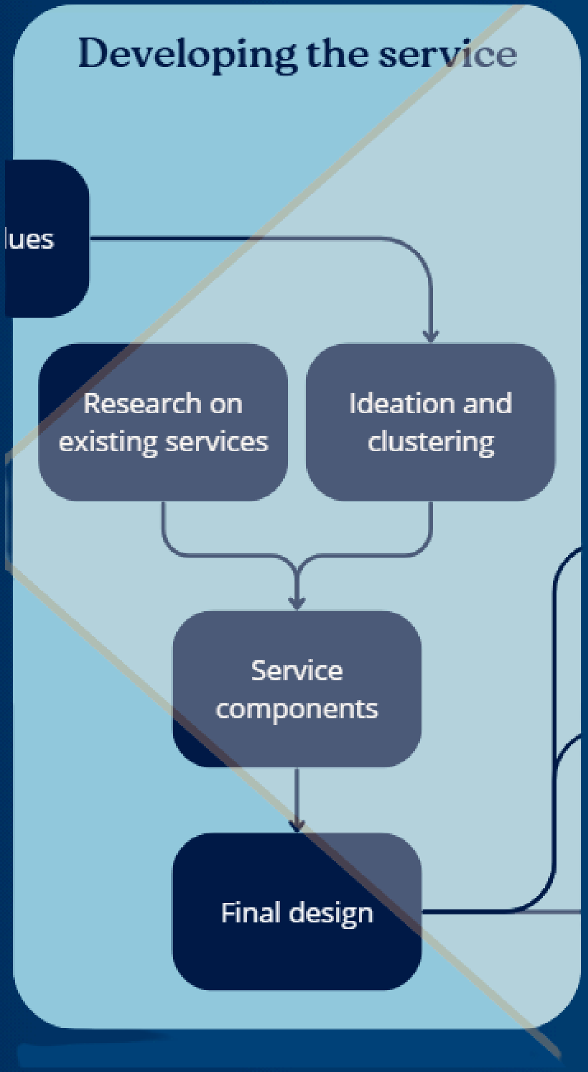
Capability	Motivation	Opportunity
Awareness Helping users recognise that lifestyle factors can influence joint complaints.	**Self-efficacy** Helping users feel capable of influencing their symptoms through their own actions.	**Actionability** Helping users translate insight into concrete, feasible next steps.
Understanding Helping users understand their complaints and which lifestyle factors are relevant to them.	**Engagement** Helping users stay involved and continue working on behaviour change over time.	**Social support** Helping users feel supported and connected to peers and the people around them.

Figure 29: The six design values categorised in the three components of the COM-B model

Chapter 6

DEVELOPING THE SERVICE

This chapter describes the development of the final service concept, Jointly. It explains how the design values were translated into ideas, how these ideas were clustered and selected, and how the final concept was shaped into a digital service for people with non-inflammatory joint complaints in primary care. The chapter introduces the core functionalities of the service, describes the service flow and the roles of different stakeholders, and presents a roadmap for future implementation.



6.1 GENERATING A WIDE RANGE OF IDEAS

With the design values and COM-B framework in place, the next step was to generate a broad range of ideas before narrowing down to a concept. This phase was intentionally divergent. The aim was not yet to define or validate one solution, but to explore how the six design values could be translated into different forms of support for people with non-inflammatory joint complaints. This helped avoid narrowing the concept too early and ensured that the final service would address multiple parts of the behavioural challenge.

6.1.1 Method

To structure the ideation process, the six design values each formed the basis for a How Might We question. These questions were derived from the descriptions of the design values and grouped according to the COM-B components: capability, motivation and opportunity, as shown in Figure 30. This structure kept the ideation connected to the behavioural foundation of the project, while still allowing different solution directions to emerge.

The ideation was carried out independently. This was a deliberate choice because the goal of this phase was to quickly explore a wide range of possible directions before selecting and developing a coherent concept.

Capability

How might we help users recognise that lifestyle factors can influence their joint complaints?
How might we help users understand their complaints and which lifestyle factors are relevant to them?

Motivation

How might we help users feel capable of influencing their symptoms through their own actions?
How might we help users stay involved and continue working on behaviour change over time?

Opportunity

How might we help users translate insight into concrete, feasible next steps?
How might we help users feel supported and connected to peers and the people around them?

Figure 30: How might we questions based on the six values

Formal co-creation or validation with patients or healthcare professionals was not yet required, as the purpose was to generate possibilities rather than evaluate a finished idea. Stakeholder perspectives had already informed the design values and were included again later during this research.

Ideas were generated through personal brainstorming, inspiration from existing services, research and other relevant domains, and informal conversations with people from the immediate environment. These conversations were not treated as formal research data, but were used to spark new directions and challenge initial assumptions.

All ideas were colour coded according to the design value they addressed, making it possible to keep capability, motivation and opportunity visible throughout the process. The ideation process is shown in Figure 31. After ideas had been generated for each How Might We question, they were clustered based on recurring mechanisms, themes or solution directions.

During the selection of clusters, attention was paid to which clusters contributed most strongly to the desired behaviour change. Clusters that addressed multiple values across capability, motivation and opportunity were considered stronger directions, as they had greater potential to support users in understanding lifestyle factors, acting on them and staying engaged over time.

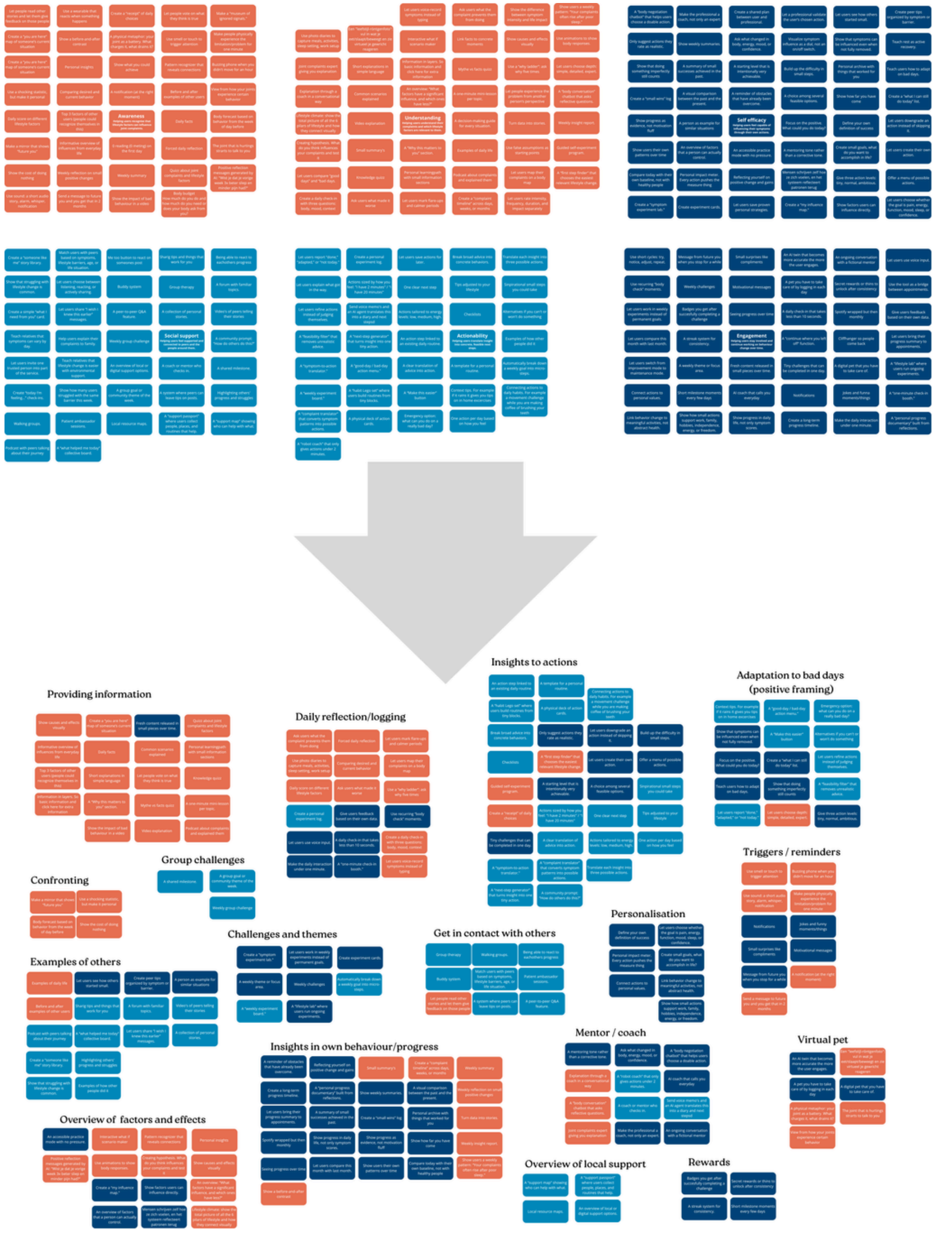


Figure 31: Ideation process from 'How Might We questions' to colour-coded idea clusters

6.1.2 Results

The ideation process generated a large number of ideas across the six How Might We questions. The full overview of all ideas per question can be found in Appendix P. After clustering based on thematic similarity, the ideas were grouped into the following fifteen clusters.

Providing information

Ideas focused on offering users accessible and relevant information about joint complaints and lifestyle factors, for example through daily facts, short explanations, videos and personalised information sections.

Daily reflection and logging

Ideas around helping users reflect on their daily situation and track relevant factors such as symptoms, mood, sleep and activity, through short check-ins or photo diaries.

Insights into own behaviour and progress

Ideas that help users see patterns in their own behaviour and complaints over time, for example through progress timelines, weekly summaries and visual comparisons between past and present.

Insights to actions

Ideas focused on translating personal insights into concrete next steps, such as action cards, step-by-step suggestions and symptom-to-action translators.

Challenges and themes

Ideas around structured weekly challenges or themes that help users experiment with small lifestyle changes in a low-pressure way.

Group challenges

Ideas that involve shared goals or community challenges, where users work towards a milestone together.

Get in contact with others

Ideas focused on connecting users with peers who share similar experiences, through group therapy, buddy systems, walking groups or patient ambassador sessions.

Examples of others

Ideas that use stories and examples from other users to inspire and normalise lifestyle change, such as before-and-after stories, podcasts and peer-generated tips.

Confronting

Ideas that use more direct or surprising feedback to create awareness, such as a mirror showing a future self or a body forecast based on current behaviour.

Overview of factors and effects

Ideas that give users a visual overview of which lifestyle factors influence their complaints and how, through interactive scenario makers or influence maps.

Personalisation

Ideas focused on tailoring the experience to the individual user, for example by defining personal goals, linking behaviour change to personal values or adjusting advice to energy levels.

Mentor and coach

Ideas around providing users with ongoing guidance through a human or AI coach, a mentoring relationship or a conversational agent that checks in regularly.

Adaptation to bad days

Ideas that help users maintain progress even on difficult days, through positive framing, emergency tips, simplified actions and flexible goal levels.

Triggers and reminders

Ideas focused on prompting users to take action at the right moment, through notifications, motivational messages or physical reminders.

Rewards

Ideas that use small rewards, streaks or milestone moments to reinforce consistent behaviour over time.

Virtual pet

Ideas around a digital companion that grows or changes based on the user's behaviour, creating an emotional connection to the process of self-management.

6.1.3 Conclusion

From the fifteen idea clusters, several clusters were selected as the foundation for the further development of the service concept. Figure 32 shows an overview of the selected and non-selected clusters. The selection was guided by the COM-B model, as the final concept needed to support users in understanding their complaints, feeling motivated to engage with their own recovery, and finding opportunities to act in daily life.

The selected clusters together address the three components of behaviour change: capability, motivation and opportunity. For capability, the clusters *Daily reflection*, *Providing information*, *Overview of factors and effects*, and *Insights into own behaviour and progress* were selected. These clusters help users build knowledge about joint complaints and lifestyle factors, recognise patterns in their own situation, and understand how their behaviour may relate to their symptoms. This was important because users first need to understand what might influence their complaints before they can take meaningful action.

For motivation, the clusters *Personalisation*, *Mentor and coach*, and *Adaptation to bad days* were selected. These clusters were chosen because they make the service feel more personal, supportive, and emotionally engaging. Rather than only providing information, the concept needed to help users feel guided and capable of continuing, even when symptoms fluctuate or progress is difficult. The idea of a coach or companion was therefore taken forward as a central element in the service.

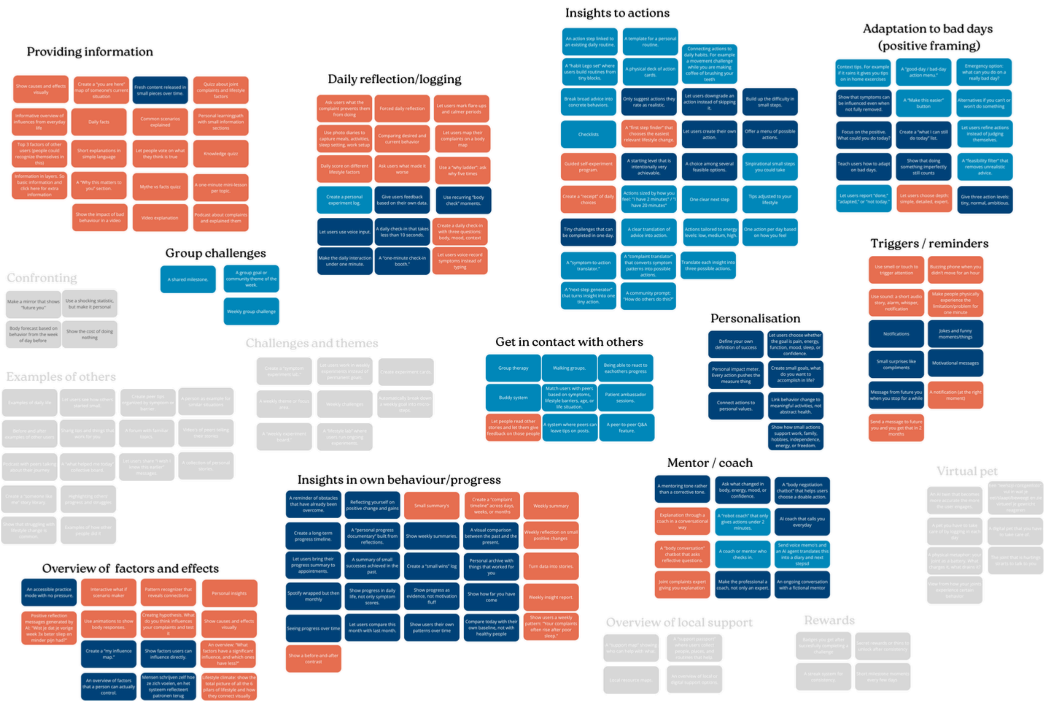


Figure 32: Overview of selected and non-selected idea clusters for the development of the service concept

For opportunity, the clusters *Insights to actions*, *Triggers and reminders*, *Get in contact with others*, and *Group challenges* were selected. These clusters help translate insight into concrete action and create opportunities for support. The app therefore includes small, feasible suggestions and reminders that help users apply insights in daily life. In addition, a community space was included where users can optionally join a group, connect with others, and participate in group challenges. This element remains optional, because not every user may want or need peer contact as part of their self-management process.

Together, these clusters formed the basis for the main service components: accessible information, personal tracking, visual insights, concrete action suggestions, continuous guidance through a digital coach, and an optional community layer. The concept therefore combines individual self-management with the possibility of social support, without making community participation a requirement.

The clusters *Confronting*, *Examples of others*, *Challenges and themes*, *Overview of local support*, *Virtual pet*, and *Rewards* were left outside the scope of the concept. These directions were not selected because they were less directly aligned with the main goal of the service: helping users understand their complaints, recognise personal patterns, and translate these insights into realistic self-management actions. Adding these clusters as separate functions would also risk making the service too complex and overloaded with features.

In addition, some of these clusters mainly addressed only one element of the COM-B model, rather than contributing to capability, motivation, and opportunity in a more integrated way. Other clusters contained interesting ideas, but not enough suitable directions yet to translate them into a coherent and fitting service component. For this reason, they were not developed further within the current concept, but could be reconsidered in a later design phase.

6.2 RESEARCH INTO EXISTING SERVICES

To develop a service that fits within the current landscape of lifestyle support and self-management, existing services were analysed as a design-oriented benchmark. The aim was not to create a complete market overview, but to understand which forms of support already exist for joint complaints, pain, movement, lifestyle change and self-management. This helped identify where current services fall short in relation to the design goal of this project, and where there is room for a more integrated and guided approach.

6.2.1 Method

Existing digital services were selected when they related to one or more of the following themes: joint complaints, physical activity, symptom monitoring, pain management, mental support, lifestyle guidance or self-management. This broad selection was chosen because the concept developed in this project is not limited to joint complaints alone, but also addresses the lifestyle factors and behaviour change processes around them.

The selected services were reviewed by looking at their main function, the type of support they offer, the lifestyle domains they address and the level of guidance they provide to the user. Based on this review, the services were grouped into four categories: exercise and movement apps, monitoring and information tools, mental support and pain management tools, and broader lifestyle approaches. An overview of the analysed services and their categories is shown in Figure 33.

6.2.2 Results

The analysis showed that most existing services focus on one specific part of lifestyle or self-management.

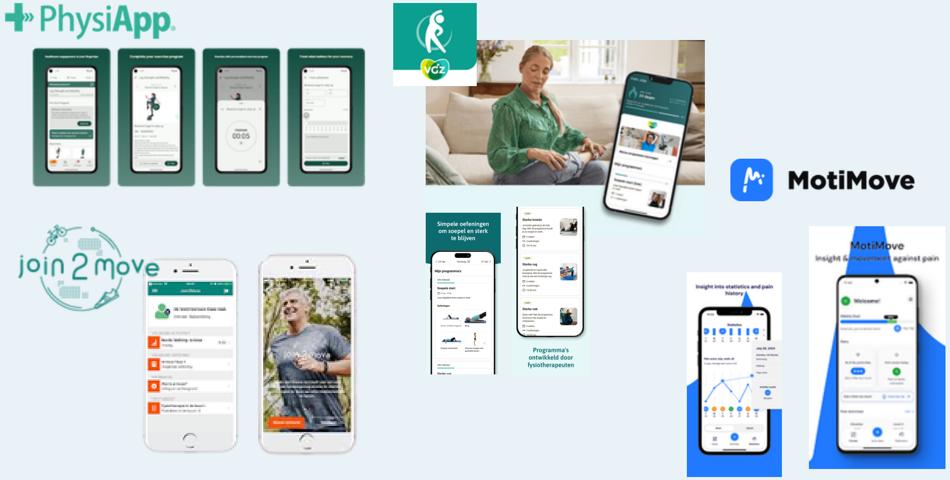
Exercise and movement apps, such as PhysApp, Join2Move, VGZ Soepel en Sterk Coach and MotiMove, mainly support users through exercise schedules, movement programmes or physical activity guidance. These services can help users become more active, but usually focus on movement as an isolated lifestyle domain.

Monitoring and information tools, such as SymptoMate, ArthritisPower and the Reuma? tool, help users track symptoms, prepare for consultations or share health data with care providers. They can create awareness, but often leave the interpretation of data and translation into concrete action to the user.

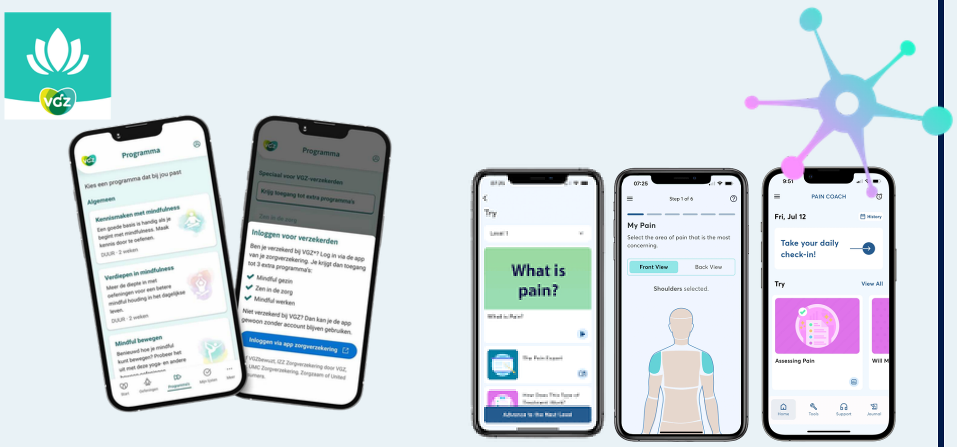
Mental support and pain management tools focus on coping with pain, relaxation or psychological support. These services can be valuable for people who experience pain in daily life, but are usually not connected to broader lifestyle behaviour or long-term self-management across multiple domains.

A smaller group of services takes a broader lifestyle approach, such as My Arthritis App and Plants for Health. These services come closer to the direction of this project because they combine lifestyle information with self-management support. However, they still rely heavily on users manually tracking, interpreting and applying information themselves.

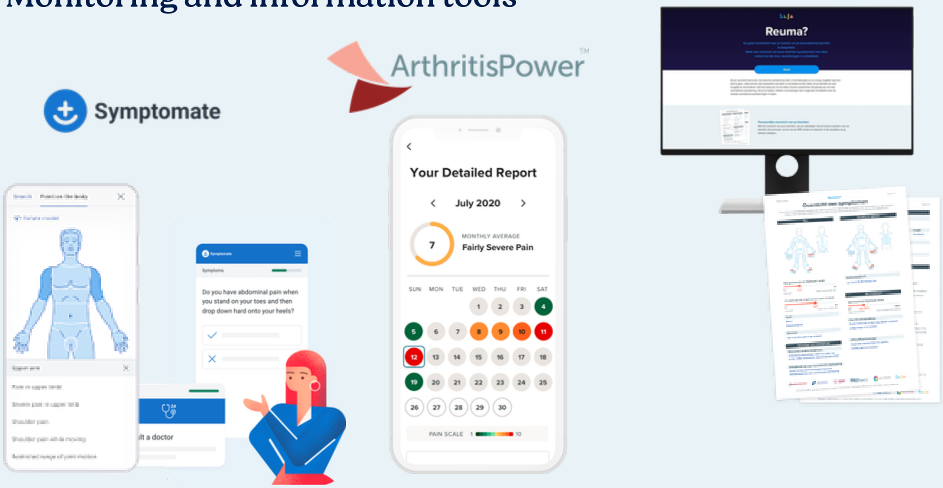
Exercise and movement apps



Mental support and pain management



Monitoring and information tools



Holistic approaches

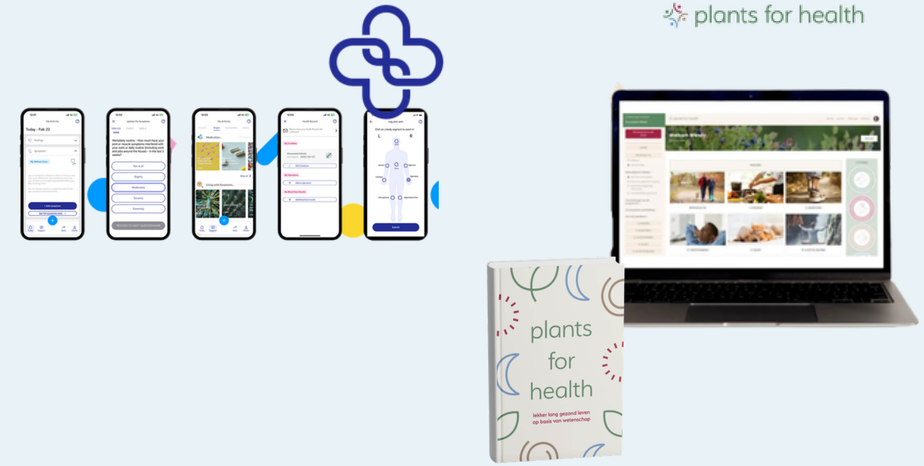


Figure 33: Overview of existing relevant services

6.2.3 Conclusion

The analysis shows that existing services already support relevant parts of the problem, but they often do so separately. They help users move more, track symptoms, understand pain or learn about lifestyle, but they rarely connect these elements into one coherent and actionable self-management experience.

This creates a gap between receiving information and knowing what to do with it in daily life. For people who are just starting to change their lifestyle, existing tools can therefore feel demanding, fragmented or difficult to sustain over time.

This insight shaped the direction of the service developed in this project. Instead of designing another standalone tracking or information tool, the service aims to bring the six domains of 'Het Leefstijlroer' (see Figure 34) together in one guided experience.

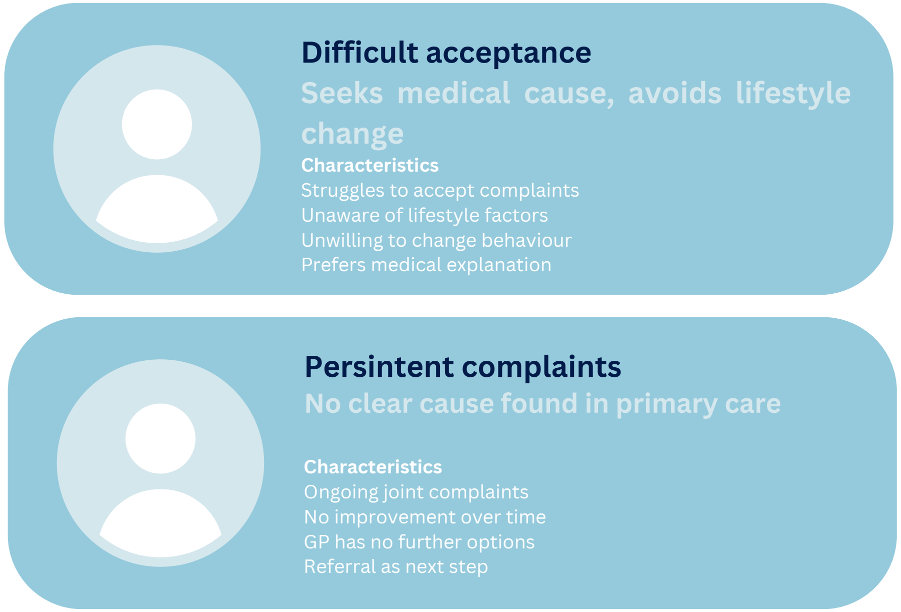
Figure 34: The six pillars of 'Het Leefstijlroer' (Vereniging Arts en Leefstijl, z.d.)

6.3 INTRODUCING JOINTLY

Based on the selected idea clusters and the research into existing services, the final concept was developed into Jointly: a digital service that supports people with non-inflammatory joint complaints in primary care. The service helps users better understand their complaints, recognise the role of lifestyle factors, and translate this understanding into small, feasible actions in daily life.

Jointly is positioned within primary care, before referral to secondary care is considered. Earlier in this research, it became clear that some patients with non-inflammatory joint complaints need support in understanding how lifestyle factors may relate to their complaints and what they can do themselves. This is especially relevant for patients with persistent complaints and patients who struggle to accept the role of lifestyle factors.

Figure 35: The Jointly logo



Difficult acceptance
Seeks medical cause, avoids lifestyle change
Characteristics
Struggles to accept complaints
Unaware of lifestyle factors
Unwilling to change behaviour
Prefers medical explanation

Persintent complaints
No clear cause found in primary care

Characteristics
Ongoing joint complaints
No improvement over time
GP has no further options
Referral as next step

Figure 36: Primary target profiles for Jointly

The target group of Jointly is therefore not defined only by a specific diagnosis, but by the type of support need patients have within the primary care pathway. Earlier in this research, 7 patient profiles were developed (see Figure 9, Chapter 2). Jointly is intended for two of those profiles, as illustrated in Figure 36. The first profile represents patients with persistent complaints. These patients continue to experience joint complaints over time, while no clear medical cause or specialist treatment need is identified in primary care. Because their symptoms persist and improvement remains limited, they may return to the GP with the same care question or start to see referral as the next logical step. For this group, Jointly can provide structure, guidance, and repeated support to help them explore what they can do themselves before specialist care becomes the default route.

The second profile represents patients with difficult acceptance. These patients may struggle to recognise the connection between lifestyle factors and their complaints, and may continue to search for a medical explanation or specialist solution. They may not yet see lifestyle change as a meaningful form of care, or may feel that self-management advice does not fully acknowledge the seriousness of their complaints. For this group, Jointly can make lifestyle factors more understandable, personal, and actionable, while supporting a more realistic understanding of what care can offer.

Both profiles represent patients for whom the current care pathway does not yet provide a sufficient answer. They do not necessarily need specialist rheumatology care, but they do need more than a single explanation or general lifestyle advice during the GP consultation. Jointly therefore focuses on patients who can be supported within primary care, but who need accessible guidance, practical tools, and long-term support to reflect on their behaviour, recognise patterns, and sustain lifestyle changes over time.

These profiles do not represent all patients with joint complaints. Jointly is only relevant for patients who can remain safely within primary care and for whom lifestyle factors may play a role. The service is not intended to replace diagnostic assessment, referral, or specialist treatment when these are needed. Patients with red flags, suspected inflammatory rheumatic disease, acute deterioration, or symptoms that require specialist assessment should still be referred according to existing clinical guidelines.

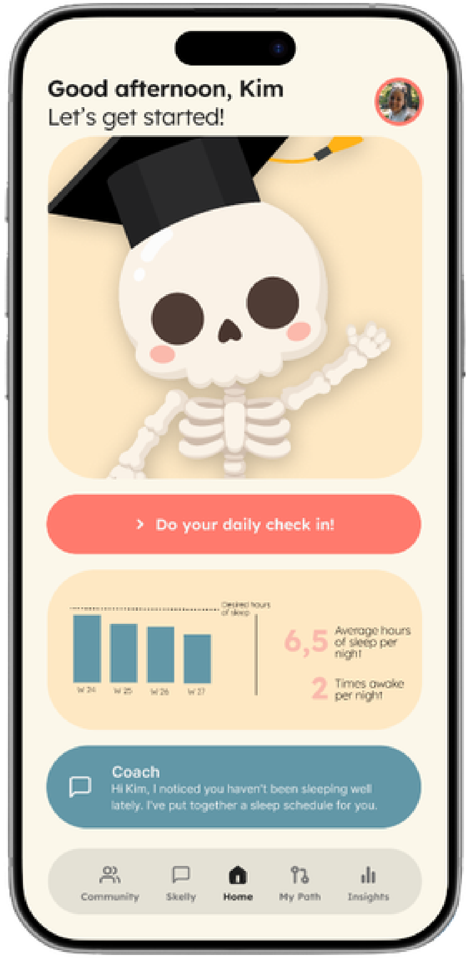
The choice for a digital service follows from the fact that the challenge is not only about providing information, but about helping users apply information over time. The analysis of existing services showed that many tools already support parts of the problem, such as movement, symptom tracking, pain management or lifestyle information, but rarely connect these into one coherent and actionable self-management experience.

A mobile application was chosen because it allows support to take place in the user's daily context, where self-management actually happens. Through diary input, personal insights, coaching, reminders and optional peer contact, the app can offer repeated and personal support without requiring continuous involvement from healthcare professionals. This fits the broader direction of healthcare, in which digital care is seen as a way to contribute to a more sustainable system without adding to the workload of healthcare professionals (Alblas et al., 2025). Research further supports this direction: a recent scoping review found that in 77% of studies, patients using a digital health platform reported improvements in their quality of life and ability to self-manage their chronic condition (Al Mahmud et al., 2026).

Jointly does not aim to replace a healthcare professional or provide a diagnosis. Instead, it offers accessible guidance that strengthens self-management and helps patients better understand what may influence their complaints. The following sections further describe the app, its core functionalities, how the service is used in practice, and its expected effect on the wider care system.

6.3.1 Concept overview

Jointly is a mobile application for people with non-inflammatory joint complaints who are supported within primary care. The app functions as a personal companion that helps users reflect on their complaints, recognise patterns and take small steps towards lifestyle change.



Good afternoon, Kim
Let's get started!

Coach
Hi Kim, I noticed you haven't been sleeping well lately. I've put together a sleep schedule for you.

Figure 37: Home page of Jointly

Scan to explore the interactive prototype.

Users share daily input about their complaints and relevant lifestyle factors, such as pain, stiffness, sleep, movement, stress and other possible influences. This input is translated into personal insights, after which the app suggests small actions that users can try in daily life.

The app is structured around the six domains of 'Het Leefstijlroer'. This creates holistic support instead of focusing only on pain or physical activity. A central element is Skelly, the skeleton character that guides users through the app, explains insights and connects daily actions to the personal goals users define during onboarding, such as walking longer distances, gardening or moving with more confidence.

Jointly also includes an optional community space where users can connect with others with similar complaints and participate in group challenges. Together, these elements support users from reflection to insight and from insight to action.

6.3.2 Core functionalities

The app consists of several core functionalities that together support the user in moving from awareness to action. Each functionality addresses a specific part of the service flow and contributes to one or more of the design values defined earlier in this report. These design values were used to translate the COM-B framework into concrete design choices within Jointly.

To make this connection explicit, each functionality is presented with a visual label. As shown in Figure 38, the colour indicates the related COM-B component: capability, motivation or opportunity. The accompanying title indicates the specific design value that the functionality supports, such as awareness, understanding, self-efficacy, engagement, actionability or social support. In this way, the description of each functionality does not only explain what the feature does, but also why it is relevant within the behavioural foundation of the concept.

The following sections describe the main functionalities of Jointly and explain how they contribute to a coherent self-management experience for people with non-inflammatory joint complaints.

Figure 38: Design values categorised and colour coded in the components of the COM-B model

Onboarding and personal goal setting

The onboarding consists of two parts. First, the user creates an account and fills in basic information, such as name, age, username and password. After this, Skelly welcomes the user and introduces itself as the personal guide within the app, explaining that it will help the user understand their complaints, reflect on lifestyle factors and take small steps towards personal goals.

The rest of the onboarding takes place as a conversation with Skelly. Instead of using a long digital form, the user is guided through a casual chat about daily life, joint complaints, routines, challenges and goals. During this conversation, the user defines one or more personal goals, focused on meaningful daily activities rather than abstract health outcomes. Examples include walking to the supermarket, gardening, cycling, climbing stairs more easily or moving with more confidence.

This functionality relates to motivation, specifically engagement. By starting with personal goals, the app connects the service to activities that matter to the user. Skelly makes the experience more personal and approachable, helping users stay involved because their input and actions are linked to meaningful outcomes. After the intake, Skelly introduces the main parts of the app, including the daily check-ins, insights, suggested actions and optional community space.

Personal lifestyle support for joint complaints

Welcome to Jointly!
Let's get started!

In collaboration with
Arts en Leefstijl
Voor de zorg van morgen

Hi! I am Skelly
I'll help you better understand your symptoms and support you step by step.

Before we start, I'd like to get to know you a little better.

Figure 39: Start of onboarding in Jointly

AI coach (Skelly)

Skelly is the main point of interaction within the app. It guides users through daily check-ins, helps interpret personal data and translates insights into concrete suggestions. Skelly does this in a supportive and accessible way, using positive language and focusing on what is still possible. Besides coaching the user, Skelly also helps with navigation by explaining where to find features, what pages are used for and what the user can do next.

The coach has several roles. First, it helps users reflect on their complaints through simple questions. Second, it summarises what the user has shared, making their situation more visible and easier to understand. Third, it explains patterns in understandable language, for example by connecting sleep, movement, stress or pain levels. Finally, it suggests small actions that fit the user's situation and personal goals.

This functionality relates to motivation, specifically engagement. Skelly acts as a recognisable guide throughout the app and makes the service feel more personal and approachable. By giving feedback, encouragement and clear next steps, Skelly helps users stay involved over time. The character also creates continuity, because users meet the same guide across different parts of the service.

However, the role of Skelly has clear boundaries. Skelly does not provide diagnoses, treatment advice or medical decision-making. Its role is limited to lifestyle support, reflection and small behavioural suggestions within predefined safety boundaries.

When users report symptoms that may require medical attention, such as worsening pain, sudden changes or persistent complaints, Skelly should not interpret these independently. Instead, it should advise the user to contact a GP or medical specialist. This ensures that Skelly can support self-management while respecting the limits of an AI-based lifestyle coach.

Motivation

Engagement

Figure 40: Skelly's face

Diary input

A key function of the app is the daily diary. Through this diary, users briefly record how they are doing and what may have influenced their complaints that day. The diary is intended to be completed daily, but the amount of input can differ depending on the user's time, energy and situation.

The diary takes place as a conversation with Skelly. Skelly asks about complaints and lifestyle factors, such as pain, stiffness, movement, sleep, relaxation, nutrition, substance use and social connection. When useful, Skelly asks follow-up questions to better understand the user's situation. This helps the app recognise meaningful patterns over time.

This functionality relates to capability, specifically awareness. By regularly reflecting on their complaints and lifestyle factors, users are encouraged to notice how they are doing and what may influence their symptoms. Because the diary is designed as a conversation with Skelly, reflection becomes part of a simple daily interaction rather than a demanding form.

The diary should remain low effort and flexible. Users can type in a chat, record a voice memo or choose to be called by Skelly. The phone-based option lowers the threshold for users who are less comfortable with digital interfaces. Users can also set reminders or choose a fixed call moment, so the check-in can become part of their daily routine. If users have little time or energy, a short check-in is sufficient and Skelly can return to certain topics later.

Capability

Awareness

Hi Kim, how was your day today?

That's too bad you did not sleep well, Can you give me more details about your sleep routine? Like if you woke up during the night, what did you do before going to bed?

I've put together a sleep schedule for you and some tips to improve your evening routine before going to bed.

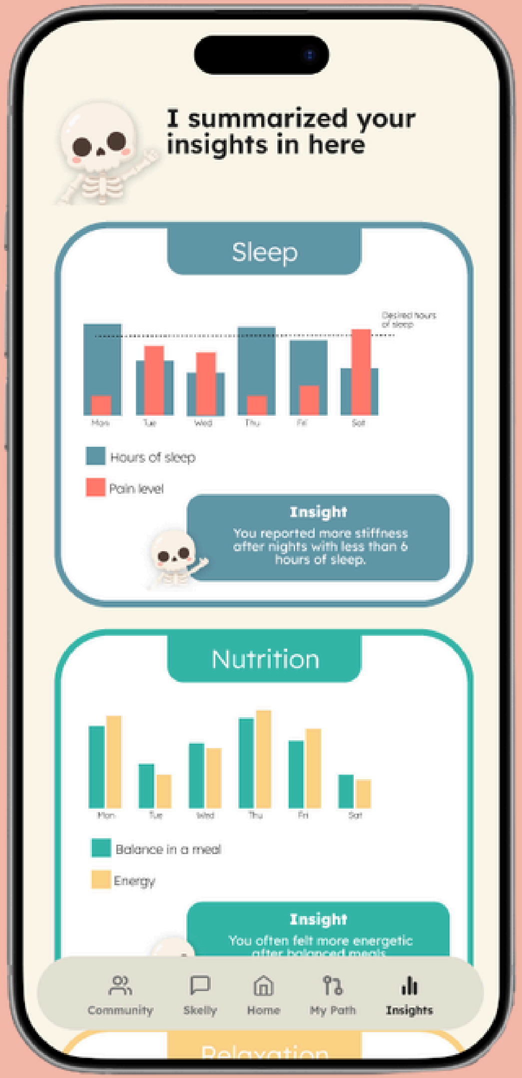
I remembered you mentioned you were feeling a little stressed about your master thesis project lately, did my tips about relaxation help you?

Yes I tried them out, the breathing exercise helped me through the stressful moments. And doing something I enjoy at least once a day helped me feel less stressed throughout the day.

Figure 41: Chat with Skelly in Jointly

Capability

Understanding



I summarized your insights in here

Insight
You reported more stiffness after nights with less than 6 hours of sleep.

Insight
You often felt more energetic after balanced meals

Figure 42: Insights page of Jointly

Personal insights

The personal insights section translates the user's diary input into clear and concrete feedback. The insights are organised around the six domains of 'Het Leefstijlroer'. Which insights are shown depend on the information the user has shared, making them based on the user's own input over time.

The data is often visualised through graphs or simple summaries that show patterns across diary entries. For example, sleep data can be compared with pain or stiffness levels across the week. The graph shows the pattern, while Skelly translates this into an understandable conclusion and explains what it may mean in daily life.

This functionality relates to capability, specifically understanding. The insights help users connect their complaints to lifestyle factors such as sleep, movement, relaxation, nutrition, substance use and connection. By presenting this information in a clear and structured way, the app supports users in recognising possible relationships between their behaviour, context and complaints.

The feedback should be specific, concrete and easy to act on. Instead of only showing that pain levels changed over time, the app explains what this change may relate to, such as less sleep, lower movement, more stress or changes in routine. Each insight is accompanied by a short explanation from Skelly and a small next step the user could take. This makes the insights accessible for users with different levels of digital skills, health literacy and capacity for self-management.

My path

My Path is the part of the app where personal insights are translated into concrete tips and small lifestyle actions. These actions are connected to the six domains of 'Het Leefstijlroer' and are based on what the user has shared in the daily diary. Based on recognised patterns, Skelly suggests small steps that fit the user's current situation, goals and capacity.

This functionality relates to both opportunity and motivation. It supports actionability by translating insights into specific actions that can be tried in daily life. Instead of only showing a pattern, the app suggests what the user could do next and explains why this action may be relevant. For example, a sleep-related insight can be translated into a daily focus, such as putting the phone away 30 minutes before bed.

At the same time, My Path supports self-efficacy. By focusing on small and manageable steps, the app helps users experience that their own actions can influence their situation. This is especially relevant for users whose symptoms fluctuate or who have limited energy on certain days. The focus can change each day and is adapted to what feels realistic at that moment.

Users can choose whether they want to set a reminder for their daily focus. Tips can also be opened for more information, where Skelly explains why the action was suggested, how it may relate to the user's complaints and what smaller alternative could be tried on a difficult day. This helps users understand, adapt and apply the advice in a way that fits their daily life.

Opportunity

Actionability

Motivation

Self efficacy

I summarized your tips in here

Your sleep has been more restless this week. Here is a simple sleep plan for you.

20:00 Drink a cup of tea
21:00 Dim the lights
21:30 Read a book
22:00 Do a breathing exercise
22:30 Go to bed

Tip

Try to avoid using screens for at least 2 hours before bedtime

Today's focus

Put your phone away 30 minutes before bed

Remind me tonight ☐

Try to avoid using screens for at least 2 hours before bedtime.

Why?

Screens can make it harder for your body to prepare for sleep. Phones, tablets and televisions give off bright light and keep your brain active. This can make it more difficult to relax, fall asleep and sleep deeply.

Your diary shows that your sleep has been more restless lately. Creating a calmer evening routine may help your body recognise that it is time to slow down.

What can you do instead?

You do not have to stop everything at once. Start with one small step. Try putting your phone away 30 minutes before going to bed. You can use that time to read, drink a cup of tea, listen to calm music or do a short breathing exercise.

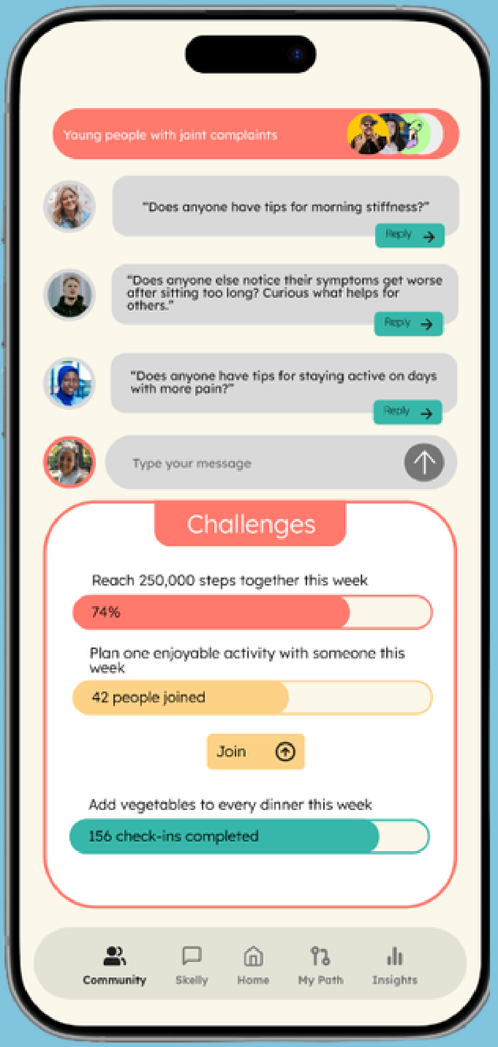
Remember!

A better sleep routine does not need to be perfect. Small changes in the evening can already help your body and joints recover better during the night.

Figure 43: My Path page of Jointly

Opportunity

Social support



Young people with joint complaints

"Does anyone have tips for morning stiffness?"

"Does anyone else notice their symptoms get worse after sitting too long? Curious what helps for others."

"Does anyone have tips for staying active on days with more pain?"

Challenges

Reach 250,000 steps together this week

74%

Plan one enjoyable activity with someone this week

42 people joined

Add vegetables to every dinner this week

156 check-ins completed

Figure 44: Community page of Jointly

Community

The community function is an optional part of the app. Users can choose to join a group where they connect with others who have similar joint complaints or goals. Within this space, users can ask questions, share experiences and exchange practical tips. This can provide recognition, encouragement and a sense of not having to manage complaints alone.

This functionality relates to opportunity, specifically social support. By offering peer contact and group challenges, the community creates opportunities for users to feel supported by others in similar situations. The challenges are designed to motivate users to work on small lifestyle actions together, such as reaching a step goal or completing a healthy habit during the week.

Because not every user wants social interaction as part of self-management, participation remains fully optional. Users stay in control of their visibility and participation, for example by choosing whether they actively post, only read along or remain anonymous. Clear moderation and boundaries are needed to prevent misinformation or inappropriate advice.

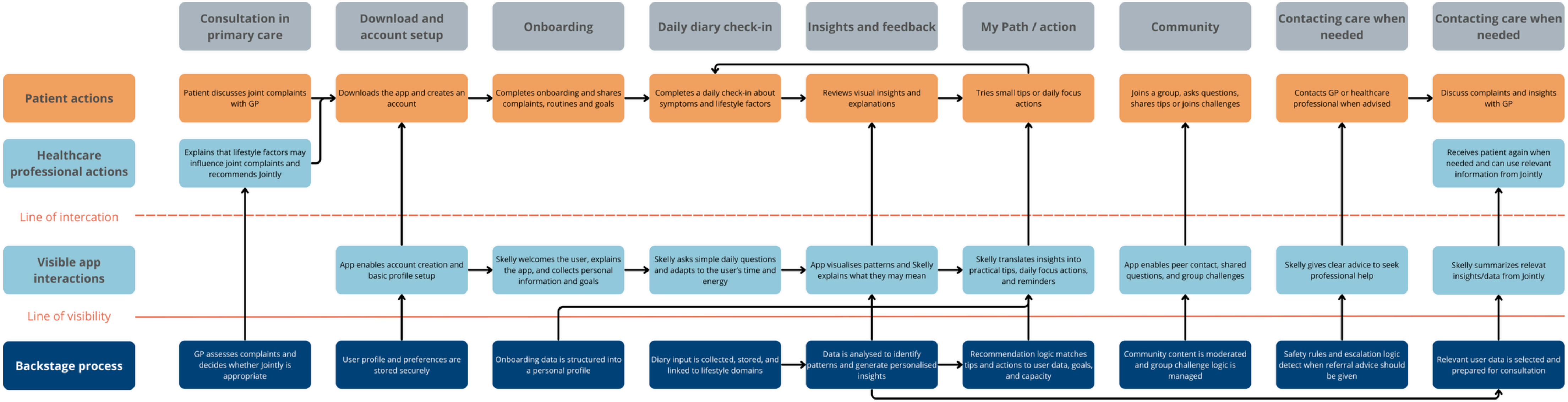
6.3.3 How Jointly is used in practice

To visualise how Jointly works in practice, a service blueprint was made (Figure 45). The blueprint maps the journey from the first GP consultation to follow-up, showing patient actions, healthcare professional actions, app interactions and backstage processes. A QR code on this page links to a short video demonstrating how the app is used.

Jointly is introduced when the GP has sufficient diagnostic certainty that immediate referral is not needed. After downloading the app, the user completes an onboarding conversation with Skelly about complaints, routines and personal goals, after which the app supports daily use through the diary, insights and My Path.

When complaints worsen, Skelly encourages the user to contact their GP or another healthcare professional. In this way, Jointly supports lifestyle-based self-management while remaining clearly positioned within the boundaries of primary care.

Scan the QR code to watch a short usage video of Jointly.



	Consultation in primary care	Download and account setup	Onboarding	Daily diary check-in	Insights and feedback	My Path / action	Community	Contacting care when needed	Contacting care when needed
Patient actions	Patient discusses joint complaints with GP	Downloads the app and creates an account	Completes onboarding and shares complaints, routines and goals	Completes a daily check-in about symptoms and lifestyle factors	Reviews visual insights and explanations	Tries small tips or daily focus actions	Joins a group, asks questions, shares tips or joins challenges	Contacts GP or healthcare professional when advised	Discuss complaints and insights with GP
Healthcare professional actions	Explains that lifestyle factors may influence joint complaints and recommends Jointly								Receives patient again when needed and can use relevant information from Jointly
Line of intercation									
Visible app interactions		App enables account creation and basic profile setup	Skelly welcomes the user, explains the app, and collects personal information and goals	Skelly asks simple daily questions and adapts to the user's time and energy	App visualises patterns and Skelly explains what they may mean	Skelly translates insights into practical tips, daily focus actions, and reminders	App enables peer contact, shared questions, and group challenges	Skelly gives clear advice to seek professional help	Skelly summarizes relevat insights/data from Jointly
Line of visibility									
Backstage process	GP assesses complaints and decides whether Jointly is appropriate	User profile and preferences are stored securely	Onboarding data is structured into a personal profile	Diary input is collected, stored, and linked to lifestyle domains	Data is analysed to identify patterns and generate personalised insights	Recommendation logic matches tips and actions to user data, goals, and capacity	Community content is moderated and group challenge logic is managed	Safety rules and escalation logic detect when referral advice should be given	Relevant user data is selected and prepared for consultation

Figure 45: Service blueprint of Jointly

6.3.4 Expected impact of Jointly

The expected impact of Jointly was explored by mapping the service back onto the cause-and-effect diagram developed earlier in this report. The first cause-and-effect diagram described the current system and showed how different themes reinforce the inflow of patients with non-inflammatory joint complaints into rheumatology care. The new impact map, shown in Figure 46 on page 106, visualises how Jointly is expected to influence these same themes.

The map should be read as a hypothetical system map. It does not prove that these effects will occur in practice, but shows how the service is expected to intervene in the system based on the findings from this research. The arrows indicate the expected direction of influence. The meaning of the different arrows is explained in the legend in Figure 46. The expected impact is described below according to the four main themes in the map.

Primary care as a powerful filter for the right care at the right place

Within the primary care theme, Jointly is expected to strengthen the GP's role in guiding patients towards the right care pathway. The app gives the GP a concrete option to offer when specialist rheumatology care is not immediately indicated, but when the patient still needs support in understanding and managing their complaints. Instead of lifestyle advice remaining a general recommendation, Jointly turns this advice into a follow-up pathway that patients can continue at home.

In this expected pathway, the GP introduces Jointly during or after the consultation and explains how lifestyle factors may influence joint complaints. This can help patients leave the consultation with a clearer understanding of what they can do themselves and where they can find support. As a result, the GP consultation becomes not only a moment of assessment, but also a starting point for guided self-management.

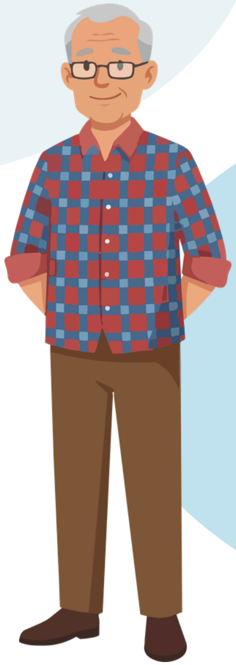
Several conditions are important for this effect. The GP needs to be aware of Jointly, believe in the relevance of lifestyle factors, and see the app as a useful and credible addition to primary care. The patient and GP also need to reach a mutual understanding. This requires sufficient diagnostic clarity and effective communication, so the patient understands why Jointly is a suitable next step and does not experience the advice as a dismissal of their complaints.

Bridging the gap between patient expectations and what care can offer

Within the theme of patient expectations, Jointly is expected to increase patients' awareness of their own impact on symptoms. When patients better understand how lifestyle factors may influence their complaints, they may also develop a more realistic understanding of what care can offer. This does not mean that their complaints are minimised, but that they are given a clearer and more actionable explanation of what can be influenced outside specialist care.

This may reduce the expectation that improvement can only be achieved through diagnosis or treatment by a rheumatologist. By giving patients a concrete pathway for self-management, Jointly may help them feel more sufficiently supported within primary care.

In this way, the app may contribute to a better match between patient expectations and the type of care that is appropriate for their situation.



The patient as the most powerful factor in their own recovery

The most direct expected impact of Jointly is found within the patient theme. Jointly aims to support patients in becoming more active participants in managing their joint complaints. By using the app, patients are expected to gain a better understanding of the possible relationship between their symptoms and lifestyle factors. They can also develop practical skills and receive guidance to apply this knowledge in daily life.

The app supports this through diary input, personal insights, coaching, reminders and optional peer contact. These functions are expected to help patients recognise patterns, experiment with small lifestyle changes, and maintain these changes over time. When patients succeed in making sufficient lifestyle changes, their symptoms may improve, or they may find it easier to accept chronic or persistent complaints.

This expected effect depends on several patient-related conditions. Patients need to be open to addressing lifestyle factors, willing to reflect on their own behaviour, and able to commit to a longer-term process of change. These conditions are important because lifestyle change requires repeated effort and usually does not lead to meaningful improvement within a short period of time.

Working smarter within the boundaries of a financially constrained system

The final expected impact is situated in the specialist care system. If Jointly supports patients with non-inflammatory joint complaints earlier in the pathway, fewer patients may need to be referred to rheumatology without a clear need for specialist treatment. This would reduce avoidable demand for specialised care.

If this effect occurs on a large scale, it could lead to a smaller and more carefully selected patient population within the rheumatology department. This would also reduce the number of unexpected cases that need to be fitted in between regular appointments. This could reduce waiting times, lower workload for rheumatologists, and create more time for patients who do require specialist care.

The main expected system impact of Jointly is that fewer patients with non-inflammatory joint complaints will be referred to rheumatology when specialist care is not necessary. By offering structured support within primary care, Jointly may help answer part of the patient’s care question earlier in the pathway. Patients who better understand their complaints, feel supported in taking action, and experience improvement or acceptance may be less likely to return to the GP with the same unresolved question. As a result, referral to secondary care may become less likely for this group.

Through this mechanism, Jointly may contribute to a more appropriate use of rheumatology care. Its impact does not come from creating additional specialist capacity, but from reducing avoidable inflow before it reaches the department. If fewer patients are referred without a clear need for specialist treatment, the patient population within rheumatology may become more focused on those who do require specialist care. This could indirectly reduce waiting times and workload, while creating more time for patients with inflammatory or complex rheumatic conditions. These broader effects remain hypothetical and would need to be evaluated in future implementation research.

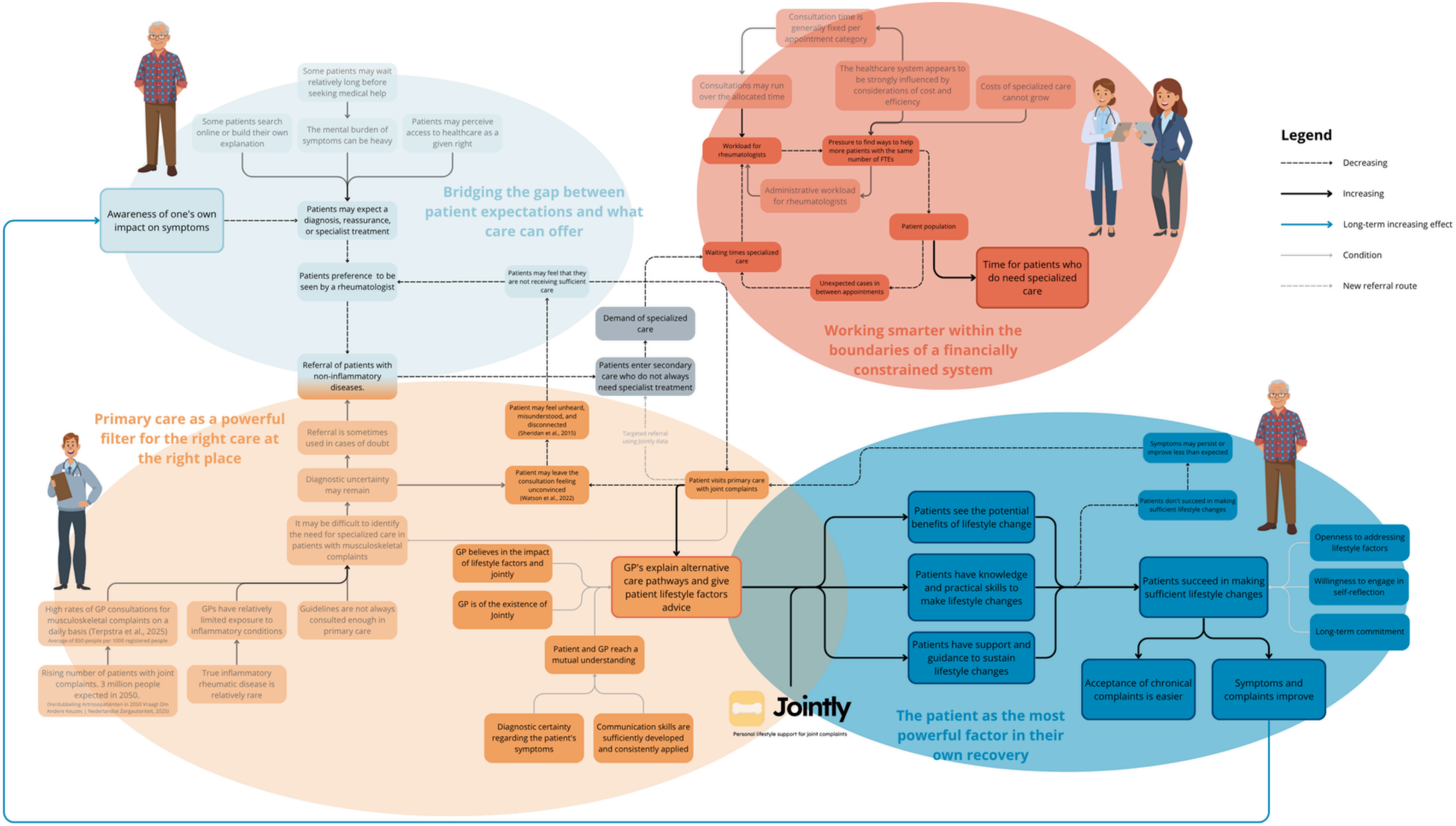
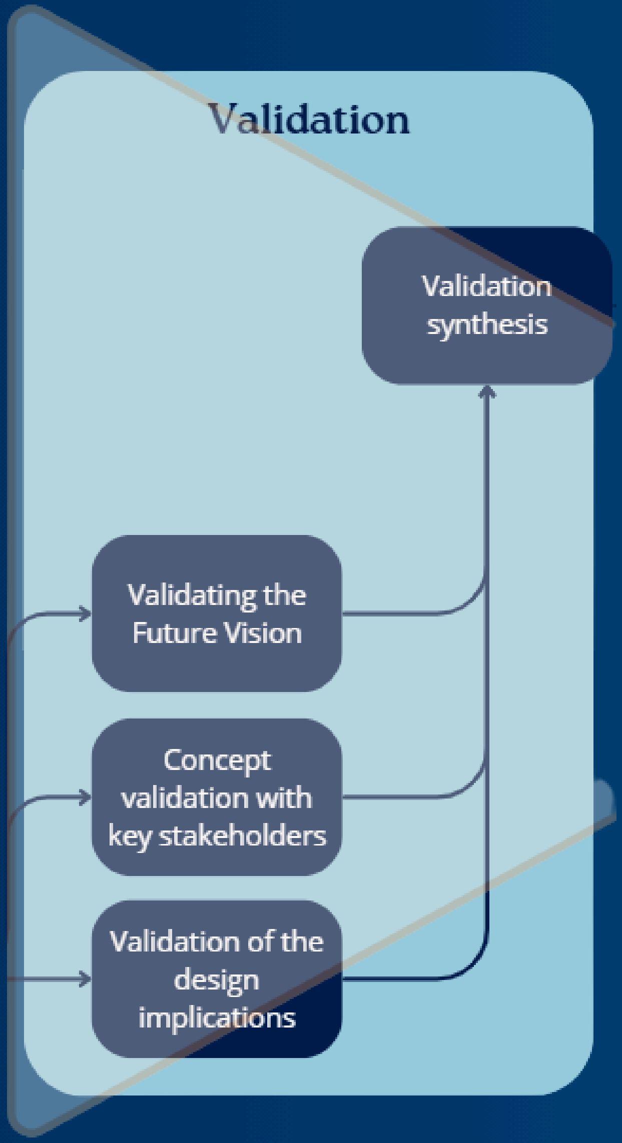


Figure 46: Impact of 'Jointly' mapped in the cause and effect diagram

Chapter 7

VALIDATION

This chapter critically reflects on the developed concept through three validation steps, creating a foundation for the recommendations. First, the concept is evaluated against the design implications that emerged from the research phase. The chapter then presents a stakeholder validation with a patient living with joint complaints and two general practitioners. This validation explores whether Jointly is perceived as understandable, relevant and feasible from both a patient and primary care perspective. Finally, the chapter evaluates how the concept contributes to the future vision developed in chapter five.



7.1 VALIDATION OF THE DESIGN IMPLICATIONS

7.1.1 Method

To evaluate whether the final design remained grounded in the research findings, all design implications from the preceding chapters were collected and reviewed. This step was used as a traceability check between the research phase and the final concept. Because the project moved from a broad system analysis towards one focused design direction, it was important to examine whether the final service still addressed the main insights and tensions identified earlier in the project.

The collected design implications were clustered based on recurring themes and translated into a set of requirements and wishes. Requirements represent conditions the design must fulfil to be considered a meaningful response to the identified challenges. Wishes represent qualities that could strengthen the design, but are not essential for the concept to function.

The final design of Jointly was then reviewed against these requirements and wishes. This made it possible to assess which research-based criteria were clearly addressed by the concept, which were only partly addressed, and which remained open for further development. This validation does not demonstrate effectiveness in practice, but evaluates the internal consistency between the research findings, the design direction and the final concept.

Requirements

7.1.2 Results

The clustering of design implications resulted in a set of requirements and wishes. These were used to evaluate the extent to which the final concept responds to the insights gathered throughout the research.

Requirements

- *The design must fit within the existing structure of Dutch primary care and respect the gatekeeping role of the general practitioner.*
  The concept is positioned around the role of the general practitioner and acknowledges primary care as the first point of access within the Dutch healthcare system. Initial validation with general practitioners showed that they recognise potential value in the concept, particularly in supporting patients before further referral. However, further research is needed into how the concept could be implemented in practice, who would take ownership, how it would be developed, and how it would be financed within the existing healthcare system.

- *The design must support patients in better understanding their complaints and the relationship with lifestyle factors, enabling them to take a more active role in their own recovery.*
  This requirement is strongly reflected in the final design. The concept is built around a coaching approach that helps patients observe their complaints, reflect on possible lifestyle-related influences, and become more aware of patterns in their symptoms.

By guiding patients to actively engage with their complaints, the design supports a more active role in their own recovery. However, long-term research would be needed to evaluate whether patients continue to use the concept over time and whether it leads to meaningful outcomes.

- *The design must be accessible to a diverse patient population, accounting for differences in age, health literacy, and digital skills.*
  Accessibility was considered in the design through features such as the voice memo function and the possibility of telephone contact. These choices were made to make the concept more approachable for patients with different levels of digital skill. However, the actual usability and accessibility of the app have not yet been extensively tested with a diverse patient population. Further user testing is needed to determine whether different patient groups understand and use the app as intended.

- *The design must address the waiting period between referral and diagnosis, supporting patients during this time by offering a sense of direction and control.*
  The concept is designed to be used during the waiting period between referral and diagnosis. It gives patients a way to actively engage with their complaints while they are waiting, instead of remaining passive during this period. By helping patients track, reflect on, and better understand their symptoms, the design aims to provide a sense of direction and control. Further validation would be needed to assess whether patients actually experience this increased sense of control in practice.

Wishes

- *The design would ideally support patients across multiple moments in the care pathway, rather than at a single isolated touchpoint.*
  The current concept mainly focuses on the moment after a patient has visited the general practitioner. However, the design also has potential to be used at other moments in the care pathway, such as before visiting the general practitioner, after consultation with a rheumatologist, or for other patient groups with similar needs. Further exploration is needed into how patients could come into contact with the concept earlier in their care journey.

- *The design would ideally contribute to better alignment between patient expectations and what care can realistically offer.*
  The concept may contribute to more realistic expectations by helping patients understand their complaints and what they can do themselves. By increasing patients' insight into their own role, the design could support a better understanding of what professional care can and cannot offer. However, this effect would need to be evaluated over a longer period of time, as changes in patient expectations are unlikely to become visible immediately.

- *The design would ideally support general practitioners in assessing and monitoring joint complaints, reducing the likelihood of unnecessary referrals.*
  The design has the potential to support general practitioners by providing more insight into the development of a patient's complaints over time.

If a patient has used the app for a longer period without improvement, the collected insights could help the general practitioner make a more targeted decision about referral. However, this still needs to be tested in practice. Further validation is required to determine which types of data would be useful for general practitioners and whether the concept actually supports decision-making.

▶ *The design would ideally fit within existing financial and organisational frameworks, making implementation realistic.*
This wish has not yet been fully addressed. Further development is needed to determine how the concept could be organised, financed, developed, and maintained. Questions around ownership and implementation remain open. Although initial conversations about these aspects are taking place, they fall outside the scope of the current project and require further exploration after its completion.

7.1.3 Conclusion

The evaluation shows that the final concept addresses the main design implications to a meaningful extent. Its strongest contribution lies in supporting patients in better understanding their joint complaints and their possible relationship with lifestyle factors. By encouraging patients to observe, reflect on, and actively engage with their symptoms, the design supports a more active role during the care pathway.

The concept also responds to the waiting period between referral and diagnosis by offering patients a sense of direction and control during a time that is often characterised by uncertainty. However, several aspects still require further validation. The accessibility of the app for a diverse patient population, its long-term value for patients, and its usefulness for general practitioners in supporting referral decisions all need to be tested in practice.

In addition, the implementation of the concept remains an important point for further development. Questions around ownership, financing, development, and integration within existing healthcare structures have not yet been fully resolved. Overall, the concept can be seen as a promising design direction, but not yet as a fully validated intervention. Further user testing, long-term evaluation, and implementation research are needed to determine its feasibility and impact in real healthcare settings.

7.2 CONCEPT VALIDATION WITH KEY STAKEHOLDERS

7.2.1 Method

To evaluate the perceived value, feasibility and implementation potential of Jointly, concept validation sessions were conducted with one patient participant and two general practitioners. This validation was chosen because the concept affects both sides of the primary care pathway: patients are the intended users of the service, while general practitioners may play an important role in introducing or recommending it. The aim was therefore not to test clinical effectiveness or long-term behaviour change, but to understand whether the concept was perceived as relevant, understandable and realistic by key stakeholders.

The patient participant was a 53-year-old woman with osteoarthritis who experiences frequent joint complaints. She was selected because she could reflect on Jointly from the perspective of someone living with joint pain and daily limitations. The two general practitioners were selected because they could evaluate whether the concept could fit within primary care. One reflected from the perspective of everyday general practice, while the other also brought expertise as a GP with a special interest in musculoskeletal care and as a GP trainer.

All sessions followed a similar structure. Participants were first introduced to the aim of Jointly and the main findings that shaped the concept. They were then shown the main parts of the app, including onboarding, the role of Skelly, diary input, personal insights, lifestyle tips, reminders, the optional community function and the possible use of summaries for communication with healthcare professionals. Rather than testing detailed usability tasks, the sessions focused on how participants interpreted the concept, what value they saw in it and under which conditions it could work in practice.

Semi-structured interview questions were used to guide the conversations while leaving room for participants to elaborate on their own concerns and reflections. The questions focused on different aspects depending on the stakeholder perspective. The patient session focused on fit with daily life, the value of daily input and personal insights, motivation for long-term use, trust in the AI coach and the optional community function. The GP sessions focused on the role of the GP, fit within consultation routines, patient safety, scientific credibility, data sharing, workload and implementation within primary care. The interview questions used during the sessions can be found in Appendix Q.

Where permission was given, the sessions were audio recorded and transcribed. The transcripts can be found in Appendix R and S. The findings were reviewed qualitatively and clustered into recurring results related to perceived value, feasibility, motivation, trust, safety and implementation. Because of the small number of participants, the results should be understood as first concept validation rather than as evidence of effectiveness or general acceptance.

7.2.2 Results

The results are presented separately for the patient participant and the general practitioners. This distinction was made to keep clear which insights came from which stakeholder group, as both groups evaluated the concept from a different position in the care pathway.

Patient perspective

Clear and approachable concept

The participant responded positively to the overall concept and described the app as clear, user-friendly and easy to understand. The different input options, such as typing, speaking or being called, were seen as accessible because they allow users to choose the method that fits their own abilities and situation.

Personal insights are the main value

The personal insights were perceived as one of the strongest parts of Jointly. The participant recognised that complaints can be influenced by factors such as sleep and movement, but explained that these connections are easy to overlook in daily life. Visualising patterns over time could therefore help users better understand what influences their complaints.

Insight needs to become action

The participant valued the translation from insight to concrete lifestyle tips. She indicated that she would be willing to work on lifestyle factors if the app made the potential benefit visible and helped her understand what small actions could make a difference in daily routines.

Long-term use depends on routine and visible benefit

The participant could imagine using the app over a longer period of time, but only if use remained low effort and became part of a fixed routine. She estimated that ten to fifteen minutes per day would be acceptable. Reminders at a chosen moment and visible progress were considered important for sustained motivation.

Community should remain optional

The community function was received with some hesitation. The participant did not immediately feel a strong personal need for peer contact, but later recognised that exchanging practical experiences and encouragement could be valuable. This supports the decision to keep the community function optional.

Trust depends on credible support

The participant mentioned trust as an important condition for use. She suggested that the app should be introduced or supported by trusted professionals or organisations, such as GPs, rheumatologists, physiotherapists, lifestyle coaches or patient organisations. Affordability was also mentioned as a condition for long-term use.

General practitioner perspective

Useful support step within primary care

Both GP's recognised potential value in Jointly as a supportive self-management tool for patients with joint complaints. They saw the concept as relevant for patients who do not immediately need specialist care, but who do need more guidance than a single consultation can provide.

Supportive, not mandatory

The GP's discouraged making Jointly a mandatory step before referral. This could undermine patient motivation and make the app feel like a barrier to care. They considered the concept more suitable as supportive guidance that can be offered when lifestyle-related self-management is appropriate.

Clear positioning is essential

The GP's emphasised that Jointly should only be introduced when there is sufficient diagnostic certainty that immediate referral is not needed. The app should not replace clinical assessment, but should function as a follow-up option for patients who can safely remain within primary care.

No additional workload for GPs

Both GP's stressed that they do not have time to interpret extensive app data during consultations. If information from Jointly is shared with a healthcare professional, it should be presented as a short and concrete summary of relevant patterns, concerns and possible next steps.

Behaviour change requires continuity

The GP's highlighted that many patients can start behaviour change, but struggle to maintain it. Jointly could add value by functioning as a digital buddy that supports patients beyond the consultation. Advice should be small, achievable and adjustable to the user's situation.

Expectation management is needed

One GP pointed out that lifestyle change can temporarily increase symptoms, for example when patients start moving more. Jointly should explain what users can realistically expect during behaviour change, so that temporary discomfort is not misinterpreted as a warning sign or reason to stop.

Safety and scientific credibility are conditions for trust

Both GP's stressed that Jointly should not make medical claims or provide diagnostic advice. The AI coach should stay within clear safety boundaries, refer users to a doctor when symptoms worsen or change, and rely on medically reliable content that is aligned with guidelines and validated by trusted organisations.

Implementation requires trusted channels

Stand-alone promotion was considered ineffective, because GP's already receive many tools and interventions. Jointly would need to become visible through trusted and integrated channels, such as patient portals, GP systems, professional associations, patient organisations or health insurers.

7.2.3 Conclusion

The validation with the patient participant and general practitioners suggests that Jointly is a promising concept, but not yet a fully validated intervention. The patient validation confirmed that the core mechanism of Jointly, moving from daily input to personal insight and from insight to action, is understandable and valuable for someone living with joint complaints. The GP validation showed that the concept also has potential within primary care, especially as an additional support option for patients who do not immediately require referral to secondary care.

At the same time, both validations point to important conditions for further development. For patients, the app must remain low effort, personally relevant, trustworthy and useful over time. For general practitioners, Jointly must be safe, scientifically credible, clearly positioned and should not add workload. The AI coach must therefore stay within clear boundaries, provide evidence-based lifestyle support and refer users back to medical care when needed.

Overall, the validations support the relevance of Jointly as a guided self-management tool within primary care. However, further research is needed with a larger and more diverse patient group, including users with lower digital skills, lower health literacy and less initial motivation for lifestyle change. Further testing with primary care professionals is also needed to determine how Jointly can be introduced, what information should be shared with GPs, and how the service can be responsibly embedded within existing healthcare structures.

7.3 VALIDATING THE FUTURE VISION

7.3.1 Method

To evaluate how the final concept relates to the future vision developed in Chapter 5, a contribution mapping approach was used. This validation was chosen because the future vision describes a desired direction for the wider care pathway, while Jointly only addresses one specific part of that system. The aim was therefore not to prove whether Jointly could realise the full future vision, but to assess which parts of the vision the concept contributes to directly, indirectly, or not at all.

The future vision was first divided into its main moments and conditions, following the structure of the narrative. Each element was then compared with the functions and intended role of Jointly. For every element, the level of contribution was classified as direct, indirect, or outside scope. A direct contribution means that Jointly addresses the element through one or more of its current functions. An indirect contribution means that Jointly may support the conditions needed for that element, but that other actors, structures or interventions are also required. Outside scope means that the element is not addressed by Jointly and falls beyond the intended role of the concept.

This method made it possible to evaluate the concept in relation to the broader system ambition, while also making its boundaries explicit.

It helped clarify where Jointly offers a meaningful contribution, where its effect remains dependent on other parts of the care pathway, and where additional interventions would be needed to move closer to the future vision.

7.3.2 Results

The future state describes seven distinct elements across the care pathway. These are evaluated below in the order they appear in the narrative.

Technology supports the GP before and during the consultation

The future vision describes technology as a support for the GP, creating more space for genuine contact with the patient. Jointly does not directly address this, because the app operates mainly outside the consultation. However, if a patient has already used Jointly before an appointment, the collected insights could provide a concise overview of daily patterns and complaints, making relevant information available during the consultation.

A shared understanding between patient and GP

Jointly does not directly create shared understanding within the consultation, as this still depends on the GP’s communication skills, diagnostic certainty and the interaction between patient and professional. However, longer-term use of Jointly may indirectly contribute to this by increasing patients’ awareness of lifestyle factors and their own role in managing complaints. This could help patients enter the consultation with more realistic expectations, although this remains an expected effect rather than a proven outcome.

The GP actively explains the link between complaints and lifestyle

In the future vision, the GP explains how lifestyle factors may relate to joint complaints. Jointly does not change what happens inside the consultation, but it can support this conversation by offering a concrete follow-up step. If the GP considers lifestyle-related self-management appropriate, Jointly can make this advice more tangible and easier to continue at home.

The patient starts using a digital lifestyle tool on the GP’s advice

This is the element to which Jointly contributes most directly. The service is designed for patients with non-inflammatory joint complaints who can be supported within primary care. Through onboarding, Skelly, diary input, personal insights and small lifestyle actions, Jointly provides a concrete tool for continuing self-management after the consultation.

Additional support is available in primary care

Jointly contributes indirectly to this element. The app can encourage users to contact a GP or other healthcare professional when complaints worsen, persist or fall outside the scope of self-management. However, whether additional support such as physiotherapy or lifestyle coaching is actually available and accessible depends on the wider primary care system.

The patient leaves with knowledge, tools and motivation
Jointly directly supports this element. The core mechanism of the app, moving from daily input to personal insight and from insight to small feasible actions, is intended to build understanding, competence and motivation over time. The concept validation suggests that this mechanism is understandable and perceived as valuable, although further testing with a broader user group is needed.

Fewer unnecessary referrals to secondary care
Jointly may contribute indirectly to fewer unnecessary referrals, but this remains the most uncertain and long-term effect. If patients feel better supported in primary care, understand their complaints more clearly and are able to act on lifestyle-related factors, repeated care demands and referral pressure may decrease over time. However, this effect depends on sustained patient engagement, GP behaviour and wider care structures, and would need to be evaluated through longitudinal implementation research.

7.3.3 Conclusion

The evaluation shows that Jointly contributes to the future state most directly where the vision describes a patient who actively uses a digital tool to understand their complaints and take small steps toward lifestyle change. This is what the concept is designed for, and the validation sessions conducted earlier in this chapter suggest that users experienced the app as supportive in this direction. Whether this holds for a broader and more diverse group of users remains an important question for further research.

For other elements of the future state, Jointly plays a more limited role. The concept does not change what happens inside the GP consultation, and it does not influence the GP's communication skills or diagnostic certainty. These elements depend on conditions that go beyond what a patient-facing app can address.

This is not a shortcoming of Jointly specifically, but it highlights relevant directions for further research. Interventions that support GPs in conducting more effective lifestyle conversations, or that strengthen the diagnostic certainty they can provide, could complement what Jointly already offers and help bring the future state closer to reality.

Some contributions are only realistic in the long term. If more patients use the app over time, the data it collects may become useful during GP consultations and could gradually contribute to a shift in how patients think about their own role in managing complaints. Whether Jointly can also contribute to fewer unnecessary referrals to secondary care remains the most uncertain and most consequential question. This effect would need to be measured through longitudinal implementation research.

Together, this evaluation shows that Jointly addresses a meaningful part of the future state, but that reaching the full vision requires more than one intervention. The gaps identified here are not dead ends. They are starting points for the next steps in building a care pathway that is ready for the future.

7.4 VALIDATION SYNTHESIS

The three validation steps in this chapter each evaluated Jointly from a different perspective. Together, they provide a clearer understanding of where the concept is currently strong, where its boundaries lie, and what still needs to be developed before it could become part of the care pathway.

The validation of the design implications showed that Jointly remains grounded in the research findings. The concept responds especially well to the need for patients to better understand their joint complaints, recognise the possible role of lifestyle factors, and translate this understanding into action. At the same time, this evaluation also made clear that some requirements are only partly addressed. Accessibility for diverse user groups, long-term engagement, usefulness for GPs and implementation within existing healthcare structures still require further validation.

The concept validation with the patient participant and general practitioners confirmed that the core idea of Jointly is recognisable and relevant for key stakeholders. From the patient perspective, the value lies mainly in the movement from daily input to personal insight and from insight to concrete lifestyle actions. From the GP perspective, Jointly has potential as an additional support option within primary care, especially for patients who do not immediately require referral to secondary care. However, both perspectives also point to important conditions. The service must remain low effort, trustworthy, safe, scientifically credible, clearly positioned and should not add workload for healthcare professionals.

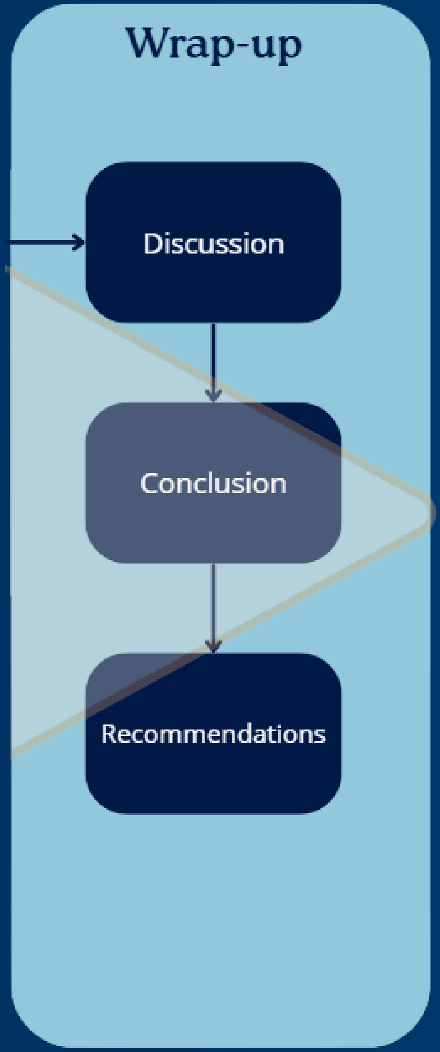
The validation of the future vision showed that Jointly contributes most directly to the patient-facing elements of the desired future care pathway. It supports patients in understanding their complaints, using a digital lifestyle tool and taking small steps toward self-management. Its contribution to broader system-level changes, such as improved GP consultations or fewer unnecessary referrals, is more indirect and remains uncertain. These effects depend on other actors, structures and long-term implementation.

Together, the validations confirm Jointly as a meaningful and promising design direction, but not yet as a fully validated intervention. The concept addresses an important part of the future care pathway, but its actual impact depends on further development, broader user testing, clinical validation and collaboration with stakeholders in primary care, secondary care and the wider healthcare system. These points form the basis for the recommendations presented in the next Chapter.

Chapter 8

WRAP-UP

This final chapter brings together the main outcomes of the project. First, the discussion interprets the findings, reflects on the value of the research, and addresses the limitations of both the research process and the final concept. The conclusion then answers the main research question and summarises how Jointly contributes to balancing patient inflow and rheumatology capacity. Finally, the chapter presents recommendations for the further development, validation and implementation of Jointly within the healthcare system.



8.1 DISCUSSION

8.1.1 Interpreting the findings

This project explored how design can contribute to balancing the inflow of patients with joint complaints and the capacity of rheumatology care. Using the rheumatology department of RdGG as the primary context, the research showed that this imbalance is not caused by one isolated problem. Instead, it emerges from the interaction between the four themes identified in this research: patient expectations, the filtering role of primary care, the underused potential of patients in their own recovery, and structural constraints within the healthcare system.

A key finding of this research is that a considerable share of patients who enter rheumatology care do not necessarily require specialist rheumatology treatment. However, this does not mean that these patients do not have a real care need. Many patients experience pain, uncertainty, functional limitations and a lack of guidance. The issue is therefore not that these patients should simply be kept out of secondary care, but that the current care pathway does not always provide the right kind of support at the right moment.

This makes the role of primary care particularly important. General practitioners are positioned as gatekeepers in the Dutch healthcare system, but this role can be difficult to fulfil in practice. Joint complaints are common, while inflammatory rheumatic diseases are relatively rare and not always easy to distinguish from non-inflammatory complaints. In addition, patient expectations, limited consultation time and the lack of intermediate support options can make referral to secondary care feel like the right next step. This suggests that strengthening primary care is not only about improving clinical decision-making, but also about offering both GPs and patients more concrete alternatives after the consultation.

The design direction chosen in this project focused on the patient as an active factor in their own recovery. This direction was selected because it offered a direct and actionable point for design intervention within the scope of the project. Patients with non-inflammatory joint complaints often need more than general lifestyle advice, but less than specialist rheumatology care. Jointly addresses this gap by helping patients understand their complaints, reflect on lifestyle factors and translate personal insights into small actions in daily life. In this way, the concept supports patients in a phase where they are often expected to manage their complaints independently, while not always having the knowledge, confidence or tools to do so.

8.1.2 Value of this project

The value of this project lies not only in the final concept, but also in the systemic understanding that was developed throughout the process. Through observations, interviews, thematic analysis, patient journey mapping and cause-and-effect mapping, the project made visible how different parts of the care pathway influence one another.

This helped move the project beyond isolated symptoms such as waiting times or referral pressure, towards a broader understanding of the mechanisms behind them.

This is where design added value as a connecting discipline. Designers do not replace medical expertise, but can bring together patient experiences, professional perspectives and systemic constraints into one shared overview. In this project, design helped to translate a complex and abstract problem into a concrete opportunity for intervention. Rather than only asking how rheumatology departments can handle more patients, the project asked where in the pathway patients could be supported earlier and more appropriately.

Jointly is the result of this shift in perspective. The concept does not attempt to solve the entire capacity problem in rheumatology, but focuses on one meaningful part of the system: supporting patients with non-inflammatory joint complaints within primary care. By offering guidance after the GP consultation, Jointly gives patients something to hold on to during a phase where support is often limited. At the same time, it offers GPs a possible support step for patients who do not immediately require specialist care, but who do need more than a short explanation or general lifestyle advice.

The scalability of this direction is also relevant. Although the project was grounded in the rheumatology context at Reinier de Graaf Gasthuis, the underlying challenge is not unique to this department. Many areas of healthcare face increasing demand, limited capacity and growing expectations that patients take a more active role in managing their own health.

The idea of offering guided self-management support earlier in the pathway may therefore also be relevant beyond rheumatology, particularly for chronic or lifestyle-related complaints where patients need long-term behavioural support rather than only medical intervention.

8.1.3 Limitations

Several limitations must be acknowledged. First, the research was qualitative and based on a relatively small number of participants. The interviews and observations provided rich insights into the care pathway, but cannot represent all patients, professionals or regional contexts. The findings should therefore be understood as an in-depth exploration rather than a fully generalisable account.

Second, the observations were exploratory. They helped build an initial understanding of consultation practices, patient profiles and the patient journey, but were not conducted as systematic observational research. The patient journey and patient profiles should therefore be seen as grounded design tools rather than definitive representations of all possible patient experiences.

Third, the cause-and-effect diagram was developed through interpretation of interviews, observations and literature, and was validated with one rheumatologist. Although this helped check whether the system dynamics were recognisable in practice, further validation with more stakeholders would have strengthened the reliability of the diagram.

The validation of Jointly was also limited in scope. The concept was tested with one patient participant and two general practitioners, which provided valuable first insights but does not yet prove long-term usefulness, accessibility or feasibility in daily practice.

Further testing is needed with a larger and more diverse patient group, including users with lower digital skills, lower health literacy and less initial motivation for lifestyle change.

Finally, the AI coach and implementation of Jointly remain conceptual. Skelly should stay within clear medical boundaries and rely on safe, evidence-based content. Questions around ownership, financing, privacy, maintenance and integration into existing care structures also require further development before Jointly could become part of the care pathway.

8.1.4 Closing reflection

Overall, Jointly should be seen as a promising design direction, not as a finished or clinically validated intervention. Its strength lies in identifying a specific moment in the care pathway where patients can be supported earlier, more personally and more continuously.

The broader contribution of this project is that it shows how design can help reframe a complex healthcare challenge. Instead of only focusing on how rheumatology departments can handle more patients, this project shows that meaningful change can also start earlier in the pathway, by supporting patients within primary care before referral becomes the next logical step.

8.2 CONCLUSION

In the coming years, rheumatology care will face a growing challenge. While the number of people with joint complaints is expected to increase substantially, the capacity of rheumatology care cannot grow at the same pace. This tension formed the starting point of this research, leading to the following research question: *'How can design contribute to balancing the inflow of patients with joint complaints and the capacity of rheumatology care?'*

This research shows that design can contribute by making the care pathway understandable, identifying opportunities, and translating these insights into a concrete intervention in the system. The challenge is not only to reduce referrals, but to offer patients more appropriate support before referral to secondary care becomes the next logical step.

The final design, Jointly, responds to this opportunity by supporting people with non-inflammatory joint complaints within primary care. The service helps patients reflect on their symptoms, understand the possible role of lifestyle factors, and translate these insights into small, realistic actions in daily life. In doing so, Jointly gives patients guidance and a stronger sense of agency during a phase in which they are often expected to manage their complaints independently.

Jointly also offers value for primary care. It gives general practitioners an additional support option for patients who do not immediately require specialist care, but who need more than a single explanation or general lifestyle advice. Over time, this helps reduce avoidable referrals to rheumatology, allowing specialist capacity to be used more effectively for patients who truly need it.

Beyond the service itself, the visual mappings developed in this project form an important contribution. The patient journey, stakeholder maps and cause-and-effect diagram helped translate scattered experiences and system dynamics into a clear overview. These mappings make the problem easier to communicate to healthcare professionals beyond this project and can help create awareness in the field about how patient expectations, primary care decisions and specialist capacity are connected.

The contribution of this thesis is therefore not only the design of a digital service, but also the reframing and visualisation of a complex healthcare challenge. It shows that meaningful change does not have to start at the point where pressure is already visible, but can begin earlier in the pathway, closer to the patient.

With Jointly, this project demonstrates how design can contribute to a more sustainable and supportive care pathway: one in which patients feel better guided, primary care has more to offer, and rheumatology care remains available for those who need it most.

8.3 RECOMMENDATIONS

The recommendations below emerge from the evaluations conducted in chapter seven and are organised by stakeholder group. They are intended to guide the next steps in the development and implementation of Jointly.

For patients

The actual usability of the app for patients with lower digital skills or health literacy has not yet been extensively tested. Further user research should explore how Jointly can be made accessible and meaningful for a broader patient population, including older adults and people less familiar with self-management.

The patient validation showed that sustained use depends on visible progress, low effort and a sense of routine. Further research should explore what keeps patients engaged over a longer period of time and how the AI coach can support users not just at the start, but throughout the process of behaviour change.

To increase findability and credibility among patients, a collaboration with a trusted and widely known platform such as 'Thuisarts.nl' is worth exploring. Patients already turn to 'Thuisarts.nl' for reliable health information, and connecting Jointly to this channel could lower the threshold for patients to find and trust the service.

The quality and scientific foundation of the content that Jointly provides also needs further research and development. The insights, tips and lifestyle advice the app offers should be grounded in evidence and personally relevant. A concrete direction for further development is building a validated content database from which the AI-coach can draw, translating evidence-based knowledge into personal and actionable guidance for each individual user.

For primary care workers

The GP validation confirmed that general practitioners are an important stakeholder in the success of Jointly. For them to recommend the app with confidence, the content and insights that Jointly provides need to be scientifically reliable and clinically relevant. This leaves room for further research and development in close collaboration with primary care professionals.

A specific research direction is what data from Jointly would actually be useful for GPs, how this information should be communicated to them and how it could support their decision-making around referral without adding workload during a consultation.

A partnership with a trusted and already established organisation such as 'Arts en Leefstijl' could strengthen the credibility of Jointly among healthcare professionals and provide a foundation for content validation and professional endorsement.

It is also worth exploring whether Jointly could add value earlier in the care pathway, before a patient has visited the GP. If patients can already reflect on their complaints and lifestyle factors before a consultation, this could change the nature of the conversation and potentially reduce the need for a GP visit altogether. Research should explore how Jointly could be introduced at this earlier stage and what conditions would need to be in place for that.

Further research is also needed into how diagnostic certainty can be strengthened in primary care and how lifestyle advice can be communicated more effectively during GP consultations. These are conditions that fall outside the scope of Jointly itself, but that are essential for the future vision to become reality.

For secondary care workers

The most consequential open question identified in the future vision evaluation is whether Jointly leads to fewer unnecessary referrals to secondary care. This effect cannot be assumed and needs to be measured. Future implementation research should therefore include longitudinal evaluation of whether sustained use of Jointly reduces repeated care demands and referral pressure on rheumatology departments. These findings would also be important for building the case with healthcare insurers and hospital management that investment in a service like Jointly is worthwhile.

For systemic stakeholders

For Jointly to move from concept to product, questions around ownership, financing, development and integration into existing healthcare structures need to be addressed. These fall outside the scope of this project but are essential conditions for the service to become sustainable.

Exploratory conversations with a potential development partner have already taken place. The recommendation from this research is to identify a suitable technology partner with experience in healthcare applications and to develop Jointly further in close collaboration with motivated specialists from within the care system. A partnership that combines clinical expertise, reliable content and technical development capacity offers a strong foundation for bringing Jointly into practice in a responsible and scalable way.

Chapter 9

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What happens when more and more people seek care for joint complaints, while pressure on rheumatology care continues to build?

This master thesis explores that question from a design perspective. Set within the context of rheumatology care, Empowered to Care follows the journey of a designer trying to understand a complex healthcare challenge: how to balance the growing demand for care with the limited capacity available to provide it.

Through observations, interviews and system analysis, the report maps the care pathway of people with joint complaints, from their first symptoms to a possible referral to a rheumatologist. It reveals that the problem is not simply about too many patients entering specialist care. Many patients have real pain, uncertainty and support needs, but do not always need specialist rheumatology treatment. What is often missing is accessible guidance earlier in the care pathway.

Based on these insights, the thesis develops Jointly: a digital service for people with non-inflammatory joint complaints in primary care. Jointly helps patients reflect on their symptoms, recognise the role of lifestyle factors and translate personal insights into small, feasible actions in daily life.

This report invites the reader to zoom out and look at the challenge from multiple perspectives. It shows that design can do more than create a solution at the end of a process. Design can help make complexity visible, connect different experiences and open up new ways of thinking about care. In doing so, Empowered to Care shows what design can bring to healthcare: not by replacing medical expertise, but by creating space to understand, reframe and act.