Network pain rehabilitation

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an integrated interdisciplinary care approach

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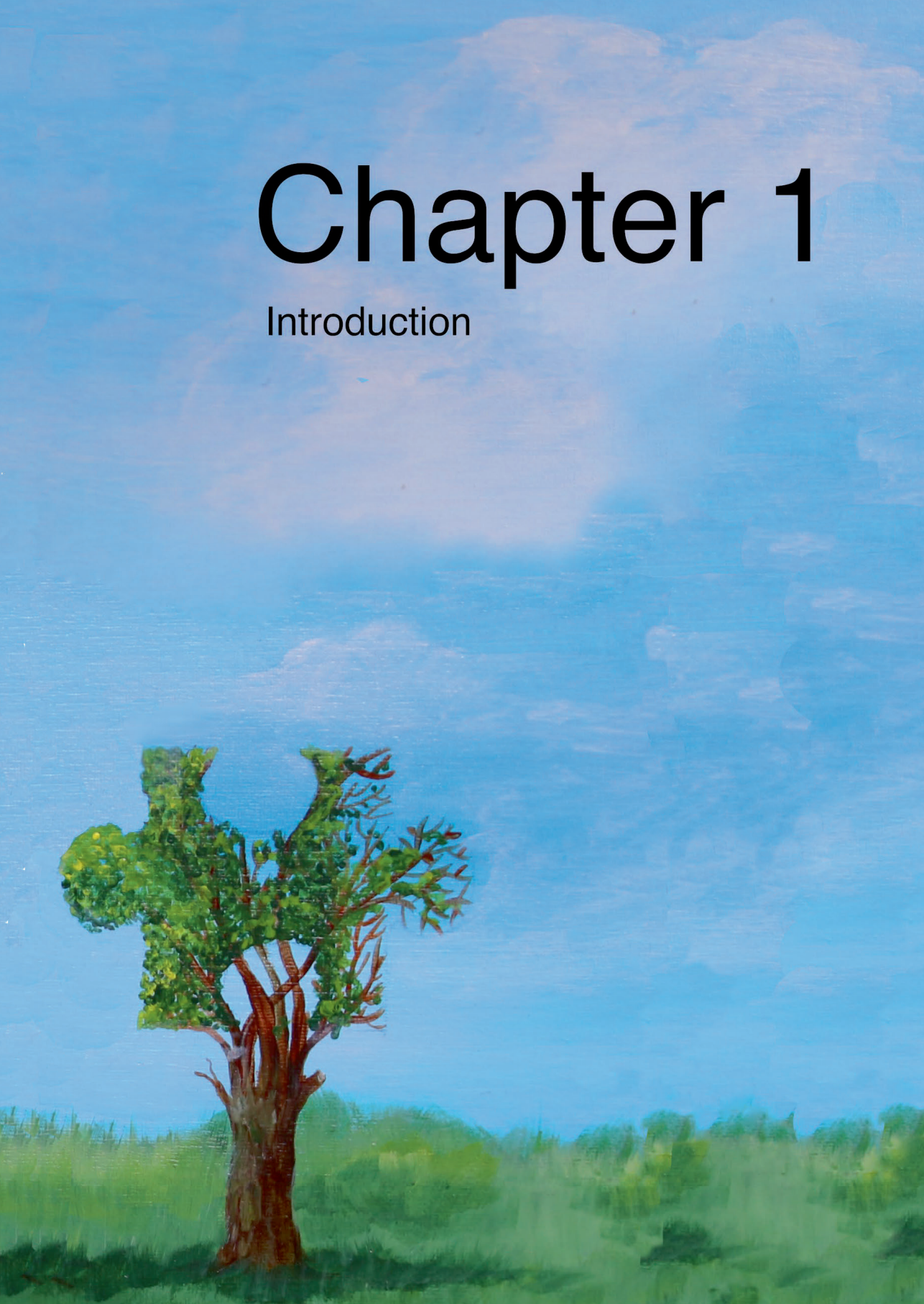
Chapter 1

Introduction



INTRODUCTION

Chronic musculoskeletal pain (CMP), the major cause of pain and disability, comprises a diverse range of diagnoses, such as nonspecific low back pain, fibromyalgia, complex regional pain syndrome, and nonspecific musculoskeletal pain.[1,2] CMP is a common health problem, with a prevalence of up to 18% in the adult population in the Netherlands.[2,3] When pain persists or recurs for at least three months, generally beyond the required time for tissue to heal, it is referred to as chronic pain.[4] Pain is a subjective sensation accompanying many disease diagnoses. The International Association for Study of Pain (IASP) defines pain as *"an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage"* (2021).[5] The prevalence of CMP is expected to increase as the population ages.[6] Moreover, elevated levels of obesity and lack of physical activity will increase the prevalence of CMP.[7] This will increase pressure on society and justify its being seen as a global health priority.[8,9] Several challenges need to be tackled to manage this group of patients with complex complaints.

Health of people with CMP

CMP places a substantial burden on patients and their families as it often affects overall self-perception of health, and interferes considerably with everyday activities. Additionally, it is associated with depressive symptoms, and negatively affects relationships and interactions with others.[10,11] The potential underlying disease (biomedical context), the meaning of pain, the contribution of (psycho)social factors (such as anxiety, depression, relationships and family life) influence the level of perceived disability.[12] The multidimensional character of CMP may negatively impact the quality of life.[13] Indeed, CMP is associated with some of the worst quality-of-life indices, with patients with CMP reporting lower quality of life than patients with, for example, cancer, endocrinological conditions, or chronic respiratory diseases.[14,15] Pain severity, duration, multiple sites, previous pain episodes, anxiety and/or depression, higher somatic symptoms and/or distress, adverse coping strategies, low social support, older age, disability, and greater movement restriction are strongly associated with impaired function and are leading causes of work absenteeism and health-related early retirement.[16-19]

Costs of health care

The direct and indirect medical costs for CMP are approximately €20 billion per year in the Netherlands.[20] Drivers for direct medical costs are visits to health care professionals (HCP), alternative medicine, and over-the-counter drugs.[21] Earlier research shows that 61% of people with CMP had visited from six to more than 20 HCPs in the year before starting a rehabilitation program.[22] Out of all health conditions, total indirect and direct

costs for CMP are even higher than those for cancer, heart diseases, and diabetes.[23] The economic impact of CMP is greater than for these diseases, due to high medical costs and its effect on rates of absenteeism, reduced levels of productivity, and increased risk of leaving the labor market.[24] In 2019, 25% of the total amount of work absenteeism in the Netherlands was due to musculoskeletal complaints.[25]

Patient-experienced quality of care

Of the population of people with CMP, 60–74% receive treatment and most of these (34-79%) find their treatment inadequate as it does not resolve their complaints. Therefore, explanations or solutions for their CMP complaints remain to be found.[3,26] In addition to ineffective treatments, there are issues relating to unnecessary referrals, diagnostic tests, and treatments, of particular concern because potentially avoidable.[27] Patients expect their health to become better, to be seen in a timely manner, with empathy, and to enjoy a continuous relationship with a high-quality HCP whom they choose.[28,29] It has been shown that more time per patient can increase the quality of care and patient satisfaction, while perhaps decreasing time pressures on HCPs in other situations.[30-32]

Work life of HCPs and staff

HCPs in the Netherlands feel inadequately equipped to treat patients with complex diseases, to increase their self-management skills, and to use ICT facilities in care.[33] In particular, general practitioners (GPs) feel less equipped to provide adequate treatment to patients with CMP, making them feel helpless.[34] Other HCPs are also often unsatisfied with the treatments they provide for these patients.[35,36] Burnout rates, especially among primary care professionals, are high.[29] In recent years, 15% of Dutch GPs and 14% of Dutch medical specialists reported burnout during their careers.[37-39] In 2018, 66% of GPs found that high workloads were leading to less job satisfaction.[38,40] Reasons for burnout were: increased administrative burden; an ethos of overtime working, with less control and autonomy; difficulties with work-life balance; and the previously mentioned gap between societal expectations and workplace reality.[27] The current organization and fragmentation of care does not lead to optimal working conditions for HCPs treating patients with complex chronic diseases.

DUTCH ORGANIZATION OF CARE FOR PATIENTS WITH CMP

In the Netherlands, delivery of primary, secondary, and tertiary healthcare services is organized based on the complexity of a disease. However, the GP is the gatekeeper and

care coordinator, supplying comprehensive and continuous care, and can refer patients to secondary or tertiary care when complaints are of moderate to high complexity.[41] Such care is accessible for all inhabitants. When a patient with musculoskeletal complaints and/or a risk of developing CMP visits a GP, the latter gives advice, makes a diagnosis, and initiates treatment. GPs can refer patients with CMP complaints of low complexity to HCPs in a monodisciplinary primary care setting (physiotherapists, remedial therapists, or mental health practice nurses).

In secondary care, specialized HCPs can be consulted following referral by GPs or medical specialists in secondary or tertiary care. HCPs (such as rehabilitation physicians, physiotherapists or psychologists) work in multidisciplinary teams in hospitals or rehabilitation centers. Tertiary care is for the few patients with highly complex, multi-morbid complaints and can be accessed following referral by GPs (primary care) or medical specialists (secondary care). These interdisciplinary HCPs have the same professions as those in secondary care, but are integrated into highly specialized teams.

The IASP defines interdisciplinary care as: *"Multimodal treatment provided by a multidisciplinary team collaborating in assessment and treatment using a shared biopsychosocial model and goals",* and multidisciplinary care as: *"Multimodal treatment provided by practitioners from different disciplines".*[5] The difference is that, in interdisciplinary care, HCPs have a uniform treatment aim and goal while, in multidisciplinary care, each discipline has its own aim and goal. In the Netherlands, the current organization of service delivery and healthcare is fragmented into different service delivery steps with individual financing patterns, and consequently collaboration between the steps is lacking.

FRAGMENTATION OF CARE

The Dutch health and social system is highly diverse, with HCPs organized in one or more umbrella organizations at national level, and with strong professional organizations. Patients are organized in both generic and categorical organizations, promoting the interests of patients in general and of those with specific conditions.[42,43] This fragmentation is seen both within healthcare levels (e.g. in primary care) and between healthcare levels (e.g. between primary care and secondary care). Care fragmentation, particularly at the boundary between primary and secondary care has been a major concern.[44] This is also the case in rehabilitation care due to, for example, structural and financial barriers.[45] Importantly, the World Health Organization has stated in a recent report that multidisciplinary rehabilitation services should be integrated into and between primary, secondary and tertiary levels of health systems. Moreover, financial resources should be made available to implement and sustain the recommendations for service

delivery.[46] Singer et al. [2010] state that integrated care consists of coordination and patient-centredness.[47] They define patient care as integrated when it is coordinated (across professionals, facilities, support systems, over time, between visits) and tailored to patient and family needs, values, and preferences. Integrated care can be coordinated within a care team, across care teams or between care teams and community resources. Integrated care leads to continuous familiarity with patients over time, proactive and responsive action between visits, and focuses on patient-centredness and shared responsibility.[42,43]

Due to an ageing population with comorbidities and chronic diseases, challenges exist in current healthcare, with its main focus on curing diseases. Therefore, care is shifting towards a more biopsychosocial approach which, in case of chronic diseases, focuses on optimal participation in society despite illness. An example of this approach is the Standard of Care for Chronic Pain in the Netherlands. This requires an integrated, multidisciplinary team of HCPs in regional networks working with a biopsychosocial vision as a possible solution for the existing fragmented care.[20] Rehabilitation care is based on this biopsychosocial approach with the International Classification of Functioning, Disability, and Health (ICF) model as a guide. Besides, teams in rehabilitation care often work on personalized patient plans in a multidisciplinary manner, so care is organized to deliver appropriate treatments to patients with CMP.[48] In this Standard of Care, the order of complexity of interventions is linked to the complexity of patients' complaints, in line with the recommendations of Lin et al. [2020] for best practice in CMP care.[49] In stepped care, more conservative and cheaper interventions are tried first, only progressing to more complex and expensive interventions when the simpler interventions fail.[50] Another approach is matched care, in which key risk factors are assessed and the intervention individualized, based on the patient's needs.[51] To overcome the problems of fragmented care in rehabilitation, an interdisciplinary matched care approach including all healthcare levels is recommended in the Standard of Care.

QUADRUPLE AIM

The increasing burden of chronic and comorbid diseases, such as CMP, and fragmented care, call for a transformation of care to avoid deteriorating care quality and higher costs.[44,52] This transformation could be 'guided' by the "Quadruple Aim", an approach to optimizing health system performance which proposes that healthcare institutions simultaneously pursue four dimensions of performance: improving health of populations; reducing the per capita cost of healthcare; enhancing the patient experience of care; and improving the work life of HCPs and staff.[29,53] The primary aim is to improve health of the population with the other three aims as subsidiary. The fourth aim, improving the work life

of HCPs and staff, was added to the earlier “Triple Aim” to address high burnout rates among HCPs and the need for workforce engagement in healthcare transition.

EHEALTH

This growing field of eHealth has the potential to provide numerous benefits for patients and health systems, such as improving the accessibility and cost-effectiveness of health care.[54] Defined as the use of information and communication technology for health, eHealth is an alternative and extra method of delivering healthcare to patients with long-lasting or complex health problems.[55] Moreover, it enables patients to access healthcare within their local community or home. The World Health Organization has recommended that digital health investments be coordinated to support continuity of care.[56] This suggests that eHealth could provide added value to healthcare delivery in interdisciplinary care.

There are three ways to classify eHealth: 1) *where* the application is used in the care process, including e-public health, e-care and e-care support; 2) *who* uses the application (patients, HCPs, patients together with HCPs, or HCPs with other HCPs); 3) on *which technologies* the application is based (e.g. mobile applications, electronic patient health records, portals, or sensors.[57] EHealth allows the integration of different self-management components that can be tailored to the individual patient’s complaints and to the situation in which support is required. The availability of accurate and timely data facilitates feedback and communication, which enables follow-up and accommodates subsequent consultations or referrals. A diverse range of effective eHealth applications for patients with CMP, from webpages with patient education, online treatment courses to video-conference calls with HCPs, have been developed and evaluated to optimize organization of healthcare and self-management.[58-62] However, the implementation of eHealth in interdisciplinary care needs further exploration.

AIMS AND OUTLINE

To gain insight into the currently available evidence for interdisciplinary treatment approaches in primary care, and between primary care and other healthcare settings, for patients with CMP, the first aim of the present study was to systematically review and synthesize the available literature (Chapter 2). Our second aim was to develop a new interdisciplinary care intervention within primary care and between primary care and the other healthcare levels: ‘Network Pain Rehabilitation Limburg’ (NPRL). The protocol for evaluating the feasibility of this intervention is presented in Chapter 3 and the results of

the study are presented in Chapter 4. Based on the results of the feasibility study, NPRL was refined and adjusted. In Chapter 5, we describe the protocol for a (cost-)effectiveness study of the intervention evaluating the Quadruple Aim outcomes, using a stepped-wedge design. In Chapter 6, the satisfaction with work of HCPs, and their enjoyment of and finding of meaning in work, are described. Unfortunately, due to COVID-19, patient recruitment and treatment for the study were halted prematurely, making it impossible to evaluate the other three Quadruple Aim outcomes: health outcomes, cost outcomes, and satisfaction with care of patients. The feasibility in primary care of eCoach-Pain, one of the tools of NPRL, was studied in during the COVID-19 period and is described in Chapter 7. Chapter 8 describes the main findings, as well as theoretical and methodological reflections on these and their implications for practice and further research. Overall, the objectives and outline presented in this thesis are:

- To systematically review the evidence for interdisciplinary treatment approaches in primary care, and between primary care and other healthcare settings, for patients with CMP (Chapter 2).
- To give an overview of the development and the rationale of the feasibility study of NPRL (Chapter 3).
- To determine the feasibility of NPRL in patients with CMP (Chapter 4).
- To describe the rationale and design for a (cost-)effectiveness study of NPRL for the Quadruple Aim outcomes, using a stepped-wedge design (Chapter 5).
- To provide insight into the satisfaction in work, enjoyment of and finding meaning in work of HCPs participating in NPRL (Chapter 6).
- To determine the feasibility of eCoach-Pain in primary care during COVID-19 (Chapter 7).
- To conclude with a general discussion of the main findings, conclusions and practical recommendations arising from this study (Chapter 8), a summary in English and Dutch, and possibilities for valorization.

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Chapter 2

Interdisciplinary Care Networks in Rehabilitation Care for Patients with Chronic Musculoskeletal Pain: A Systematic Review

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ABSTRACT

This systematic review aims to identify what rehabilitation care networks, within primary care or between primary and other health care settings, have been described for patients with chronic musculoskeletal pain, and what their impact is on the Quadruple Aim outcomes (health; health care costs; quality of care experienced by patients; work satisfaction for health care professionals). Studies published between 1 January 1994 and 11 April 2019 were identified in PubMed, CINAHL, Web of Science, and PsycInfo. Forty-nine articles represented 34 interventions: 21 within primary care; 6 between primary and secondary/tertiary care; 1 in primary care and between primary and secondary/tertiary care; 2 between primary and social care; 2 between primary, secondary/tertiary, and social care; and 2 between primary and community care. Results on impact were presented in 19 randomized trials, 12 non-randomized studies, and seven qualitative studies. In conclusion, there is a wide variety of content, collaboration, and evaluation methods of interventions. It seems that patient-centered interdisciplinary interventions are more effective than usual care. Further initiatives should be performed for interdisciplinary interventions within and across health care settings and evaluated with mixed methods on all Quadruple Aim outcomes.

INTRODUCTION

Chronic musculoskeletal pain (CMP) is a leading cause of disability occurring in 19–28% of the European population.[1,2] As many as one-third of primary care consultations concern CMP complaints such as back or knee pain.[3] Complaints often persist for more than five years and have significant impacts on patients' daily life, leading to high societal and health care costs.[4-6]

Research indicates that pain needs an integrated biopsychosocial approach to decrease its impact on health. Nevertheless, this impact is expected to increase as people live longer.[7,8] Current care is organized in "silos" with a focus on only one aspect of pain (biomedical, psychological, or societal), instead of an integrated approach. There is little coordination and communication among health care professionals (HCPs), leading to fragmented care.[9-11] This results in many monodisciplinary treatments, with a wide variety of treatment approaches, restricted in available time and resources. Thus, there is a call for a different organization of care for patients with CMP.[12] As a possible solution for this fragmented care, the general practitioner (GP) should have a more prominent role in managing patients with chronic and complex diseases such as CMP[13], as there is a need for continuity, comprehensiveness, and coordination in CMP care.[14] Primary care should play a central role in effectively managing and integrating care with mono- and multidisciplinary treatments, with the GP as the case-manager for chronic and complex diseases.[15]

Accordingly, the World Health Organization (WHO) developed a guideline for redesigning rehabilitation in health systems.[16] It indicates that rehabilitation services should be integrated within primary care, as well as between primary, secondary, and tertiary levels of health systems, with a case-management role for primary care. This is in line with Coleman et al., who state that disease management interventions that target only patients may be less effective than those that also focus on organization of care and redesign of care delivery.[9] Cieza et al. advise scaling up rehabilitation services in primary care worldwide to ensure that a life-course and integrated perspective on care is achieved.[2] CMP must be approached within a biopsychosocial framework in order to deliver the most effective treatment. Depending on the complexity of the pain problem, it must be provided by different health care disciplines in collaborative teams, either in primary care alone or combined with secondary and tertiary care.[17,18]

Collaborative teams of HCPs for pain management in primary care could range in scope from less extensive combinations of GPs and HCPs, focusing on physical and psychological aspects of pain, to broad teams including rehabilitation, psychology, nursing, and case management.[19,20] If these treatments are multimodal, meaning one therapeutic aim per discipline, and involve HCPs from different disciplines, they are

termed “multidisciplinary”.[21] For patients with more complex complaints, an interdisciplinary treatment is needed, where all HCPs involved have a common therapeutic aim and a shared biopsychosocial focus. These interdisciplinary care networks can improve clinical care and service delivery, as suggested by Coleman et al..[9]

In order to optimize health system performance, including interdisciplinary care networks, an approach known as the Quadruple Aim is recommended. This comprises four dimensions: health, quality of care experienced by patients, healthcare costs, and HCP work satisfaction.[22,23] There is some evidence that interdisciplinary care networks designed for various diseases can improve these four Quadruple Aim pillars.[24-26] Moreover, interdisciplinary care networks for CMP, incorporating a biopsychosocial model in assessing and treating pain, can result in pain reduction, improved quality of life, and improved social functioning.[20] In some cases, return-to-work and vocational outcomes may be seen.

However, it is not known which biopsychosocial interdisciplinary care networks exist within primary care, or between primary care and other health care settings, for the rehabilitation of patients with CMP. Furthermore, the impact of such networks on the Quadruple Aim outcomes of health, health care costs, quality of care experienced by patients, and work satisfaction of HCPs, is unknown. Therefore, this study aims to address these uncertainties. The first research question is: Which interdisciplinary care networks within primary care and between primary care and other health care settings have been implemented in rehabilitation care for patients ≥18 years with CMP over the last 25 years? The second question is: What is the impact of these interdisciplinary care networks on rehabilitation care for patients with CMP, in terms of the Quadruple Aim outcomes: health, health care costs, quality of care experienced by patients, and HCP work satisfaction?

MATERIALS AND METHODS

We conducted a systematic literature review to synthesize studies with interdisciplinary care networks in care for patients with CMP. These interdisciplinary care networks must be implemented within primary care or between primary care and other healthcare settings (secondary or tertiary care, social care, or community-based care) (see Figure 2.1). As this research did not involve human subjects, we did not seek ethics clearance for the project. The protocol was registered in the international prospective register of systematic reviews (PROSPERO; http://www.crd.york.ac.uk/PROSPERO/ (accessed date: 6 May 2021)) on 28 August 2020 (registration number CRD42020158057). The review was conducted following PRISMA guidelines.[27,28]

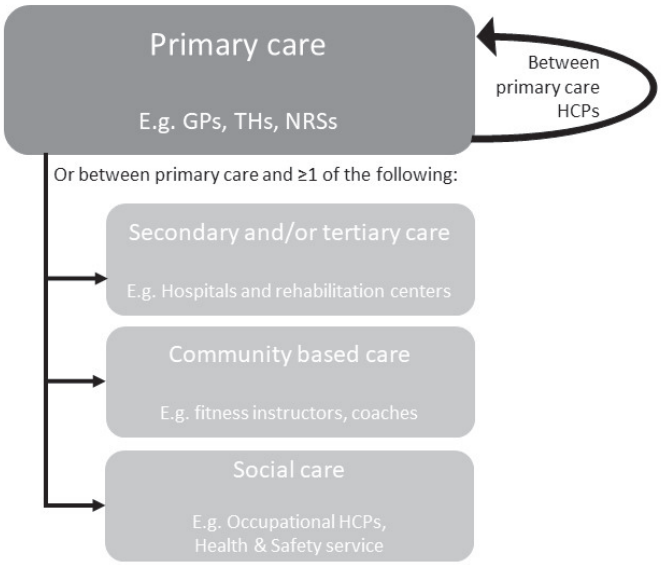

Figure 2.1 Overview of interdisciplinary care networks.
GPs = general practitioners; THs = therapists; NRSs = nurses; HCPs = health care professionals.

Databases searched and inclusion and exclusion criteria

Studies published between the 1 January 1994 and the 14 November 2019 were identified by searching the databases PubMed, CINAHL, Web of Science, and PsycInfo, and tracing publications from the reference sections of included papers and relevant reviews. Studies were included if the main population comprised patients with CMP, the intervention was implemented in primary care, or a combination of primary care and other health care settings, with a rehabilitation aim and an interdisciplinary care network. Only original descriptions of interventions in Dutch, English, or German were included. Detailed definitions of the in- and exclusion criteria can be found in Table 2.1. In addition to these criteria, studies with populations comprising a mix of patients with subacute and chronic complaints or with a non-disease-specific intervention were included. From these studies, only the results for patients with CMP were taken into account. Studies investigating group interventions delivered at the same time by HCPs of different disciplines were also included in this review as it was assumed that they would have discussed treatment approaches. In all interventions, the collaboration between HCPs had to be bidirectional to be included. When other articles described the same intervention, these were also included in our review.

Table 2.1 In- and exclusion criteria.

Inclusion	Exclusion
An intervention for patients with chronic musculoskeletal pain (CMP) of the posture- and locomotion apparatus. Studies were also included if the study population was a mix of patients with subacute and chronic complaints.	An intervention developed for headache or stomach-ache, or only for patients with subacute pain (<12 weeks).
Rehabilitation care enabling individuals aged ≥18 years to maintain or return to their daily life activities, fulfil meaningful life roles and maximize their well-being[30]. The goal of the rehabilitation is on the improvement of participation or functioning of the patient.	A (rehabilitation) intervention which was designed for pre-post surgery care, or if it consisted of eHealth, which substitutes the treatment given by an HCP, or if the intervention only focusses on medication prescription or use.
An interdisciplinary care network based on the IASP definition [21]: *a multimodal treatment provided by a multidisciplinary team collaborating in assessment and/or treatment using a shared biopsychosocial model and goals. The HCPs all have to work closely together with regular team meetings (face to face or online), agreement on the diagnosis, therapeutic aims and plans for treatment and review.*	An intervention in which HCPs of different disciplines treated a patient but without a mutual goal, bidirectional discussion, or exchange of treatment approaches. An intervention that focusses only on the referral or triage of patients without collaboration during the treatment itself.
There was a bidirectional discussion or exchange of treatment approaches with the same goal between HCPs of different disciplines (e.g., a GP with a physiotherapist).	An intervention with only extended practices roles. E.g. the physiotherapist takes over the roles of the GP.
Implemented within primary care or between primary care and other healthcare settings (secondary or tertiary care, social care, or community based care) (see Figure 2.1)	Interventions implemented within or between secondary or tertiary clinic(s).
Original descriptions of (results of) an intervention, such as protocol articles, feasibility studies, process evaluations, and qualitative and quantitative (cost)-effectiveness studies.	A review or guideline. The references for these studies were checked for eligible articles.
Only full texts which were available in Dutch, English or German.	
Articles published between 1st of January 1994 and 14th of November 2019.	

Search strategy

Terms used were defined by scoping searches and team discussions. An information specialist finalized the search strategy and adapted keywords according to the configuration of each database. Our search strategy has been published online in detail (Appendix 2.A). Briefly, it included variations on the following terms: ‘chronic musculoskeletal pain, fibromyalgia, regional pain, arthritis, interdisciplinary, integrated, multidisciplinary, service, system, delivery, network, physical and rehabilitation medicine, Quadruple Aim, health outcome, quality of care, healthcare costs and satisfaction with work’. Three reviewers (CL (100%), WM (75%), and LB (25%)) independently screened

title and abstract, and two reviewers (CL (100%) and LB (100%)) screened all full texts. Disagreements were solved by an arbitrator (IH). Identified references were downloaded and collected using EndNote bibliographic software (Clarivate Analytics, Philadelphia, PA, USA), and the article selection was performed in the review processing software, Rayyan.[29]

Data extraction and analysis

CL extracted data on the interdisciplinary care networks, study aims, and outcomes of the included articles. LB reviewed 25% of the data extraction. First, descriptions of the included interventions were compiled. These included: country; name of intervention; target population; health care setting; and description of the collaboration and intervention. If multiple articles were published for one intervention, these were merged to give a complete overview. As shown in Figure 2.1, health care settings were classified based on the type of intervention: within primary care or between primary care and secondary or tertiary care, community-based care, and/or social care. Interventions in secondary or tertiary care were combined as one category because the distinction between secondary or tertiary care was not always clear from the descriptions given. Descriptions of interventions were extracted from the studies and classified into these categories:

- Assessment (a systematic approach to ensuring that the health service uses its resources to improve the health of the population most efficiently)[31];
- Education—basic knowledge (anatomy, biomechanics, the function of the body, and pathophysiology)[32];
- Education—knowledge of disease prevention and ergonomics (information on prevention, cause of pain, ergonomics, information on posture, information on activity, exercise)[32];
- Education—knowledge of treatment (self-management, lifestyle modification, information on coping with the problems)[32];
- Manual Therapy (passive joint mobilization and massage therapy)[33];
- Specific Exercise Therapy (active and/or active-assisted strengthening, mobilizing, and stretching exercises to restore the function of the affected region)[34];
- General Exercise Therapy (aerobic and resistance training, causing an increase in energy expenditure, to maintain health-related outcomes)[35];
- Mind-Body Exercise Therapy (to enhance the mind's capacity to positively affect bodily functions and symptoms, including pain, by combining exercises with mental focus)[36];
- Cognitive behavioral therapy (CBT) (integration of exercise therapy with daily performed activities based on cognitive-behavioral principles, time-contingent)[37-41];
- Workplace intervention (a set of comprehensive health promotion and occupational health strategies implemented in the workplace to improve work-related outcomes)[42];

- Anesthetics (local anesthetics for diagnosis and therapy, indications include functional disorders, inflammatory diseases, and acute and chronic pain)[43];
- Medication management (a systematic process of ensuring that the patient's medication regimen is optimally appropriate, effective, and safe, and that the patient is adhering to this regimen to promote health and reduce the need for health care use).[44]

Second, outcomes relevant to the Quadruple Aim were extracted for each intervention. For these, study dates, study designs, outcome measures with measurement instruments for relevant primary outcomes, and results were recorded. The results of randomized trial designs were presented in two categories: either (1) positive and significant (+) ($p<0.05$) compared to the comparator intervention for randomized controlled trial (RCT) designs; or (2) positive and non-significant ($p>0.05$), no difference between the intervention and comparator intervention, or alternatively negative and significant for the intervention compared to the comparator intervention (-) ($p<0.05$). For non-randomized trial designs, results were classed as significant (+) ($p<0.05$) or non-significant (-) ($p>0.05$), compared to baseline. Mixed positive and negative results for subdomains are indicated by +/-. For the qualitative studies, opinions are summarized as all positive (+), negative (-), neutral (=), or mixed (+/-). All outcomes from the studies relevant to the Quadruple Aim are presented. Primary outcomes of the studies were identified using the following procedure. First, the primary outcome, as described by the authors, was chosen. If this was not described, the outcome measure used in the sample size calculation was chosen. If this was also not described in the article, the outcome measure best fitting the aim of the intervention was chosen (e.g., aim: improving functioning, outcome measure: health-related quality of life or functioning; aim: return to work, outcome measure: return to work or sick leave; etc.). In the case where this was also unclear from the article, the first choice was the outcome measure for quality of life (often measured in this type of study, making it comparable). Then, costs such as sick leave or return to work were the second choice. After that, quality of care experienced by patients or HCP work satisfaction were the third choice. Based on the homogeneity and the chosen outcome measures, a meta-analysis was considered.

Risk of bias in individual studies

Quality assessment tools specific to the method(s) employed were used. These tools were used to assess and compare the quality of RCT designs, non-randomized study designs and qualitative designs. For RCT designs, the risk of bias was assessed using Version 2 of the Cochrane risk-of-bias tool for randomized trials (RoB2 tool).[45] The Risk of Bias in Non-randomized Studies-of Interventions (ROBINS-I) tool was used for assessing non-randomized study designs.[46] Domains not relevant for studies without a control group are marked (-) or (NA). For qualitative designs, the Joanna Briggs Institute Critical Appraisal Tools, Checklist for Qualitative Research, was used for a critical

appraisal.[47] This critical appraisal tools assist in assessing the trustworthiness, relevance and results of published papers. At least seven questions (out of 10) had to be answered "yes" to receive a positive overall appraisal. Articles describing study protocols were not assessed for risk of bias. One researcher (CL) assessed the risk of bias and performed the critical appraisal for each study. One researcher (LB) randomly cross-checked 25% of the included studies. Disagreements were resolved by an arbitrator (IH). Review authors were not blinded for author names, institutions, or journals. If additional information was needed, corresponding authors would have been contacted. Results are reported through graphical representation of bias judgements grouped by design of study.

RESULTS

The process of the literature review is shown in Figure 2.2. The combination of keywords yielded 15,428 potentially relevant articles in the databases on 14 November 2019. Overall, 2926 articles were excluded by deduplication, and 11 studies were added with the snowball method, resulting in 12,513 articles. After reviewing the titles and abstracts of the articles, 12,152 of these were excluded. In total, 361 full-text articles were assessed for eligibility, and 320 were excluded for not meeting one or more of the criteria. The most common reasons for exclusion were interventions without an interdisciplinary care component or interdisciplinary interventions without a role for primary care. If interventions were described in other articles as protocols or allied studies, these were also included, leading to 49 included articles describing 34 interventions.

Overview of included studies

An overview of the included interventions is presented in Table 2.2. Of the 34 included, 21 consisted of a collaboration of HCPs within primary care.[25,48-76] Examples of these were collaborations between therapists (TH) and nurse practitioners (NP) or more extensive collaborations between physicians/physiatrists (PH), psychologists (PSY), and various THs. These collaborations ranged from merely performing an assessment to giving a complete interdisciplinary treatment in primary care. Nearly all interventions included at least one education module. Only three had a medication management module. Moreover, most studies with collaborating THs had general or specific exercise therapy modules in the intervention. If the interventions had a PSY or Psychosocial counsellor (PSY-C) in the team, these interventions were often focused on Mind-Body Exercise Therapy or CBT.

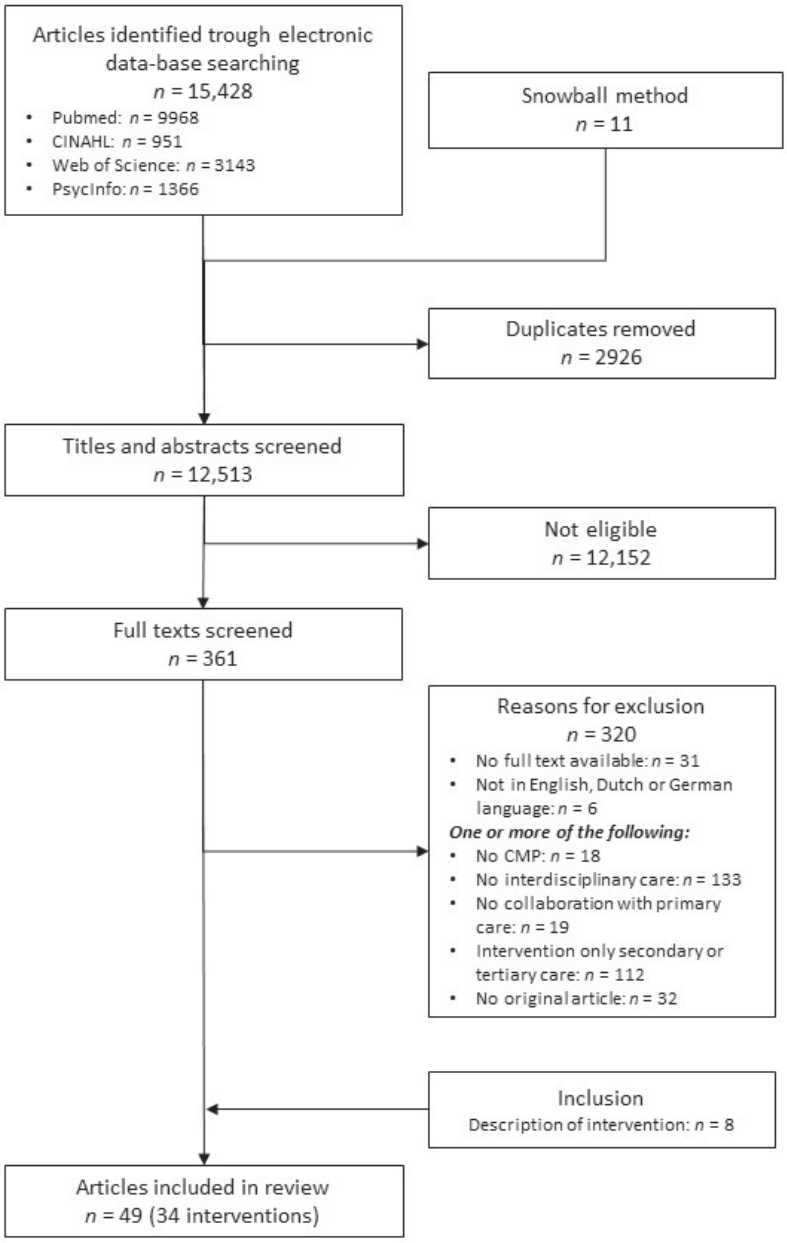

Figure 2.2 Process of literature selection.

Furthermore, six interventions existed of a collaboration between primary care and secondary or tertiary care.[48-53] Two of these interventions were between a rehabilitation department and primary care.[48,51] Examples of these collaborations were a GP in primary care with a TH, orthopedic surgeon/specialist (OS), or NP in secondary or tertiary care. Collaborations between GPs and extensive rehabilitation teams, consisting of a nurse (NRS), PSY, TH, or PSY-C, and OS. Four interventions existed of an interdisciplinary assessment. In one study, assessment and follow-up were performed by an HCP in secondary care, a TH and a patient via video-conferencing (due to long-distance).[53] Rothman et al. evaluated a collaboration in assessment and giving advice between a GP and at least three HCPs in secondary or tertiary care.[52] Two of these interventions consisted of an interdisciplinary assessment followed by treatment.[48,51] The other two interventions consisted of an interdisciplinary treatment without an interdisciplinary assessment.[49,50]

Additionally, one intervention was applied in an interdisciplinary pain clinic in primary care with collaboration in primary care, as well as between primary care and secondary and tertiary care.[54] THs who usually work in both primary care and secondary/tertiary care settings delivered the treatment in this interdisciplinary pain clinic in primary care, consisting of specific exercise therapy, medication management, and education.

Two interventions were a collaboration between primary care and social care.[55,56] Here, the teams consisted of several THs, a PH, and a case manager. Together, they performed a team assessment and, during the treatment and follow-up meetings, combinations of the HCPs involved delivered the treatment. In both treatments, workplace interventions were included, aimed at a return to work.

In addition, two interventions consisted of a collaboration between primary care, secondary/tertiary care, and social care.[57,61] These extensive interventions also involved the patients' medical specialists during workplace interventions, in addition to THs, GPs, and occupational physicians (OPs). While both interventions had many similarities, the recruitment of the study populations differed. In the studies of Steenstra et al. and Anema et al., the participants were recruited by the OP, while in the studies of Lambeek et al., the recruitment was by the PHs of the outpatient clinics of participating hospitals.[57,59-61]

Finally, two interventions existed of a collaboration between primary care and communitybased initiatives.[62,66] In the intervention ofMcBeth et al., & Bee et al., the TH delivered the CBT, and the fitness instructor (FI) from a community-based initiative gave the general exercise therapy.[62,66] The intervention of Bennell et al., and Hinman et al. comprised a physical therapy programdelivered by the TH in primary care, CBT by the telephone coach (TC), and an information booklet for education about the disease.[64,65]

Table 2.2 Overview of included studies.

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Within primary care					
Randomized trial designs					
1	Calner et al. (2016) ** Intervention is linked to interventions of Nordin (number 8)* Sweden	Multimodal pain Rehabilitation (MMR) & web behaviour change program for activity (Web-BCPA)	Chronic musculoskeletal pain of the back, neck, shoulders, and/or a generalized pain condition	PH THs PSY or PSY-C NRS 1x Team discussion with patient about treatment plan	**MMR** ≥2x/w, ≥6w At least 3 different healthcare professionals *Specific Exercise Therapy* *General Exercise Therapy* *Manual Therapy* *Mind-Body Exercise Therapy* **Web-BCPA** 24h, 7d, 16w Self-guided by the patient *Education – Knowledge of disease prevention and ergonomics* *Education - Basic knowledge* *Education - Knowledge of treatment* *Cognitive-behavioural therapy*
2	Chelimsky et al. (2013) US	Primary Practice Physician Program for Chronic Pain (4PCP)	Chronic Pain (back pain 51.9%, fibromyalgia 23.1%, neck pain 6.7%, others)	PH PSY THs	** No separate intervention for patients* **Collaborative training of PHs** consisting of: Active learning: Evidence-based active learning seminars, self-directed learning Clinical support: to collaborate with the interdisciplinary treatment team comprising pain-informed THs and PSY providing cognitive-behavioural therapy

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
3	DeBar et al. (2018) USA	Pain Program for Active Coping and Training (PPACT)	Chronic pain On opioid treatment (≥6m) On health plan	PPACT interventionist team: PSY-C NCM PCPs: PS PR PPACT interventionists and PCPs meetings for treatment plan (before start treatment) and evaluation (end of treatment)	**Comprehensive intake evaluation** NCM or PSY-C *Assessment* *Medication management* 1x TS *Education - Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* **Cognitive-behavioural therapy (CBT)-based pain coping skills training and adapted movement practice** 12w (group) *Cognitive-behavioural therapy* **PCP consultation and patient outreach** By NCM and PSY-C
4	1: Dobscha et al. (2008) 2: Dobscha et al. (2009) USA	Study of the Effectiveness of a Collaborative Approach to Pain (SEACAP)	Musculoskeletal pain Chronic Exclusion: fibromyalgia	PSY: care manager IT: intervention & workshop teacher TH: workshop teacher Discussion between PSY and IT about assessment results and treatment recommendations. These are sent by email to clinicians. Leading workshop with PSY and IT or TH.	**Telephone contact** **Written materials** *Education - Basic knowledge* **Assessment** by PSY *Assessment* *Education - Knowledge of treatment* **Recommendation treatment plan** Based on discussions about symptoms or additional education by PSY and IT **Workshop** 90m, 4x, 4months By PSY, co-led by IT or TH *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
5	Gustavsson et al. (2018) Sweden	Activity and life-role targeting rehabilitation (ALAR)	Musculoskeletal pain Chronic	TSs PH PSY-C TSs: Participating in education meetings about treatment protocol and behavioral medicine approach, 3x,4h MMR: team discussions about assessment and treatment plan	**Multimodal pain rehabilitation (MMR)** Content and intensity are patient dependent *Assessment* *Cognitive-behavioural therapy* **ALAR + MMR** 1h, 10x, 10w Workbook and therapist for goal setting *Assessment* *Education - Knowledge of treatment* *Cognitive-behavioural therapy*
6	Hansson et al. (2010) Sweden	Patient education program for osteoarthritis (PEPOA)	OA in hip, knee or hand	THs OS NRS DT Providing PEPOA	**PEPOA** (n=8-10) 3h, 5x, 1x/w, 5w *Education - Knowledge of treatment*
7	1: Helminen et al. (2013) 2: Helminen et al. (2015) Finland	Cognitive-behavioural (CB) intervention for OA	Knee pain Chronic	PSY TH Providing CB intervention	**Cognitive Behavioral group intervention** (n=8-10): 1x/w, 2h, 6w *Education - Basic knowledge* *Education - Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* *Mind-Body Exercise Therapy*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
8	1: Nordin et al. (2016) 2:Nordin et al. (2017) Sweden	Web Behavior Change Program for Activity (Web-BCPA) added to multimodal pain rehabilitation (MMR)	Pain in the back, neck, shoulder, and/or generalized pain	NRS THs PH PSY PSY-C PH for contact with the team and Swedish Social Insurance Agency	**MMR** 2-3x/w, 6-8w By ≥3 disciplines *Specific Exercise Therapy* *General Exercise Therapy* *Manual Therapy* *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* *Cognitive-behavioural therapy* *Mind-Body Exercise Therapy* **Web-BCPA** 16w Self-guided *Cognitive-behavioural therapy* *Education - Knowledge of treatment*
Non-randomized trial designs					
9	1: Dunstan et al. (2007) 2: Dunstan et al. (2014) Australia	Light multidisciplinary Work-Related Activity Program (WRAP)	Musculoskeletal pain Chronic	PSY TH GP ORP	**WRAP** (n=30, 7 groups) 4h, 1x/w, 6w By PSY and TH providing treatment, GP as medical case-manager, and ORP as a return-to-work case manager *Mind-Body Exercise Therapy* *Specific Exercise Therapy* *General Exercise Therapy* *Education - Basic knowledge* *Education – Knowledge of disease prevention and ergonomics* *Workplace intervention*
10	Gurden et al. (2012) UK	North East Essex Primary Care Trust manual therapy service	Back or Neck pain Subacute and chronic	GP CH THs Prescribed treatment plan Advise during referral after treatment (TH to GP)	**GP consultation** *Assessment* *Education - Basic knowledge* *Medication management* **Manual therapy** (within 2 weeks) max. 6x CH, TSs *Manual Therapy* **Discharge with a report to GP**

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
11	1: Mårtensson et al. (1999) 2: Mårtensson et al. (2004) 3: Mårtensson et al. (2006) Sweden	Biopsychosocial rehabilitation programme, Focus on Health (FoH)	Pain Chronic	GP NRS THs PSY-C Teaching in FoH program	**FoH Group sessions** (n=5-9) 2x/w, 6w: 6x 6h+ 6x 3h *Education - Basic knowledge* *Education – Knowledge of disease prevention and ergonomics* *Mind-Body Exercise Therapy* *Education - Knowledge of treatment* **Ergonomics** **Individual introductory and concluding conversation for activity and locomotion analysis**
12	Schütze et al. (2014) Australia	Mindfulness-Based Functional Therapy (MBFT)	LBP Chronic	PSY TH Co-facilitated sessions	**MBFT** - group session (n=6 & n=10) 2h/w, 8w *Education - Knowledge of treatment* *Mind-Body Exercise Therapy* *Cognitive-behavioural therapy*
13	Stein et al. (2013) Sweden	Multidisciplinary pain rehabilitation (MDR)	Musculoskeletal pain Chronic	GP PSY THs Examination report of GP visible by all Team meeting about biopsychosocial motivation to participate Providing treatment	**MDR** - group session (n=6-8): 5h, 3d/w, 6w GP (12h) *Education - Basic knowledge* *Mind-Body Exercise Therapy* TH(18h) *Education – Knowledge of disease prevention and ergonomics* *Mind-Body Exercise Therapy* TH (20h) *Specific Exercise Therapy* *Cognitive-behavioural therapy* *Mind-Body Exercise Therapy* PSY (28h) *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* *Cognitive-behavioural therapy* Additional education (12h), provided by Swedish Insurance Agency, Swedish Employment Agency, local fitness centre, dietary adviser

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
14	Tyack et al. (2013) Australia	Student-led interdisciplinary chronic disease health service	Back pain Chronic	NRS PO THs Exercise PSY PSY-C SP DT PR Indigenous health worker Case conference and service delivery	**Intake** by 1 HCP and 2 students *Assessment* **Case conference** By the team Selection of appropriate services **Services** from one or more HCP 3-6 months
15	Westman et al. (2006) Sweden	STAR project; multimodal rehabilitation program	Musculoskeletal pain Chronic Sick listed	PSY PH TH A representative from the National Insurance Company Team discussions about treatment plan	**STAR project** group based (n=8-10) 3.5h/d, 5d, 8w *General Exercise Therapy* *Mind-Body Exercise Therapy* Creative activities *Education - Basic knowledge* *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* Individual (when necessary): **Physiotherapy or psychotherapy or orthopaedic consultation**

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
16	Westman et al. (2010) Sweden	Multidisciplinary rehabilitation program	Musculoskeletal pain Chronic Sick listed	GP TH PSY or PSY-C Team discussions about diagnosis and treatment plan	**Assessment and deciding treatment program** 1x/w By the team *Assessment* And one or more of the following interventions: **Multimodal Group** (n=6-8) 4h/d, 4d, 6w *General Exercise Therapy* *Mind-Body Exercise Therapy* Creative activities *Education - Basic knowledge* *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* **Three-way communication** Patient, GP/PSY or PSY-C Adjustments of treatment plan **Individual** TH or PSY or orthopaedic consultation **Workplace-based intervention** *Workplace intervention*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Qualitative designs					
17	1:Dorflinger et al. (2014) 2: Purcell et al. (2018) USA	Integrated Pain Team (ITP)	Pain Chronic	PH and/or NP PSY PR Team discussions about diagnosis and treatment plan Providing treatment Keeping track of treatments (inside and outside ITP)	**ITP** existing of: 3x, 2-3m, N=15-20/m **Interdisciplinary Assessment** 1h by complete team and patient *Assessment* *Education - Basic knowledge* **Medication management** During complete follow-up by ITP *Medication management* **Additional** *Education – Knowledge of disease prevention and ergonomics* *Education – knowledge of treatment* *Cognitive-behavioral therapy*
18	1: Bath et al. (2016) 2: Lovo et al. (2019) Canada	Secure video conferencing/telehealth	LBP Chronic	TH (urban-based) NP (local rural) 1x Digital assessment	**Digital assessment** 1x NP at patient side performing a physical examination *Assessment* *Education - Knowledge of treatment*
19	Pietilä Holmner et al. (2018) Sweden	Multimodal rehabilitation (MMR)	Pain Chronic Sick listed (or at risk)	THs PH PSY Team discussions about assessment and treatment	**MMR** Individual and/or group intervention *General Exercise Therapy* *Mind-Body Exercise Therapy* *Education - Knowledge of treatment*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
20	Stenberg et al. (2016) Sweden	Multimodal rehabilitation (MMR)	Pain Chronic Sick listed (or at risk)	THs PSY-C PSY GP DT NRS THs deliver treatment. Other members deliver treatment or have a consultation function	**MMR** By THs and optionally ≥1 of the other HCPs Group, individually, or combination *Cognitive-behavioural therapy*
21	1: Sundberg et al. (2007) 2: Sundberg et al. (2009) Sweden	Integrative medicine (IM) management	Back or Neck pain Mixed population subacute and chronic	GP Senior CT providers Team discussions about treatment plan	**IM** Conventional therapies, advise by GP *Education – Knowledge of disease prevention and ergonomics* *Anaesthetics* *General Exercise Therapy* **Complementary therapies by CT providers** 10x, 12w *Manual Therapy*
Between primary care and secondary or tertiary care					
Randomized trial designs					
22	Haldorsen et al. (1998) Norway	Multimodal Cognitive Behavioral Treatment (MMCBT)	Back, neck, shoulder pain, generalized muscle pain, more localized musculoskeletal disorders Subacute and chronic Sick listed	NEU GP PSY Registered NRS TH Team discussions on diagnosis and treatment plan Providing treatment (e.g., Education)	**Multidisciplinary rehabilitation** 6h, 5x/w, 4w Combination of group and individual treatment *Assessment* *Specific Exercise Therapy* *General Exercise Therapy* Individual by TH *Cognitive-behavioural therapy* (8x) *Education - Basic knowledge* *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment* 2x lectures and discussions by all healthcare professionals *Workplace interventions* By physician, human resource officer, occupational counsellor, representative of a governmental social insurance authority.

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
23	Rothman et al. (2013) Sweden	Multidisciplinary, multimodal (MM), multi-professional assessment	CMP Chronic	GP And ≥ 3: NRS PSY TH PSY-C OS when necessary: liaison PH at the Psychosomatic Medicine Clinic (PMC) Interdisciplinary team meeting about assessment	**Assessment in the MM Group** Each discipline had 1 meeting with patient (mean 7 sessions) Conference meeting to give treatment advice: Multidisciplinary group pain management at the PMC, Multidisciplinary individual pain management at the PMC, Multidisciplinary individual pain management at GP and associated team or at a multidisciplinary clinic. *Assessment*
24	Taylor-Gjevre et al. (2017) Canada	Video-conferencing	RA	Urban-based RT On-site TH Performing assessment and follow-up care	**Video-conferencing treatment** 4x TH is at patient side for physical examination and set up conferencing with the rheumatologist who is performing the assessment and follow-up care *Assessment*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Non-randomized trial designs					
25	Burnham et al. (2010) Canada	Central Alberta Pain and Rehabilitation Institute (CAPRI) program	Pain Chronic	PH TH GP PSY NRS DT KN Team discussions about treatment plan Executing of treatment (full multidisciplinary management)	**Referral documentation review** GP **Initial assessment** 1: spine care assessment: 1,5h, by PH and TH 2: medical care assessment (optional): 2h, by GP *Assessment* **Treatment** (1 of the options) I-1: Consultation only: education, activity modification and a customized home exercise program *Education* *General exercise therapy* I-2: Interventional management: anaesthetic block by PH *Anaesthetics* I-3: Supervised medication management: by GP *Medication management* I-4: Full multidisciplinary management (n=4-6): 5h, 1x/w, 2-3months, the whole team Group discussions about education and treatment plan *Psychotherapy* *Education - Basic knowledge* *Education - Knowledge of treatment*
26	Claassen et al. (2018) The Netherlands	Osteoarthritis (OA) education	OA in hip or knee	GP TH OS or NP Public health advisor (when available) Teaching in OA educational program	**OA educational program** (n=10-12) 1,5h, 2x *Education - Knowledge of disease prevention and ergonomics* *Education - Basic knowledge* *Education - Knowledge of treatment* **Booklet** Information, monitoring forms, course handout, 20 FAQs, a pedometer, and a list of websites and contact information

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
27	Plagge et al. (2013) USA	Integrated Management of Pain and PTSD in Returning OEF/OIF/ONDVEterans (IMPPROVE)	Pain Chronic Posttraumatic stress disorder Veterans	PSY PH Discussions about assessment and weekly telephone meetings about treatment	**Biopsychosocial evaluation** 90min by PSY *Assessment* **Care management** 1x/w by PSY and PH Reviewing recommendations with veterans, assessing interest and willingness to engage in recommended treatments, discussing concerns or questions, coordination of care between services, facilitating communication between the veteran and providers, helping veterans navigate the VA system, monitoring treatment plans **Behavioural Activation Psychotherapy** 8x, 75-90min Individual by PSY *Cognitive-behavioural therapy*
In primary care and between primary care and secondary or tertiary care					
Randomized trial design					
28	Stoffer-Marx et al. (2018) Austria	The combined intervention	OA in hand Chronic	RT THs NRS DT They have primary or specialized care setting expertise (or both) Two deliver treatment together	**Baseline assessment** By blinded assessor *Assessment* **The combined intervention** Individual treatment 7x/w, 8w By 2 HCPs *Specific Exercise Therapy* *Medication management* *Education – Knowledge of disease prevention and ergonomics* *Education - Knowledge of treatment*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Between primary care and social care					
Randomized trial designs					
29	Bültmann et al. (2009) Denmark	Coordinated and Tailored Work Rehabilitation (CTWR)	Musculoskeletal disorders or LBP Subacute and chronic Sick listed	OP TH CH PSY PSY-C Team discussions about diagnosis and treatment plan PSY-C as caseworker establishing and maintaining contact with the workplace and the municipal case manager Report of a work rehabilitation plan to GP	**CTWR**: existing of Work disability screening 1x, 2 h, 4-12w after sick leave Interdisciplinary *Assessment* Work rehabilitation plan max. 3 months Interdisciplinary with patient *Assessment* *Workplace intervention*
Non-randomized trial design					
30	Heijbel et al. (2013) Sweden	Occupational Health Service (OHS)	Mixed group Musculoskeletal problems Subacute and chronic Sick listed	PH TH PSY NRS Team assessment	**Team assessment** With team *Assessment* **Rehabilitation meeting and plan of measures** With patient, supervisor, several OHS team members, local insurance office, trade union (optional) **Treatment** *Education* *Cognitive-behavioural therapy* 4w, FU 6m or 12m *Workplace intervention* **Follow-up meeting after rehabilitation**

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Between primary care and secondary or tertiary care and social care					
Randomized trial designs					
31	1: Lambeek et al. (2007) 2: Lambeek et al. (2010) 3: Lambeek et al. (2010) **Interventions are identical to the interventions of Steenstra and Anema. (number 32)* The Netherlands	Multidisciplinary outpatient care program (MOC)	Non-specific LBP Chronic Sick listed <2 years	CM: coordination of care and communication team (primary-tertiary care) THs Patients own medical specialist GP OP Conference call with team: 1x/3w	**MOC** existing of: **Case management protocol** CM collect information from HCP team. Referral in collaboration with OP. Organization of conference calls. *Assessment* **Workplace intervention protocol** 8h, 4w TH helps to achieve consensus between patient and supervisor for return to work *Workplace intervention* **Graded activity program** max. 26 sessions, max. 12 weeks Local TH practices *Cognitive-behavioural therapy*
32	1: Steenstra et al. (2003) 2: Anema et al. (2007) **Interventions are identical to the interventions of Lambeek. (number 31)* The Netherlands	Workplace intervention and Graded Activity	Non-specific LBP Subacute and chronic Sick listed	1: OP GP Contact about referral 2: OP GP THs Workplace intervention with worker, employer, OP, GP	**Combined intervention (CI):** existing of **Workplace intervention (WI)** direct after inclusion (2-6 weeks after sick leave), 24d *Assessment* *Workplace intervention* **Graded Activity Program** (optional) 0,5h, 2x/w, max.26x After 8 weeks of sick leave By TH *Cognitive-behavioural therapy*

Table 2.2 (continued)

No.	Author, Year & Country	Intervention name	Target population	Collaboration	Content and intensity intervention
Between primary care and community-based care					
Randomized trial designs and qualitative designs					
33	1: McBeth et al. (2012) 2: Bee et al. (2016) England	Combined Cognitive Behavioral Therapy (T-CBT) and prescribed exercise (PE)	Fibromyalgia Chronic	TH FI Two-way information exchange between TH and FI	**T-CBT** 1h telephone assessment 30-45min, 1x/w, 7w, FU 3 and 6m By TH *Education - Knowledge of treatment* *Cognitive-behavioural therapy* **PE** 20-60h - 2x/w By FI *General exercise therapy*
34	1: Bennell et al. (2012) 2: Hinman et al. (2015) 3: Bennell et al. (2017) Australia	Physiotherapy plus telephone coaching	Patients with knee OA Subacute and chronic	TH TC Written information exchange between the TC and TH occurred after each session.	**Physical therapy program** 30m, 5x, 6 months *Specific exercise therapy* *General exercise therapy* **Information booklet** *Education – Knowledge of disease prevention and ergonomics* **Telephone coaching** 6-12x, 6 months *Cognitive-behavioural therapy*

Care manager (CM), Chiropractor (CH), Dietician (DT), Fitness instructors (FI), General practitioner/Primary care physician (GP), Internist (IT), Kinesiologist (KN), Neurologists (NEU), Nurse (NRS), Nurse care managers (NCM), nurse practitioners (NP), Occupational health nurse (OHN), Occupational physician (OP), Occupational rehabilitation providers (ORP), Orthopaedic surgeon/specialist (OS), Pharmacists (PR), Physician (Physiatrist, Rehabilitation physician) (PH), Podiatrists (PO), Psychologist (PSY), Psychosocial counsellor (Behavioural specialist, Counsellors, psychotherapist, Social worker) (PSY-C), Rheumatologist (RT), Speech pathologist (SP), Telephone coaches (TC), Therapists (Ergonomist, Occupational physiotherapist, Occupational therapist, Osteopaths, Physiotherapists) (TH). Low back pain (LBP), chronic musculoskeletal pain (CMP), osteoarthritis (OA), rheumatoid arthritis (RA).

Quadruple aim outcomes

An overview of the Quadruple Aim outcomes for each intervention is presented in Table 2.3. After data extraction from the included studies, it became evident that the interventions, outcome measures, and study designs were too heterogeneous to justify meta-analysis in the included studies. Therefore, narrative analyses were conducted.

Among the 49 articles, 19 randomized trials, 12 non-randomized studies, 7 qualitative studies, 7 study protocols, 1 description of an intervention, 2 studies with a population with mixed diagnoses, and 1 study regarding barriers and facilitators, were found. Thirty-nine articles had at least one of the Quadruple Aim outcomes as the primary outcome: 18 articles described health outcome measures, 12 described cost outcome measures, 4 described quality of care experienced by patients, and 5 articles describe work satisfaction for HCPs. Hinman et al. described quality of care experienced by patients and HCP work satisfaction as the combined primary outcome.[65] Most studies measured more than one Quadruple Aim outcome, but only two interventions intended to assess all Quadruple Aim outcomes. Dobscha et al. measured all Quadruple Aim outcomes but presented only the baseline results.[67] Bath et al. described all Quadruple Aim outcomes in the protocol article, but not all results are published yet.[68]

The outcomes of Dobscha et al., and Gustavsson et al., were only described as baseline measurements for an RCT.[67,69] From the remaining articles, comprising study protocols, description of the intervention, studies with mixed diagnoses, and the study regarding barriers and facilitators, no outcomes could be extracted.[25,48,51-54,58,60,71,72,83-85,96] These studies were used for descriptions of interventions in Table 2.2.

Within primary care—randomized trial designs

The most frequently presented outcome measure among randomized trial designs was pain intensity (five studies[70-74]). For Helminen et al., the maximum follow-up time was three months, resulting in a non-significant difference between intervention and control groups.[73] Four studies reported outcomes at one-year follow-up: two reported a significant improvement (50%)[71,72], while two reported no significant improvement (50%).[70,74] Pain intensity scores were measured with the 100-mm Visual Analogue Scale (VAS), the Chronic Pain Grade Severity subscale, or the 0–10 numerical pain rating scale (NPRS). Health-related quality of life (HRQoL) was measured in five studies. The improvement on the VAS score at six months of Hansson et al. (2010) was significantly different between intervention and control groups (20%).[75] In the other four studies (80%), HRQoL was not different between the groups at three, four, or twelve months, as measured with the RAND-36, Short Form-36, and EQ-5D questionnaires.[70,72,73,76]

Table2.3 Overview of study designs, study outcomes and results based on the Quadruple Aim.

	Author & year	Study date	Study design & N	Study outcomes	Results
In primary care					
Randomized trial designs					
1	Calner et al. (2016)	2011-2014	RCT N= I:60, C:49	*Health* * Pain intensity (100-mm Visual Analogue Scale) * Pain-related disability (Pain Disability Index) * Health-related quality of life (36-item Short-Form Health Survey) *Costs* * **Work-related aspects and behaviour §** (Work Ability Index (7-49)) * **Working percentage §**	 4m: **-** 1y: **-** 4m: **-** 1y: **-** *All domains:* 4m: **-** 1y: **-** 4m: **-** 1y: **-** +/-
2	Chelimsky et al. (2013)	-	Controlled pilot study N=40 pt N= I:12, C:16 HCPs HCPs are controlled, not the pts	*Health* * Pain intensity (0-10 Numeric Rating Scale) * Pain qualities (Short-Form McGill Pain Questionnaire) * Physical functioning; measured with: - Multidimensional Pain Inventory Interference Scale - Brief Pain Inventory - Multidimensional Health Locus of Control Scale * Emotional functioning; measured with: - Back Depression Inventory - Profile of Mood States *Experienced quality of care by patients* * Participant ratings of global improvement and satisfaction with treatment; measured with: - Patient Global Impression of Change - Treatment helpfulness questionnaire - Facilitation of patient involvement in care *Satisfaction with work by HCPs* * **Experiences with work ¥** (24-item physician perspectives questionnaire) - Knowledge - Diagnosis/Management - Treatment Comfort - Treatment Satisfaction - Use of Referrals * Interview regarding: MD functional approach, Patient functional approach, Enabling self-management, Assessing patient mood, Assessing patient sleep, Comfort with use of medication	*n.d between groups, over time:* 0m-1y: + 0m-1y: + 0m-1y: + 0m-1y: + 0m-1y: - 0m-1y: + 0m-1y: + *n.d.* *n.d.* + *n.d between groups, over time:* I: 0m-1y: - C: 0m-1y: - I: 0m-1y: + C: 0m-1y:+ I: 0m-1y: - C: 0m-1y: - I: 0m-1y: + C: 0m-1y: - I: 0m-1y: + C: 0m-1y: - *All:* +

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
3	DeBar et al. (2018)	2014-2017	Protocol Randomized pragmatic trial Intended N=851 pt in clusters	*Health* * **Pain, Enjoyment, General Activity (PEG) §** (3-item measure based on Short Form of the Brief Pain Inventory) * Pain-related disability (Roland Morris Disability Questionnaire) *Costs* * Healthcare utilization (opioids dispensed, both aggregated and disaggregated primary care contact, use of speciality pain services, inpatient services related to pain, and overall outpatient utilization) *Experienced quality of care by patients* * Patients' satisfaction with their primary care services (one question) * Satisfaction with overall pain-related services provided by the health plan (one question)	*n.a.*

Table 2.3 (continued)

Author & year	Study date	Study design & N	Study outcomes	Results
1: Dobscha et al. (2008)		1: RCT (baseline findings) I: 187 pt, 20 HCPs C: 214 pt, 22 HCPs	1: *Health* * Quality of life (EuroQoL-5D) * **Pain-related function/disability §** (Roland Morris Disability Questionnaire) * Pain severity (Chronic Pain Grade Severity subscale) * Depression severity (Patient Health Questionnaire) * Comorbidity (Chronic Disease Score (RxRisk-V [pharmacy data])) * Readiness for change (modelled after Epler) * Global Impression of Change *Costs* * Opioid prescriptions (number, type, doses, duration) * Use of adjuvant pain medications * Concurrent use of multiple short-acting opioids * Utilization and costs (primary care, pain speciality, mental health/SUD speciality, emergency, other ambulatory treatment visits, contact, inpatient days) *Experienced quality of care* * Global Care Satisfaction * Survey of Health Experiences of Veterans (pain care, 1-item) *Work satisfaction by HCPs* * Pain management attitudes/behaviors items * Job satisfaction * Provider helpfulness of intervention	*n.a. (only baseline results)*
4	2006-2007			
2: Dobscha et al. (2009)		2: RCT N= I:187, C:214	2: *Health* * Quality of life (EQ-5D) * **Pain-related function/disability §** (Roland Morris Disability Questionnaire) * Pain intensity (Chronic Pain Grade Severity subscale) * Depression severity (Patient Health Questionnaire) * Global Impression of Change *Costs* * Opioid prescriptions (number, type, doses, duration) * Use of adjuvant pain medications, use of multiple short-acting opioids * Utilization and costs (Primary care, pain specialty, mental health/SUD specialty, emergency, other ambulatory treatment visit, and contacts; inpatient days) *Experienced quality of care by patients* * Global Care Satisfaction	0-1y: - 0-1y: + 0-1y: + 0-1y: + 0-1y: + 0-1y: + 0-1y: - 0-1y: +/- 0-1y: -

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
5	Gustavsson et al. (2018)	2011-2013	Feasibility study Pragmatic RCT N= I:15, C:17 pt N= 7 HCPs	*Health* * Health-related quality of life (EuroQoL-5D) * Disability * Pain intensity * Pain catastrophizing * Pain-related fear-avoidance * Depression * Anxiety *Costs* * Sickness absence * Costs-utility *Experienced quality of care by patients* * Patients' satisfaction with treatment (Self-assessment questionnaire) *Satisfaction with work by HCPs* * **Perceived usability of the program ¥** (interview) * **Proficiency in applying the techniques and delivering of the intervention components ¥** (interview)	*n.a. (only baseline results)* 1y: - 9w: +/- 1y: + 9w: - 1y: - + +
6	Hansson et al. (2010)	-	RCT N= I:61, C:53	*Health* ** Self-perceived health ¢ (EuroQol-5D)* ** Function lower extremities (one-leg rising from sitting to standing)* ** Balance performance; measured with:* *- standing one leg eyes open* *- standing one leg eyes closed* ** Function upper extremities (Grip Ability Test)*	*6m: Index: - VAS: +* *6m: -* *6m: -* *6m: +* *6m: -*

Table 2.3 (continued)

Author & year	Study date	Study design & N	Study outcomes	Results
1: Helminen et al. (2013)		1: Protocol RTCT Intended N= I:54, C:54	*1: Health* * **Self-reported pain §** (pain subscale of the Western Ontario and McMaster Universities Osteoarthritis Index) * Physical functioning and stiffness (corresponding subscales of the Western Ontario and McMaster Universities Osteoarthritis Index) * Pain intensity (0-10 Numeric Rating Scale) * Health-related quality of life (RAND-36 item Health Survey and 15-dimensional Health-related Quality of Life) * Life satisfaction (4-item Life Satisfaction) * Kinesiophobia (Tampa Scale for Kinesiophobia) * Catastrophizing (Pain Catastrophizing Scale) * Depressive symptoms (Beck Depression Inventory) * Global assessment of change *Costs* * Use of analgesics, topical pain medication (patient reports) * Number of intra-articular injections * Use of health services * Number of sick-leave days * Cost-effectiveness (QALY)	*n.a.*
7	2011-2012		*2: Health* * **Self-reported pain §** (pain subscale of the Finnish version of the Western Ontario and McMaster Universities Osteoarthritis Index) * Physical functioning and stiffness (corresponding subscales of the Western Ontario and McMaster Universities Osteoarthritis Index) * Pain intensity (0-10 Numeric Rating Scale) * Health related quality of life (RAND-36 item Health Survey and 15-dimensional Health-related Quality of Life) * Life satisfaction (4-item Life Satisfaction) * Kinesiophobia (Tampa Scale for Kinesiophobia) * Catastrophizing (Pain Catastrophizing Scale) * Depressive symptoms (Beck Depression Inventory) * Global assessment of change * BMI (weight/length2) *Costs* * Pain medication * Use of health services * Number of sick-leave days	3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: - 3m: -
2: Helminen et al. (2015)		2: RCT N= I:55, C:56		

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
8	1: Nordin et al. (2016) 2:Nordin et al. (2017)	2011-2015	1: RCT N= I:55, C:43 2: Qualitative interviews N=19	*1: Health* * **Pain intensity ¶** (100-mm Visual Analogue Scale) *Experienced quality of care by patients* * Patients' satisfaction with the intervention (2-items) *Costs* * Intervention characteristics * Health care consumption * Sick leave *2:* ***Experienced quality of care by patients ¶*** * Experiences of patient participation in the rehabilitation and intervention Theme: It's about me - Take part in a flexible framework of own priority - Acquire knowledge and insights - Ways toward change - Personal and environmental conditions influencing participation	4m: - 1y: - 4m&1y: *intervention:* + 4m&1y: *own effort:* - *no significance calculated* +/- + +/- +/-
Non-randomized trial designs					
9	1: Dunstan et al. (2007) 2: Dunstan et al. (2014)	-	1: Pilot study Uncontrolled repeated measures design N=30 2: Qualitative design N=33	1: *Health* * Pain severity (0-10 Numeric Rating Scale) * Mood (Depression, Anxiety, Stress Scales) * Disability (Modified Roland Morris Disability Questionnaire) * Catastrophizing (Pain Catastrophizing Scale) * Fear-avoidance (Tampa Scale for Kinesiophobia) *Costs* * **Paid work participation ¥** (for any number of hours) 2: ***Experienced quality of care by patients ¶*** * How much the program helped them to manage their pain, become more active, and get back to work (5-point Likert-type scales) * The helpfulness of each component of the program (5-point Likert-type scales) * The quality of the psychologist's and physiotherapists' input (5-point Likert-type scales) * Program improvements	*Pre- post program:* + + - + + 6m: - +/- +/- + *n.d.*

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
10	Gurden et al. (2012)	2009-2010	Uncontrolled pilot study N=696	*Health* * **Back and neck pain ¥** (Bournemouth Questionnaire) *Costs* * Medication usage * Other healthcare utilization * Work status *Experienced quality of care by patients* * a patient satisfaction with treatment scale (5-point scale)	*Baseline and discharge:* + + + *no results described* +
11	1: Mårtensson et al. (1999) 2: Mårtensson et al. (2004) 3: Mårtensson et al. (2006)	2004 2002-2003	1: Longitudinal pre-post test design N=70 2: A longitudinal intervention study design N=54 3: Explorative descriptive qualitative design N=24	1: *Health* * **General well-being ¥** (100-mm Visual Analogue Scale) * Pain management ability (100-mm Visual Analogue Scale) * Perceived complaints (100-mm Visual Analogue Scale) * Influence of the intervention and perceived change due to treatment (Personality-Physical-Cognitive) 2: *Costs* * **Sick leave days ¶** (Statistics register at the social insurance office) * Doctor visits (Statistics register at the county council in question) * Level of absenteeism due to occupational disability (Statistics register at the social insurance office) 3: ***Experienced quality of care by patients §*** * Content, format, the group's role, the leader's role, and the participant's role - A place to which you belong - An encouraging environment - Expectations of being regarded as a sick person - The value of one's own contribution - Reacting but not acting - Awareness and integration	0m-2m: + 0m- 2y: + 0m-2m: - 0m- 2y: + 2m-2y: + 0m-2m: + 0m- 2y: + *Body awareness:* + *Other:* - 0m-1y: - 0m-2y: + 1y-2y: + 0m-1y: + 0m-2y: + 1y-2y: + 0m-post: + 0m-1y: + 0m-2y: + + + - + - -

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
12	Schütze et al. (2014)	-	Pilot study Repeated measures design N=12	*Health* * Risk of future disability (Örebro Musculoskeletal Pain Questionnaire) * Low-back related functional disability (Oswestry Disability Questionnaire) * Emotional functioning (Short form of the Depression, Anxiety, Stress Scales) - Depression - Anxiety - Stress * Present-moment awareness of actions, interpersonal communication, thought, emotions, and physical state (Mindful Attention Awareness Scale) * Catastrophizing (Pain Catastrophizing Scale) * **Health status and health-related quality of life ¶** (36-item Short-Form Health Survey) *Experienced quality of care by patients* * Patient satisfaction (Client Satisfaction Questionnaire)	0m-3m: - 0m-6m: - 0m-3m: + 0m-6m: - 0m-3m: - 0m-6m: + 0m-3m: - 0m-6m: - 0m-3m: + 0m-6m: + 0m-3m: - 0m-6m: + 0m-3m: + 0m-6m: + *All:* 0m-3m: + 0m-6m: + +
13	Stein et al. (2013)	2008-2011	Controlled pragmatic trial N = 59	*Health* * Pain intensity (0-10 Numeric Rating Scale) * Anxiety and depression (Hospital and Anxiety Depression Scale) - Anxiety - Depression * Pain severity (Multidimensional Pain Inventory) * Health-related quality of life; measured with: - 36-item Short-Form Health Survey, social function - EuroQoL-5D, physical function *Costs* * Sick-leave (Software-system “Swedestar”) * **Consumption of opioids §** (Software-system “Swedestar”) * Healthcare utilization	1y: - 1y: - 1y: + 1y: - 1y: + 1y: - 1y: + 1y: - 1y: +

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
14	Tyack et al. (2013)	2010	Protocol Longitudinal cohort study Intended N=130	*Health* * **Health § (36-item Short-Form Health Survey)** * BMI (weight/length2) * Waist circumference * Psychological distress (6-item Kessler) * Disease burden (self-report comorbidity measure) * Comorbid conditions (self-report comorbidity measure) * Perceived functional and structural social support (Medical Outcomes Study Social Support Survey) * Self-reported health perception (one question) *Costs* * Hospital utilization (number of days spent in hospital, and number of hospital admissions) * Healthcare costs (Medicare and hospital utilization records)	*n.a.*
15	Westman et al. (2006)	1994-1996	Cohort N=72	*Health* * **Quality of life - life satisfaction ¥** (10-items self-constructed questionnaire) * Intensity of pain and frequency (100-mm Visual Analogue Scale) * Function (Disability Rating Index) * Anxiety and depression (Hospital and Anxiety Depression Scale) * Health profile assessment *Experienced quality of life by patients* * Patient satisfaction (three questions) *Costs* * Sick leave/Return to work (self-reported data) * Job strain (11-items self-constructed questionnaire)	0m-1y: - 0m-5y: + 0m-1y: + 0m-5y: + 0m-1y: - 0m-5y: + 0m-1y: - 0m-5y: + 0m-1y: + 0m-5y: +/- + +/- 0m-1y: + 0m-5y: -

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
16	Westman et al. (2010)	1998-2000	Trial with control group N= I: 59, C:52	*Health* * **Health-related quality of life ¥** (36-item Short-Form Health Survey) * Coping (Coping strategies questionnaire) * Catastrophizing (Pain Catastrophizing Scale) * Fear of movement (Tampa Scale for Kinesiophobia) * Psychosomatic symptoms *Costs* * Work capacity/sick leave (reported by patients) * Job strain (11-items, self-constructed questionnaire) * Health care utilization (how many visits (0 to 10) during the past 12 months) - GP - Physiotherapist, - Naprapath or chiropractor * Drug consumption (one question)	 3y: - 3y: - 3y: - 3y: - 3y: - 3y: - 3y: - 3y: + 3y: - 3y: + 3y: -
Qualitative designs					
17	1:Dorflinger et al. (2014) 2: Purcell et al. (2018)	2015-2016	1: Description of intervention 2: Mixed methods trial Interviews: N=61 Questionnaire: N=65	1: n.a. 2: *Work satisfaction by HCPs* * **Perspectives on the perceived effectiveness of the chronic pain care provided to their patients ¥** * Job satisfaction, stress level, and burnout * Confidence in and comfort with providing chronic pain care * Provider confidence in and satisfaction with chronic pain care and the intervention (questionnaire) * Burnout measure (1 item, based on Maslach Burnout Inventory)	*n.a.* *n.a. mixed population*

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
18	1: Bath et al. (2016)	2014-2015	1: Protocol RCT Intended N= I:20 C:20	1: *Health* *__Self-perceived function §__ (Modified Oswestry Disability Questionnaire) * Pain intensity (0-10 Numeric Rating Scale) * Quality of life/general health status (EuroQoL-5D) *Costs* *Costs (self-report diaries: intervention/treatment costs, work status, absenteeism and disability days related to back pain, health service use, other pain-related costs, and costs from participation in the study) *Experienced quality of care by patients* *Patient satisfaction (a modified version of the Visit Specific Satisfaction Instrument) *Work satisfaction by HCPs* *Satisfaction of HCPs with intervention (semi structured interview)	*n.a.*
	2: Lovo et al. (2019)		2: Qualitative design Questionnaire: N=19 pt Interview: N=2 HCP, N=6 pt	2: *Experienced quality of care by patients* *Patient satisfaction (a modified version of the Visit Specific Satisfaction Instrument, a space for comment, and semi-structured interviews) *Work satisfaction by HCPs* * **Satisfaction of HCPs with PT-delivered telehealth assessments §** (semi structured interview) - Access to care - Effective interprofessional practice - Enhanced clinical care - Technology	+ + + + +/-
19	Pietilä Holmner et al. (2018)	-	Qualitative interviews N=12	*Experienced quality of care by patients* * **Experiences of MMR §** (interview) - from discredited towards obtaining redress - from uncertainty towards knowledge - from loneliness towards togetherness - “acceptance of pain”: an ongoing process	 +/- + +/- +/-

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
18	1: Bath et al. (2016) 2: Lovo et al. (2019)	2014-2015	1: Protocol RCT Intended N= I:20 C:20 2: Qualitative design Questionnaire: N=19 pt Interview: N=2 HCP, N=6 pt	1: *Health* ***Self-perceived function §*** (Modified Oswestry Disability Questionnaire) * Pain intensity (0-10 Numeric Rating Scale) * Quality of life/general health status (EuroQoL-5D) *Costs* *Costs (self-report diaries: intervention/treatment costs, work status, absenteeism and disability days related to back pain, health service use, other pain-related costs, and costs from participation in the study) *Experienced quality of care by patients* *Patient satisfaction (a modified version of the Visit Specific Satisfaction Instrument) *Work satisfaction by HCPs* *Satisfaction of HCPs with intervention (semi structured interview) 2: *Experienced quality of care by patients* *Patient satisfaction (a modified version of the Visit Specific Satisfaction Instrument, a space for comment, and semi-structured interviews) *Work satisfaction by HCPs* * **Satisfaction of HCPs with PT-delivered telehealth assessments §** (semi structured interview) - Access to care - Effective interprofessional practice - Enhanced clinical care - Technology	*n.a.* + + + + +/-
19	Pietilä Holmner et al. (2018)	-	Qualitative interviews N=12	*Experienced quality of care by patients* * **Experiences of MMR §** (interview) - from discredited towards obtaining redress - from uncertainty towards knowledge - from loneliness towards togetherness - “acceptance of pain”: an ongoing process	 +/- + +/- +/-

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
20	Stenberg et al. (2016)	2013-2014	Qualitative design N=14	***Satisfaction with work by HCPs §*** * Benefits and drawbacks of including patients in MMR * Types of patients in MMR * Factors that facilitate or impede conduct of MMR * Professional views on MMR * Teamwork experiences - Select patients for success - Multilevel challenge - Ethical dilemmas - Considering what is a good result	*n.a. mixed population*
21	1: Sundberg et al. (2007) 2: Sundberg et al. (2009)	2003-2006	1: Qualitative study design 2: Feasibility study Pragmatic RCT N= I:36, C:27	1: Barriers and facilitators: Notes of research group meetings (N=40) and field notes from seminars and lectures about results from the development and implementation phases *Outcomes are not one of the Quadruple Aim outcomes* 2: *Health* * **Health-related quality of care §** (36-item Short-Form Health Survey) * Disability (0-10 Numeric Rating Scale) * Stress (0-10 Numeric Rating Scale) * Well-being (0-10 Numeric Rating Scale) * Days in pain (0-10 Numeric Rating Scale) *Costs* * Use of analgesics (0-10 Numeric Rating Scale) * Use of health care (0-10 Numeric Rating Scale)	*n.a.* 16w: *All subscales:* - 16w: - 16w: - 16w: - 16w: - 16w: - 16w: -

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
Between primary care and secondary or tertiary care					
Randomized trial designs					
22	Haldorsen et al. (1998)	-	RCT N= I:312; C:157	*Health* * Quality of life (6-items, self-constructed questionnaire) * Pain intensity (drawing test and 100-mm Visual Analogue Scale) * Amount of pain caused by daily activities (Activity Discomfort Scale) * Subjective health (Ursin's Health Inventory) * Anxiety (Spielberger State Trait anxiety Scale) * Psychological distress (brief version of the Hopkins Symptom Check List) * Health locus of control (Multidimensional Health Locus of Control Scale) * Physiotherapy examination (functional ability, movement, relaxation ability, pain, aerobic capacity test, practical skills) *Costs* * **Return to work after 12 months §** * Subjective work ability (Graded Reduced Work Ability scale)	 1y: +/- *n.d.* 1y: +/- 1y: + 1y: - 1y: + 1y: + 1y: +/- 1y: - 1y: +
23	Rothman et al. (2013)	2001-2004	RCT N= I:91, C:91	*Health* * **Pain intensity ¢** (100-mm Visual Analogue Scale) * Depressive symptoms (Zung Self-Rating Depression Scale) * Stress-related symptoms (Stress and Crisis Inventory) * Quality of life (36-item Short-Form Health Survey) * Pain related disability (Oswestry Disability Index) *Costs* * Work ability (Swedish government insurance company) *Experienced quality of care by patients* * Patient satisfaction with assessment (study-specific questionnaire)	 15m: - 15m: - 15m: - 15m: +/- 15m: - 15m: + 15m:+
24	Taylor-Gjevre et al. (2017)	-	RCT N= I:31, C:23	*Health* * **Disease activity §** (Disease Activity Score-28) * Quality of Life (EuroQoL-5D) * Patient's global function score (100-mm Visual Analogue Scale, global function) *Experienced quality of care by patients* * Satisfaction (9-item visit-specific satisfaction questionnaire)	 9m: - 9m: - 9m: - 9m: -

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
Non-randomized trial designs					
25	Burnham et al. (2010)	2006-2007	Prospective cohort N=29	*Health* * Pain intensity (0-10 Numeric Rating Scale) * **Pain interference ¥** (Pain Interference Questionnaire)	 I-4: 0m-discharge: + I-4: 0m-discharge: +
26	Claassen et al. (2018)	2015-2016	Observational pilot study N=107	*Health* * BMI (weight/length2) * Pain and limitations in functional activities (Western Ontario and McMaster Universities Osteoarthritis Index, pain and physical functioning subscales) * Illness perceptions (Brief illness Perception Questionnaire) * Physical activity (Short Questionnaire to Assess Physical Activity) *Costs* * **Healthcare Utilization ¥** (self-constructed questionnaire and patient diary pain medication, total number of contacts) *Experienced quality of care by patients* * Patient satisfaction (1-item, with satisfaction with course)	 0m-3m: - 0m-3m: - 0m-3m: + 0m-3m: - 0m -3m:+ +
27	Plagge et al. (2013)	-	Retrospective study N=30	*Health* * Pain severity and interference (Chronic Pain Grade) * Pain catastrophizing (Pain Catastrophizing Scale) * Fear avoidance (Tampa Scale for Kinesiophobia) * Depressive symptoms (Patient Health Questionnaire) * **Quality of life ¶** (Center for Disease Control Health-Related Quality of Life Measure) * Satisfaction with life (Satisfaction with Life Scale)	 0m-post: All: + 0m-post: + 0m-post: + 0m-post: + 0m-post: All: + 0m-post: +
In primary care and between primary care and secondary or tertiary care					
Randomized trial designs					
28	Stoffer-Marx et al. (2018)	2012-2014	RCT N= I:59, C:69	*Health* * Pain * Health status * **Grip strength §** *Experienced quality of care by patients* * Satisfaction of patients with their health care	 2m: - 2m: - 2m: + 2m: +

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
Between primary care and social care					
Randomized trial designs					
29	Bültmann et al. (2009)	2004-2005	RCT N= I:66 C:47	*Health* * Pain intensity (2-items from Örebro Musculoskeletal Pain Questionnaire) * Functional disability (Oswestry Disability Questionnaire) *Costs* * **Administrative data on cumulative sickness absence hours §** (The Danish National Health Insurance Service Registry) * Work status; return to work, full-time/part-time sick leave) (from the Danish National Health Insurance Service Registry) * Cost-benefit analysis; cumulative sickness absence hours, consultations and costs of primary health care utilization, outpatient treatment, hospitalization, and prescribed medications (the Danish National Health Insurance Service Registry, the Danish National Patient Registry, and the Danish National Prescription Registry)	3m: + 6m: - 3m: - 6m: - 0-3m: - 3-6m: - 6-1y: + 0-6m: + 0-1y: + *n.d.* 3m: +/- 1y: +/-
Non-randomized trial designs					
30	Heijbel et al. (2013)	2000-2003	Longitudinal design N=779	*Costs* * **Return to work ¥** (number of days to full- or part-time return to work) *Satisfaction with work by HCPs* * Experiences of driving and implementing a workplace-based rehabilitation intervention	2y: + +/-

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
Between primary care and secondary or tertiary care and social care					
Randomized trial designs					
	1: Lambeek et al. (2007)		1: Protocol RCT Intended N= I:65, C:65	*1: Health* * Pain intensity (10-point Visual Analogue Scale) * Functional status (Roland Morris Disability Questionnaire) * Quality of life (EuroQoL-5D) *Costs* * **Return To Work §** (sick leave in calendar days during study until full return to work in own or other work, for at least 4 weeks without recurrence) * Total duration of sick leave * Direct (non)-medical costs (diaries) *Experienced quality of care by patients* * Patient satisfaction (Patient Satisfaction with Occupational Health Services Questionnaire)	*n.a.*
31	2: Lambeek et al. (2010)	2005-2009	2: RCT N= I:66, C:68	*2: Health* * Pain intensity (10-point Visual Analogue Scale) * Functional status (Roland Morris Disability Questionnaire) *Costs* * **Return To Work §** (sick leave in calendar days during study until full return to work in own or other work, for at least 4 weeks without recurrence) * Total duration of sick leave	3m: - 6m: - 1y: - 3m: - 6m: - 1y: + 1y: + 1y: +
	3: Lambeek et al. (2010)		3: RCT N= I:66, C:68	*3: Costs* * **Duration until sustainable Return To Work §** (sick leave in calendar days during study until full return to work in own or other work, for at least 4 weeks without recurrence) * Direct (non)-medical costs (diaries) - Total costs and indirect costs - Total direct costs - Cost-effectiveness - Cost-benefit	1y: + 1y: + 1y: - 1y: +/- 1y: +

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
32	1: Steenstra et al. (2003)	2000-2002	1: Protocol RCT Intended N= I:100, C:100	*1: Health* * Functional status (Roland Morris Disability Questionnaire) * Pain intensity (10-point Visual Analogue Scale) * Kinesiophobia (Tampa Scale for Kinesiophobia) * Fear of movement (Fear Avoidance Beliefs Questionnaire) * Coping (Pain Coping Inventory Scale) *Costs* * **Return to work in the year after the first day of sick leave §** * Workers use of pain medication and use of medical and alternative medical resources and general health status (EuroQoL-5D) *Experienced quality of care by patients* * Patient satisfaction (short version Patient Satisfaction with Occupational Health Services Questionnaire)	*n.a*
	2: Anema et al. (2007)		2: Pragmatic RCT N= I:27, C:85	*2:Health* * Functional status (Roland Morris Disability Questionnaire) * Pain (10-point Visual Analogue Scale) *Costs* *** Sick leave duration due to LBP §**	1y: - 1y: - 1y: -

Table 2.3 (continued)

Author & year	Study date	Study design & N	Study outcomes	Results
Between primary care and community-based care				
Randomized trial designs a qualitative designs				
1: McBeth et al. (2012)	-	1: RCT N= I:102 C:98	1: *Health* * **Change in health §** (7-point, Clinical Global Impression Change Score) * Quality of life (36-item Short-Form Health Survey) - Physical component score - Mental component score * Pain severity (Chronic Pain Grade) * Mental health (General Health Questionnaire) * Fear of movement (Tampa Scale for Kinesiophobia) *Costs* * Cost-effectiveness analysis	6m: + 9m: + 6m: + 9m: + 6m: - 9m: - 6m: - 9m: - 6m: - 9m: - 6m: - 9m: + 6m: - 9m: -
2: Bee et al. (2016)		2: Qualitative study N=44	2: *Health* * Participants' illness experiences (patients' physical and emotional reactions to pain, their rationalization of chronic or unexplained symptoms) *Experienced quality of care by patients* * **Participants' treatment experiences ¥** (their treatment preferences and the perceived fit between the trial interventions and patient need)	+/- +/-

Table 2.3 (continued)

	Author & year	Study date	Study design & N	Study outcomes	Results
	1: Bennell et al. (2012)		1: Protocol Pragmatic RCT Intended N= I:67, C:67	1: *Health* * **Average pain in the past week §** (11-point Numeric Rating Scale) * Physical function in past 48 h (Western Ontario and McMaster Universities Osteoarthritis Index, physical function subscale) * Global rating of change * Change in pain (7-point ordinal scale) * Change in physical functioning (7-point ordinal scale) * Physical activity (Physical Activity Scale for the Elderly, Active Australia Survey, stepping duration and steps per day over 7 consecutive days) * Health-related quality of life (Assessment of Quality of Life Instrument version 2) * Mood (Arthritis Impact Measurement Scale Version 2) * Emotional state (Depression, Anxiety and Stress Scale) * Fear of injury (Brief Fear of Movement Scale) * Symptom severity (Patient Health Questionnaire) * Coping (Coping Strategies Questionnaire) * Catastrophizing (Pain Catastrophizing Scale)	*n.a.*
34		2012-2015			

Table 2.3 (continued)

Author & year	Study date	Study design & N	Study outcomes	Results
			2: *Experienced quality of care by patients*	
			Satisfaction with care by HCPs	
			- Theme 1: genuine interest and collaboration	+
			- Theme 2: information and accountability	+/-
			- Theme 3: program structure	+/-
		2: Process evaluation	**- Theme 4: roles and communication in teamwork**	+/-
1 2: Hinman et al. (2016)		N=6 pt; N=14 HCP	3: *Health*	
			*** Knee pain intensity §** (11-point Numeric Rating Scale)	6m: - 1y: - 18m: -
34			*** Physical function in the previous 48 h §** (Western Ontario and McMaster Universities Osteoarthritis Index)	6m: - 1y: - 18m: -
			* Pain on walking in the past week (11-point Numeric Rating Scale)	6m: - 1y: - 18m: -
		3: Pragmatic RCT	* Pain (Western Ontario and McMaster Universities Osteoarthritis Index)	6m: - 1y: - 18m: -
3: Bennell et al. (2017)			* Health related quality of life (Assessment of Quality of Life Instrument version 2)	6m: - 1y: - 18m: -
		N= I:84 C:84	* Physical activity (stepping duration and steps per day over 7 consecutive days)	6m: - 1y: - 18m: - 6m: + 1y: + 18m: +
			Costs	
			* Number of physiotherapy visits	*No comparison between groups*

-: year not known; pt: patient; HCP; healthcare professional; N: number of participants; I: intervention; C: control; §: primary outcome as described in article; ¢: primary outcome as based on sample size calculation; ¥; primary outcome as based on aim of intervention; ¶: primary outcome based on appearance in Quadruple Aim; in bold: primary outcome; n.a.: not applicable; n.d.: no data presented; In randomized designs: + is significant compared to control group; - is non-significant compared to control group; In non-randomized designs: + is significant over time; - is non-significant over time; qualitative: + only positive opinions mentioned; - only negative opinions mentioned; +/- positive as well as negative opinions mentioned. Articles without results are described in grey.

Outcomes regarding sick leave/working days or medication prescription and use were most often measured for the Quadruple Aim of health care costs (five studies). At four-month follow-up, Calner et al. found positive and negative changes at the different levels of working percentages for the number of working participants in the intervention group compared to the control group.[70] Regarding sickness absence, Gustavsson et al. found no significant change in absence at one-year follow-up.[69] Additionally, Helminen et al. found no significant difference in the number of sick-leave days at three-month followup between the intervention and control groups.[73,76] They also found no difference in medication use at three-month follow-up between the control and intervention group, just like Sundberg et al. at four-month follow-up.[73,76] Dobscha et al. found a significant difference in opioid prescriptions at one-year follow-up but non-significant differences in the use of adjuvant pain medications between intervention and control groups.[72]

Quality of care experienced by patients was measured in two studies. On a selfassessment questionnaire measuring the quality of care completed by patients, Chelimsky et al. found a significant result at one year for the facilitation of patient involvement in care, though no differences at nine weeks and one year were seen by Gustavsson et al..[69,71]

Both of these studies also examined HCP satisfaction with the care they delivered. At one-year follow-up, HCPs providing the interventions rated their work (significantly) more positively than did HCPs in the control conditions.

Within primary care—non-randomized study designs

All included studies had a longitudinal design (follow-up after intervention), but only two studies included a control condition. All seven interventions evaluated health outcomes. Pain intensity was only reported in two studies, with mixed results at one year and significant pain decreases at five years in both studies.[87,89] In four studies, including one protocol, HRQoL was the primary outcome, and in one study, it was the secondary outcome. At three months, six months, one year, and five years, significant changes were found. HRQoL was measured with the Short Form-36 or a self-constructed questionnaire.[86,87,90] Three studies reported no change in quality of life at one- and three-year follow-ups, as measured with the Short Form-36, EQ-5D, or self-constructed questionnaire.[87,89,90]

Costs were evaluated in six interventions, with sick leave or paid work participation as the most frequently reported measurement. In Dunstan et al. andWestman et al., the changes in paid work participation and sick leave were non-significant (40% of the studies) at six-months and three-year follow-up, respectively.[80,90] Stein et al. and Mårtensson et al. found at one- and two-year follow-ups significant changes, compared

with baseline assessment (40% of the studies).[84,87] Westman et al. reported mixed results (20% of the studies) for both sick leave and return to work.[89] Stein et al. and Westman et al. found no significant changes at one- and three-year follow-ups for opioids and drug consumption.[87,90] On the other hand, Gurden et al. found a significant decrease in medication usage after discharge.[82]

Three studies found significant positive (100%) results for quality of care experienced by patients.[82,86,89]

None of these interventions evaluated HCPs' satisfaction with the care they delivered.

Within primary care—qualitative designs

None of the six qualitative designs within the primary care interventions evaluated changes in health or costs.

Quality of care experienced by patients was assessed on different items by three studies, with mixed results.[79,81,93] For example, Dunstan et al. found that patients made both positive and negative points about the usefulness of the program for managing their pain, helping them to become more active and to get back to work, but expressed only positive views about the quality of treatment by HCPs.[81] Additionally, one study found clear positive results (atmosphere, environment, value of one's contribution) and negative results (expectations of a sick person, reacting but not acting, awareness and integration) on various items.[85] Lovo et al. reported positive results for the quality of care, measured with both qualitative questionnaires and interviews.[92]

Lovo et al. evaluated HCP work satisfaction, reporting overall positive results regarding access to care, effective inter-professional practice, and enhanced clinical care.[92] Only technology (telehealth) was scored less positively.

Between primary care and secondary or tertiary care—randomized trial designs

All three randomized trial designs of the interventions combining primary care and secondary or tertiary care measured health outcomes.[50,52,53] Rothman et al. reported a non-significant difference between the intervention and control groups at 15-month followup for the primary outcome of pain intensity.[52] In the study of Taylor-Gjevre et al., the difference between intervention and control groups in disease activity at a nine-month follow-up was also non-significant.[53] All three studies measured HRQoL but different measurement instruments were used (EQ-5D, Short Form-36, and a self-constructed questionnaire). In two studies, significant results were found on some questionnaires'

subscales, with non-significant results on other subscales, at one-year and 15-month follow-ups, while one study found non-significant results at a nine-month follow-up.

Cost outcomes were measured by Haldersen et al., and Rothman et al..[50,52] Changes in return to work after 12 months did not differ between groups, while changes in ability to work did at a 15-month follow-up.

Rothman et al., and Taylor-Gjevre et al. measured experienced quality of care by patients with questionnaires.[52,53] Although no differences were found at nine months, at the 15-month follow-up, the intervention group rated quality of care experienced higher than did the control group. HCP work satisfaction was not measured in any of these three studies.

Between primary care and secondary or tertiary care—non-randomized trial designs

Health outcomes were assessed with less widely used outcome measures by all three non-randomized trial designs.[48,49,51] Burnham et al. had pain interference as the primary outcome, which was significant after treatment discharge in the cohort study.[48] Plagge et al. found significant changes in all domains of HRQoL post-intervention.[51] Claassen et al. found significant improvement only in illness perceptions after three months, whereas non-significant differences were found for BMI, pain, and limitations in functional activities, and physical activity after three months.[49]

The study of Claassen et al. was the only one measuring the health care costs and quality of care experienced by patients, goals of the Quadruple Aim; both had significant results at the three-month follow-up.[49]

None of the three included studies measured HCP work satisfaction.

In primary care and between primary care and secondary or tertiary care—randomized trial design

Only one study was included which described a collaboration within primary care as well as between primary care and secondary or tertiary care.[54] The study had grip strength as the primary outcome, which was significantly different in the intervention group at the two-month follow-up. The other health outcomes, pain and health status, showed non-significant differences at that time point.

This study also found significant results regarding quality of care experienced by patients at the two-month follow-up.

Costs and HCP work satisfaction were not measured.

Between primary care and social care—randomized trial design

Bültmann et al. was the only included study evaluating collaboration between primary and social care.[55] For health outcomes, no significant changes in pain intensity and functional disability between intervention and control groups were reported at any time point.

Cumulative sickness absence hours was the primary outcome of this study. Results showed a significant decrease in sick leave at six and 12 months, compared to the control group.

Bültmann et al. did not measure outcomes on quality of care experienced by patients or HCP work satisfaction.[55]

Between primary care and social care—non-randomized study design

Heijbel et al. evaluated the collaboration between primary and social care, but, in this study, health outcomes and quality of care experienced by patients were not measured.[56] For return to work, the primary outcome of this study, a significant improvement was found after two years.

Mixed results were reported regarding HCP work satisfaction, measuring the experiences of executing and implementing a workplace-based rehabilitation intervention.

Between Primary Care and Secondary or Tertiary Care and Social Care—Randomized Trial Designs

Two interventions in this group were evaluated, one intervention by two studies and the other by one.[57,59,60] Two studies measured health outcomes: pain intensity with the VAS and functional status with the Roland-Morris Disability Questionnaire.[57,60] Only functional status was positively changed at 12 months, whereas the other associations at 3, 6, and 12 months were all non-significant between the groups.

In all three studies, the primary outcome was the duration of sick leave to a full return to work. In both studies of Lambeek, significant differences were found at the 12-month follow-up, favoring the intervention over the control group.[59,60] However, in the study of Anema et al., non-significant differences between interventions were found within the same timeframe.[57]
No measurements were performed for the quality of care experienced by patients or HCP work satisfaction.

Between primary care and community-based care—randomized trial designs

Two interventions, with three randomized trial designs, of which one was a protocol, were found reporting such collaboration between primary care and community-based care. Two studies measured health outcomes.[63,66] McBeth et al. had change in health as the primary outcome, which was significantly more improved at six and nine months than in the control group.[66] Significant differences in changes were also found between both conditions for kinesiophobia at nine months and for the physical component of HRQoL at both time points, measured with the Short Form-36. For the mental component score, general health and chronic pain grade, no significant results were found. Bennell et al. found non-significant differences in measured health outcomes, of which knee pain intensity and physical functioning in the previous 48 h were the primary outcomes.[63]

Costs were assessed in the study of McBeth et al. with a cost-effectiveness analysis.[66] Non-significant differences between intervention and control group at the six- and ninemonth follow-ups were found.

No measurements were performed for the quality of care experienced by patients or for HCP work satisfaction.

Between primary care and community-based care—qualitative designs

Bee et al., and Hinman et al. performed qualitative evaluations for Quadruple Aim goals.[62,65] Mixed results were found regarding participants' illness experiences, which was a health outcome.[62] No cost outcomes were assessed qualitatively.

Quality of care experienced by patients had mixed results in the study of Bee et al..[62] Positive as well as negative results were found regarding treatment preferences and the perceived fit with the interventions and their patients' needs. Hinman et al. measured the satisfaction of HCPs in combination with experiences of patients[65]: their only positive results regarded HCPs' interest in patients during the treatment and in collaboration. Mixed results were found regarding information and accountability, program structure, and roles and communication in teamwork.

Risk of bias

The results of the risk of bias (RoB) per domain for the randomized trial designs (n=19) are presented in Figure 2.3 and for the non-randomized study designs (n=12) in Figure 2.4. The results of the critical appraisal of the qualitative designs (n=7) can be found in Figure 2.5.

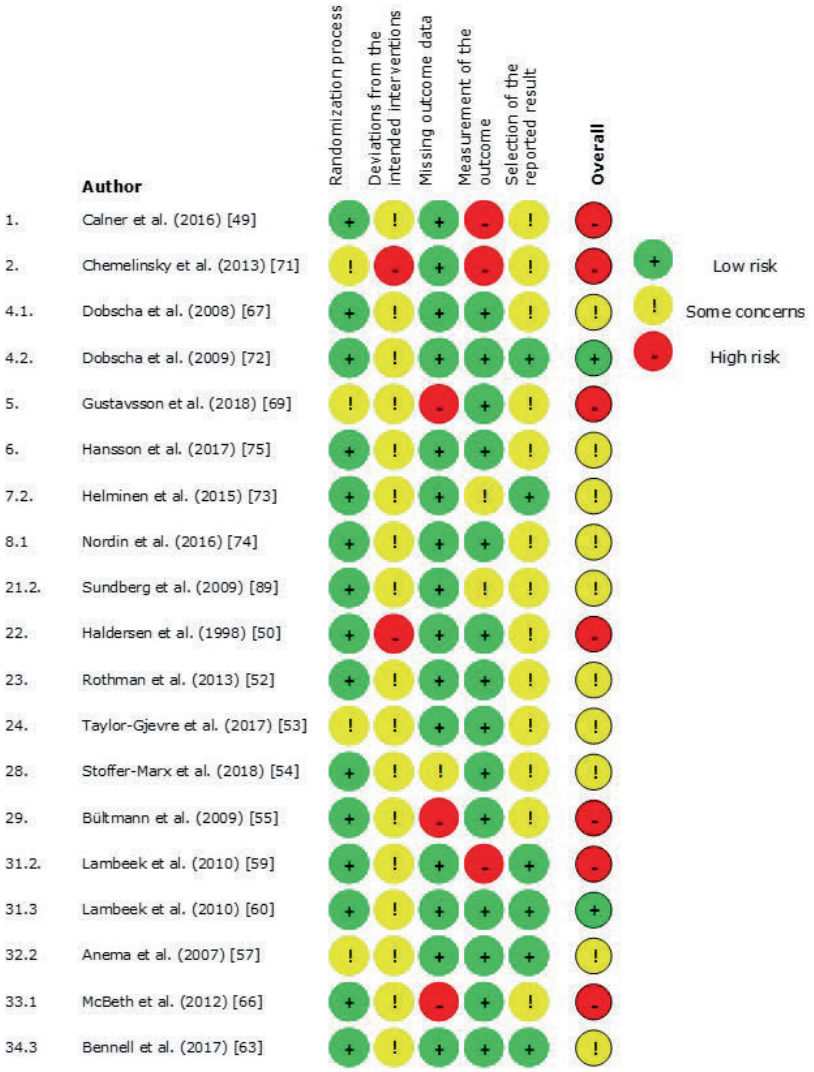

Figure 2.3 Risk of bias of randomized trial designs.

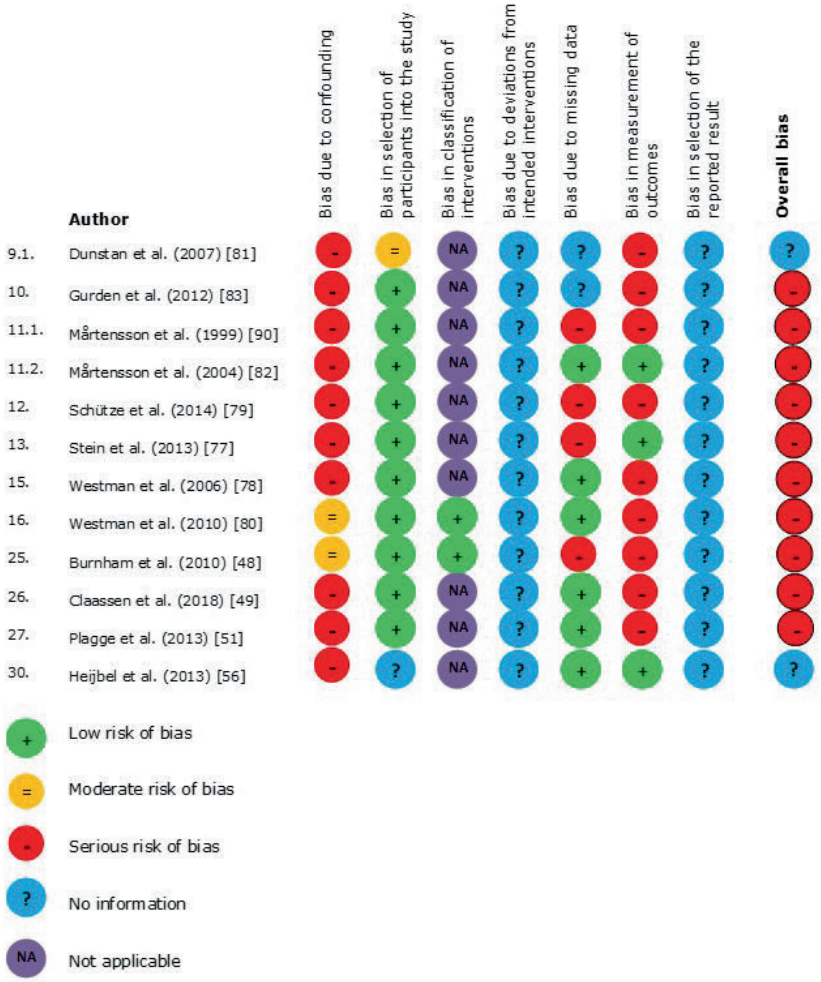

Figure 2.4 Risk of bias of non-randomized study designs.

Randomized trial designs

Overall, the studies of Dobscha et al., and Lambeek et al., were found to have a low RoB.[60,72] Ten studies raised some concerns in the RoB, and seven studies had a high RoB. The randomization process had a low RoB for 15 studies, while four studies had some concerns.[53,57,69,71] Deviations from the intended interventions most often led to there being some concerns for RoB, in most cases because participants, patients and HCPs, were unblinded. Chemelinsky et al. and Halderson et al. were judged to have some concerns for this RoB domain.[50,71] Completeness of outcome data and measurements of outcomes most often had a low RoB, though there some concerns for

three studies.[54,73,95] Six studies had a high RoB on these domains.[55,60,66,69-71] There were some concerns about possible selection of reported results with fourteen studies because most study protocols were not published, so planned outcomes could not be matched with published outcomes.[49,50,52-55,66,67,69-71,74-76]

Non-randomized study designs

The studies of Dunstan et al., and Heijbel et al. did not report enough information to assess the RoB.[56,80] All other studieswere assessed as at high RoB.[48-51,56,80,82-84,86,90] The main reason was the lack of a control group in these studies, which indicated a serious RoB in the domain of confounding. The domain classification of the interventions was not applicable for studies without a control group. Moreover, this domain was found to have a serious RoB because outcome measures could be influenced by the outcome assessors and/or unblinded patients in most studies. The lack of publication of a protocol in any of these studies led to an absence of information about any bias in the selection of the reported results.

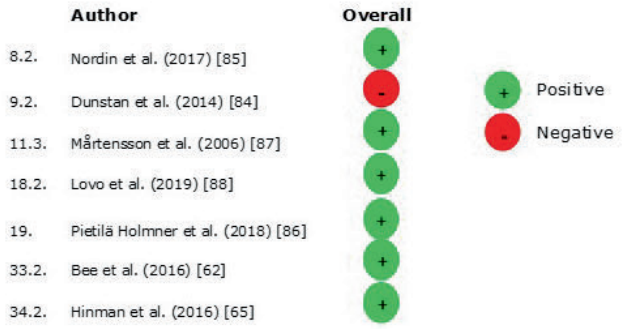

Figure 2.5 Critical appraisal qualitative designs.

Qualitative designs

Six studies scored positively in the critical appraisal of study methods.[62,65,79,85,92,93] The study of Dunstan et al. was described only briefly, hindering assessment, and so this study scored negatively.[81] In most studies, the philosophical perspective was not described and a statement locating the researcher culturally or theoretically was not made.

DISCUSSION

As far as we know, this systematic review is the first to identify which interdisciplinary rehabilitation interventions have been described within primary care, and between primary care and other health care settings, delivering rehabilitation care to patients with CMP. In addition, we describe the impact of these interdisciplinary interventions in rehabilitation care for patients with CMP, in terms of the Quadruple Aim goals: health, quality of care experienced by patients, health care costs, and HCP work satisfaction. The review was based on 49 articles (34 separate interventions), including 19 randomized trials, 12 non-randomized studies, 7 qualitative studies, and 11 articles with a description of the intervention but without a description of relevant outcomes and/or results.

In summary, of the studies that examined interventions situated in primary care (n=19), most did not find significantly improved health outcomes compared to care as usual. In the non-randomized designs, in general, health outcomes seemed to improve over time. However, cost outcomes and quality of care experienced by patients in intervention groups showed a mixture of significant improvements and non-improvements in both randomized and non-randomized trial designs. The differences in satisfaction levels may relate to the fact that new interventions can change the usual care pathways, which could be challenging for the patient to follow and thus lead to lower satisfaction. Alternatively, patients who were already very satisfied with the current regular health care received might experience little or even no improvements in satisfaction level after receiving the new intervention (which has also been seen in other studies on substitution of care[96-98]). However, it may be concluded that an intervention provides added value even if not all Quadruple Aim goals have shown improvement. For example, if costs decrease, patients' health and HCP work satisfaction increase, but the quality of care experienced by patients remains unchanged, the intervention is of added value. It is essential that all Quadruple Aim goals be assessed and that a balanced conclusion for follow-up be drawn based on these outcomes.[99,100] For included interventions, HCP work satisfaction was found to be improved in the intervention groups, compared with care as usual and with baseline.

For interventions between primary care and secondary or tertiary care (n=6), in the randomized trial designs, no significant differences between intervention and care-as-usual groups were found for most health outcomes. Over time, no improvements were seen in a restricted program containing a three-hour educational intervention[49], whereas improvements were seen in two, more extensive, interventions. These latter comprised more treatment hours, involved more health care disciplines, and consisted of an assessment and, depending on patients' needs, psychological and exercise treatments. Both of the interventions showing improvement included collaboration with a rehabilitation

setting.[48,51] Unfortunately, both also displayed a serious risk of bias and, therefore, more research is warranted before drawing definite conclusions. Regarding cost outcomes, ability to work significantly improved while the return to work after 12 months did not improve in these groups.[49,50,52] Grant et al. found that facilitators such as managing pain, managing work, and making workplace adjustments appear to be key factors for successful return to work.[101] It could be that patients perceived their ability to work sufficiently improved for return to work, but that, for example, workplace adjustments were not yet adequate to allow this. Mixed results were reported regarding quality of care experienced by patients in two different interventions containing an interdisciplinary assessment.[52,53] while this was perceived positively in a three-hour educational intervention.[49]

The combined intervention in primary care and between primary care and secondary or tertiary care (n=1), described by Stoffer-Marx et al., had some concerns in the risk of bias.[54] The study only showed improvements on the primary health outcome of grip strength, while no difference between groups was seen for pain and health status after two months. Patients receiving the intervention perceived the quality of care as improved after a two-month follow-up, compared to patients receiving care as usual. As this was the only intervention with an extensive interdisciplinary collaboration, no comparisons could be made. However, as future care aims to shift to clinical networks based on collaborations[30], it is important to further explore implementation in clinical practice and research with such collaborations.

An assessment and workplace intervention between primary care and social care (n=2) did not show a significantly greater improvement in health outcomes for the intervention compared with care as usual.[55] Cost outcomes showed a mixture of improved and unchanged results between the intervention and care as usual at different measurement points in a randomized trial design[55], while return to work improved over time after two years in a longitudinal study.[56]

In interventions between primary care and secondary or tertiary care and social care (n=2), most health outcomes did not differ between patients who received a workplace intervention combined with graded activity and those who received usual care. For cost outcomes, the duration of sick leave differed between groups in two studies[59,60], but not in another.[57] This could probably be explained by the fact that, in addition to the study of Anema et al.[57], in the studies of Lambeek et al.[59,60], the intervention was extended, involving HCPs of different disciplines (such as a case manager and the patients' pre-existing specialists), potentially leading to a better effect on duration of sick leave. Due to this interdisciplinary collaboration, such interventions may have a more patient-centered focus and biopsychosocial approach, which could explain the reported results. Currently developed eHealth technologies could make it easier to work interdisciplinarily.[102]

However, little research has been performed for both types of workplace interventions. This was also found in the systematic review of Skamagki et al..[103] In contradiction to our review, they found some consistency in health outcomes for (integrated) workplace interventions. In contrast with our included studies, in the review of Skamagki et al., not all included studies comprised integrated, interdisciplinary interventions.[103]

For interventions between primary care and community-based care (n=2), most health outcomes did not differ more in the integrated care condition than with usual care.[62,64,66] No differences in cost outcomes were found between the groups of an intervention existing of combined cognitive behavioral therapy and prescribed exercise compared to treatment as usual (high risk of bias). Quality of care experienced by patients and HCP work satisfaction were found to have both positive and negative results in the interventions. In contrast to our results, other studies found community-based interventions to lower health care costs and improve health outcomes.[80,104] They found that patients often visit HCPs for other complaints than their actual pain or during periods of stress. Easily accessible community-based interventions could take over these kinds of health care visits to both lower costs and increase health.

Strengths and limitations

This review is the first with an overview of interdisciplinary rehabilitation interventions within primary care and between primary care and other healthcare settings for patients with CMP. The interventions identified cover a broad spectrum of interdisciplinary care interventions with a wide variety of content, duration, and HCP disciplines involved. Moreover, this review is the first focusing on all Quadruple Aim outcomes for integrated interdisciplinary care interventions. Such an overview is valuable given the recommendation of the WHO that rehabilitation services should be integrated within primary care, as well as between primary, secondary, and tertiary levels of health systems, with a case-management role for primary care.[16,105] Another strength of our study is the classification of interventions into subgroups, facilitating comparisons of studies. This classification is based on classifications used earlier and on definitions of intervention types. Moreover, a strength of our study process was the involvement of an information specialist to ensure the quality of the search strategy. Additionally, the PRISMA guidelines for reporting reviews were used. However, a meta-analysis could not be performed as the intervention types and outcome measures were too heterogeneous.

That the selection of articles was limited to those in English, Dutch, or German may have resulted in the exclusion of valid interventions reported in other languages. Unfortunately, interventions were often not described in full detail and/or the health care settings left unclear, potentially resulting in erroneous exclusions of studies. In some studies, it was not clear in which health care setting an HCP, for example, a physician, worked.

Furthermore, it was also not always clear how a health care setting should be classified, due to differences between countries and/or the lack of appropriate descriptions. Due to time constraints, it was not possible to contact the authors for additional information. Therefore, potentially relevant interventions (reported with incomplete descriptions of content) may have been excluded in error. In this review, an interdisciplinary care network is defined based on the IASP definition.[21] Thus, all studies with a multimodal treatment provided by a multidisciplinary team (with at least one participating primary care HCP collaborating in assessment and/or treatment using a shared biopsychosocial model and goals) were taken into account. An alternative definition of interdisciplinary care might have led to a different selection of articles. For the randomized trial designs, positive but non-significant results (compared to the control intervention), results with no difference, and results in favor of the control intervention, were all grouped into one category (nonsignificant (-)). We chose this grouping because not all articles described the results in much detail. A more precise categorization of significant or non-significant results would have given a broader overview.

Implications for future innovations and studies

As future health care shifts to the implementation of clinical networks, more interdisciplinary collaborations will have to be developed and evaluated in the field of rehabilitation for patients with CMP. As it is important that these interventions have a good fit with, and are implemented in, daily health care, we recommend applying co-creation research together with the HCP disciplines involved, patients with CMP, and other stakeholders. In the ideal situation, an evaluation of all Quadruple Aim outcomes needs to be performed with mixed methods to give a full overview of a new interdisciplinary care intervention's impact.

In order to develop, implement, and evaluate interdisciplinary care interventions across different health care settings, it is recommended that an adjusted version of the IASP definition of interdisciplinary care be used, the current one having been developed for treatments in secondary or tertiary care settings. Moreover, the Quadruple Aim was used to classify the various outcomes in four outcome domains to identify the effect of interventions in these domains. However, in our review, it was difficult to compare the effect of the various interventions on these outcomes, as a wide range of outcome measures and assessment methods were used. Due to the large variation found, a meta-analysis could not be executed. Therefore, to improve uniformity, we propose to develop a core outcome set with measurement instruments and assessment methods with standardized measurement moments for each Quadruple Aim goal (health, quality of care experienced by patients, health care costs, andHCP work satisfaction). This will facilitate future research comparing the effect of interventions. Moreover, not all study designs (e.g., mixed methods or qualitative methods) incorporated Quadruple Aim outcomes so

our overview could not be complete. Therefore, it is recommended that interventions developed in the future be evaluated with mixed methods study designs. In this review, a large number of full papers had to be screened before making a decision because most abstracts, and some full papers, did not clearly describe the content of their intervention and the degree of collaboration between HCPs. We recommend that articles use reporting guidelines for abstracts and intervention details, such as the Template for Intervention Description and Replication (TIDieR) checklist.[106]

CONCLUSIONS

There is a wide variety in content, collaboration, and evaluation methods of interdisciplinary rehabilitation interventions within primary care, and between primary care and other health care settings, delivering rehabilitation care for patients with CMP. Most interdisciplinary interventions are evaluated in primary care, while fewer interventions are implemented between primary care and other health care settings. It seems that interventions with the involvement of different HCP disciplines, and more patient-centered interventions, with a broader content and duration of treatment, are more effective than care as usual. Therefore, further initiatives and research have to be performed for interdisciplinary care interventions within and across health care settings for patients with CMP. These interventions have to be evaluated with mixed methods on all Quadruple Aim outcomes.

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Chapter 3

Developing the Network Pain Rehabilitation Limburg: a feasibility study protocol

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ABSTRACT

Introduction: Patients having chronic musculoskeletal pain (CMP) face challenges as mismatches often exist between the complexity of patient's pain problem and the rehabilitation treatment offered. This can result in less efficient care for the patient and increased medical shopping. The Network Pain Rehabilitation Limburg (NPRL), a transmural integrated healthcare network, will be designed to improve daily care for patients with CMP. NPRL focusses on improving patient's level of functioning despite pain by stimulating a biopsychosocial approach given by all involved healthcare professionals. A feasibility study will be performed which will give insight into the barriers and facilitators, perceived value, acceptability, and implementation strategies for NPRL.

Methods and analysis: This study has a three-phase iterative and incremental design, based on key principles of an user-centred design. Mixed methods will be used in which healthcare professionals and patients involved in NPRL, will participate. In phase 1, NPRL will be developed and healthcare professionals educated. Phase 2 focusses on the implementation and phase 3 on the transferability of NPRL. In addition, preliminary data on patient's work status, general health, and participation level will be collected. The qualitative results of each phase will be analysed following the Consolidated Framework for Implementation Research (CFIR) and will be used to refine NPRL in daily practise.

Ethics and dissemination: Informed consent will be obtained from all participants. The results of this feasibility study will form the basis for refinement of NPRL and planning of a large-scale process and effect evaluation of the Quadruple Aim outcomes. Dissemination will include publications and presentations at national and international conferences. Ethical approval for this study was granted by the Medical Ethics Committee Z, the Netherlands, METC 17-N-133.

INTRODUCTION

Nineteen percent of adults in Europe suffer from moderate to severe chronic pain with a duration of at least 6 months according to a large-scale epidemiological study.[1] Also, about 18% of adults in the Netherlands have moderate to severe general chronic pain.[2] Almost 90% of individuals with chronic pain had experienced it for over 2 years.[3] The most reported chronic pain complaint was chronic musculoskeletal pain (CMP). CMP is a complex biopsychosocial experience that varies widely between people depending on the context and meaning of the pain and the impact of psychosocial factors on patient's functioning.[4,5]

Breivik et al.[1] found that people with CMP were less able or even unable to do a range of daily activities and to maintain an independent lifestyle. In addition to pain itself, patients with CMP are often confronted with an elevated level of disability, depression, and anxiety resulting in an increased disease burden.[6-8] In addition, work absenteeism among these patients is very high.[1,9,10] In recent years, the direct and indirect costs for CMP patients are estimated at 20 billion Euro's in the Netherlands.[11] These costs are even higher than the annual costs of heart disease, cancer, and diabetes.[12] Although costs for CMP are high, only up to 60-74% of patients with CMP get treated, and only 2-5% get treated by a pain management specialist.[1,2,13] Currently, regardless treatment as received, 34-79% of Dutch CMP patients still indicate a feeling of inadequate treatment.[2,14] These patients seek a diagnosis or solution to their pain problem, which explains medical shopping. Even 61% of patients that started a multidisciplinary rehabilitation program visited 6 to >20 different healthcare professionals one year before starting with multidisciplinary rehabilitation program.[15] A potential reason for these inefficiencies might be that the complexity of the patient's pain problem does not match with treatment as delivered, resulting in over or under treatment[16], which highlights the need for adequate (cost) effective treatment strategies.

This mismatch may be explained by the fact that the knowledge and perspective of healthcare professionals, decision makers, and the public varies regarding CMP, referral, and treatment.[13] Healthcare professionals receive inadequate training on the diagnosis and treatment of CMP, causing different points of view.[17] Some healthcare professionals are more biomedical oriented and focus on explaining and solving the pain, whereas others are more biopsychosocial oriented and focus on optimising functioning despite CMP.[18] Therefore, referral and treatment selections vary among healthcare professionals, which may result in less efficient care for patients with CMP.

Besides the different perspectives regarding CMP, general practitioners (GPs) in primary care and rehabilitation physicians (RPs) in secondary and tertiary care refer patients mostly based on their anamnesis and clinical experience. However, it appears to be

difficult for GPs to identify the impact of all psychosocial factors on chronic low back pain patients, one of the most frequently encountered CMP problems.[19] Recently, different tools became available to support GPs in the decision-making process concerning (initial) treatment options for patients with chronic low back pain and fibromyalgia, especially focusing on the impact of psychosocial components.[20-23] However, these decision-making tools are not implemented in daily care yet in the Netherlands. In the Dutch health care system, patients with moderate to severe levels of disability and associated influencing psychosocial factors are seen by a RP. To support decision making by RPs, an evidence-based objective tool to classify patients objectively and transparently for a specific treatment is needed. Earlier studies have shown that the interrater reliability of the method currently used by RPs to classify the level of disability (WPN classification) is at least questionable.[24,25] In addition, healthcare professionals indicate a lack of overview regarding the complete supply of treatment methods, resulting in inadequate referrals.[26]

Ideally, after assessing the level of disability, the patient receives a treatment matching the complexity of the pain problem in line with the biopsychosocial profile. As in most situations, no cure for CMP is possible and evidence-based treatments are multicomponent pain rehabilitation with a biopsychosocial focus on being active and living a valuable life despite pain.[5,27-29] In primary care physiotherapy, cognitive-behavioural interventions and interventions focusing on biopsychosocial factors have shown long-term effects on patient outcomes.[30,31] Moreover, even positive effects were found when advice combined with pain education alone is given by GPs or therapists to patients with CMP.[32-34] In secondary and tertiary care, multidisciplinary pain rehabilitation programs with physical, psychological, and/or social/work related components, like Acceptance Commitment Therapy (ACT), Graded Activity (GA), and Exposure in vivo (EXP), are more effective than treatments focusing on one aspect of the biopsychosocial model for decreasing pain and disability in patients with disabling chronic low back pain.[35-40]

Despite this knowledge of the effective components of multidisciplinary rehabilitation programs, a wide variety of treatment approaches in various dosages are currently applied in regular rehabilitation programs in different private and public rehabilitation centres.[41] To overcome the different points of view as well as the lack of overview about treatment options, objective decision-making tools, and variety of treatments in the Netherlands, a national care standard for chronic pain was presented in 2017.[11] In this standard, a matched and person-centred care approach for patients with CMP was proposed.[42]

To implement care as part of the national care standard, a transmural network could be designed in which different healthcare professionals collaborate in providing person-centred rehabilitation care. Recently, different transmural integrated care health networks, for example for Parkinson's disease and palliative care, have been successfully

developed and implemented in the Netherlands.[43,44] In line with these findings, a transmural pain rehabilitation network can provide a shared vision regarding CMP, including early recognition of subacute pain patients followed by suitable person-centred treatment and referral, is supposed to improve patients' levels of functioning despite pain and to prevent medical shopping of patients with CMP.[11] It should have an unambiguous view, matched care, and a person-centred approach with guidelines for referral and treatment, coordination, and a continuous focus on improvement of care to increase the effectiveness, quality, and efficiency of healthcare for patients with CMP.[45] This approach fits with the advice of the World Health Organisation to focus on stimulating functioning when designing rehabilitation care.[46,47]

The Network Pain Rehabilitation Limburg (NPRL), a transmural healthcare network for CMP rehabilitation, will be designed to ultimately fulfil the Quadruple Aim in the province of Limburg, the Netherlands.[48,49] NPRL provides integrated care for patients with CMP in order to improve their level of functioning despite pain by stimulating a biopsychosocial approach for all involved healthcare professionals. As a first step a feasibility study will be performed. This study aims to provide insight into the barriers and facilitators, perceived value, acceptability, and implementation strategies for the development, implementation, and transferability of the NPRL. This paper describes the study protocol of the feasibility study of NPRL for adults with CMP.

METHODS

Study design

A feasibility study with an iterative and incremental design, based on key principles of user-centred design[50,51] will be conducted in the South-East region of the Netherlands from October 2017 till October 2018. This will follow the UK Medical Research Council framework[52] for developing complex interventions. It will be useful as NPRL is a complex intervention because of the number of practices and integrated healthcare settings targeted in the NPRL and the number and variability of outcomes. In this iterative process, the development of NPRL will take place in three phases, namely development, implementation, and transferability. The results of each phase will be used to refine the elements of the intervention and to shape the next phase, in which the barriers and facilitators of the different phases will be evaluated. During meetings, all healthcare professionals involved will be informed about the results and the adjustments to NPRL. In the subsequent phase, new adjustments will be integrated in daily practise. The development and implementation process will be 'practise-focused', indicating that the development will be based on the healthcare professionals' experiences with the current healthcare situation.

In phase 1, exploration of context will take place in order to develop the design of the NPRL and to educate the healthcare professionals involved. The focus will be on the barriers and facilitators in the development process of NPRL. Next, in phase 2 (implementation), the project focus will be on the specification of the content to adjust the design of the NPRL to daily practise. More insight into the barriers and facilitators of the implementation process will be collected. In phase 3 (transferability), the project will focus on the organisation of care in daily practise and the research focus will be on the barriers and facilitators for further implementation in other practices and organisations. In addition, preliminary data on efficiency will be collected. The qualitative data collected during the study will be analysed using The Consolidated Framework for Implementation Research (CFIR).[53] NPRL will be feasible in daily practise if the studied barriers and facilitators from the perspectives of healthcare professionals and patients are translatable to policies or guidelines that can be adjusted and integrated in daily practise.

Participants

In this transmural NPRL, healthcare professionals from different disciplines (GPs, physiotherapists, exercise therapists, mental health practice nurses, RPs, and rehabilitation teams) and different healthcare settings (primary, secondary, and tertiary care) will be asked for participation (Figure 3.1). The setting in primary care concerns general and therapy practices, in secondary care a private outpatient rehabilitation clinic and the outpatient rehabilitation department of a regional hospital, and in tertiary care a specialised rehabilitation clinic. The quality criteria established for practices and organisations for enrolling in NPRL are described in Table 3.1.

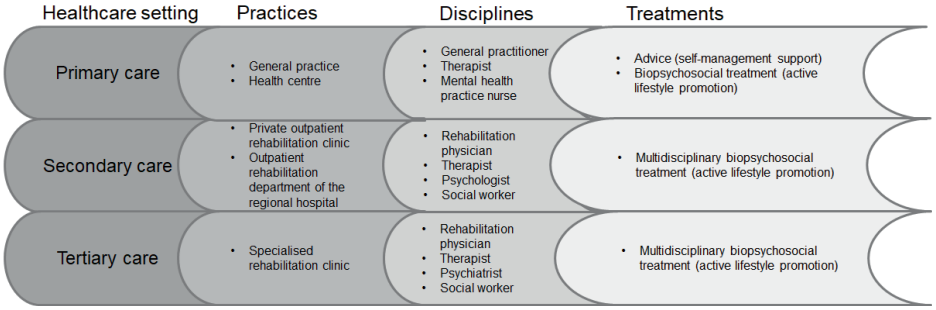

Figure 3.1 Construction of the health care system in Network Pain Rehabilitation Limburg.

Table 3.1 Inclusion criteria for healthcare professionals for enrolling in NPRL

Inclusion	Exclusion
Having a practice in the pilot area of NPRL. Willingness to attend the meetings and to implement the different elements of NPRL. GPs and mental health practice nurses must be linked to a participating therapist in order to make effective referrals to treat patients in (interdisciplinary) primary care regarding the protocol and vision of NPRL. Physiotherapists having a participating GP or RP. As they cannot refer a patient when the patient is too complex for them, they will not have an inclusion option for study participants if there is no participating GP or RP. Secondary and tertiary organisations have to meet the criteria of the Position Paper 'Medical Specialist Rehabilitation for chronic musculoskeletal pain' [2017].[54]	A GP who has visited less than 2 out of 3 education days or a therapist who has participated in less than 3 out of 4 education days. Are not able to implement the protocols or assessment tool of NPRL in their own practice.

NPRL = Network Pain Rehabilitation Limburg; GP = general practitioner; RP = rehabilitation physician.

In primary care, the recruitment will start with a primary care therapist or a GP interested in pain, and after consent to participate in NPRL. This person will be asked to recruit a GP or therapist with whom they already have intensive collaboration. For secondary and tertiary care, main organisations in the region providing rehabilitation care for patients with CMP will be asked to participate, so all healthcare settings in this region will be covered. Because of the nature and aim of this feasibility study, we decided to keep the number of healthcare professionals restricted. Based on earlier research, it has to be expected that in this situation the implementation process in daily practise can be easily adjusted when barriers arise.[44]

In addition to the involvement of healthcare professionals in this study, all patients treated by the participating healthcare professionals will be asked to evaluate NPRL and the perceived quality of care. The inclusion criteria for patients to participate in this study are described in Table 3.2.

It is expected that approximately 100 patients from all participating healthcare settings will give informed consent during the course of this study. They will receive questionnaires regarding satisfaction with care and their health status and pain related disability. Moreover, a sample of approximately 10 patients, who finished a treatment according to

the protocol of NPRL, will be recruited for a focus group. In this focus group more information about barriers and facilitators from a patient perspective will be collected. In this way patients are able to react to each other which will illuminate various perspectives which leads to a faster data saturation about each topic, which is an advantage above interviews.[55]

Table 3.2 Inclusion criteria for patients in this feasibility study.

Inclusion	Exclusion
Age ≥18 years old at the start of the study. Patient living in the pilot area (physiotherapist, GP, or RP) of NPRL. Having musculoskeletal pain that is (suspected to be) chronic. Treatment aim of the patient is to improve functioning despite the pain. Adequate Dutch literacy to complete the assessments.	Any suspicion of a medical (orthopaedic, rheumatic, or neurological) disease that can explain the current pain (e.g. rheumatism or hernia) complaints or that can be treated by sufficient therapy. Any suspicion of a (underlying) psychiatric disease, for which psychiatric treatment is better suited, according to the expert opinion of the GP and RP. Pregnancy.

NPRL = Network Pain Rehabilitation Limburg; GP = general practitioner; RP = rehabilitation physician.

Intervention: Network Pain Rehabilitation Limburg

The main aim of NPRL is to provide integrated care for patients with CMP in order to improve their level of functioning despite pain by stimulating a biopsychosocial approach for all involved healthcare professionals. This should accomplish the Quadruple Aim: improvement of CMP patient functioning, experiences of care, and work life satisfaction of physicians and staff, as well as a reduction of healthcare costs of patients with CMP.

Each patient will receive the treatment needed to reach his/her optimal level of functioning. In order to reach this, a matched care approach will be used for every individual patient. Depending on the level of disability and biopsychosocial factors involved, this will either include; 1) education only and no further treatment, 2) monodisciplinary treatment in primary care, 3) multidisciplinary treatment in primary care (collaboration between GPs, primary care therapists, and mental health practice nurses in assessing and treating patients with CMP who need mental support besides physical exercise), 4) interdisciplinary treatment in secondary or 5) interdisciplinary treatment in tertiary care. Collaboration will be supported by facilitating communication between patients and all healthcare professionals involved in the trajectory of an individual patient by E-health.[56] In addition, the collaboration between healthcare professionals in different practices and organisations will be further supported by

informative meetings and education days. All healthcare professionals with different specialisms will participate together in the meetings and education days. This ensures a common understanding of the biopsychosocial approach and rehabilitation treatment options. In order to facilitate this in daily practice, the following elements are integrated in NPRL:

Integral focus on assessment and referral: assessment tools

To support the healthcare professionals in their decision making for problem mapping and treatment selection, two evidence-based objective assessment tools will be used. These tools will support the assessment of the complexity of the pain problem; one tool for GPs and primary care therapists and one tool for RPs. The assessment tool for primary care is based on the Start Back Tool[20] and will help to advise patient treatment matched to the patient's biopsychosocial profile. The options are: advice only, treatments in primary care, or for decision making by a RP (Figure 3.2). The GP can also decide to advise patients for a treatment outside NPRL (psychiatrist, specific healthcare specialist, etc.). Since 2006, patients in the Netherlands can visit a primary care therapist without a referral of a GP,[57] so these therapists will also use this assessment tool. In this situation, a primary care therapist of NPRL will advise the patient to visit the GP for additional assessment and referral if needed as the GP is the gatekeeper to secondary and tertiary care.

When a patient visits a RP, the assessment tool for specialised rehabilitation care is used for decision making. This tool will assess the patient's view as well as the RP's view of the biopsychosocial problem and consists of two parts. The first part will guide the anamnesis of the RP and is based on two different ways to score disability related complexity, namely the Case Complexity Index and INTERMED method.[25,58,59] First, a standardised scoring method for assessing the biopsychosocial profile and care for the past and current situations will be used by the RP. Second, a set of CMP related questionnaires assessing anxiety, depression, catastrophising, fatigue, pain level, participation level, and general health will be completed by the patient. After completion of these questionnaires, scores will be interpreted by the RP. Based on scoring in both parts of the RP-assessment tool, patients will be categorised by profile, representing the patient's level of disability. In addition to primary and interdisciplinary primary care, the second tool will assist the RP to further differentiate between available secondary or tertiary multidisciplinary rehabilitation programs (Figure 3.2).

Integral focus on treatment content and duration: treatment protocols

When the patient receives treatment, an individualised treatment plan based on their current needs will be made. The patient decides the treatment aim when he visits a healthcare professional. In case this is necessary, the practitioner will support the patient

in setting functional goals. Protocols will be based on the most recent evidence-based treatment methods such as GA, EXP, and ACT[35-38,40] and these will be used in all healthcare settings. As these evidence-based methods are developed for secondary and tertiary care, they will be adjusted for primary care. During evaluations in phase 1 and 2, healthcare professionals will be invited to provide feedback on the treatment protocols. As a result, adjustments to the content and duration of treatment protocols will be made if these adjustments are in line with the evidence-based treatment methods.

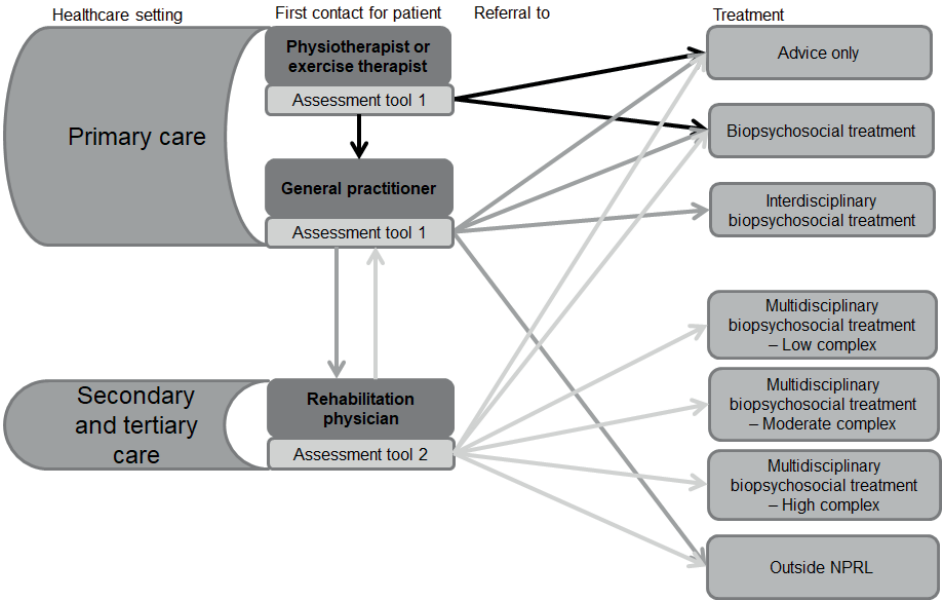

Figure 3.2 First patient contact and referral options per healthcare setting and discipline. NPRL = Network Pain Rehabilitation Limburg.

Integral focus on self-management: E-health application

All professionals and patients participating in the NPRL will make use of an E-health application: SanaCoach Pain Rehabilitation.[56] Also, primary care patients who receive 'advice only' can make use of this SanaCoach Pain Rehabilitation. The coach has different functions and goals in the treatment process. The primary goal is to support self-management. The main function of the coach is to provide pain education based on the education modules. Different eLearning modules are developed for the patients in order to teach them about the biopsychosocial aspects of pain. Furthermore, diaries are integrated into the coach in which patients can give feedback on changes in pain intensity, level of activity over time, and the interrelation between these variables. Moreover, healthcare professionals can use scores from these diaries to adjust treatment

to individual patients. The coach also consists of a chat function between the patient and healthcare professionals to ensure short communication lines. All healthcare professionals involved in the care process of a patient have access to this chat function with that patient. Additionally, the assessment tool for primary care is integrated, which makes these results available for all involved healthcare professionals. For this study, the questionnaires for patients are also available via the coach. Based on the level of complexity of disability, the functions in the SanaCoach Pain Rehabilitation will be adjusted to the patient, such as the number of diaries and level of education.

Patient and public involvement

During the development of the research question, design, recruitment, and conduct of the study no patients were involved in the process. However, during the development of NPRL itself, a patient was involved in the development of the SanaCoach Pain Rehabilitation and treatment protocols. Moreover, the focus of this feasibility study is mainly on healthcare professionals. They were involved in the development of the treatment protocols, SanaCoach Pain Rehabilitation and in the development of the different communication strategies between the healthcare professionals themselves. The results of the study will be disseminated to the study participants via the webpage (www.netwerkpijnrevalidatie.nl) and social media accounts.

Data collection

In this study, the feasibility of the development, implementation, and transferability of NPRL for adults with CMP will be investigated. Therefore, different data collection techniques such as observations, interviews, focus groups, and questionnaires will be combined to get more insight into the barriers and facilitators of NPRL (Table 3.3).

During the informative meetings and education days, field notes will be made in order to collect information about the views on NPRL and its elements out of the perspectives of the healthcare professionals involved. At the end of each phase, focus groups and/or interviews will take place with (a selection of) the healthcare professionals involved. During the evaluation of phase 1, healthcare professionals will be asked about the barriers and facilitators they perceived while working in NPRL. Therefore, more information will be collected about expectations, views, experiences, and satisfaction. Also, experiences and opinions about the informative meetings and education days will be collected. Healthcare professionals will fill in an electronic questionnaire in phase 1 concerning decision making, treatments, and characteristics of the patients involved in the study. This information will give more insight into potential changes in referral policy between the situation in usual care and the situation within NPRL. Moreover, the questionnaire also asks for knowledge and perspectives regarding patients with CMP.

Table 3.3 Overview of data collection methods and respondents per phase.

Phase **Time period**	**1** **October 2017–February 2018**	**2** **February 2018–June 2018**	**3** **June 2018–October 2018**
Goal project	Exploration of context will take place in order to develop the design of the NPRL and to educate the involved healthcare professionals.	Specification of the content to adjust the design of the transmural network to daily practise.	Organisation of care in daily practise and barriers and facilitators for implementation in other practices and organisations.
Goal evaluation	Insight into the barriers and facilitators of the development of NPRL.	Insight into the barriers and facilitators of the implementation of NPRL.	Insight into the barriers and facilitators of the transferability of NPRL.
Data collection method, respondents, and outcomes	**Focus groups and interviews** *Healthcare professionals* Experiences with the informative meetings Experiences with the education days Expectations and views on working in NPRL Current experiences (satisfaction) with working in NPRL Barriers and facilitators **Questionnaire** *Healthcare professionals* Current views and thoughts regarding patients with CMP Referral pattern Patient characteristics	**Focus groups and interviews** *Healthcare professionals* Views on working in NPRL Current experiences (satisfaction) with working in NPRL Implications and recommendations of the implementation strategy for practise Barriers and facilitators	**Focus groups and interviews** *Healthcare professionals* Current experiences (satisfaction) with working in NPRL Implications and recommendations of the implementation strategy for practise Implications and recommendations for future research and project Satisfaction with NPRL and with work life Barriers and facilitators **Focus group** *+/- 10 patients* Perceived quality of care Experiences with NPRL Barriers and facilitators **Questionnaire** *Healthcare professionals* Referral pattern Patient characteristics
	Questionnaire start and end of treatment (T0 and T2) *Patients* Health status Quality of care Usability of the SanaCoach Pain Rehabilitation **Questionnaire after referral (T1)** *Patients* Quality and satisfaction with referral and care **Questionnaire or logbook of treatment** *Healthcare specialists* Barriers and facilitators of the treatment protocol per patient **Notes** Current views regarding NPRL Barriers and facilitators		

NPRL = Network Pain Rehabilitation Limburg; CMP= chronic musculoskeletal pain

In phases 2 and 3, more emphasis will be put on the added value of NPRL including barriers and facilitators for implementation. This information will be used for recommendations for practise and future research. Also in these phases, information will be gained about the experiences and satisfaction with NPRL during a focus group with healthcare professionals. Moreover, in phase 3 (transferability), they will fill in an electronic questionnaire concerning decision making, treatments, and characteristics of the patients involved in the study. As part of the evaluation of phase 3, a focus group with a sample of 6 to 10 patients with CMP who are being treated by participating healthcare professionals will take place. During this focus group, the emphasis will be on the satisfaction of care and experiences, leading to barriers and facilitators with NPRL.

Besides this information, the research team will keep up a logbook to get insight into the barriers and facilitators of NPRL. The field notes in this logbook will be the results of discussions with different healthcare professionals, patients, and stakeholders, as well as researchers. Additionally, patients will be asked to complete study-related questionnaires about the quality and their satisfaction with the decision making, treatment and education, and usability of the SanaCoach Pain Rehabilitation in order to further improve different elements of NPRL. Besides this feasibility data, also some questions about their work status, general health, and participation level will be asked as preliminary data on efficiency to objectify the progress of the treatment. They will receive this questionnaire at the start of the treatment (T0) and at the end of the treatment (T2). Patients referred to another healthcare professional will receive an extra questionnaire after the referral (T1) regarding the quality of and satisfaction with the decision making. Additionally, after completion of the treatment, a small questionnaire or logbook about the treatment of each patient separately must be handed in by the healthcare professionals. This information will be used to discover barriers and facilitators and desired adjustments of the treatment protocols.

Data analysis

In this iterative design with key principles of user-centered design, the results will be gathered in daily practice from the healthcare professional and patient perspective. The results of each phase will be used to adapt the intervention for the next phase. The Consolidated Framework for Implementation Research (CFIR) protocol according to Damschroder et al.[53] will be used to develop this feasibility evaluation and analysis plan of the results. This explanatory framework with theory-based constructs and mechanisms will be used to explain whether an implementation may or may not succeed and to identify barriers and facilitators.

All field notes and logbooks will be collected. Additionally, the focus groups and interviews will be audio recorded and transcribed verbatim. Qualitative data will be

analysed using the NVivo software (NVivo.version 11.1.0.411) following a directed content analysis method.[60] The analysis will be deductive (e.g. the identified themes will derive from existing theory). After familiarisation with the data, definitions for the CFIR constructs will be made based on the intervention in collaboration with the project team. Next, the different constructs will be assigned to the fewest codes possible. After developing analytic summaries and matrices, the data will be compared to derive barriers and facilitators. A researcher with expertise in qualitative research without any involvement in the project will peer review the analysis by verification of the analysis of 20% of the interviews and focus groups. Also, a cross-check for interim findings with respondents will be performed.

Quantitative data will be analysed concurrently with the qualitative data. Descriptive statistics will be denoted as mean (standard deviation) or median (range) and number (%) for continuous and categorical data, respectively, with the use of IBM SPSS Statistics 24.

ETHICS AND DISSEMINATION

Informed consent will be obtained from all participants. Ethical approval for this study was granted by the Medical Ethics Committee Z, the Netherlands, METC 17-N-133. The results of this feasibility study will form the base for refinement of NPRL and planning of a large-scale process and effect evaluation on the Quadruple Aim outcomes. Dissemination will include publications and presentations at national and international conferences.

DISCUSSION

This study will provide insight into the feasibility of NPRL, a transmural integrated healthcare network for CMP rehabilitation. The aim is to provide integrated care for patients with CMP in order to improve their level of functioning despite pain by stimulating a biopsychosocial approach for all involved healthcare professionals. It is expected that the study will provide information on barriers and facilitators, perceived value, acceptability, and implementation strategies for the development, implementation, and transferability for further develop and refinement of the NPRL. If the study results suggest that NPRL is feasible and preliminary outcomes are positive, a large-scale process and effective evaluation of the Quadruple Aim outcomes will be performed.

The process of developing NPRL is in accordance with the Medical Research Council guidance on how to develop and evaluate complex interventions.[52] In the development

process, existing evidence together with collected evidence based on the expertise of healthcare professionals was combined to develop the first version of NPRL. This first version of NPRL will be implemented on a restricted scale to test the feasibility. The evidence generated from this feasibility study will not only help to adjust the design and content of NPRL but will also inform future methodological studies on developing and implementing a transmural network in healthcare. It is expected that this bottom-up development in combination with the limited number of participating healthcare professionals will lead to a successful implementation of the network. Nijkrake et al.[44] did indicate this approach as one of the success factors of ParkinsonNet, a successful and cost-effective network in the Netherlands for patients with Parkinson's disease.

In conclusion, there is need for a transmural network in which different healthcare professionals collaborate in providing integrated healthcare for patients with CMP. The aim of NPRL is to improve the level of functioning of individual patients despite pain, experience of care by patients, and work-life satisfaction for physicians and staff, as well as a reduction in costs. Therefore, this feasibility study will be conducted to explore the barriers and facilitators of the development, implementation, and transferability of NPRL. The results will be applied to refine a large-scale process and effective evaluation of the Quadruple Aim outcomes.

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Chapter 4

Exploring the feasibility of a network of organizations for pain rehabilitation: what are the lessons learned?

Feasibility of a network for pain rehabilitation

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ABSTRACT

Background and aims: Integration of care is lacking for chronic musculoskeletal pain patients. Network Pain Rehabilitation Limburg, a transmural health care network, has been designed to provide integrated rehabilitation care from a biopsychosocial perspective to improve patients' levels of functioning. This feasibility study aims to provide insight into barriers and facilitators for the development, implementation, and transferability.

Methods: This study was conducted with a three-phase iterative and incremental design from October 2017 to October 2018. The network comprises two rehabilitation practices, and three local primary care networks, with a general practitioner together with, a mental health practice nurse, and a physiotherapist or exercise therapist. These stakeholders with a random sample of participating patients took part in evaluations, consisting of interviews, focus groups, and observations. Field notes and observations were recorded during meetings. The Consolidated Framework for Implementation Research guided data collection and analysis. Results were used to refine the next phase.

Results: According to health care professionals, guidelines and treatment protocols facilitate consistency and transparency in collaboration, biopsychosocial language, and treatment. One mentioned barrier is the stigmatization of chronic pain by the general population. In regular care, approaches are often more biomedical than biopsychosocial, causing patients to resist participating. The current organization of health care acts as a barrier, complicating implementation between and within practices. Health care professionals were enthusiastic about the iterative, bottom-up development. A critical mass of participating organizations is needed for proper implementation.

Conclusion: Network Pain Rehabilitation Limburg is feasible in daily practice if barriers are overcome and facilitators of development, implementation, and transferability are promoted. These findings will be used to refine Network Pain Rehabilitation Limburg. A large-scale process and effect evaluation will be performed. Our implementation strategies and results may assist other health care organizations aspiring to implement a transmural network using a similar model.

INTRODUCTION

Nineteen percent of adults in Europe have moderate to severe chronic pain.[1] The most widely reported complaint is chronic musculoskeletal pain (CMP), representing a complex interaction of biopsychosocial components, varying in complexity between patients.[2,3] CMP can have a significant impact on patients' daily activities and, therefore, rehabilitative treatments are needed.[4] Most patients with CMP have had this pain for more than two years.[5] Due to a high burden of disease and work absence in these patients, the direct and indirect costs of CMP are estimated at 20 billion euros in the Netherlands yearly.[6-9] While 60-74% of Dutch CMP patients receive treatment, 34-79% of these patients feel that this is inadequate.[1,4,10,11] Such patients continue seeking a solution for their CMP, resulting in high medical resource consumption by this group.[12]

A possible explanation for the level of resource consumption is that the complexity of the patient's pain problem does often not match the treatment delivered, resulting in over- or under-treatment.[13] This mismatch can be explained by three factors. Firstly, understanding of biopsychosocial treatment of CMP varies amongst health care professionals (HCPs), decision-makers, and the public. Secondly, clinical decision-making, classification of complexity, and referrals are based on medical history and clinical experience, with huge inter-physician variation. Although earlier studies have shown inter-rater reliability in classifying the complexity of pain problems by rehabilitation physicians (RPs) to be at least questionable, the use of objective measures by general practitioners (GPs) and RPs to diagnose and classify patients with complex problems is scarce.[14-17] Thirdly, treatment approaches, including dosage and content, delivered through all types of care providers, are often not adequately tailored to the level of complexity of the pain problem.[18] Therefore, patients with CMP often do not receive the right care, at the right place, at the right time, as described in the National Care Standard for Chronic Pain, the Netherlands.[6]

To overcome this problem, integrated transmural health care networks, including all health care settings, might have a beneficial role.[19] Integrated transmural care is what is described by the World Health Organization as "*the management and delivery of health services so that clients receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system*".[20] It is most often directed towards bridging the gap between care providers in different levels of care, for example between primary and secondary care. The World Health Organization recommends networks in integrated transmural rehabilitation care as future developments.[21]

The transmural Network Pain Rehabilitation Limburg (NPRL) was designed to implement rehabilitation care according to the National Care Standard for Chronic Pain in the

province of Limburg in the Netherlands.[6] To overcome mismatches in current CMP rehabilitation care, NPRL has an unambiguous view: integrated matched care, biopsychosocial treatment protocols for primary, secondary and tertiary care, guidelines for referral and coordination, and a continuous focus on improvement of care. Matched care comprises identifying patients at higher risk. However, unlike stratified care, it tailors the intervention to the individual patient's specific existing complaints and risk.[22,23] In NPRL, patients can be referred by their GP, a primary care physical therapist or the RP. In the Netherlands, patients can also visit a primary care therapist (e.g. physiotherapist or occupational therapist) directly without a referral. If patients enter the health care system in this way, therapists can screen the patient as to their suitability for treatment within NPRL. Treatment is offered, based on complexity profiles, by primary, secondary or tertiary care members of the NPRL. In order to develop and implement NPRL in daily care, a feasibility study was performed. Details of the protocol of this study are described elsewhere.[24]

The aim of the feasibility study was to provide insight into barriers and facilitators for the development, implementation, and transferability of NPRL, and to provide insight into its perceived value and acceptability.

METHODS

Study design

This feasibility study had an iterative and incremental design based on key principles of user-centred design.[25] It was conducted from October 2017 to October 2018 in the South-East region of the province of Limburg in the Netherlands. As NPRL is a complex intervention, the UK Medical Research Council (MRC) Framework was used as guidance for development (Phase 1), implementation (Phase 2), and transferability (Phase 3) of NPRL.[26] The barriers and facilitators that emerged during the evaluations of previous phases were used to refine elements of NPRL in the next phase. HCPs and patients actively participated in evaluations, leading to adjustments in daily health care practice.

Topic lists for individual interviews and focus group sessions were constructed, and the results were analysed deductively, in accordance with the Consolidated Framework for Implementation Research (CFIR), following a directed content analysis method.[27] This framework, published by Damschroder et al. (2009), is an overarching list of constructs to verify the design's efficacy across multiple contexts when implementing a complex multi-component intervention such as NPRL, with rapid-cycle evaluation.[27,28] It consists of five major domains (intervention characteristics, outer setting, inner setting, characteristics of individuals, and process of implementation) with 39 underlying constructs and sub-

constructs that can potentially influence implementation efforts. The study was reported using the COnsolidated criteria for REporting Qualitative research items (COREQ).[29]

Ethics and dissemination

Written and verbal informed consent was obtained from all patients and HCPs before the start of the interview or focus group. The verbal informed consent was recorded. Ethical approval for this study was granted by the Medical Ethics Committee Z, the Netherlands, METC 17-N-133. Dissemination includes publications and presentations at regional, national and international conferences.

Organization of care in Network Pain Rehabilitation Limburg

NPRL is described more extensively in Lamper et al. (2019) (a summery can be found in Supporting File S4.1): it was developed by a project team consisting of the authors CL, IH, AK, JV and an advisory board consisting of interested HCPs.[24] The project team as well as advisory board consisted of HCPs of different disciplines and they had experience in the development of treatment protocols. The main aim of NPRL was to provide integrated, biopsychosocial rehabilitation care for the right patients with CMP at the right place and at the right time.[22] The content is based on the National Care Standard for Chronic Pain, which proposes a matched care approach in an integrated transmural network for patients with CMP.[6] Based on the matched care approach, HCPs from different disciplines participated and provided several treatments. For a detailed overview of the structure and organization of the health care system in NPRL see Figure 4.1 published in Lamper et al. (2019).[24] Elements were integrated into NPRL to reach the overall goal. Two assessment tools supported the decision-making for problem and complexity mapping and treatment selection, based on the patient's biopsychosocial profile. GPs and therapists in primary care used Assessment Tool 1 (Supporting File S4.2); Assessment Tool 2 was used by RPs in secondary and tertiary care. In the individualized treatment plan, the patient together with the HCP set activity- and participation-related goals. An e-health application was integrated into matched care protocols for every setting with the primary goal of supporting pain education and self-management by the patient.

Health care professionals

In this transmural NPRL, HCPs from all health care levels with a prior interest in CMP were included as participants. In primary care, local networks were set up in villages or city districts with local HCPs. For inclusion in a local network, it was necessary to have a GP (general practitioner, family doctor) participating, with in addition at least one physiotherapist (PT) or exercise therapist (ET), and, optionally, a mental health practice nurse (MHPN). Initially, six local networks were contacted for participation of which three

were included in this study (1: one GP, two PTs; 2: one GP, one MHPN, one PT, one ET; 3: one GP, two PTs). One local network stopped participating because of lack of time, but their PT participated in focus groups. The other two local networks were not included because they did not meet the inclusion criteria. GPs were excluded if they participated in fewer than two out of three education days; therapists were excluded if they participated in fewer than three out of four education days.

In addition, a private outpatient rehabilitation clinic (two RPs; one psychologist (PSY)) and a specialized rehabilitation clinic in tertiary care (two RPs; one physician assistant (PA); one nurse practitioner (NP); one treatment coach (TC)) participated in this study. One outpatient rehabilitation clinic did not meet the inclusion criteria, but its RP participated in this study. HCPs were educated in the clinical guidelines as described in the National Care Standard for Chronic Pain and in the study process before its start and participated in focus groups at the end of each phase. Moreover, every six to eight weeks, all HCPs within one local network in primary care received supervision at their own practice. Secondary and tertiary care organizations had to meet the criteria of the Position Paper 'Medical Specialist Rehabilitation for chronic musculoskeletal pain' (2017).[30] Practices and organizations were excluded when they were unable to implement the different elements of NPRL.

Patients

Of the 58 patients participating in NPRL, nine registered in primary care were randomly asked by telephone to participate in a focus group, with six agreeing. They had to be older than 18 years at the start of the study, have musculoskeletal pain that was (expected to become) chronic as indicated by a HCP, and be treated by participating HCPs who also participated in a focus group. Their treatment aim had to be improvement of daily functioning despite pain. They were excluded from the study if there was any suspicion of a biomedical (orthopaedic, rheumatic, or neurological) disease that could explain the current pain complaints and could be treated by adequate existing therapy. In addition, they were excluded if there was any (underlying) psychiatric disease (Personality disorder, schizophrenia, or clinical depression) that limit the possibility for behavioral change. Pregnancy and inadequate Dutch literacy were also exclusion criteria.

Data collection

To achieve triangulation, data were collected with different methods, such as field notes or observations during meetings, individual interviews, focus groups, and questionnaires, which were all combined to get more insight into barriers and facilitators (Supporting File S4.3).[31] The observations and individual interviews were conducted by CL. The focus groups were all led by GB, an independent researcher not aligned with the project; CL, the main researcher of the project, was the observer and made field notes during and

after the focus groups. At the time of data collection, CL and GB were PhD students and had 1-2 years of experience in health care sciences. Both the individual interviews and focus groups, for which semi-structured guides were made based on CFIR, were audio-recorded and transcribed verbatim. All interviews took place at the work place of the HCP; all focus groups were organized in the tertiary care organization.

Phase 1: development of NPRL

Phase 1 was conducted from October 2017 to February 2018. The goal of the phase was to design and develop the content of NPRL and to educate participating HCPs. In the evaluation, the focus was on the perceived barriers and facilitators of this development process. Focus groups were held with HCPs from the local networks, and interviews were held with HCPs from secondary and tertiary care organizations at the end of the phase to gather information about their experiences with the informative meetings and education days, and about their expectations and current experiences of working in NPRL.

Phase 2: implementation of NPRL

Phase 2 was conducted from February to June 2018. The goal during this phase was to specify the content and to implement NPRL in daily practice. During the evaluations, barriers and facilitators regarding the implementation of NPRL were identified. Focus groups were held with HCPs from the local networks and secondary and tertiary care practices combined, and the individual interviews with the MHPN and a RP. The focus was on their current experiences of working in NPRL, and implications and recommendations for the implementation strategy in the practices.

Phase 3: transferability of NPRL

Phase 3 was conducted from June to October 2018. The goal of this phase was to organize care in daily practice. Evaluations focused on barriers and facilitators for the transferability of NPRL beyond the pilot region. At the end of the phase, focus groups and interviews were organized with the HCPs to collect more information on current experiences of working with NPRL, and implications and recommendations for the implementation strategy regarding the transferability of NPRL to practices. Additionally, information was gathered about satisfaction with NPRL and its effect on work life. Moreover, a focus group with six patients was organized to develop more insight into the perceived quality of care, their experiences with NPRL, and barriers and facilitators associated with different elements of NPRL observed by them.

Overall

After completing treatments, HCPs submitted predefined questionnaires or logbooks about the treatment (number of consultations, barriers and facilitators during treatment,

achievement of treatment goal) of each individual patient. In addition to the information collected in the three phases, CL kept a logbook of barriers and facilitators of NPRL mentioned by participants, the field notes and observations in these logbooks being the result of discussions with different HCPs, patients, and researchers.

Data analysis

A content analysis with mostly a deductive approach was used, with the CFIR as coding framework.[27,32] After familiarization with the data, definitions for the CFIR constructs based on NPRL were compiled (Figure 4.1) and used to guide data analysis. For each construct, CL composed codes based on the data, using NVivo software (NVivo version 11.1.0.411). After analyzing all data, the codes were summarized in barriers and facilitators per construct. GB performed a peer review of the analysis by verifying 20% of the interviews and focus groups. When disagreement occurred, the research team was consulted. The coding process was guided by consensual qualitative research methods.[33,34] Moreover, two HCPs performed a cross-check for interim findings by providing feedback on the results.

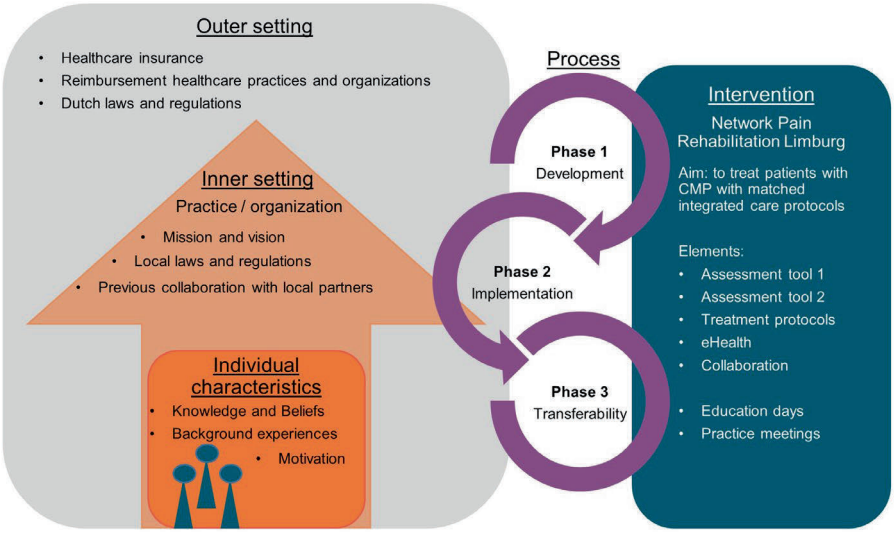

Figure 4.1 Consolidated Framework for Integrated Care adjusted for Network Pain Rehabilitation Limburg.

RESULTS

Table 4.1 displays the content, duration, and disciplines involved in each interview and focus group. Five focus groups and six interviews with 21 HCPs from different disciplines, and one focus group with six patients were held. The results were analysed and described, based on the domains of the CFIR (Figure 4.1).

Intervention

Assessment Tool 1 & Assessment Tool 2

HCPs in primary care found Assessment Tool 1 too time-consuming, because of the extra burden for the patient and the extra time for the consultation itself. A further consultation to discuss the results with patients was not desirable. *"I have no time to discuss the results with the patient in an extra consultation." (P12: GP, FG2).* In addition, several HCPs thought that the results of Assessment Tool 1 were not in line with their conclusions, based on their observations, experience, and assessments of patients. All secondary and tertiary rehabilitation physicians reported that Assessment Tool 2 supported their knowledge and assessments, but found its administration too time-consuming.

Treatment protocols and guidelines

According to most of the HCPs, the treatment protocols and guidelines within NPRL provide a common biopsychosocial language and transparency in treatment duration, intensity, and content: *"In my opinion, in NPRL the treatment approach is more explicit and I know these are the steps to take to achieve a result compared to usual care." (P2: PT, focus group 5).* HCPs in local networks indicate that the protocols and guidelines provide a clear overview of the total approach in CMP management. Patients are more familiar and better informed about the content of various treatments in transmural care, compared with those treated before NPRL started. Due to the restricted number of consultations prescribed in the treatment protocol of NPRL as compared to care as usual, some therapists in primary care indicated fear that this would lead to a drop in income from that achieved before NPRL's start.

Table 4.1 Description of the content, duration, and discipline involved for the focus groups and interviews

				Phase 1						Phase 2				Phase 3	
				FG 1	FG 2	INT 1	INT2	INT 3	INT 4	FG 3	FG 4	INT 5	INT 6	FG 5	FG 6
Duration				1h45m	1h26m	37m	36m	29m	28 m	1h35m	1h24m	27m	49m	1h34m	1h48m
Goal															
Experiences with the organization of rehabilitation care for patients with CMP before participating in NPRL						x	x	x	x		x	x	x		
Expectations for participation in NPRL				x	x	x	x	x	x				x		
Barriers and facilitators of the development process				x	x						x	x			
Barriers and facilitators of the implementation strategy										x		x		x	
Expected barriers and facilitators of the transferability phase														x	
Current experiences being a patient in NPRL (eg. eHealth, healthcare professional skills, referral, treatment, feeling of collaboration)															x
	Discipline	Gender	Exp. (yrs)												
P1	PT	F	2.5	x						x					
P2	PT	M	0.5	x										x	
P3	PT	M	34	x						x					
P4	PT	M	38	x											
P5	PT	F	7		x					x					
P6	PT	M	30		x										
P7	PT	M	33		x										
P8	ET	F	25		x					x					
P9	PNMH	F	-									x			
P10	GP	M	10	x						x					
P11	GP	M	31	x											
P12	GP	M	8		x									x	
P13	PSY-2	F	-					x							
P14	RP-2	F	6						x		x				
P15	RP-2	M	-								x			x	
P16	RP-3	F	-			x									
P17	RP-3	F	<1				x								
P18	PA-3	M	15								x			x	
P19	NP-3	F	6								x			x	
P20	TC-3	F	-											x	
P21	RP-2	M	-										x		
P30	PNT	F	n.a												x
P31	PNT	F	n.a												x
P32	PNT	F	n.a												x
P33	PNT	M	n.a												x
P34	PNT	F	n.a												x
P35	PNT	M	n.a												x

FG: focus group; INT: interview; EXP: years experience; PT: physiotherapist; ET: exercise therapist; PNMH; practice nurse mental health; GP: general practitioner; PSY-2: psychologist secondary care; RP-2: rehabilitation physician secondary care; RP-3: rehabilitation physician tertiary care; PA-3: physician assistant tertiary care; NP-3: nurse practitioner tertiary care; TC-3: treatment coach tertiary care; PNT: patient; F: female; M: male; -: unknown; n.a.: not applicable.

HCPs have different personal preferences and opinions about the freedom in implementation of the treatment protocol and guidelines. Some HCPs felt that this freedom was desirable as it could be adjusted to the local organization of the primary care practices: *"Currently, it is not a tight protocol, of which we are the executors, searching for patients who fit. And I think the strength lies in the fact that we as HCPs can decide how to implement the knowledge that we have gained in the area of chronic pain, in a way that will fit into our daily care routines. That is an essential difference, as P10* [GP] *said" (P3: PT, FG1)).* This freedom might be an important facilitator, according to the HCPs, if NPRL is to be implemented in the Netherlands. Other HCPs underlined the importance of standardization, with fixed treatment protocols, as they wanted more control of the treatment of this complex patient population.

EHealth application

The participants indicated that e-health has a central position in NPRL: it facilitates and supports the patient in the treatment process, and collects biopsychosocial information about the patient. According to primary HCPs, the eHealth application is user-friendly and the collected information derived from assessment reduces the duration of consultations. However, some GPs see the collection of extra information as an extra burden for patients. Other barriers of the eHealth application mentioned were: the slow speed of the two-step authentication log-in facility, lack of an overview of the steps in the treatment, and difficulties in using the chat function in daily practice because no HCP is assigned to keep track of it. These barriers meant that some HCPs had little experience of using the eHealth application. RPs saw no added value of the diary function in the eHealth application as they did not see patients frequently enough during rehabilitation to integrate it into treatment.

All patients agreed that the eHealth application (existing of pain education and self-management exercises) stimulated them to adhere to the treatment. Both the graphs of their daily activity and the education material provided were especially motivating: *"The most important advantage of the eHealth application is the diaries: they keep me motivated. I like the competition with myself to be more active" (SP35, patient, FG6).* On the other hand, it was hard for some patients to complete the diary daily so they missed the added value of this daily returning questionnaire. Also, some patients could not participate in this study because they had no internet connection.

Collaboration

Some therapists appreciated the fact that interdisciplinary collaboration with GPs and MHPNs working closely together is a major pillar of NPRL. However, collaboration with GPs was perceived as difficult as it takes a lot of effort to contact them for consultation and discussion. At the end of Phase 1, some HCPs reported no change in levels of

collaboration in local networks of NPRL. In Phases 2 and 3, more change in collaboration was reported, though this was still not optimal. Better interdisciplinary collaboration was achieved in local networks based in one site, compared to those in which the GP and MHPN were located at a different address from the therapists. According to the HCPs in primary care, interdisciplinary collaboration in a local network will facilitate treatment of patients with more complex pain complaints, leading to a decrease in referrals to secondary or tertiary care. Also, they felt that young and dynamic teams would facilitate implementation. In the future, it is hypothesized by the HCPs that local networks and the use of eHealth applications would encourage further collaboration.

HCPs perceive a barrier when a patient needed to be referred to a non-participating practice or HCP. For these treatments, patients may be less well served as practitioners outside NPRL would not have such a detailed insight into the treatment protocols. Patients might get more biomedically oriented treatments, leading to confusion. HCPs in secondary and tertiary care thought that NPRL would especially have advantages for primary care since interdisciplinary teamwork with a focus on CMP patients is already regular care in secondary and tertiary organizations.

Education days and practice meetings

At the end of Phase 1, HCPs found the education days somewhat confusing. Using their feedback during these education days, the taught treatment protocol was further improved and made flexible, but it seemed that HCPs preferred a more defined protocol. Therefore, in later phases, the project team composed a more fixed treatment protocol, which was found to be clearer. Overall, they instituted a clearer layout of the education days. HCPs indicated that the visits of the project team to the primary care practices gave added value. They changed mindsets and encouraged active participation. However, after the project team left, it was difficult to maintain focus on NPRL in daily practice.

Inner setting

Mission and vision

According to some HCPs, most Dutch health care practices have a more biomedical oriented vision which clashes with the biopsychosocial vision of NPRL. This may be caused by the biomedical education which they had received, as described in paragraph *Dutch culture, laws, and regulations* (see below). For this reason, some HCPs may feel misunderstood by their colleagues in their CMP treatment approach.

Local laws and regulations

Due to personnel shortages (for example MHPNs) and the increased workload associated with transition from secondary to primary care, HCPs in primary care have a

full schedule. This hinders recruitment and active participation. In the future, the organization of care will shift towards the enlargement of primary care practices with more HCPs for the same number of patients, which could be an advantage for implementing NPRL. *"Our practice is large enough to divide projects among staff, resulting in enough time and funding to participate. I think the reorganization of general practice care towards practice enlargement will be important. With more GPs in one practice, you have time for multidisciplinary collaboration" (P10, GP, FG1)*.

Additionally, current daily general practice care is unsuitable for networking on a large scale. There is a growing number of GPs with specializations but patients are connected to a practice based on geographical location, not on specialization, and often they are connected to only one GP in a practice. Primary HCPs do not often refer their patients to colleague GPs based on their specializations. Some HCPs in primary care commented on the complexity of NPRL. They said it was hard to implement all the new desired elements and protocols at once, finding it difficult to learn different tools at the same time when the general workload was also heavy.

Collaboration with local partners

Multidisciplinary care is not feasible for small practices in primary care because of restrictions in financing, according to the HCPs employed: i.e. their financial buffer is smaller. Some GPs have a preference for a specific therapist practice in their local network. Moreover, HCPs experience competition between physiotherapy practices and commercial rehabilitation treatment centres. As a result, practice owners neglect the screening of patients with a specific level of complexity on the assumption that this would negatively influence the number of patients able to be treated. *"I have a patient who can be treated better elsewhere, but I do not work there. I think it is good if you can neglect that, I can do that, but I am not the director who is responsible for the finance. But I think this will be a barrier for the future" (P15, RP, FG5).*

Outer setting

Health care insurance

Health insurance policies in the Netherlands restrict the number of physiotherapy consultations that they will reimburse. HCPs and patients saw this as a pitfall for implementing NPRL as the consultations paid for are often insufficient to learn and apply the new self-management principles. In Dutch health care in 2018, patients may purchase additional insurance packages to cover extra physiotherapy sessions. Several different packages for different numbers of therapy sessions are available but HCPs are aware that patients with a low socioeconomic status cannot afford these. Unfortunately, the highest prevalence of CMP is amongst those patients. This affects the motivation of

HCPs as well when it is already known at the beginning of treatment that the number of available consultations is insufficient.

Reimbursing health care practices and organizations

Multidisciplinary patient-related meetings between HCPs in primary care are not financially covered, which is a barrier for implementation. Financing and attending multidisciplinary meetings regularly is an especial problem for small practices with only a few staff members. Besides, when practices participate in more networks for various diseases, all with additional multidisciplinary meetings, this results in even heavier workloads and burdens for a primary care practice. As patients with CMP are often confronted with comorbidities, HCPs are required to attend several meetings for the same patient, making treatment and collaboration challenging.

MHPNs have an important role in NPRL as they can reduce burdens on GP. However, GPs point out that they receive little funding for deployment of a MHPN, which is not enough to cover all CMP patients who need their help. RPs, GPs, and therapists advocate future bundled payments to facilitate multidisciplinary meetings. *"I think, there should be bundled payments which also cover multidisciplinary meetings. These meetings are often with a limited number of PTs and GPs, while meetings with more disciplines and structure are needed. I think if you do not structure it with bundled payments, due to the bustle of the day, NPRL will not be rolled out more broadly." (P4, PT, FG1).*

Dutch culture, laws, and regulations

HCPs indicated that diagnosing someone with CMP makes the patient feel they are not being taken seriously. As CMP is an abstract phenomenon with large inter-individual variations in perception, patients often feel they are not understood by their HCPs, family, and friends. *"Patients perceive difficulties with the fact that they are diagnosed with fibromyalgia* [a subgroup of CMP]. *When you bring this message, they are staring at you: they think that something is wrong with them" (P12, GP, FG2).*

Overall, current health care is biomedically oriented and HCPs not participating in NPRL often share this orientation. This makes it challenging for professionals working to NPRL guidelines to discuss the patient from a biopsychosocial viewpoint. *"I have problems with the fact that the practice I work in has a more hands-on view of treatment… It is difficult to convince my colleagues* [of the need] *for CMP rehabilitation" (P5, PT, FG3).* Also, CMP is not recognized as a disease in itself, causing a lack of clarity in defining which kind of care suits these patients. During HCPs' education, little attention is paid to the biopsychosocial model and/or patients with unexplained complaints. In addition, the content and amount of information varies per discipline. HCPs still have to check for red

flags which indicate an underlying medical disease needing further treatment. This necessary biomedical screening is an important part of a proper biopsychosocial approach, but HCPs often see this as different to biopsychosocial screening. RPs felt that there were large number of unjustified referrals from primary care, indicating a lack of knowledge of CMP among GPs.

HCPs stated that they were more willing to participate in NPRL if the workload was not too heavy, as there was a pleasant ambiance in the collaboration with colleagues.

Additionally, frequently mentioned laws and regulations which hinder the implementation of eHealth include the new general data protection regulations (GDPR) and the inability to link ICT-systems, as these hinder data transferal.

Individual characteristics

Knowledge and beliefs

Matched care is perceived as an added value by HCPs. Due to stigmatization and large variations in complexity between patients, HCPs in primary care may see patients with CMP as difficult to guide. Even after participation in the educational meetings, they wanted more training to increase their competencies to refer and treat these patients adequately. *"Maybe, more training about CMP education is necessary, so that we receive more tools to increase certainty" (P1, PT, FG1)*.

In Phase 1, the HCPs in primary care reported difficulties in recognizing and quantifying the level of complexity of patients with CMP. They estimated that they only recognized 10-20% of the CMP population during consultations, as they tended to have a prototype patient with CMP in mind. *"Personally, I was frantically searching for the ideal patient to include him, following the protocol" (P3, PT, FG1).* They felt uncertain and afraid to make a false diagnosis of someone suspected to have CMP as they did not want to burden the patient unnecessarily. The fact that the group of patients in primary care is diverse with a wide variety of complaints makes recognition of CMP more difficult. In Phase 3, after additional training, HCPs found recognition easier but they still desired more experience. Also, some HCPs thought that not all patients were eager to participate in a study with questionnaires and/or eHealth and for this reason they did not invite all patients to participate.

Background experiences

The difference in the level of knowledge about CMP at the start of NPRL made it difficult to adjust the content and duration of training to everyone's needs. Some HCPs had prior experience with projects addressing CMP and with collaboration in primary care. This

could have facilitated the implementation as they already had a more biopsychosocial orientation and collaborative experience but they were disappointed that the results of these previous projects had not been integrated into daily care processes.

Motivation

Reasons for HCPs to participate included providing evidence-based health care, keeping health care affordable, increasing their personal network by multidisciplinary collaboration in a matched care setting, earlier involvement in projects for patients with CMP, the scientific basis of NPRL, or the fact that their practice owners agreed to participate. HCPs saw challenges in motivating patients to participate in a biopsychosocial treatment as, in general, patients had a more biomedical focus. For example, in physiotherapy, therapists indicated that patients expected a biomedical therapy such as massage. This led to rather low participation rates. However, some patients in the final focus group emphasized the added value of exercises. *"I really like my physiotherapist because I get a few exercises, such as riding the bike, walking, and exercises with a machine. That is going well. Afterwards I get also a massage, also really helpful" (SP34, patient, FG6).* HCPs stated that patients already receiving biomedical treatment, often for years, are less open to a change of approach. Therapists thought that, with some patients, starting treatment with a biopsychosocial approach decreased their credibility, which made them reluctant to invite them for participation. Moreover, not all patients want to be referred to secondary or tertiary care, although this might better suit the complexity of their pain complaints, because of their good relationship with their primary care therapist.

A facilitator for recruitment is an enthusiastic HCP, which makes it easier to motivate patients to participate. Conversely, when patients are eager to participate in the biopsychosocial treatment and research study, it enthuses the HCPs. *"My therapist let me see the connection between being more physically active after practising, despite the pain. When I saw this link, that was nice to see" (P34, patient, FG6).*

Process

Development

According to HCPs, the iterative, bottom-up implementation strategy suits those in primary care working in CMP as it allows adjustments to situations in daily practice. *"Most innovations use window dressing, first a lot of participating organizations, and after that development of the content. In NPRL, it looks like the other way around. First, the content development in a small network, which fits better with daily care" (P18: PA, FG4).*

An advisory board before the start of the project and the recruitment methods of HCPs were seen as facilitators. HCPs were attracted to participate in NPRL by the project

group, other participating HCPs, practice owners, a local physiotherapist network, or an advertisement. HCPs found it important that a tertiary rehabilitation centre, which has expertise in pain rehabilitation, was the intervention source of NPRL. Also, multidisciplinary meetings with the project team were seen as facilitators as they changed HCPs' mindsets and reminded them of the active participation aspects. However, the subject of the meetings was often about getting started with NPRL, instead of experiences of working in NPRL. According to the HCPs, the project team used their input, had a fixed protocol, and communicated well. During the recruitment of health care practices, two local networks declined participation due to lack of time in their practice. They stated that they were too busy to implement a new project adequately.

Implementation

Only three local networks participated in this study, which was however perceived as positive because, in a pilot study for complex interventions, a small group of HCPs is recommended. However, the small number of networks was also a barrier as it was difficult to collaborate and refer patients efficiently. Therefore, a critical mass of health care organizations is needed for proper implementation. Non-participating practices, organizations or colleagues lacked the multidisciplinary collaboration and shared biopsychosocial vision. For example, therapists found difficulties in the collaboration when patients, entering their practice by direct access, had to be referred for additional diagnostics to a non-participating GP.

Transferability

HCPs believe that NPRL is a solution for the current gap in care for patients with CMP and they have the confidence that NPRL will be embedded in daily care. However, at the end of Phase 3, they still felt as if they were in separate practices instead of part of a local network. *"Currently, it is not a common work method" (P12, GP, FG5).* According to the participating HCPs, in further implementation of NPRL, it will be challenging to attract HCPs with less interest in a biopsychosocial view. Nevertheless, they were willing to assist in the recruitment of new HCPs from their network of colleagues when NPRL is expanded. They also indicated that, as the organization of primary care in general shifts towards practice enlargement with more HCPs for the same amount of patients, this could be an advantage for NPRL.

Summary

As most findings are related to several CFIR domains and constructs, extra analyses were performed. This resulted in four summaries pertaining to biopsychosocial treatment protocols and guidelines, stigmatization of CMP in society, organization of health care, and the bottom-up implementation strategy. These summaries and main findings, along with the CFIR domains and constructs, are presented in Table 4.2. An extensive overview can be found in Table S4.3.

Table 4.2 Summary and main findings assigned to CFIR domains and constructs.

Summary	Main findings	CFIR	
		Domain	**Construct**
1. Within NPRL, treatment protocols and guidelines provide consistency and transparency in collaboration of HCPs regarding biopsychosocial language and treatment intensity, duration, and content. However, the implementation of guidelines and protocols has different barriers in daily practice	1A. The guidelines and protocols stimulate intensive collaboration between HCPs, such as consistency in biopsychosocial language and transparency in treatment duration, intensity, and content	Intervention characteristic	• Design Quality & Packaging • Cost
		Outer setting	-
		Inner setting	• Networks & Communications
		Characteristics of individuals	• Knowledge & Beliefs about the intervention • Self-efficacy
		Process	-
	1B. HCPs experience tension between a fixed protocol and the freedom to adjust the protocol into daily practice. This is influenced by their professional preferences	Intervention characteristic	• Adaptability • Complexity • Design Quality & Packaging • Cost
		Outer setting	-
		Inner setting	• Readiness for implementation • Self-efficacy
		Characteristics of individuals	• Knowledge & Beliefs about the intervention
		Process	• Executing
	1C. It is difficult to apply the guidelines about the eHealth application and assessment tools for satisfactory use in daily care	Intervention characteristic	• Relative advantage • Trialability • Complexity • Design Quality & Packaging • Cost
		Outer setting	• Patient Needs & Resources
		Inner setting	• Structural characteristics • Readiness for implementation
		Characteristics of individuals	• Knowledge & Beliefs about the intervention • Self-efficacy
		Process	• Executing

Table 4.2 (continued)

Summary	Main findings	CFIR	
		Domain	**Construct**
2. Participation and implementation are hindered because of stigmatization of CMP in society. Moreover, HCPs' approaches are often more biomedically oriented than biopsychosocially.	2A. In Dutch society, CMP is stigmatized because the pain is not visible.	Intervention characteristic	-
		Outer setting	• Patient needs & Resources
		Inner setting	-
		Characteristics of individuals	• Knowledge & beliefs about the intervention
		Process	-
	2B. Because the biopsychosocial vision is less common, HCPs have difficulties with (early) recognition of patients with CMP in primary care.	Intervention characteristic	• Complexity • Design Quality & Packaging
		Outer setting	• Patient needs & Resources
		Inner setting	• Culture • Implementation climate
		Characteristics of individuals	• Knowledge & beliefs about the intervention • Self-efficacy • Individual stage of change
		Process	• Executing
	2C. HCPs have difficulties motivating patients for a biopsychosocial treatment because the attitudes of both are more biomedically focused.	Intervention characteristic	• Complexity • Design Quality & Packaging
		Outer setting	-
		Inner setting	-
		Characteristics of individuals	• Self-efficacy
		Process	-

Table 4.2 (continued)

Summary	Main findings	CFIR	
		Domain	**Construct**
3. The current organization of health care for patients with CMP, such as the culture, structure, and financing of health care practices, complicates the implementation between and within the practices.	3A. The culture of health care practices, such as the ambiance and attitude, determines the success of the collaboration between HCPs.	Intervention characteristic	-
		Outer setting	• Cosmopolitanism • External policy & incentives
		Inner setting	• Structural characteristics • Culture • Implementation Climate
		Characteristics of individuals	• Self-efficacy
		Process	-
	3B. The current organization of financing health care in the Netherlands hinders the implementation of NPRL.	Intervention characteristic	• Complexity • Cost
		Outer setting	• Patients' needs & Resources • Cosmopolitanism • External Policy & Incentives
		Inner setting	• Structural Characteristics • Network & Communications
		Characteristics of individuals	-
		Process	-
	3C. The structure of the organization of health care practices in primary care is complex.	Intervention characteristic	• Adaptability • Trialability • Complexity • Cost
		Outer setting	• Cosmopolitanism • Peer pressure • External Policy & Incentives
		Inner setting	• Structural Characteristics • Networks & Communications • Implementation Climate • Readiness for Implementation
		Characteristics of individuals	• Self-efficacy
		Process	-

Table 4.2 (continued)

Summary	Main findings	CFIR	
		Domain	**Construct**
4. The iterative, bottom-up implementation strategy fits with the HCPs in CMP. However, a critical mass of health care organizations is needed for proper implementation.	4A. The active iterative, bottom-up development and participation of HCPs and the project team in the implementation process of NPRL is seen as an advantage.	Intervention characteristic	• Intervention source • Evidence strength & Quality • Relative Advantage • Adaptability • Design Quality & Packaging
		Outer setting	• Implementation Climate
		Inner setting	-
		Characteristics of individuals	• Knowledge & Beliefs about the intervention • Self-efficacy • Individual identification with Organization
		Process	• Engaging • Executing
	4B. A critical mass of health care organizations is necessary for properly implementing NPRL.	Intervention characteristic	• Complexity • Design Quality & Packaging
		Outer setting	-
		Inner setting	• Structural characteristics • Network & Communications • Culture • Implementation Climate
		Characteristics of individuals	-
		Process	-
	4C. HCPs believe that NPRL is a solution to the current gap in care for patients with CMP.	Intervention characteristic	• Evidence strength & Quality • Relative Advantage • Adaptability
		Outer setting	-
		Inner setting	• Structural characteristics
		Characteristics of individuals	• Knowledge & Beliefs about the intervention
		Process	-

DISCUSSION

The aim of this feasibility study was to provide insight into barriers and facilitators for the development, implementation, and transferability of NPRL, and to provide insight into its perceived value and acceptability. Intervention characteristics and implementation processes appeared to have a major positive impact on NPRL implementation. The treatment protocols and guidelines within NPRL provide consistency and transparency in the collaboration as they guide a common biopsychosocial language and consensus in treatment duration, intensity, and content (see Summary 1, Table 4.2). Earlier studies found that successful implementation of new knowledge takes place at the individual, group and organizational levels.[35] This requires complex changes in clinical routines, collaboration among disciplines, and changes in the organization of care, or even in cultural beliefs and attitudes.[36] However, in the review of Holopainen et al. (2020), it was found that most biopsychosocial interventions to improve health care are focused on the individual skills of HCPs instead of on collaboration.[37] An added value of our study was the multidisciplinary transmural education days and practice meetings with all HCPs from primary, secondary, and tertiary care together, which also stimulated implementation at the group and organizational levels. One barrier encountered was the difference in preferences for fixed or flexible treatment protocols and guidelines. Other studies found that the professional autonomy of HCPs underlies these differences in preferences, which causes difficulties in implementation.[38,39]

An important facilitator of the development and implementation of NPRL in normal rehabilitation care was the iterative and incremental design, based on key principles of user-centred design (see Summary 4, Table 4.2). This bottom-up strategy increases the focus on patients' and HCPs' needs. When primary users are incorporated into the iterative design process, this leads to greater usability and acceptance. However, the project team had limited experience with this design and a longer duration of the phases might have been valuable. Some of the challenges, such as the difference in terminologies and theoretical bases, seen in user-centred design with digital health records, can also be seen in this study, due to the very diverse group of HCP disciplines, heavy workloads, and varying levels of complexity of CMP.[40,41]

A barrier to participation and implementation is the stigmatization of CMP in society (see Summary 2, Table 4.2). Earlier research found that 38% of patients living with CMP endorse internalized stigma, which reflects feelings of alienation, social withdrawal, and discriminatory experiences based on pain.[42] This may be caused by the fact that most CMP complaints are without underlying disease, which deviates from the widely held biomedical model. The review of De Ruddere et al. (2016) reports that individuals in the general population and HCPs such as physiotherapists and GPs, discount pain reports, take patients less seriously, and express doubt about the credibility of patients with

nonmalignant pain.[43] HCPs' approaches during consultations were often more biomedical than biopsychosocial, before their participation in NPRL. In contrast to the increasing evidence for the biopsychosocial model of CMP, the majority of the HCPs have received a biomedical-focused training or education.[44-46] This biomedical training is likely to shape their attitudes and core beliefs toward CMP.[47]. In our study, it has been shown that different views exist between GPs, therapists, or RPs about the biopsychosocial treatment of patients with CMP. Therapists with a biomedical orientation are more likely to advise patients to limit activities, and the attitudes and beliefs of GPs towards CMP are characterized by underuse of exercise referrals.[48-51] Where therapists hold strong biomedical beliefs about CMP, patients will tend to adopt these beliefs accordingly.[48] A finding of this study is that dynamic and flexible teams with young personnel make implementation easier as they are more likely to have been trained with a biopsychosocial vision, and they are more comfortable implementing treatment protocols. Due to this tension between biomedical and biopsychosocial visions, and the fact that primary care is more generic than specialized secondary and tertiary care, collaboration in a transmural network is challenging.

A second barrier is the organization of health care for patients with CMP, including the culture, structure, and financing of health care practices, which complicates implementation between and within practices (see Summary 3, Table 4.2). An optimal organization of outer and inner settings is important when implementing a new e-health technology.[52] However, in line with another study, several barriers are mentioned in the outer setting, such as a lack of integration with other electronic systems, and time constraints.[53] One reason for these time constraints is the heavier workload entailed in NPRL. Forty-four percent of the Dutch HCPs reported a heavy workload in 2019.[54] And as many as 72% of Dutch general practices and primary health care centres reported their workloads to have increased in the last year. Because of these workloads, they had limited time to implement a new complex intervention, such as NPRL. If HCPs had more time per patient, requiring another way of financing health care, this would lead to fewer referrals.[55] Therefore, a different way of financing health care could lead to better implementation of NPRL. This is in line with Singer et al. (2011), who declared that most health care and payment systems are not designed to achieve integrated patient care.[19] Therefore, a case-manager in primary care is recommended to overcome barriers with time constraints and follow-up of patients, as they will have the resources for this.[6]

Additionally, a critical mass of health care organizations is needed for proper implementation. The study sample seems to be representative of HCPs working in primary, secondary, and tertiary care with considerable variation in the context of where and how the HCPs practised. However, our convenience sample of three local networks only covers a small number of practices and is from one geographic area, and therefore may not be representative of other populations. One barrier could be that not all HCPs

are open to multidisciplinary treatment in primary care or multidisciplinary collaboration with secondary and tertiary care. Moreover, not all HCPs are interested in specializing in treatment for patients with CMP, which makes the enlargement of NPRL with more HCPs difficult. However, a facilitator could be the increase of medical staff in primary care practices, with the same number of patients, which is expected to be the future in primary care.[56]

A strength of this study is that it follows MRC guidance for complex interventions, which advises non-randomized feasibility studies.[26] Moreover, the iterative method is recommended to progressively refine the design before embarking on a full-scale evaluation. The HCPs felt involved in the development of NPRL because adjustments based on the barriers and facilitators found were made after each iterative cycle. However, for further research, it is important to involve HCPs even more in the development of the intervention, which can be executed with Design Thinking. The review of Altman et al. (2018) indicates that Design Thinking may result in more usable, acceptable, and effective interventions, compared to traditional expert-driven methods.[57] And they describe Design Thinking as a promising approach for the development, implementation, and transferability of an intervention. In a further study with Design Thinking, it will be important to treat all participants as equal, reimburse them for time spent, and give them equal control over decision-making, which was not the case in this study.

In our study, patients are included via the eHealth application. The fact that some HCPs and patients did not know all the functions of the application resulted in suboptimal integration of NPRL in daily care and this may have limited the number of inclusions of patients. The eHealth application was a sub-intervention of NPRL. Because of the complexity of all sub-interventions, such as assessment tools, treatment protocol and focus on collaboration, implementation of the eHealth application in daily care was limited. Proper implementation in daily care is important before using eHealth as a recruiting strategy for patients. Besides, it is recommended that sub-interventions be implemented step-by-step instead of all at once to stimulate effective implementation in daily care. Sub-interventions must be developed based on the inner setting, which is more easily adapted to use in daily care than factors in the outer setting.

The CFIR is a comprehensive model for understanding implementation barriers and facilitators: it was used in this study to develop the topic lists and analyse the qualitative data.[27] Because of the complex interactions in the implementation of NPRL, there was an overlap in the use of domains and constructs for some results. In particular, the differences between inner and outer settings were sometimes difficult to distinguish. An example of this is the size, geographical location, and attitude towards CMP of GP and therapist practices in primary care. On the one hand, this is determined by the inner

setting, the way practices develop their business plans. On the other hand, the government and authorities in the outer setting can create laws and regulations to steer these business plans. Therefore, data were assigned to all domains and constructs which were related to that part of data but summarized in the domain which reflected the best that theme. In our experience, the CFIR must be used as a flexible framework, in line with the findings of another recent study.[58]

It can be concluded that NPRL seems feasible if the identified barriers and facilitators are anticipated. This study contributes to understanding factors that influence the development, implementation, and transferability of NPRL. Currently, international and national guidelines mention network collaborations as the future of care in (pain) rehabilitation, which is in line with NPRL.[21,59,60] Our implementation strategies, as well as barriers and facilitators, may assist managers and therapists in other clinical settings who aspire to implement NPRL using a similar model. Moreover, it forms the basis for refinements of NPRL. The barriers will be broken down as much as possible and facilitators will be used to plan a large-scale process and effect evaluation on Quadruple Aim outcomes such as health of the patients, (cost-)effectiveness, the satisfaction of patients with care, and meaning in the work of HCPs.

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S4.1 PROTOCOL OF NETWORK PAIN REHABILITATION LIMBURG

NPRL is described more extensively in Lamper et al. (2019), a summary is provided below:

Intervention

The main aim of Network Pain Rehabilitation Limburg was to provide integrated care for patients with CMP in order to improve their level of functioning despite pain by stimulating a biopsychosocial approach for all involved healthcare professionals. In this transmural NPRL, healthcare professionals from different disciplines and different healthcare settings were asked for participation (Figure S4.1).

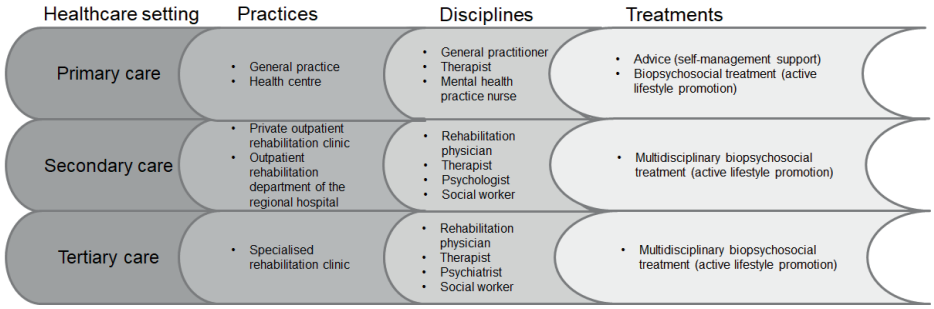


Figure S4.1 **Construction of the health care system in Network Pain Rehabilitation Limburg**. Published in Lamper et al.(2019).

Recruitment of healthcare professionals

In primary care, the recruitment started with primary care therapists or a GPs interested in pain. The interested therapists or GPs were asked to recruit a therapist or GP with whom they already have intensive collaboration. For secondary and tertiary care, main organizations in the region providing rehabilitation care for patients with CMP were asked to participate.

Setting

Each patient received the treatment needed to reach the optimal level of functioning. In order to reach this, a matched care approach was used for every individual patient. Depending on the level of disability and biopsychosocial factors involved, this either included;

(1) education only by a GP and no further treatment,

(2) monodisciplinary treatment in primary care by GP and therapy practices,
(3) multidisciplinary treatment in primary care, a collaboration between GP, primary care therapist and mental health practice nurse in assessing and treating patients with CMP who need mental support besides physical exercise,
(4) interdisciplinary treatment in secondary care in a private outpatient rehabilitation clinic,
(5) interdisciplinary treatment in tertiary care.

Collaboration was supported by facilitating communication between patients and all healthcare professionals involved in the trajectory of an individual patient by E-health. In addition, the collaboration between healthcare professionals in different practices and organizations was further supported by informative meetings, education days, an ECoach-Pain, assessment tools and treatment protocols. All healthcare professionals with different specialisms participated together in the meetings and education days. This ensures a common understanding of the biopsychosocial approach and rehabilitation treatment options.

Reference

Lamper C, Kroese M, Köke A, Ruwaard D, Verbunt J, Huijnen I. Developing the Network Pain Rehabilitation Limburg: a feasibility study protocol. BMJ Open. 2019;9(6):e025962.

S4.2 ASSESSMENT TOOL 1: PRIMARY CARE

Based and adjusted from:
Hill, J. C., et al. (2011). "Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial." Lancet 378(9802): 1560-1571.
Campbell, P., et al. (2016). "Keele Aches and Pains Study protocol: validity, acceptability, and feasibility of the Keele STarT MSK tool for subgrouping musculoskeletal patients in primary care." Journal of Pain Research 9: 807-818.

1. Overall, how bothersome has your pain been in the last 2 weeks?
   O Not at all O Slightly O Moderately O Very much O Extremely

Thinking about the last 2 weeks thick you response to the following questions:

2. My pain has spread down to other parts of my body at some time in the last 2 weeks
   O Agree O Disagree

3. I have had pain in other parts of my body than where I had pain before at some time in the last 2 weeks
   O Agree O Disagree

4. It is not really safe for a person with a condition like mine to be physically active
   O Agree O Disagree

5. I was bothered by my pain when executing activities at some time in the last 2 weeks
   O Agree O Disagree

6. I have only walked sort distances because of my pain
   O Agree O Disagree

7. Worrying thoughts have been going through my mind a lot of the time
   O Agree O Disagree

8. I feel that my pain is terrible and it’s never going to get any better
   O Agree O Disagree

9. In general I have not enjoyed all the things I used to enjoy
   O Agree O Disagree

Additional information for healthcare professional:
Calculation of scores:

Question 1: *if 'Very much' of 'extremely'= 1,* *Other score=0*
Question 2 t/m 9: *Agree=1,* *Diasgree=0*

Total (1 to 9) = *(score basic questions)*
Score questions 6,7,8,9 = *(psychosocial risk factors)*

'low risk' = Score basic questions: 0-3
The GP informs the patient with education or advice and uses the education sessions in the eHealth application.

'medium risk' = Score basic questions: 4-6, with 1 or 2 psychosocial risk factors
Referral of the patient to a basic exercise program with the goal to improve functioning in primary care. Executed by a physiotherapist or exercise therapist in NPRL.

'high risk' = Score basic questions: 6-9, with ≥ 3 psychosocial risk factors
The set A with additional questions has to be filled in by the healthcare professional in primary care.

Set A additional questions:

A1.	Has the patiënt medical co-morbidity with influces daily functioning?	O Yes	O No
A2.	Have you been absent from work for more than 3 weeks?	O Yes	O No
A3.	Has the patient already undergone unsuccessful behavioral treatment for improving daily functioning in primary care?	O Yes	O No

0x Yes in Set A:
Referral to behavioral treatment in primary care executed by a physiotherapist or exercise therapist in NPRL.

≥ 1 Yes in Set A:
The Set B with additional questions has to be filled in by the healthcare professional in primary care.

Set B additional questions:

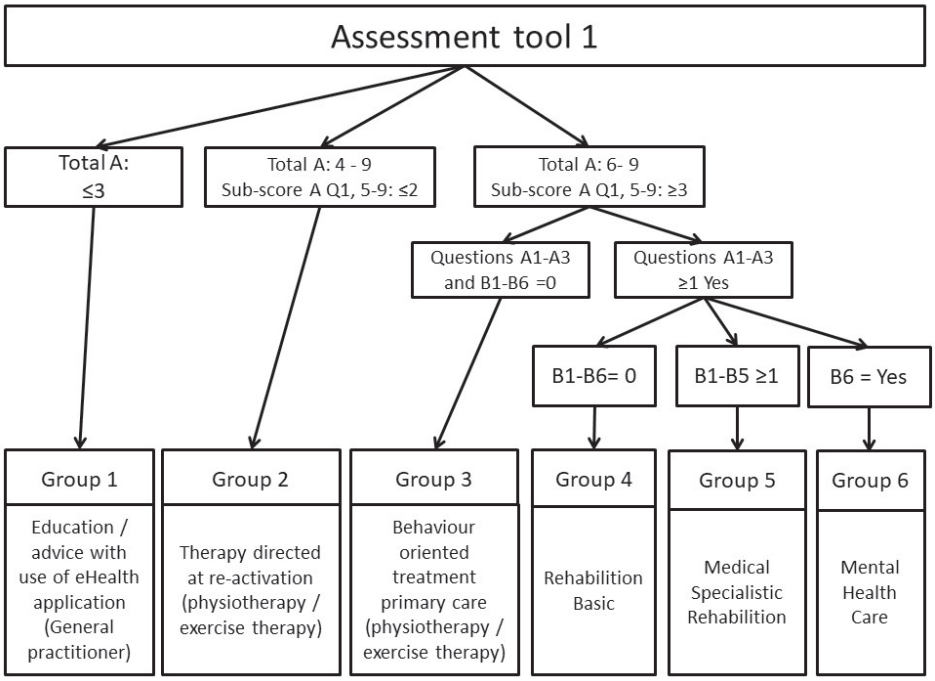
B1.	Does the patient have pain in at least 2 (independent of each other) body parts?	O Yes	O No
B7.	Is a patient's social environment a strong barrier to conducting behavioral treatment in primary care?	O Yes	O No
Eg.	little or no social support and / or the presence of physical / mental stressors.		
B8.	Has the patient sought treatment more than 3 times in the past six months (at the GP and / or physiotherapist) for the same or similar non-specific pain complaints of the musculoskeletal system?	O Yes	O No
B2.	Are there mood problems, not as a result of the pain complaints, that hinder the implementation of behavioral treatment in primary care?	O Yes	O No
B3.	Are there anxiety problems, not as a result of the pain complaints, that hinder the implementation of a behavioral treatment in primary care?	O Yes	O No

B4.	Are there any personality problems that hinder the implementation of behavioral treatment in primary care?	O Yes	O No
B5.	Are there other psychiatric problems that hinder behavioral treatment in primary care?	O Yes	O No
B6.	s the psychiatric problem primarily in the foreground and is it responsible for any daily dysfunction?	O Yes	O No

0x Yes in Set B:
Referral to Rehabilitation basic in NPRL (secondary care)

Question B6 = Yes:
Referral to mental healthcare

≥ 1 Yes in Set B:
Referral to medical specialist rehabilitation (tertiary care)



Indicatietool 1: eerste lijn

[Tekst voor de patiënt: Basis vragen]

Geef alstublieft een antwoord op elk onderdeel. Kruis bij ieder onderdeel het vakje aan dat op jou van toepassing is. Soms is het moeilijk om tussen twee vakjes te kiezen, kruis dan het vakje aan dat jouw probleem het beste beschrijft. Zou je bij het beantwoorden van onderstaande vragen willen terugdenken aan pijn **gedurende de laatste 2 weken**.

1. Over het geheel genomen, hoe hinderlijk is uw - huidige pijn - de afgelopen 2 weken geweest?
   O In het geheel niet O Een beetje O Matig O Erg O Extreem

   Kruis bij elk van de onderstaande vragen het hokje aan dat aangeeft of het eens of oneens bent met de stelling, terugdenkend aan de laatste 2 weken.

2. Gedurende de laatste 2 - weken heeft mijn huidige pijn zich verspreid naar ander delen van mijn lichaam
   O Eens O Oneens

3. Gedurende de laatste 2 weken heb ik soms last gehad van in andere delen van mijn lichaam dan waar ik eerst pijn had
   O Eens O Oneens

4. Het uitvoeren van lichamelijke activiteiten zou mijn herstel kunnen vertragen.
   O Eens O Oneens

5. Gedurende de laatste 2 weken werd ik bij het uitvoeren van gewone dagelijkse bezigheden belemmerd door mijn huidige pijn
   O Eens O Oneens

6. Gedurende de laatste 2 weken heb ik vanwege mijn huidige pijn alleen korte afstanden gelopen.
   O Eens O Oneens

7. Gedurende de laatste 2 weken maak ik me zorgen over mijn pijn
   O Eens O Oneens

8. Mijn huidige pijn is een groot probleem en ik geloof dat het niet meer over zal gaan
   O Eens O Oneens

9. Over het geheel genomen heb ik gedurende de laatste 2 weken niet meer genoten van dingen waarvan ik normaal wel geniet.
   O Eens O Oneens

[Tekst voor de eerstelijns verwijzer / behandelaar]
Voor verwijzing van patiënten met chronische pijn wordt in de eerste lijn, naast anamnese en lichamelijk onderzoek een screeningstool afgenomen. Op basis van de uitkomsten op een aantal anamnestische vragen worden afkappunten berekend. Deze afkappunten bepalen waar patiënten naar toe worden verwezen voor vervolgbehandeling.

Berekenen van de scores:
Het berekenen van de scores zal geïntegreerd worden in de Pijnrevalidatie Coach. Mocht je toch een vragenlijst op papier afnemen dan kun je de scores op deze manier berekenen:

Vraag 1: *als 'erg' of 'extreem'= 1,* *anders score=0*
Vraag 2 t/m 9: *Eens=1,* *Oneens=0*

Totaal (1 t/m 9) = *(score basis vragen)*
Score vragen 6,7,8,9 = *(psychosociale risicofactoren)*

'laag risico' = Score basis vragen: 0-3
De huisarts geeft patiënt voorlichting/educatie en advies, daarbij gebruikmakend van de educatie in de Pijnrevalidatie Coach.

'matig risico' = Score basis vragen: 4-6, waarvan 1 of 2 psychosociale factoren
Deze patiënt wordt doorverwezen naar een basisoefenprogramma gericht op verbeteren van dagelijks functioneren in de eerste lijn uitgevoerd door een fysiotherapeut of oefentherapeut in het netwerk.

'hoog risico' = Score basis vragen: 6-9, waarvan ≥ 3 psychosociale factoren
De set A met aanvullende vragen dient afgenomen te worden door de verwijzer/behandelaar in de eerste lijn.

Set A aanvullende vragen: [dient afgenomen te worden door de verwijzer / behandelaar in de eerste lijn]

A1.	Is er sprake van medische co-morbiditeit (zoals bv pulmonale of cardiale problematiek) die het dagelijks functioneren en/of het verbeteren ervan sterk beïnvloeden?	O	JA	O NEE
A2.	Is er sprake van arbeidsverzuim langer dan 3 weken?	O	JA	O NEE
A3.	Heeft de patiënt al niet succesvolle gedragsgeoriënteerde behandeling voor verbeteren dagelijks functioneren in de eerste lijn doorlopen?	O	JA	O NEE

0x JA op Set A:
Verwijzing naar gedragsgeoriënteerde behandeling in eerste lijn door fysiotherapeut/ oefentherapeut uit netwerk.

≥ 1 JA op Set A:
De set B met aanvullende vragen dient afgenomen te worden door de verwijzer/behandelaar in de eerste lijn.

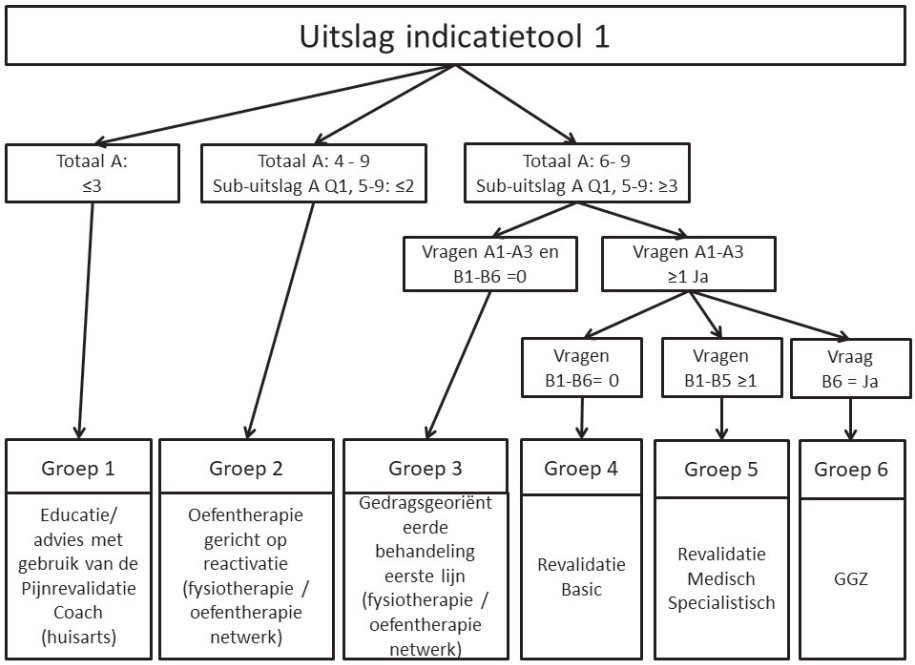
Set B aanvullende vragen: [dient afgenomen te worden door de verwijzer / behandelaar in de eerste lijn]

B1.	Heeft de patiënt pijn in minstens 2 (onafhankelijk van elkaar) lichaamsdelen	O JA	O NEE
B7.	Is de sociale omgeving van een patiënt sterk belemmerend voor het uitvoeren van een gedragsmatige behandeling in de eerste lijn Bv. geen of nauwelijks sociale steun en/of de aanwezigheid van fysieke/mentale stressoren.	O JA	O NEE
B8.	Heeft de patiënt het afgelopen half jaar meer dan 3x behandeling gezocht (bij de huisarts en/of fysiotherapeut) voor dezelfde of soortgelijke aspecifieke pijnklachten van het bewegingsapparaat?	O JA	O NEE
B2.	Is er sprake van stemmingsproblematiek, niet als gevolg van de pijnklachten, die belemmerend is voor uitvoering van een gedragsmatige behandeling in de eerste lijn?	O JA	O NEE
B3.	Is er sprake van angstproblematiek, niet als gevolg van de pijnklachten, die belemmerend is voor uitvoering van een gedragsmatige behandeling in de eerste lijn?	O JA	O NEE
B4.	Is er sprake van persoonlijkheidsproblematiek die belemmerend is voor uitvoering van een gedragsmatige behandeling in de eerste lijn?	O JA	O NEE
B5	Is er sprake van andere psychiatrische problematiek die belemmerend is voor uitvoering van een gedragsmatige behandeling in de eerste lijn?	O JA	O NEE
B6.	Staat de psychiatrische problematiek primair op de voorgrond en is verantwoordelijk voor het eventueel aanwezige dagelijks disfunctioneren?	O JA	O NEE

0x JA op Set B:
Verwijzing naar revalidatie Basis (1,5e lijn) in het Netwerk.

Vraag B6 = Ja:
Verwijzing naar de GGZ (in overleg met patiënt).

≥ 1 JA op Set B:
Verwijzing naar medisch specialistische revalidatie.



S4.3 TOPIC LIST FOCUS GROUPS AND INTERVIEWS

Focus groups 1&2 – phase 1 – primary care

- General opinion about NPRL
  - Adequate level of knowledge and resources
  - Added value for daily practice
  - Useability of tools

- Start meeting
  - Content
  - Alignment with daily practice
  - Way healthcare professionals are involved in NPRL

- Education meetings
  - Usefull for daily practice
  - Knowledge about CMP

- Practice meetings
  - Added value
  - Implementation of disucced topics in daily practice

- Assessment tool 1
  - Usability
  - Practical use
  - Complexity of patients
  - Integration in eHealth

- eHealth
  - Usability
  - Practical use
  - Comparison with other eHealth applications
  - Added value

- Treatment protocol
  - Usability
  - Fixed protocol in the future
  - Adaptations in protocol during education meetings

- Collaboration
  - Interdisciplinary collaboration
  - Subdividing tasks
  - Difference with usual care

- Expectations for the future
    - Implementation of NPRL in daily care
    - Implementation in your practice/organisation
    - Barriers

Focus group 3 – phase 2 – primary care

- Additional education recognition patient with CMP
    - Usability
    - Understandable
    - Added value for use in daily care
    - Need for extra education/information

- Collaboration
    - Workshops from secondary and tertiary care
        - Understandable
        - Referral to secondary and tertiary care
        - Need for extra information
    - Interdisciplinary collaboration in local network
        - Use of practice nurse mental health

- Treatment protocol
    - Summary of the protocol
    - Need for extra education/information

- eHealth
    - Extra education
    - Usability daily practice
    - Need for extra education/information
    - Preventive care

- Assessment tool
    - Usability extra rules and information
    - Integration in daily care
    - Need for extra education/information

- Network meeting with all healthcare professionals
    - General opinion
    - Points for improvement
    - Subject next edition
    - Summary of the network meeting

- Participation of patients
    - Eligible patients who did not start treatment
    - ‘Automatic process’ of inclusion and treatment

- Expectations for the future
    - What do you need?
    - Barriers
    - Adjustments

Focus group 4 – phase 2 – secondary/tertiary care

- General opinion about NPRL
    - Adequate level of knowledge and resources
    - Added value for daily practice
    - Useability of tools

- Assessment tool 2
    - Usability
    - Practical use
    - Complexity of patients
    - Patient satisfaction

- eHealth
    - Practical use
    - Comparison with other eHealth applications
    - Added value

- Collaboration
    - Primary care
    - Communication
    - Expansion with other healthcare disciplines

- Network meeting with all healthcare professionals
    - General opinion
    - Points for improvement
    - Subject next edition

- Expectations for the future
    - Better implementation in daily care
    - Barriers
    - Adjustments

Focus group 5 – phase 3 – primary, secondary and tertiary care

- Experiences in phase 2
  - Barriers
  - Facilitators

- Network meeting with all healthcare professionals
  - General opinion
  - Points for improvement
  - Subject next edition
  - Summary

- Collaboration
  - Interdisciplinary collaboration
  - Local network
  - Local networks vs secondary/tertiary care
  - eHealth and collaboration

- Network vs. usual care
  - Activities
  - Way of working

- Participation of patients
  - 'Automatic process' of inclusion and treatment
  - Barriers
  - eHealth and participation
  - Biopsychosocial model

- Assessment tool 2
  - New version
  - Usability
  - Added value

- Expectations for the future
  - Treatment of all available patients in NPRL
  - Barriers
  - Adjustments
  - Continuity NPRL inside each organization/ practice
  - Education meetings

Focus group 6 – phase 3 – patients

- General opinion about treatment and eHealth

- Treatment
    - Content of education
    - Information about treatment GP and/or therapist
    - Collaboration GP and therapist
    - Content of exercises
    - Positive points of treatment
    - Adjustment of treatment to CMP
    - Functioning and participation in daily life
    - Result
    - Recommend to family and friends

- eHealth
    - Goal
    - Interaction with therapist
    - Content of the application
    - Giving control over treatment
    - Recommend to family and friends

- Assessment tool / questionnaire
    - General opinion
    - Need of help of relatives
    - Which moment in the treatment

- Referral
    - Why and to which discipline
    - Opinion referral
    - Waiting times
    - Information given
    - Alignment with CMP

- Social environment
    - Involvement of family or friends in treatment and eHealth
    - Opinion about treatment and eHealth

Interview 1 – phase 1 – RP – tertiary care

- Current organisation of care
    - Barriers
    - Facilitators
    - Management

- Collaboration with primary care
    - Referrals

- Collaboration with other departments in same organization
    - Use of questionnaires

- Content of NPRL
    - Expectations for future implementation
    - NPRL solution for barriers of care as usual

Interview 2 – phase 1 - RP – tertiary care

- Assessment tool 2
    - General opinion
    - Comparison with care as usual
    - Opinion of the team
    - Practical barriers

- Current organisation of care
    - Barriers
    - Facilitators
    - Referral patterns

- Content of NPRL
    - Opinion about participation of commercial organization of pain rehabilitation
- Collaboration with primary care
    - Referrals

- Collaboration with other departments in same organization

Interview 3 – phase 1 – psychologist – secondary care

- Current organisation of care
    - Barriers
    - Facilitators
    - Referral patterns
    - Management

- Content of NPRL
    - Expectations for future implementation
    - NPRL solution for barriers of care as usual

- Assessment tool 2
    - Barriers
    - Adjustments in daily practice

- eHealth
    - Expectations
    - Adjustments in daily practice

- Collaboration
    - Primary care
    - Other organizations
    - Influence of NPRL

Interview 4 – phase 2 – RP – secondary care

- Current organisation of care
  - Barriers
  - Facilitators
  - Referral patterns
  - Management
- Content of NPRL
  - Expectations for future implementation
  - NPRL solution for barriers of care as usual
  - Expected added value
- Assessment tool 2
  - Barriers
  - Adjustments in daily practice
- eHealth
  - Expectations
  - Adjustments in daily practice
- Collaboration
  - Primary care
  - Other organizations
  - Influence of NPRL

Interview 5 – phase 2 - practice nurse mental health – primary care

- Network meeting with all healthcare professionals
  - General opinion
  - Points for improvement
- Collaboration
  - Facilitators
  - Local network
  - Comparison with usual care
- Treatment protocol
  - Specific for practice nurse mental health
  - Content
- eHealth
  - Experiences
  - Feedback system
  - Collaboration
- Participation of patients
  - Financial situation
  - Satisfaction

- Transferability of NPRL
    - Healthcare disciplines
    - Local network

Interview 6 – phase 2 – RP – secondary care

- Current organisation of care
    - Barriers
    - Facilitators
    - Referral patterns
    - Management

- Content of NPRL
    - Expectations for future implementation
    - NPRL solution for barriers of care as usual
    - Expected added value

- Assessment tool 2
    - Barriers
    - Adjustments in daily practice

- eHealth
    - Expectations
    - Adjustments in daily practice

- Collaboration
    - Primary care
    - Other organizations
    - Influence of NPRL

S4.4 TABLE. OVERVIEW OF MAIN BARRIER AND FACILITATOR NODES PER CFIR DOMAIN AND CONSTRUCT

1 Intervention Characteristic
- 1A Intervention Source
- 1B Evidence Strenght & Quality
- 1C Relative Advantage
- 1D Adaptability
- 1E Trialability
- 1F Complexity
- 1G Design Quality & Packaging
- 1H Cost

2 Outer setting
- 2A Patient Needs & Resources
- 2B Cosmopolitanism
- 2C Peer Pressure
- 2D External Policy & Incentives

3 Inner Setting
- 3A Structural Characteristics
- 3B Network & Communications
- 3C Culture
- 3D Implementation Climate
- 3D1 Tension for Change
- 3D2 Compatibility
- 3D3 Relative Priority
- 3D4 Organizational Incentives & Rewards
- 3D5 Goals and Feedback
- 3D6 Learning Climate
- 3E Readiness for Implementation
- 3E1 Leaderschip Engagement
- 3E2 Available Resources
- 3E3 Access to knowledge and information

4 Characteristics of individuals - Zorgverleners
- 4A Knowledge & Beliefs about the intervention
- 4B Self-efficacy
- 4C Individual Stage of Change
- 4D Individual Identification with Organization
- 4E Other personal Attributes

5 Process

- 5A Planning
- 5B Engaging
- 5B1 Opinion Leaders
- 5B2 Formally appointed internal implementation leaders
- 5B3 Champions
- 5B4 External Change Agents
- 5B4a Key stakeholders including staff
- 5B4b Patients or Customers
- 5C Executing
- 5D Reflecting & Evaluating

Summary 1: Within NPRL, the guidelines and treatment protocols provide consistency and transparency in the collaboration of healthcare professionals regarding a biopsychosocial language and treatment intensity, duration, and content. However, the implementation of guidelines and protocols has different barriers in daily practice.

	CFIR construct	*Barrier (✗) facilitator (✓)*
Main finding 1A: The guidelines and protocols stimulate intensive collaboration between healthcare professionals, such as consistency in the biopsychosocial language and transparency in treatment duration, intensity, and content		
Healthcare professionals indicate that NPRL forces collaboration in the transmural chain, which can be supported by the eHealth application.	1G/4A	✓/✗
(Transmural) collaboration makes it more efficient to collect biopsychosocial information about the patients	1H/4B	✓
Healthcare professionals perceive that exchanging experiences helps them to be more certain during inclusion and treatment	4B	✓
For therapists, the collaboration with a GP and practice nurse mental health is an added value	3B/3D	✓
Patients have often a biomedical vision towards treatment. Collaboration between healthcare professionals helps to change the mindset of the patient when healthcare professionals speak the same biopsychosocial language.	1G	✓
Within local networks in primary care, collaboration within healthcare centers (Dutch: Gezondheidscentrums) exists more often within NPRL compared to collaboration between GPs and paramedics with separate practices	3B	✓/✗
Due to collaboration in a local network in primary care, patients with more complex pain complaints can be treated in primary care instead of a referral to secondary or tertiary care	1C	✓
Most advantages of NPRL are for primary care as secondary/ tertiary care practices work already with patients with CMP intensively.	1C	✗

	CFIR construct	*Barrier (✗) facilitator (✓)*
Main finding 1B: Healthcare professionals experience tension between a fixed protocol and the freedom to adjust the protocol into daily practice. This is influenced by their professional preferences.		
Tension between fixed protocol and more freedom		
Freedom is desired in the use of the treatment protocol into daily practice. Healthcare professionals underline this as an advantage	1D/1G/ 4A/5C	✓
At the end of phase 1.1, there was a desire for more fixed protocols. Some healthcare professionals stated that it will give them more grip in this complex patient population	1G/4B	✓
After making the treatment protocol more fixed, healthcare professionals stated that a summary of the protocol was desired. The fixed treatment protocol together with the summary were suitable in daily practice.	5C	✓
On one hand, healthcare professionals stated that the treatment protocol must be fixed and standard when NPRL1.0 will be expanded to other regions. However, on the other hand, due to the complexity of organization of primary care in the Netherlands, it is not possible to accomplish this.	3E/1G/1F	✗
Personal preferences		
In the treatment protocol, fewer consultations are prescribed compared to standard pain rehabilitation care in primary care. Healthcare professionals are afraid that less consultations will lead to less income	1H	✗
Main finding 1C: Difficult to apply the guidelines about the eHealth application and assessment tools for satisfactory use in daily care.		
eHealth application SanaCoach Pain Rehabilitation: use in daily practice		
By using eHealth, biopsychosocial information about the patient will be collected easily which saves time during consultation and better preparation of consultation	1C	✓
Some healthcare professionals mentioned that the eHealth application is easy to use during consultations. However, other healthcare professionals perceived the eHealth application as complex.	1G/1H/ 4B	✓/✗
The chat function of the eHealth application does not fit with daily practice. In primary, secondary and tertiary unknown who has to keep track of the chat function and respond to patients.	3A	✗
In healthcare several eHealth applications are used for several health conditions. Healthcare professionals have difficulties combining these different eHealth applications during consultations.	1G	✗
eHealth application SanaCoach Pain Rehabilitation: content		
Functioning of the complete eHealth application is unknown for some healthcare professionals	4A	✗
The eHealth application places the patient central in the treatment, which is seen as an advantage by healthcare professionals	1G	✓
Rehabilitation physicians in secondary and tertiary care indicated that the diary function in the eHealth application had no added value as they see patients not often enough during the rehabilitation	3A	✗

	CFIR construct	*Barrier (✗) facilitator (✓)*
eHealth application SanaCoach Pain Rehabilitation: Experiences of patients		
Patients discussed the results in the eHealth application at the start of the treatment with the healthcare professional, but later on, this happened less	1E	✗
The diary questionnaires are perceived as hard to fill in daily by patients. Some patients did not see the added value of it	1G/4A	✗
Patients indicated that the graphics about daily activity are an advantage for their treatment.	1G	✓
Overall, patients indicated the education material in the eHealth application as very useful. However, patients who were first treated in secondary or tertiary before visiting a primary healthcare professional mentioned that there is no new information in the education materials	1G	✗ / ✓
Some patients preferred education materials on paper than integrated in an eHealth application. Not all patients have an internet connection	1G/2A	✗
All patients agreed that the eHealth application stimulates them to adhere to the treatment	1G/4B	✓
Some patients did not know their healthcare professional was able to view their scores in the eHealth application	1G	✗
Patients indicated that it is difficult to get an overview of all the functions of the eHealth application	1G	✗
Assessment tool 1 primary care		
Use of assessment tool during consultation is too time consuming	1G/1H	✗
Healthcare professionals expect that an extra consultation to discuss the results of the assessment tool with the patient is not practical; it is an extra burden for the patient.	1G/2A	✗/✓
Some healthcare professionals indicate that the assessment tool is not much effort for the patient, while other healthcare professionals perceive it as too much effort.	1H/4A	✓/✗
Results of the assessment tool in primary care are not in line with their knowledge and anamnesis for some healthcare professionals. Therefore, some of them indicate that modifications are necessary while more experienced healthcare professionals indicated this is not necessary.	4A/1G	✗ / ✓
Healthcare professionals find it important that assessment tool 1 has a good validity	1B/1G/ 4A	✓
Assessment tool 2 secondary and tertiary care		
Healthcare professionals report that assessment tool 2 supports their knowledge and anamnesis	4B	✓
Healthcare professionals point out that their available administrative time is not sufficient to fill in assessment tool 2	3A	✗
After adjustments, it is easier to fill in the assessment tool, but it is still time consuming	1H/1G	✗ / ✓

	CFIR construct	*Barrier (✗) facilitator (✓)*
Use in daily practice		
The assessment tools and lessons learned during the education days gives the healthcare professionals more grip to coach the patient during a biopsychosocial treatment	4A	✓
Complex to start using the assessment tool, eHealth application and contacting other involved healthcare professionals during inclusion of a new patient	1F/1G/ 5C	✗
Because the use of the eHealth application is not an automatized process in daily care. The patient inclusion for the study is hindered as these inclusions are done via the eHealth application	3E	✗
Assessment tools and treatment protocols make referral and treatment more consistent and objective	1C	✓

Summary 2: Participation and implementation are hindered because of the stigmatization of CMP in society. Moreover, healthcare professionals' approaches are often more biomedical oriented instead of biopsychosocial oriented.		
	CFIR construct	*Barrier (✗) facilitator (✓)*
Main finding 2A: In the Dutch society, there is a stigma on CMP because pain is not visible.		
Patients as well as healthcare professionals reported an stigma on CMP in the Dutch society	2A	✗
Healthcare professionals mentioned that diagnosing someone with CMP feels for patients as not being take serious	4A	✗
Main finding 2B: Because of the less supported biopsychosocial vision, healthcare professionals have difficulties with (early) recognition of patients with CMP in primary care.		
Motivation of healthcare professionals		
Healthcare professionals' intrinsic motivation for participation is overall positive. Reasons for participation are: Patients are not treated with evidence based care Keep healthcare affordable CMP is a social problem, the empowerment of these patients is important Difficult to treat patients with CMP successfully Increasing their personal professional network Multidisciplinary collaboration Earlier involved in projects with CMP Practice owners agreed participation, healthcare professionals were obligated to participate Trust in this scientific grounded network	1D/4A/ 4D	✓
Vision of healthcare professionals		
Matched care is perceived as an added value for care	4A	✓
In order to successfully recognize patients, healthcare professionals' vision must be biopsychosocial. They perceive this as difficult because they are trained with a biomedical vision so it requires more attention to screen with a biopsychosocial vision	4B	✗
Research with questionnaires is a burden for patients	1G	✗
Knowledge of healthcare professionals		
Participating healthcare professionals have different starting levels of knowledge regarding CMP	3D/4B	✗ / ✓
Difficult to align the training to the different levels of knowledge regarding content and duration	1B/1G/ 5C	✗
Some healthcare professionals need more tools to increase their certainty in treating patients with CMP.	1G/4B/ 4C	✗
At the end of phase 1, healthcare professionals perceived the education days as confusing because the treatment protocol was not fixed, as it was developed during the meetings using input of healthcare professionals. In later phases, this became more clear	1G/4B	✗
Education days had a clear layout	1G	✓
Healthcare professionals perceive patients with CMP as a difficult population to manage	4B/4C	✗
Secondary and tertiary care receives a lot of unjustified referrals from primary care, which indicates a lack of knowledge among GPs	2B/2D	✗

	CFIR construct	*Barrier (✗) facilitator (✓)*
Recognition of patients with CMP		
In phase 1, it was difficult to determine the level of complexity of a patient with CMP	4A	✗
In general practice, the group of patients is diverse, which makes recognition difficult	2D	✗
Search for the ideal patient with CMP make that healthcare professionals have other expectations and recognize only 10-20% of the CMP population	4B/3C	✗
Healthcare professionals are afraid and insecure to make a false diagnosis of someone suspected to have CMP as they do not want to burden the patient if afterwards it might not have been necessary	4B	✗
At the end of phase 3, healthcare professionals indicated easier recognition of patients CMP, but they still need more experience to make it a habit	5C	✗
Main finding 2C: Healthcare professionals have difficulties with motivating patients for a biopsychosocial treatment because both their attitude is more biomedical focused		
Vision		
Difficult for healthcare professionals to change the biomedical vision of patients to a biopsychosocial vision	1F	✗
In physiotherapy, patients expect a biomedical oriented therapy, with preferable massage.	3A	✗
Some patients indicated that exercises during physiotherapy have an added value	3A	✓
Patients who receive primary physiotherapy have not always the feeling that they can talk about their confidential CMP problem	3A	✗
Participation of patients		
The participation of patients is lower as expected. One reason is that patients do not want to participate in a biopsychosocial treatment.	5C	✗
If healthcare professionals are more enthusiastic, it is easier to motivate the patients for participating in the study	4B	✓
Therapists perceive it as difficult to motivate patients, who are already visiting them for years for a biomedical treatment, for the biopsychosocial treatment. Therapist have the feeling that it lowers their credibility when they start with a 'totally different' treatment approach. Therefore, some practices choose to not include well-known patients.	3D	✗
Not all patients are eager to participate in a study with questionnaires or eHealth	2A	✗
The patients who are eager to participate in the biopsychosocial treatment and the research study increase the enthusiasm of the healthcare professionals	1C/1G/ 2A	✓
Patients do not always want to switch to another healthcare professional if they have a good relationship with their current healthcare professional. Even if that treatment fits more with the level of complexity of the pain complaints.	2A/1G	
The consumption of care is high among patients with CMP, which makes it more difficult to motivate them for a compact treatment program	2A/2B	✗

Summary 3: The current organisation of healthcare for patients with CMP, such as the culture, structure, and financing of healthcare practices complicates the implementation between and within the practices.		
	CFIR construct	*Barrier (✗) facilitator (✓)*
Main finding 3A: The culture of healthcare practices, such as the ambiance and attitude, determines the success of the collaboration between healthcare professionals.		
A pleasant ambiance and work pressure at the work place determines someone's willingness to participate in NPRL	3A/ 3C	✓
Current Dutch healthcare is biomedical oriented, which makes it difficult to: Get insight into treatment protocols when a patient will be referred outside NPRL During referral outside NPRL, the patient will get another explanation for the complaints. Difficult to expand NPRL to other practices or regions. Not all healthcare professionals want to switch to a biopsychosocial treatment	2B/2D/ 3D	✗
During the professional training of nearly all disciplines, only a little attention is paid to the biopsychosocial model and patients with unexplained complaints. Moreover, this information differs depending on the discipline	2D	✗
Healthcare professionals indicate uncertainty to look further than only the biomedical part when assessment of a patient. They are afraid to miss some essential pure biomedical complaint	4B	✗
Young and dynamic staff makes implementation easier	3D	✓
Therapists perceive difficulties in the collaboration with GPs, which takes a lot of effort.	3B	✗
Main finding 3B: The financing of the current organization of healthcare in the Netherlands hinders the implementation of NPRL..		
Multidisciplinary meetings		
It is difficult to organize multidisciplinary meetings because: Currently, there is no existing structure for organization of multidisciplinary meetings and collaboration in Dutch primary care In primary care, they are not financed. Healthcare professionals have to finance this by themselves, which is difficult for small practices as their buffer is small Not every discipline is able to be physical available every time The time pressure in primary care makes it difficult to organize enough time for meetings For several diseases or syndromes, meetings are organized. Therefore, healthcare professionals must be available at different meetings, which takes a lot of time. Moreover, patients are often confronted with more than one disease or syndrome, which makes care more complex	1F/1H/ 2D/3A/ 3B	✗
Financing of Dutch healthcare		
Practice nurses mental health have an important role in NPRL, they support general practitioners tasks. However, in Dutch care there is not much finance available for practice nurses.	1H/2D	✗
Healthcare professionals whish there is a bundled payments structure for primary care. As not every patient is even as complex or needs treatment in the same biopsychosocial domains. With bundled payments they assume they are better able to organize care and collaboration for patients with complex complaints	1F/2D	✗
Healthcare insurance for patients		
In the current basic healthcare insurance, nine consultations at a therapist are financed by the insurance. Patients as well as healthcare professionals indicate that nine consultations is not enough for most patients, as the problem is more complex	1H/2A	✗

Patients can buy additional healthcare insurance themselves. However, healthcare professionals perceive that patients with a low socioeconomic status are not able to afford this, while they need it the most	2A	✗
Healthcare professionals are less motivated to treat patients if they already know at the start that nine consultations will not be enough	2D	✗
Main finding 3C: The structure of the organisation of healthcare practices in primary care is complex.		
Time pressure in primary care		
During recruitment of healthcare practices, several practices declined participation due to lack of time	3D/3E	✗
Participating healthcare practices are too busy to implement a new project sufficient. If busy, they work again on the automatic pilot	4B	✗
Networking in current organization of care		
Current general practice care is unsuitable for networks on a large scale. Most GPs have their own specialization. NPRL is too complex to fit in this organization of care	1D/1E/ 2B	✗
Multidisciplinary care in primary care is not suitable for small practices.	2B/3B	✗
Primary care healthcare professionals are not used to referrals within their own discipline, which is necessary within NPRL	2B/2D	✗
In current healthcare, there is no clear treatment protocol for CMP. It fits partly within different disciplines	2B/2D	✗
Organization of primary care in the Netherlands shifts towards practice enlargements, which could be an advantage for NPRL	2D	✓
Multidisciplinary meetings at the primary care practices stimulate the implementation of NPRL	1D/1E	✓
If healthcare professionals within primary care are based on one address, it stimulates collaboration	3A/3D	✓
Competition		
Competition between practices influences collaboration	1F/2B/ 2C/2D	✗
Market forces influences referrals within primary physiotherapy, even within practices	3A	✗
Some practice owners in physiotherapy are against selection of patients with a level of complexity which fits within primary care	3D/3E	✗
Other		
Difficult to link ICT-systems in healthcare which barriers use of eHealth	2D	✗
The new privacy law hinders communication between disciplines	2D	✗

Summary 4: The iterative, bottom-up implementation strategy fits with the target audience and CMP, however, a critical mass of healthcare organisations is needed for proper implementation.	*CFIR construct*	*Barrier (✗) facilitator (✓)*
Main finding 4A: The active iterative, bottom-up development and participation of healthcare professionals and the project team in the implementation process of NPRL is seen as an advantage.		
Before the start of the project, an advisory board was started in order to discuss multidisciplinary treatment for CMP	4A	✓
Healthcare professionals are involved in NPRL via: The project group Other participating healthcare professionals Their practice owners A local physiotherapist network An advertisement	5B	✓
In research, small groups of healthcare professionals are recommended in a pilot study to implement complex interventions	1G	✓
Healthcare professionals indicate that they were active involved in the bottom-up development of NPRL which allows adjustments which fits in daily practice	1B/1D/ 4D/5B/ 5C	✓
Practice meetings with the project team were seen as an benefit, as they change their mindset, and are a reminder for active participation.	1G/4A/ 4B/5B/ 5C	✓
Healthcare professionals state that the project team uses their input, has a fixed protocol, and communicates well.	1D/1G/ 3D/4D/ 5B/5C	✓
The fact that a center of expertise is the intervention source is seen as an advantage	1A/1B/ 1C/4D	✓
Main finding 4B: A critical mass of healthcare organisations is necessary for a proper executing of NPRL.		
In this pilot study, the amount of participating healthcare organizations was limited. This makes it difficult to collaborate and refer patients efficiently	1F/1G/ 3A	✗
Practices and organizations outside NPRL are not used to multidisciplinary collaboration	3B/3D	✗
Therapists have difficulties in collaboration for patients who visit them by direct access, because often their GP does not participate in NPRL	1G/1H/ 3A/3B	✗
Within one general practice not all GPs were educated, however, sometimes a referral from within the practice itself was seen	3B	✓
Practices within NPRL have a shared vision which makes referrals more trustful	3C	✓
Main finding 4C: Healthcare professionals believe that NPRL is a solution to the current gap in care for patients with CMP.		
Healthcare professionals have the confidence that NPRL will be embedded in daily care for patients with CMP	1B/1C/ 1D/4A	✓
At the end of phase 3, healthcare professionals had not a real 'network feeling' yet, but more separate practices	1D/3A	✗
A challenge to attract healthcare professionals who are not motivated for multidisciplinary treatment or CMP	5B	✗
Healthcare professionals have a network of colleagues, they are willing to expand NPRL within their network	3B	✓

Chapter 5

The (cost-)effectiveness and cost-utility of a novel integrative care initiative for patients with chronic musculoskeletal pain: the pragmatic trial protocol of Network Pain Rehabilitation Limburg

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ABSTRACT

Background: Rehabilitation care for patients with chronic musculoskeletal pain (CMP) is not optimally organized. The Network Pain Rehabilitation Limburg 2.0 (NPRL2.0) provides integrated care with a biopsychosocial approach and strives to improve the Quadruple Aim outcomes: pain-related disability of patients with CMP; experiences of care of patients with CMP; meaning in the work of healthcare professionals; and healthcare costs. Firstly, in this study, the effectiveness (with regard to the functioning and participation of patients) of primary care for patients with CMP will be assessed, comparing care organized following the NPRL2.0 procedure with usual care. Secondly, the cost-effectiveness and cost-utility with regard to health-related quality of life and healthcare costs will be assessed. And thirdly, the effect of duration of participation in a local network in primary care will be studied.

Methods: In this pragmatic study, it is expected that two local networks with 105 patients will participate in the prospective cohort study and six local networks with 184 patients in the stepped-wedge based design. Healthcare professionals in the local networks will recruit patients. Inclusion criteria: age ≥ 18 years; having CMP; willing to improve functioning despite pain; and adequate Dutch literacy. Exclusion criteria: pregnancy; and having a treatable medical or psychiatric disease. Patients will complete questionnaires at baseline (T1), 3 months (T2), 6 months (T3), and 9 months (T4). Questionnaires at T1 and T4 will include the Pain Disability Index and Short Form Health Survey. Questionnaires at T1, T2, T3, and T4 will include the EQ-5D-5L, and iMTA Medical Consumption and Productivity Cost Questionnaires. Outcomes will be compared using linear mixed-model analysis and costs will be compared using bootstrapping methods.

Discussion: NPRL2.0 is a multidimensional, complex intervention, executed in daily practice, and therefore needing a pragmatic study design. The current study will assess NPRL2.0 with respect to the Quadruple Aim outcomes: patient health and costs. This will provide more information on the (cost-) effectiveness of the organization of care in a network structure regarding patients with CMP. The other two Quadruple Aim outcomes will be examined alongside this study.

BACKGROUND

In Western society, the prevalence of chronic musculoskeletal pain (CMP) is up to 20% in the adult population.[1,2] CMP, the major cause of pain and disability, includes a diverse range of diagnoses such as nonspecific low back pain, fibromyalgia, complex regional pain syndrome, and nonspecific musculoskeletal pain.[2,3] Biopsychosocial factors contribute to the development and persistence of pain and the associated perceived disabilities. However, the level of complexity of biomedical and psychosocial factors varies widely between people with CMP. This depends on the biomedical context and meaning of the pain, and on the impact of psychosocial factors, such as depression, anxiety, and social influences, on patients' functioning.[4,5] People with CMP often have difficulties in performing a range of daily activities and in maintaining an independent lifestyle. A high intensity of CMP is strongly associated with impaired function and is one of the leading causes of long-term work absenteeism and health-related early retirement, leading to high societal costs.[6-10] Earlier studies have shown that the health-related quality of life and levels of physical activity in people with CMP with a duration of 3-6 months is already low, and work absenteeism is high.[1,11,12]

Due to high healthcare costs and high work absenteeism, CMP is one of the most expensive health conditions worldwide. In the Netherlands, CMP costs approximately 20 billion euros per year (direct and indirect costs).[11] Of people with CMP, 60-74% receive treatment and most of these (34-79%) perceive the treatment as inadequate and therefore seek an explanation or solution for their pain problem.[1,13-15] Earlier research shows that 61% of people with CMP had visited from six to more than 20 healthcare professionals in the year before starting a rehabilitation program.[16] A reason for medical 'shopping around' might be the more biomedical-oriented (instead of biopsychosocial-oriented) outlook of the general population, healthcare professionals, and decision-makers, in which explaining and solving the pain remains the ultimate focus.[15,17] Additionally, healthcare professionals receive inadequate training on the assessment and management of CMP, leading to over- or under-treatment. As a result, the complexity of the patient's pain problem does not accord with the treatment delivered.[17-19] This highlights the need for adequate (cost-) effective treatment strategies.

Multidisciplinary and interdisciplinary treatments, with a biopsychosocial focus in primary, secondary, and tertiary care, have been shown to be both clinically- and cost-effective for people with CMP.[20-26] In order to overcome the previously-mentioned challenges in rehabilitation care for people with CMP, a National Care Standard for Chronic Pain (NCSCP) was presented in the Netherlands in 2017.[11] In this standard, a matched and person-centered care approach with multi- and interdisciplinary treatments in an integrated care network was proposed. This integrated care network would provide a shared vision of CMP and its biopsychosocial treatment through guidelines for referral

and treatment. Moreover, there would be a focus on the early recognition of subacute pain in order to prevent this from becoming chronic. In line with this, the World Health Organization advises focusing on the stimulation of functioning and participation in the design of (new) rehabilitation care.[27,28]

As an elaboration of the NCSCP, the Network Pain Rehabilitation Limburg 1.0 (NPRL1.0) was developed to provide integrated care with a biopsychosocial approach for people with CMP in order to improve their level of functioning. Its main aim is to deliver the right care, at the right place, by the right person, for the right price, thus accomplishing the Quadruple Aim: improving the functioning and participation of people with CMP; improving the experiences of care of people with CMP; improving the meaning of the work of healthcare professionals; and reducing the healthcare costs of people with CMP.[29,30] As a first step, a feasibility study was performed in 2017 and 2018 to assess the barriers and facilitators for the development, implementation, and transferability of NPRL1.0.[31] The main facilitators were that the guidelines provide consistency and transparency in the collaboration of the healthcare professionals and that the iterative, bottom-up implementation strategy fits in with the target population with CMP. However, the current views and knowledge of CMP from the patient's perspective, as well as from the healthcare perspective, and the current organization of care, are challenges for the implementation of NPRL1.0. The results of this feasibility study were used to adjust NPRL1.0 in areas such as the content of the education days for healthcare professionals, the eHealth application for healthcare professionals and patients, and educational information for patients, in the development of NPRL2.0.[32] The existing local networks in primary care will participate in a cohort study in NPRL2.0. Additionally, extra local networks in primary care will be recruited. It is expected that healthcare professionals will experience a learning curve, as NPRL2.0 is a multidimensional, complex intervention.[33] Therefore, the long-term results of effectiveness, as well as views and knowledge, regarding CMP must be studied.

In this phase, the Quadruple Aim outcomes from NPRL2.0 will be evaluated. This study will focus on the (long-term) effectiveness, cost-effectiveness, and cost-utility part of the Quadruple Aim for primary care of patients with CMP organized according to NPRL2.0 compared to usual care. The research aims of this study are:

1. To evaluate whether primary care organized according to NPRL2.0 leads to a lower level of pain-related disability in patients with CMP than in patients receiving usual care (effectiveness).
2. To evaluate whether primary care organized according to NPRL2.0 is more cost-effective for the health-related quality of life in patients with CMP than in patients receiving usual care (cost-effectiveness).

3. To evaluate whether primary care organized according to NPRL2.0 leads to higher Quality Adjusted Life Years (QALYs) than in patients receiving usual care (cost-utility analysis).

To study the effect of duration of participation and the experience of using biopsychosocial principles in treatment of local networks on (cost)-effectiveness (learning curve).

METHODS

Study design

In this pragmatic study, the recruiting period will be from April 2019 till March 2020, with follow-ups till December 2020. This study comprises two designs; a prospective cohort study and a stepped-wedge based design.

Two local networks of NPRL1.0 will be enrolled in NPRL2.0. They will receive additional education and information based on the results of the feasibility study of NPRL1.0. In NPRL2.0, they will invite patients to participate in a prospective cohort study.

In the stepped-wedge based design working according to NPRL2.0 will be introduced in three steps in two local primary care networks at the same step (step A, B or C). Local networks that intensively collaborate, due to their geographical location, will be placed together in one step (A, B or C). An independent research assistant will randomly allocate the local networks over the steps. In one local network, at least one therapist, general practitioner (GP), and mental health nurse will participate. Each local network will first recruit patients as controls during a period of care as usual, followed by a 3-month 'wash-out' period in which education is given (see Figure 5.1). After the wash-out period, a local network will then recruit patients during the intervention period in which NPRL2.0 is the standard of care. According to the stepped-wedge based design, length of control and intervention periods vary in each group: Group A will spend three months as control and five months with intervention; for Group B, there will be four months as control and four months with intervention; and Group C will spend five months as control and three months with intervention. Thus, healthcare professionals in all local networks will recruit patients for participation in both control and intervention groups. Patients will contribute data to either the control group or the intervention group, but not both. A stepped-wedge based design is the most feasible design in this pragmatic study as it has the following advantages: 1) it controls for between-local network variation in daily practice; 2) it gives the opportunity to assess intervention effects in a pre/post comparison across local networks, which increases statistical power; 3) it gives an opportunity to assess learning

effects by comparing the results of local networks that transit earlier with those that transit later.[34]

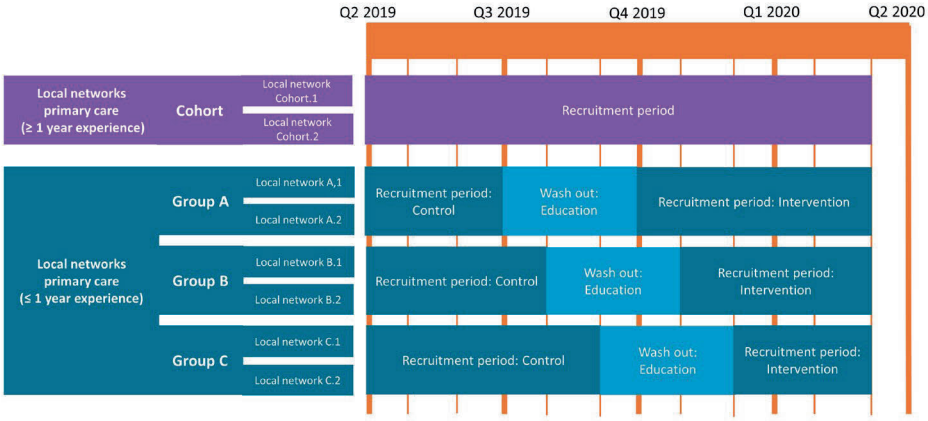

Figure 5.1 Design of the study. Cohort: prospective cohort; Group A, B, C: steps in the stepped-wedge based design. Q=quarter.

Intervention

NPRL2.0 is an integrated, transmural healthcare network for patients with CMP, focusing on improving the level of functioning of patients, despite pain. In the primary care of NPRL2.0, the GP is the gatekeeper for assessing the level of complexity of pain complaints, referral, and treatment selection. In the Netherlands, therapists (such as physiotherapists, practice therapists, and occupational therapists) in primary care can be visited by people with CMP directly, without referral. Therefore, therapists will also be able to assess the level of complexity of the pain complaints and to advise these patients to visit a GP if necessary. Depending on the level of complexity involved, the follow-up policy will either include advice without further treatment, monodisciplinary treatment in primary care, interdisciplinary treatment in primary care (collaboration between GPs, primary care therapists, and mental health practice nurses in assessing and treating patients with CMP who need mental support besides physical exercise) or interdisciplinary treatment in secondary or tertiary care (Figure 5.2). Primary care in NPRL2.0 consists of the following elements:

Integral focus on assessment and referral: assessment tool

To support the healthcare professionals in their decision-making for problem-mapping and treatment selection, an evidence-based objective assessment tool will be used for the assessment of complexity of the pain problem: the STarT MSK Tool.[35] The Dutch version of this tool is translated and validated (not published yet). STarT MSK will support

decision-making by choosing the right treatment to match the patient's biopsychosocial profile.

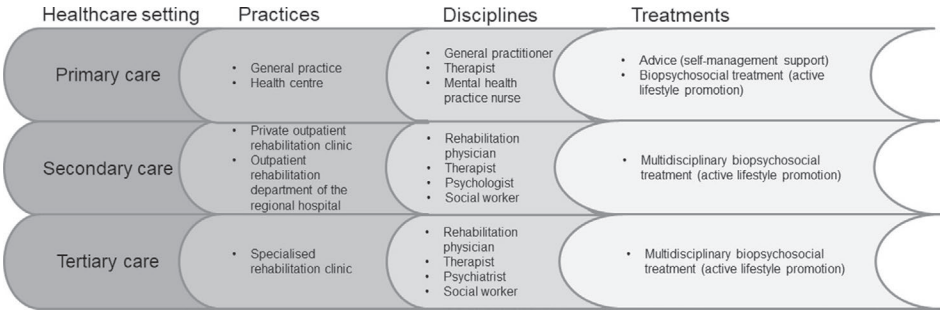

Figure 5.2 Referral options within Network Pain Rehabilitation Limburg: previously published in Lamper et al..[73]

Integral focus on treatment content and duration: treatment protocols

Patients will receive individualized treatments based on their current needs in order to improve their daily functioning. NPRL2.0 protocols are based on the most recent evidence-based treatment methods, such as Graded Activity, Exposure *in vivo*, and Acceptance and Commitment Therapy, and are adjusted to the primary care setting.[22-24,36,37] In the feasibility study, healthcare professionals were invited to provide feedback on the NPRL2.0 treatment protocols. Based on this, adjustments were made to the content and duration of NPRL2.0 treatment protocols. The primary care NPRL2.0 protocols are extended with a module focusing on self-management in daily living after treatment by a primary care therapist. In these treatment protocols, no advice for medication will be described. It is hypothesized that the biopsychosocial oriented healthcare professionals working in NPRL2.0 will prescribe less medication compared to patients receiving usual care.

Integral focus on self-management: eHealth application

Healthcare professionals and patients participating in the NPRL2.0 will make use of the eHealth application: SanaCoach Pain Rehabilitation.[38] The coach's primary goal is to support self-management. Its main function is to provide module-based pain education. Different eLearning modules are developed for the patients in order to teach them about the biopsychosocial aspects of pain. In addition, diaries are integrated in which patients can provide information on their pain intensity, level of activity, mood, and participation level. Moreover, healthcare professionals can use scores from these diaries to adjust treatment protocols to the needs of individual patients. The application also consists of a chat function between the patient and their healthcare professionals to ensure prompt

communications. The functions in the SanaCoach Pain Rehabilitation, such as the number of diaries and the level of education, will be adapted to the patient, based on his/her complexity and level of disability.

Education and collaboration

Healthcare professionals will receive education during the 3-month wash-out period: GPs 2x3 hours and therapists 3x3 hours. Topics in the education program include biopsychosocial theories of CMP, recognition of patients with or at risk of CMP, providing education to patients with CMP, use of the assessment tool and eHealth application, and treatment selection. The first two sessions are organized jointly for all disciplines of healthcare professional in order to promote a common understanding of biopsychosocial treatment. Separately, therapists will also receive information about the treatment protocols. To encourage collaboration in the local networks, three additional peer-review meetings of one hour (every 6-8 weeks) are organized by the project team in each local network after the wash-out period. During these meetings, healthcare professionals apply the theories and treatment protocols learned during the education program in daily practice, with room for extra education by the teachers if necessary. After these three peer-review meetings, the local networks are encouraged to organize further such meetings in order to align the working procedures and treatment plans of the patients.

Control

All networks start with a control period, in which local networks will invite patients who are attending consultations for CMP complaints to participate in the study. The healthcare professionals will refer and treat the patients, following the usual way of working in pain rehabilitation care in the Netherlands. In usual care, patients can receive treatments from a variety of approaches: from a more biomedical to a psychological or biopsychosocial approach. This results in a wide range of treatments that can vary in duration, content, and intensity, like medication prescription, a few sessions of physiotherapy in primary care or a complex multidisciplinary treatment in tertiary care. In usual care, the goal of the treatment does not have to be on daily functioning of the patient.

Recruitment of primary healthcare professionals

Primary healthcare professionals (therapists, GPs and mental health nurses) working in the Parkstad region (Limburg, the Netherlands) who have no prior experience with NPRL1.0 will be recruited for participation in the study. Social media and the network of healthcare professionals of NPRL1.0 will be used to recruit new healthcare professionals. Healthcare professionals must be willing to recruit patients for the control and intervention periods, to attend the education days, and to make use of the assessment tool and treatment protocol of NPRL2.0.

Recruitment of patients

Patients with CMP complaints, who visit the participating GPs and therapists via direct access, will be informed about the study and asked for consent to transfer their contact details to the research team. The research team will contact these patients by phone to inform them about the study and ask for oral consent for participation. Subsequently, the patients will receive the first questionnaire (T1) electronically or by post, in which they can give electronic/written informed consent for participation in the study.

Patients will be eligible if they are ≥ 18 years at the start of the study, have CMP or musculoskeletal pain with a high risk of becoming chronic, are willing to improve their functioning despite the pain, and have adequate Dutch literacy to complete the questionnaires. Exclusion criteria are pregnancy or any medical (orthopedic, rheumatic or neurological) or psychiatric disease which could be treated by a more appropriate therapy, according to the expert opinion of the GP. The data will be handled based on intention-to-treat.

Sample size

In the prospective cohort, all patients with CMP who visit the two local networks of NPRL1.0 will be invited to participate in the study. Based on the recruitment results of the feasibility study of NPRL1.0, and the number of patients visiting a GP practice, we expect that each local network will also recruit about six patients per month. Therefore, the two local networks from NPRL1.0 together should recruit approximately 132 patients in 11 months. Assuming a dropout rate of 20%, we expect to include approximately 105 patients in this study.

To calculate the desired sample size for the stepped-wedge based design, we used the method described by Woertman et al..[39] The calculations of the number of patients needed are based on the primary outcome of the cost-utility analysis, the health-related quality of life measured with the 5-level EQ-5D version (EQ-5D-5L). Based on McClure et al., we consider an increase of 0.063 points (SD=0.013) in one year as clinically relevant.[40] In addition, an alpha of 0.05, a power of 80%, a 1:1 ratio between control and intervention groups, and a dropout rate of 30% were assumed. Based on these values and the stepped-wedge based design, a design effect (DEsw) of 0.416 exists, which leads to a required sample size of 184 patients (92 control and 92 intervention). Based on the recruitment results of the feasibility study of NPRL1.0, and the number of patients visiting a GP practice, we expect that each local network will recruit 6 patients per month.[32] Therefore, with a dropout rate of 30% of local networks, six local networks will need to participate.

Data collection

An overview of the content of the different data collection methods can be found in Figure 5.3.

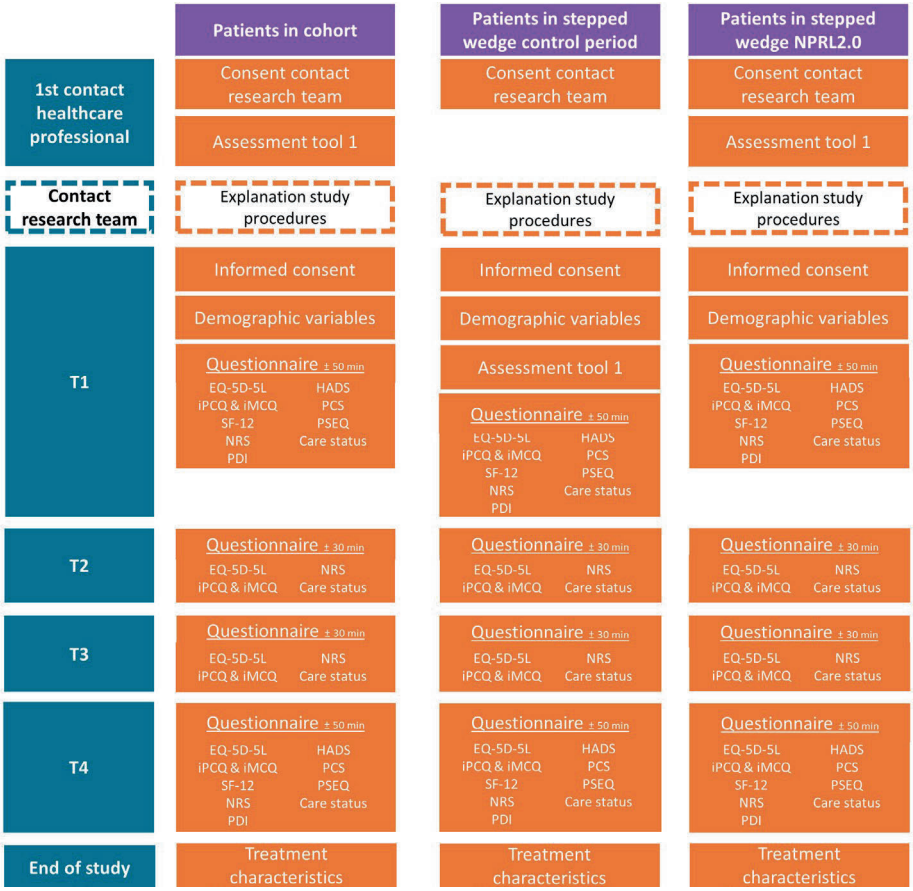

Figure 5.3 Content of data collection in 'Patients in cohort': patients participating in the prospective cohort design; 'Patients in stepped-wedge based control period: data collection for patients participating in the control group of the stepped-wedge based design; 'Patients in stepped-wedge NPRL2.0; data collection for patients participating in the intervention group of the stepped-wedge design.

Patients participating in NPRL2.0 are asked to fill in four questionnaires electronically or on paper: T1 after initial contact with healthcare professionals about their CMP complaints (50 minutes completion time); T2 three months after T1 (30 minutes

completion time); T3 six months after T1 (30 minutes completion time); and T4 nine months after T1 (50 minutes completion time).

Additionally, assessment tool 1 will be used for research purposes, as well as for decision-making in primary care. Therefore, patients in the control group will complete assessment tool 1 as part of the questionnaire at T1. Patients in the intervention group will complete it during their consultations in primary care. Assessment tool 1 will assess the level of complexity of the pain complaints and consists of one Visual Analogue Scale (VAS) for pain intensity and nine dichotomous questions on biopsychosocial factors.

At the end of the study, records of the treatment characteristics of each patient will be collected from the participating practices and rehabilitation centers.

In order to encourage completion of the questionnaires, patients will be reminded up to three times by phone if they have not responded within one week. If incomplete questionnaires are returned, patients will be contacted by phone to answer the remaining questions. The researcher who performs the analyses will be blinded as to patient allocation.

Outcome measures

Baseline characteristics

Baseline characteristics will be collected at T1 and they will include questions about: birth date, gender, nationality, marital status, family composition, level of education, and co-morbidities.

Health assessment

The Pain Disability Index (PDI) will be used as the primary outcome for pain-related disability. It measures the influence of pain on a patient's life and on the performance of daily activities. The questionnaire consists of seven items that measure the complexity of the disabilities experienced in different situations such as work, leisure time, activities in daily life, and sport. Each item is scored on a scale from 0 (no disability) to 10 (severe disability). Scores from the individual items are summed to a total (0-70). The minimal important change is 13 points for patients with CMP.[41] The Dutch version of the PDI has proven internal consistency and test-retest reliability.[42]

The Dutch language version of the Short Form Health Survey (SF-12) will be used as the primary outcome for cost-effectiveness, measuring quality of life on specific domains. The SF-12 has proven to be a practical, reliable, and valid instrument for use in both general population surveys and in studies of chronic disease populations in the Netherlands.[43,44]

The SF-12 will be summarized into two scales: a physical component score (PCS) and a mental component score (MCS), in accordance with the guidelines for the SF12 instrument.[45] The PCS comprises the domains of physical functioning, physical role limitation, bodily pain, and general health perceptions. The MCS comprises the domains of vitality, social functioning, emotional role limitations, and general mental health. Both scores range from 0 to 100 (a higher score indicates a better quality of life) with a minimal clinically important difference of 8.9 for low back pain.[46] These sub-scales will be used in the effectiveness analysis. Besides the SF-12 score, the Short-Form Health Survey with six dimensions (SF-6D) scores will be used in a sensitivity analysis.

The EQ-5D-5L will be used for the cost-utility analysis: it provides a single health index based on self-reported mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with a minimal clinically important change of 0.04.[47] There are five levels in each dimension from which respondents select that which most closely matches their health state. The levels are no, slight, moderate, severe, and extreme problems, coded 1 to 5. A health state index score, ranging from -0.446 to 1 (worst to best imaginable health status), will be calculated from individual health profiles, using the Dutch utility tariff.[48] QALYs were calculated from utilities by using the area under the curve method. The accompanying visual analogue scale (VAS: 0-100) rates the current health state, with higher scores indicative of better experienced health. The minimal clinically important difference for low back pain is 22.5.[46] The Dutch version of the EQ-5D-5L was found valid and reliable.[49,50]

The Numeric Rating Scale (NRS) will be used to measure pain intensity on an 11-point scale varying from 0 (no pain) to 10 (worst pain imaginable). At each measurement point (T1-4), the patient will complete the NRS three times: current pain intensity; lowest pain intensity in the last week; highest pain intensity in the last week. The NRS has shown high test-retest reliability and validity.[51] A reduction of 2 points, or 30%, on the pain NRS scores can be seen as clinically important.[52]

The Hospital Anxiety and Depression Scale (HADS) consists of 14 items of which seven are related to anxiety and seven to depression. The patient is asked to rate the items on a 4-point scale ranging from 0 (not at all) to 3 (most of the time). Total scores range from 0 to 21 on each subscale: a higher score reflects higher distress. The HADS has a sensitivity and specificity of about 80% and a predictive validity for identification of about 70%.[53] The reliability ranges from 0.84 to 0.96.[54]
The six-item short form Pain Catastrophizing Scale (PCS-6) comprises six definitions of thoughts and feelings when experiencing pain.[55] The patient is asked to rate the definitions on a 5-point scale, ranging from 0 (not at all) to 4 (all the time), with total scores ranging from 0 to 24.[55] The six-item version is used because it places a lower burden on patients than the original PCS. This form is adequate for detecting pre- to post-

treatment changes in pain catastrophizing.[56] The PCS-6 is highly comparable to the original PCS and meets the construct validity criteria. Internal consistency and test-retest reliability of the original PCS appears to be adequate.[55-57]

The Pain Self-Efficacy Questionnaire (PSEQ) is used to measure pain self-efficacy.[58] In patients with CMP, it shows satisfactory internal consistency and construct validity.[59] The four-item short form PSEQ-4 (items 4, 6, 8 and 9) will be used because it places a lower burden on patients than the original PSEQ.[55] Items are rated on a 7-point Likert scale ranging from 0 (not at all confident) to 6 (completely confident). The scores are summed, ranging from 0 to 24: the minimal important change is 1.5 points.[60] The PSEQ-4 is a good alternative for the PSEQ as the sensitivity and specificity of the PSEQ-4 are 0.803 and 0.687 respectively, compared with 0.648 and 0.875 respectively for the PSEQ.[60]

Cost assessment

To evaluate the economic consequences of NPRL2.0 from a societal perspective, as recommended by the Dutch guidelines for costing studies in healthcare, the intervention costs, other healthcare costs, patient and family costs, and productivity losses will be assessed.[48]

The intervention costs include costs of education meetings for healthcare professionals and peer review meetings for the intervention group, and consulting and/or treatment hours for the intervention and control groups. The education costs are for 2x3 hours of education and 1x3 hours of additional education for therapists. For each education session, the costs of two teachers and one meeting room will be taken into account. These costs will be charged at 10% per patient as it is assumed that healthcare professionals need education only once. Multidisciplinary consultations are organized with all healthcare professionals of the local networks in the absence of patients. For the multidisciplinary consultations per patient, the costs of the healthcare professionals will be divided by six, assuming that during one hour the status of six patients will be discussed. Moreover, it will be assumed that on average each patient is discussed during three multidisciplinary consultations. The number of consultations and/or treatment hours will be collected by the research team from the records of the patients in both the intervention and control groups. To calculate costs for healthcare professionals, standardized cost-prices as prescribed in the Dutch manual for cost-analysis in healthcare research will be used.[48]

Healthcare usage will be measured with the iMTA Medical Consumption Questionnaire (iMCQ). It contains questions about healthcare consumption related to frequently-occurring contacts with healthcare professionals (www.imta.nl). The iMCQ will be combined with the iMTA Productivity Cost Questionnaire (iPCQ), a standardized instrument suitable for self-completion by patients for measuring and valuing all relevant

productivity losses of paid and unpaid work for use in economic evaluations.[61,62] The manual for the iMCQ and iPCQ will be used for evaluating healthcare usage and productivity losses with the friction cost approach. The costs of prescribed medication will be calculated by multiplying the number of tablets that participants used during three months with the cost price as described at the Dutch webpage http://www.medicijnkosten.nl; the pharmacist costs will also be included. For over-the-counter medication, the lowest prices of Dutch drugstores and pharmacies will be used. All costs will be given in euros and, when necessary, indexed using the general Dutch Consumer Price Index rates.[63]

Besides the iPCQ and iMCQ, the patients will be asked about their current care status and the treatment program for their CMP complaints. Moreover, at the end of the study, participating practices and rehabilitation centers will use the records of the patients to collect data about the length, content, and duration of the program.

Learning curve

Data regarding the background experience and knowledge of healthcare professionals will be assessed at the start of the study to judge whether there is a learning curve when participating in NPRL2.0. Whether patient outcomes regarding health and costs are improved when healthcare professionals have more experience of and knowledge about treating patients with CMP will be assessed.

The Pain Attitudes and Beliefs Scale (PABS) will be used to measure clinicians' biomedical and biopsychosocial treatment orientations with respect to back pain.[64] It consists of 36 statements about treatment preferences, scored on a six-point Likert scale (from 1 = 'totally disagree' to 6 = 'totally agree'). The sum score ranges from 6 to 60 for the biomedical factor and 6 to 54 for the biopsychosocial factor.[65] The PABS shows a consistent factor structure and good test-retest reliability and construct validity.[66]

Data analysis

Demographic data (e.g. gender, age, home situation, level of education, nationality, and co-morbidities) will be described overall and separately for the intervention and control groups. Frequencies are to be presented for categorical variables, means and standard deviations (SDs) for normally-distributed continuous variables, and medians and ranges for non-normally-distributed continuous data. The two groups will be tested on differences between characteristics, using the t-test for continuous variables and the chi-squared test for categorical variables. If variables differ between the two groups, with $p \leq 0.10$, they are considered to be potential confounders in further analyses.

Outcomes on questionnaires will be compared using linear mixed-model analysis, to take into account repeated measurements in patients as well as the effects of the clustering of patients within local networks. The fixed part of the model contains treatment group (intervention/control), time, treatment group*time, and cluster (local network). To assess the learning effect in local practices, the time (months) that a local network participates in NPRL2.0 will also be taken into account as a fixed variable. Variables known to be related to the outcome and differing between treatment groups at T1 ($p \leq 0.10$) will be added to the model. An unstructured covariance structure will be used for repeated measures. Missing values for items in the questionnaires will be handled according to the scoring algorithms of the questionnaires. Missing variables in the follow-up data will not be imputed because linear mixed-model analysis is a flexible method for handling missing data for stepped-wedge and repeated-measures designs (likelihood-based approach). Linear mixed-model analyses will be performed using IBM SPSS Statistics for Windows (version 24.0 or higher, Armonk, NY: IBM Corp.) according to the intention-to-treat principle. Other missing values for non-repeated measures will be handled by multiple imputation, which means that missing values will be predicted using existing values for other variables.[67]

Costs will be compared using bootstraps (1,000 replications) with Microsoft Excel 2016 with mean differences and 95% confidence intervals. Subsequently, sample uncertainties around the incremental cost-effectiveness ratio (ICER) and incremental cost-utility ratio (ICUR) will be explored using bootstrapping with a minimum of 5,000 replications. The ICER and ICUR will be defined by the difference in costs between NPRL2.0 and the control group, divided by the difference in incremental effects of the SF-12 and incremental QALYs respectively. Cost-effectiveness analyses will be performed with the mean total costs and the mean SF-12 scores. The cost-utility analysis will be performed by relating the mean total costs to the mean QALY scores of both groups, and the bootstrapped ICURs will be plotted in cost-effectiveness planes. Moreover, uncertainties of the ICERs and ICURs will be graphically presented in cost-effectiveness planes (CE plane), as well as cost-effectiveness acceptability curves (CEAC). A CEAC will be calculated to describe the probability of NPRL2.0 being a cost-effective alternative to the control group.[68] This CEAC includes the amount of money the society is willing to pay (WTP) in order to gain one unit of effect (one QALY here). The WTP threshold in the Netherlands for one QALY is based on the health burden and varies between €20,000 (health burden 0.1 to 0.4), €50,000 (health burden 0.41 to 0.7) and €80,000 (health burden 0.71 to 1) (2015).[69]

Four sets of sensitivity analyses will be performed to measure the robustness of the economic evaluation. These analyses will explore the impact of an assumption on the results when changing one value of one parameter while keeping all the other parameter values unchanged.[70] One sensitivity analysis will be performed to measure the influence

of taking the educational costs included the intervention costs. Because healthcare professionals will only need training once, the intervention costs may be overestimated. The secondary sensitivity analysis will be performed to assess the influence of the multidisciplinary consultation costs. No standard cost price exists for multidisciplinary consultations in primary care in the Netherlands and it is not known how many patients will be discussed in order to be able to split the costs over these patients. The tertiary sensitivity analysis will be performed to see if there is over- or under-reporting of healthcare consumption in the iMCQ. The data from the records regarding GP and therapist sessions will be compared with the patient data from the iMCQ. When over- or under-reporting is found, a secondary cost analysis will be performed with corrections on all healthcare consumption data, assuming that the same amount of over- or under-reporting is present in the iMCQ. In a fourth sensitivity analysis the impact of the SF-6D to calculate QALYs instead of the EQ-5D-5L will be assessed.

DISCUSSION

The Network Pain Rehabilitation Limburg 2.0 (NPRL2.0) has been developed in order to provide integrated care with a biopsychosocial approach for people with CMP with the goal of improving their level of functioning. Moreover, it is intended to accomplish the Quadruple Aim: improvement of pain-related disability of people with CMP; improvement of experiences of care of people with CMP; improvement in the meaning of work for healthcare professionals; and the reduction of healthcare costs of people with CMP. In this quantitative study, the effectiveness of NPRL2.0 in reducing the pain-related disability of people with CMP will be assessed. In addition, the influence of NPRL2.0 on healthcare costs will be examined with a cost-effectiveness and cost-utility analysis. Moreover, the learning curve of healthcare professionals working in NPRL2.0 will also be studied.

NPRL2.0 is a multidimensional, complex intervention, executed in daily practice.[33] Because of the practice-based approach of this study, a randomized controlled trial design (RCT) is not suitable. Therefore, a pragmatic study with stepped-wedge based design using randomization of the local networks was seen as a viable alternative to an RCT.[71] The local primary care networks involved would be randomly assigned to the three steps (A, B or C) in order to randomize the duration of being a control group or intervention group. Local networks are their own controls in a stepped-wedge based design. Healthcare professionals are instructed to recruit patients at their first consultation for CMP complaints. Therefore, it is expected that patients with comparable complexities of complaints will be distributed equally over the control and intervention groups. Moreover, in this practice-based research, connections between science, policy, and practice exist during implementation and execution of NPRL2.0, leading to evidence-based practice. The external validity of the results of such as this pragmatic study of

NPRL2.0 is commonly higher than that of RCTs because the results are more generalizable.

As NPRL2.0 is a complex intervention, it takes time for healthcare professionals to fully adopt the guidelines and treatments in their daily practice. Also, the internalization of the biopsychosocial perspective by healthcare professionals takes time and so no beneficial change in pain-related disability or healthcare costs is expected in the short term, as shown in other studies of complex interventions.[72,73] Instead, the learning effect on the healthcare professionals will be studied. However, it is hypothesized that the effectiveness outcomes and healthcare costs, without the educational costs, will be no worse than with usual pain rehabilitation care. The results for the other Quadruple Aim outcomes, the experiences of care of people with CMP and meaning in the work of healthcare professionals, will be discussed elsewhere. These outcomes will be studied alongside this effectiveness and cost-utility study with a mixed-methods approach. A strength of this approach is that NPRL2.0 will be studied from different domains simultaneously.

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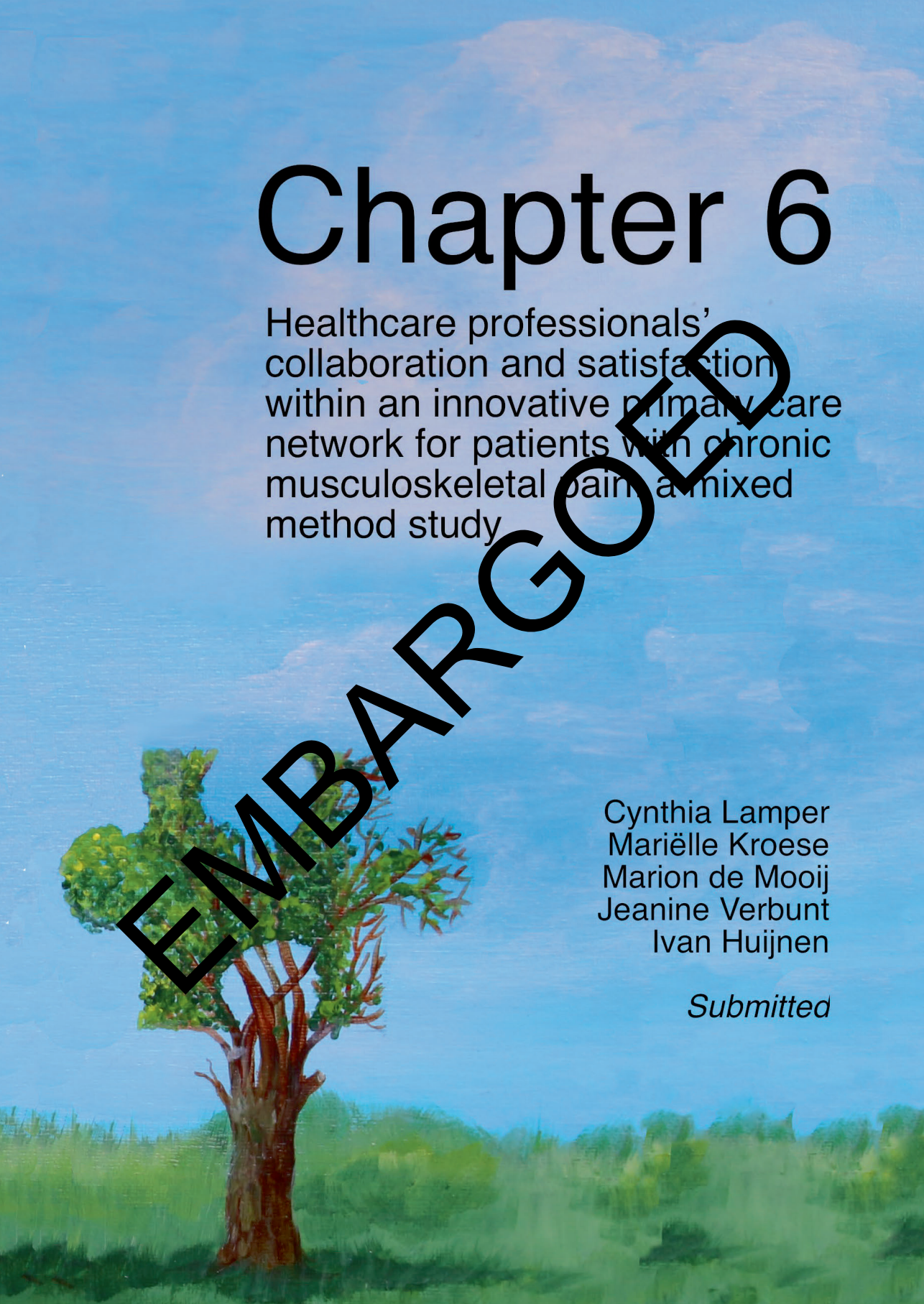
Chapter 6

Healthcare professionals' collaboration and satisfaction within an innovative primary care network for patients with chronic musculoskeletal pain: a mixed method study



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Submitted

Chapter 7

An eCoach-Pain for Patients with Chronic Musculoskeletal Pain in Interdisciplinary Primary Care: A Feasibility Study

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ABSTRACT

eHealth could support cost-effective interdisciplinary primary care for patients with chronic musculoskeletal pain. This study aims to explore the feasibility of the eCoach-Pain, comprising a tool measuring pain complexity, diaries, pain education sessions, monitoring options, and chat function. Feasibility was evaluated (June–December 2020) by assessing learnability, usability, desirability, adherence to the application, and experiences from patients and general practitioners, practice nurses mental health, and physiotherapists. Six primary healthcare professionals (PHCPs) from two settings participated in the study and recruited 29 patients (72% female, median age 50.0 years (IQR=24.0)). PHCPs participated in a focus group. Patient data was collected by evaluation questionnaires, individual interviews, and eCoach-Pain-use registration. Patients used the eCoach during the entire treatment phase (on average 107.0 days (IQR=46.0); 23 patients completed the pain complexity tool and used the educational sessions, and 12 patients the chat function. Patients were satisfied with the eCoach-Pain (median grade 7.0 (IQR=2.8) on a 0–10 scale) and made some recommendations for better fit with patient-specific complaints. According to PHCPs, the eCoach-Pain is of added value to their treatment, and patients also see treatment benefits. However, the implementation strategy is important for successful use of the eCoach-Pain. It is recommended to improve this strategy and involve a case-manager per patient.

INTRODUCTION

Chronic musculoskeletal pain (CMP) is a significant public health problem occurring in 19–28% of the European population.[1,2] It is expected that this number will increase in the next years, in line with an aging population.[3] The current health system for patients with CMP is fragmented, leading to high societal and healthcare costs.[4-6] Therefore, the World Health Organization (WHO) calls for a change in health systems focusing on interdisciplinary rehabilitation care and the improvement of self-management skills of patients on long term.[7] However, in order to reach this, there is a need for changes in knowledge, skills, and attitudes of healthcare professionals, as well as changes in the organization of healthcare.

Challenges in this change are accessibility and cost-effectiveness of rehabilitation care, for which eHealth can be a solution.[8] eHealth is defined as the use of information and communication technology for health.[9,10] A wide range of eHealth tools (such as mobile applications and online interventions) have been developed to improve self-management for acute and chronic pain, with promising results regarding their effectiveness.[11-13] Several reasons for the additional value of eHealth in the treatment for patients with CMP can be mentioned.

First, current care for chronic pain is fragmented and continuity of care for the individual patient is often lacking. eHealth can improve healthcare organization as it can facilitate communication and collaboration between healthcare professionals of different disciplines.[14] Accordingly, the WHO advises integrating rehabilitation care within and between primary (general practice), secondary (general hospital), and tertiary care (specialized care centers).[7] They advise to implement eHealth to facilitate continuity of care in integrated health systems by stimulating daily activities and participation of patients, which are rehabilitation goals.[15]

Second, currently, healthcare professionals receive training on diagnosis and treatment, primarily focused on knowledge within their own discipline.[16] This ranges from biomedical oriented care focusing on attempts to solve the pain, toward biopsychosocial oriented care which focuses on optimizing functioning despite pain.[17,18] However, the recommended approach by the WHO requires an integral biopsychosocial vision applied by all healthcare professionals. Currently, patients receive various treatment approaches causing confusion, resulting in unsuccessful organization of integrated care. An eHealth application can facilitate an integral vision on pain and a common language, which are components of integrated care.[19] In this way, it supports the treatment program of all participating healthcare professionals.

Third, earlier studies indicated that eHealth improves self-care support and improves daily activities for people with chronic illnesses.[20-22] eHealth, consisting of a combination of tools, might be of added value and useful as part of a blended care intervention. This is studied previously with separate tools for online pain education or keeping track of daily activities and participation in combination with face-to-face consultations.[23,24] The combination of tools is not studied previously and might lead to better informed and more actively involved patients with increased autonomy, as well as a shift of the role of the healthcare professional into adviser or coach.[25] Moreover, it is assumed that this blended care can stimulate integrated care in the long term and decrease healthcare costs.[26,27]

To study the additional value of eHealth in an interdisciplinary network of healthcare professionals for patients with CMP, we implemented an electronic Coach (eCoach-Pain) to facilitate pain rehabilitation within the South East of the Netherlands.[28,29] Based on feedback in this earlier performed implementation, the eCoach-Pain is further improved into its current version. The eCoach-Pain aims to support the provision of integrated rehabilitation care with a shared biopsychosocial vision on health within the Network Pain Rehabilitation Limburg. Within this network, patients and Primary Health Care Professionals (PHCPs), existing of general practitioners (GPs), physiotherapists (PTs), and practice nurses mental health (PNMHs) use the eCoach-Pain. It comprises a measurement tool for assessing complexity of the pain problem, diaries, pain education sessions, monitoring options, and a chat function. Whether it is feasible to use in clinical practice is currently unknown. Therefore, this study aims to explore the feasibility of the eCoach-Pain for patients and PHCPs.

MATERIALS AND METHODS

This study (June 2020 and December 2020) had a mixed-methods design. Feasibility was evaluated with a focus on learnability, usability, desirability, adherence to the application, and experiences from patients and PHCPS. These were measured by use of patient questionnaires, data about eCoach-Pain-use, a focus group with PHCPs, and interviews with patients. Ethical approval was obtained from the Medical Ethics Committee Z, the Netherlands (METCZ20190037). Patients did not have to pay for participation in Network Pain Rehabilitation Limburg or the eCoach-Pain. During a patient's first login in the eCoach-Pain, an electronic informed consent for the use of the eCoach-Pain and consent for transferability of their contact details to the researcher were registered. Additionally, for the telephonic interview, patients were asked for informed consent and for recording the interview. PHCPs were asked for informed consent at the start of the focus group.

Sample and setting

PHCPs (GPs, PNMHs, and PTs) of two interdisciplinary primary care practices were recruited to participate in this feasibility study (n=6). They all participated in the Network Pain Rehabilitation Limburg (situated in the South East region of the province Limburg, The Netherlands). This network within and between primary, secondary, and tertiary care aims to support a shared biopsychosocial vision regarding CMP, early recognition of patients with subacute complaints, and a person-centered referral and treatment.

For the current project, patients were recruited by the participating PHCPs. They were eligible if they were ≥18 years at the start of the study, had CMP or musculoskeletal pain at increased risk of becoming chronic (based among criteria on the STarT MSK tool[30,31]), were willing to improve their functioning despite the pain, and had adequate Dutch literacy to use the eCoach-Pain. Exclusion criteria were pregnancy or any medical (orthopedic, rheumatic, or neurological) or psychiatric disease which could be treated by a more appropriate therapy, according to the expert opinion of the GP.

Once a new patient with CMP, or with an increased risk of developing chronic pain, consulted a PHCP, the patient was asked to use the eCoach-Pain. The PHCP gave the main instructions and sent a manual by email.

The eCoach-Pain

The eCoach-Pain has been designed by Sananet Care B.V., based on earlier developed eCoaches, such as for Inflammatory Bowel Disease and heart failure.[29,32,33] It contains different goals or opportunities for both patients with CMP and their PHCPs. For patients, the goal is to improve and maintain self-management in coping with pain. For PHCPs the goal is to facilitate biopsychosocial assessment for treatment planning and to monitor the treatment progress of patients with CMP. The eCoach-Pain has been developed in an iterative co-creative development process with the collaboration of researchers, technical experts, patients, and PHCPs. The results of this study will be published elsewhere.[28] The eCoach-Pain can be used on mobile phones, tablets, laptops, and PCs with internet connections.

Application for the patient

Each patient has an own account for the eCoach-Pain (Figure 7.1), which could be created in two different ways: First, the PHCP could create a patient's account by filling in the patient's contact details after which the patient receives two emails, one with an account name and one with a password. Consecutively, the patients' account is automatically linked to that of his/her treating PHCP. Second, patients could do a self-subscription throughout a webpage. In this way, a patient is invited to complete contact

details, to create a password, and to connect him/herself to his/her own PHCP. Subsequently, the patient's username is sent to the patient by email.

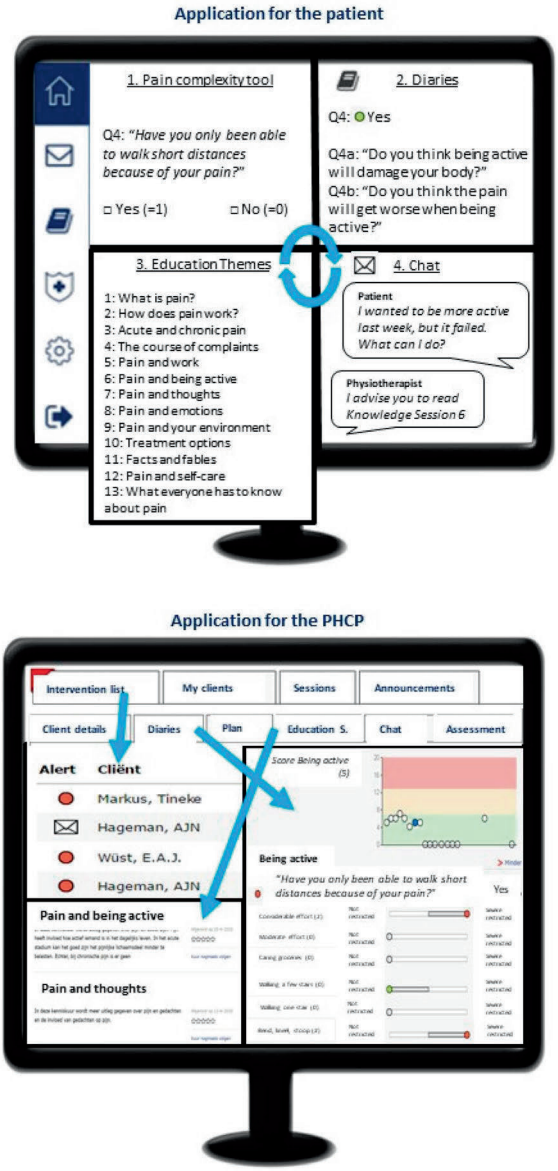

Figure 7.1 Content of the eCoach-Pain. At the top is the application for the patient, with the pain complexity tool, diaries, educational sessions, and chat function. At the bottom is the application for the primary healthcare professional (PHCP) with an intervention list, an overview of the diaries, and an overview of educational sessions.

After login by the patient, a home screen is presented, which contains four different elements (Figure 7.1).

1. The pain complexity tool:
   The pain complexity tool supports the PHCPs in their decision-making for problemmapping and treatment selection. It consists of two parts:
   (A) The STarT MSK Tool assessing the complexity of the pain problem for referral within primary care. The patient's first action in the eCoach-Pain is completing this questionnaire.
   The Dutch version of the STarT MSKTool is translated and validated.[30,31] The STarT MSK Tool exists of nine Yes (=1) or No (=0) questions regarding activity level, anxiety, depression, and thoughts about CMP and one Visual Analogue Scale (0–10) to assess pain intensity (0–4 = 0 points, 5–6 = 1 point, 7–8 = 2 points, 9–10 = 3 points).
   All scores are summed, and a total score of 0–4 indicated a low risk, a total score from 5-8 indicated a moderate risk, and a total score from 9-12 indicated a high risk of developing CMP.
   (B) To further differentiate within the range of primary, secondary and tertiary rehabilitation care an additional set of questions about the biopsychosocial complaints and background of the patient was added to be filled in by the PHCP. After completion of both parts of the complexity tool, the eCoach-Pain calculates the score and assigns the best-fitting referral option to assist the PHCP. The PHCP discusses the results with the patient and refers him/her to the most appropriate treatment via shared decision making.
2. Diaries:
   The eCoach-Pain also contains the possibility to use diaries. The PHCP decides, together with the patient, if and how often diaries will be sent to the patient. Diaries can automatically be sent every week, every two weeks, or once a month. However, the diary option can also be neglected. The automatic setting of these diaries is once a week.
   The diaries exist of the pain complexity tool with additional questions. This extension exists of additional questions based on the questions in the STarT MSK tool scored with "Yes". The answers to these additional questions could be discussed with the PHCP during consultation and used to adjust the treatment or to provide additional educational material to the patient.
3. Education sessions:
   The educational sessions provide patients background information about topics related to pain and pain-related disability, such as the difference between acute and chronic pain, treatment of pain, biopsychosocial influences on their pain, information about work and pain, and treatment options. The educational sessions are interactive (YouTube videos and quiz questions with feedback on answers), and they are integrated to stimulate learning and improving knowledge about (chronic) pain. The

educational materials are presented in 13 themes and per theme subdivided over several sessions (Figure 7.1).

4. Chat function:
   The chat function is used to send bidirectional messages containing questions or treatment material between patient and PHCP. All communication between patient and PHCP remains accessible in the eCoach-Pain to enable patients to reread answers, advice, or treatment exercise at later moments and times.

Application for the PHCPs

PHCPs could access the eCoach-Pain via a secured webpage on their own device. The PHCPs were instructed to monitor and analyze the patient's situation within a few working days after the patient had completed the pain complexity tool or diary, and to respond as quickly as possible to messages from the patients. To facilitate interpretation of the pain complexity tool and diaries and to save PHCPs' time, information within the application was supportively presented using overviews, graphs, and colored risk flags. Based on the results of the pain complexity tool, different flags appeared on the intervention list: a red flag for a high risk, an orange flag for a medium risk, and a green flag for a low risk for developing CMP (Figure 7.1).

PHCPs had only access to data of patients treated by themselves. It was possible that more PHCPs, for example, a PT and GP, have access to the data of the same patient in case it was a joint patient. When the PHCP sent a message to a patient or another PHCP, respectively, the other PHCPs and patient were able to read this message in the chat function.

An instruction meeting of one hour to become familiar with the possibilities of the eCoach-Pain was provided to all PHCPs before the start of the study. The software developers and research team facilitated this meeting. Afterward, a paper-copy instruction manual was provided. Moreover, during the pilot, the PHCPS could contact the service desk of the software developers when help was needed or technical issues occurred.

Data collection and analysis

Learnability, usability, and desirability

In September 2020, when the PHCPs had used the eCoach-Pain already for approximately three months, the researcher sent a questionnaire to participating patients. The questionnaire assessed learnability (5-items), usability (5-items), and desirability (6-items) and was an adjusted version of a questionnaire used in a study by Hochstenbach et al. (2016).[34] Usability was defined as 'the extent to which the application could be used by patients with CMP to monitor their pain, physical activity, and

participation level effectively, efficiently, and satisfactorily in everyday practice'. Learnability was defined as 'the time and effort required for these patients to use the application'. Desirability was defined as 'the extent to which the application was fun and engaging to use for these patients. Patients rated each item on a 1-5 Likert scale (completely disagree-completely agree); higher scores indicated better learnability, usability, and desirability. A separate item about the recommendation of the eCoach-Pain to family and friends on a 5-point scale, and a separate item about the overall acceptance of the eCoach-Pain for treatment purposes on a 10-point scale, were added.

Before data analysis, negatively-keyed items were reversed-scored using Microsoft Excel, version Professional Plus 2016, the Microsoft Corporation, Santa Rosa, CA, USA. Median scores with interquartile ranges per item and category were calculated. To identify differences between the PHCPs disciplines, a sub-analysis with discipline as dependent variable was performed.

Adherence to the application

To assess the patients' adherence, process data from the pain complexity tool, diaries (filled out or not, time of fill out, answers), and from the educational sessions (opened or not, time of opening, how often opened) were logged on the server. The data collected between June 2020 and September 2020 were exported in October 2020.

Median scores and interquartile ranges were calculated using Microsoft Excel, for the number of days patients were active in the eCoach-Pain, number of completed pain complexity tools, diaries, educational sessions, and chat messages used.

Moreover, data about the PHCPs was collected. The median and interquartile ranges of the number of log-ins of the PHCPs was registered overall and per PHCP discipline.

Experiences of patients

Based on stratified probability sampling on sex, age, and PHCP, patients were contacted for a telephonic interview by the researcher to gain more insight into the experiences with the eCoach-Pain in September 2020. It was intended to ask approximately 16 patients, of which eight agreed, until data-saturation would be reached. However, as data saturation was not reached after this number of interviews, five additional interviews were performed in December 2020. Topics discussed in the semi-structured interviews included: the use and acceptance of the pain complexity tool, diaries, educational sessions, and chat function, the supportiveness of the application regarding self-management, and technological functioning of the application. Interviews were audio-recorded.

The audio recordings of the interviews were transcribed verbatim. These written interviews were independently analyzed with inductive and deductive thematic analysis by two researchers (C.L. and M.d.M.) using QSR International Pty Ltd. (Melbourne, Australia) (2018) NVivo (Version 12), https://www.qsrinternational.com/nvivo-qualitative-dataanalysis-software/home (accessed on 4 November 2021).[35-37] Data were sorted based on pre-defined themes of the semi-structured interview-guide. Within these themes, subcategories were created based on the data. After the first two interviews, main themes and codes were discussed and finalized. Thereafter, all other interviews were analyzed and discussed by adding additional codes under the predefined themes.

Experiences of PHCPs

In September 2020, the researcher (C.L.) and observer (A.K.) held an online focus group interview with all participating PHCPs via Zoom.[38] Technical experts of Sananet B.V. (manufacturers of the eCoach-Pain) were available to take notes for future improvements. Before the start of the focus group, participating PHCPs completed questions about the topics on the agenda for the focus group. This encouraged them to formulate an individual opinion before the focus group started and to share this during the meeting. Topics discussed included: use and acceptance of the application, supportiveness of the application in monitoring, advising and treating patients, fit with daily care, and technical functioning of the application. The focus group was audio-recorded.

During the focus group with the PHCPs, the observer (A.K.) made notes and gave a summary per topic discussed. These summaries were asked to be confirmed by the PHCPs during the focus group. Before analysis, the audio recording was used to add additional notes to the summaries by the researchers (C.L. and M.d.M.). These summaries were independently analyzed with thematic analysis on the topics discussed by two researchers (C.L. and M.d.M.) using QSR International Pty Ltd. (2018) NVivo (Version 12), https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home (accessed on 4 November 2021).[35]

RESULTS

Data was collected from 29 patients in total; see Table 7.1. They were eight male and 21 female participations aged between 24–71 years (Median=50, IQR=24). The GPs were the primary contact person for 14 patients, the PTs for 13 patients, and the PNMH for two patients. Sixteen patients used the self-registration webpage, while 13 patients were registered by their PHCP. The GP and PNMH of primary care practice one recruited,

together, eight patients. The PT of primary care practice one did not recruit any patients. In primary care practice two, 21 patients were recruited by the GP, PNMH, and PT.

Table 7.1 Patient characteristics.

					Registration via		Primary Care Practice		Data Available		
Participant Number	Sex (%)	Age (y) (Median, IQR)	Days Active in the Coach Till Export (Median, IQR)	First Contact Person	PHCP (*n*, %)	Webpage (*n*, %)	1 (*n*, %)	2 (*n*, %)	Questionnaire (*n*, %) September 2020	Export (*n*, %) October 2020	Interview (*n*, %) September + December 2020
R01	M	41	103	GP	X		X		X	X	
R02	M	61	86	GP		X	X		X	X	X
R03	M	36	124	GP		X	X		X	X	
R04	F	69	109	PT		X		X	X	X	
R05	M	70	54	GP		X		X	X	X	
R06	M	71	115	GP		X		X	X	X	X
R07	F	67	133	PT	X			X	X	X	X
R08	M	70	61	GP		X	X			X	
R09	F	43	150	PT	X			X	X	X	
R10	F	65	7	PT		X		X	X	X	X
R11	F	66	112	GP		X		X	X	X	
R12	F	47	68	PT	X			X	X	X	
R13	F	46	117	PT	X			X		X	X
R14	F	60	92	GP		X	X			X	X
R15	M	62	117	GP		X		X		X	X
R16	F	32	83	GP		X		X		X	X
R17	F	50	n.a.	PNMH	X			X			X
R18	F	41	n.a.	PT	X			X			X
R19	F	45	n.a.	PT	X			X			X
R20	M	50	65	PT	X			X		X	
R21	F	57	98	GP		X	X			X	
R22	F	35	56	PT	X			X		X	
R23	F	44	105	GP		X		X		X	
R24	F	24	127	GP		X	X			X	
R25	F	29	118	PNMH	X		X			X	
R26	F	64	115	GP		X		X		X	
R27	F	40	59	PT	X			X		X	
R28	F	38	144	PT	X			X		X	
R29	F	65	127	PT		X		X		X	
Total:	**F:21 72%**	**50.0—24.0**	**107.0—46.0**	**GP: 14, PT: 13, PNMH: 2**	**13 45%**	**16 55%**	**8 28%**	**21 72%**	**11 38%**	**26 90%**	**11 38%**

Learnability, usability, and desirability

Twenty-three patients received the invitation for the evaluation questionnaire (September 2020), of whom 11 patients responded (48%). The responders were older (65 (IQR=23) years old) than the non-responders (48.0 (IQR=24) years old), and there were less females than males (female responders: 55% (6 out of 11); female non-responders: 83% (10 out of 12)) compared to the total sample.

Six patients started using the eCoach-Pain after the questionnaire was sent and were therefore not invited. The patients who filled in the evaluation questionnaire were an average of 65 (IQR=23) years old, 55% (6 out of 11) were female, and, on average, active in the eCoach-Pain for 109 (IQR=41) days. Ten patients answered all questions, and one patient answered only the questions regarding learnability and usability.

Table 7.2 presents the overall median score (GP and PT), as well as the median score of the categories, and items separately per discipline (by a GP or PT). The scores show that patients learned quickly how to manage the application (Median=5.0, IQR=1.0) and could easily use the different components of the eCoach-Pain (Median=5.0, IQR=1.5). The desirability was scored with a median score of 4.0, IQR=2.0. The overall acceptance, rated by the question “I would like to recommend the application to other patients” was scored with a median of 4.0 (IQR=2.0). Patients gave the eCoach-Pain a total overall score of 7.0 (IQR=2.8) on a 0-10 Numeric Rating Scale. Patients subscribed by GPs (n=6) scored 5.0 (IQR=0.0) for learnability, 5.0 (IQR=1.0) for usability, and 4.5 (IQR=2.0) for desirability, while patients subscribed by PTs (n=5) scored 5.0 (IQR=1.0), 5.0 (IQR=2.0), and 4.0 (IQR = 1.0), respectively.

Adherence to the application

At the end ofOctober 2020, for 26 of the 29 patients (median age 53.5 years (IQR=24.75), 69% female (18 out of 26)), the export data about adherence to the application was available. Three patients were asked to participate in the interviews in December 2020. At that moment, exports were already performed; therefore, no export data of them were available. At the moment of data export, the included 26 patients were, on average, 107.0 (IQR=46.0) days active in the eCoach-Pain. Ten of them stopped using the eCoach-Pain prematurely because they finished treatment (n=3) or did not want to use it anymore (n=7). The other 16 patients were still active in the eCoach-Pain at that time.
Twenty-three patients completed the pain complexity tool (Median=7.0, IQR=3.0, 1x low risk, 16x medium risk, 7x high risk). For 21 patients, their PHCPs also answered the second part of the pain complexity tool. On average, the diaries were 6.0 (IQR=3.5) times filled (n=23).

The educational sessions were opened by 23 patients, and they read, on average, 12.0 (IQR=5.0) educational sessions per person. On average, each separate educational session in the eCoach-Pain was started by 19.5 (IQR=6.3) individual patients. In total, 224 unique educational sessions were opened by these patients. As there were 13 sessions, this means that some patients read (a part of) the educational sessions several times. Fourteen patients completed all education sessions.

Table 7.2 Median (IQR) learnability, usability, and desirability scores for the total patient group, patients subscribed by GPs, and patients subscribed by PTs.* (1–5).

	GP and PT (*n*=11)	Subscribed by GP (*n*=6)	PT (*n*=5)
Learnability	5.0 (1.0)	5.0 (0.0)	5.0 (1.0)
It was easy to learn how to use the application.	5.0 (0.5)	5.0 (0.0)	5.0 (1.0)
I think the application was very complicated. [a]	5.0 (0.5)	5.0 (0.5)	5.0 (1.0)
I needed a lot of help to learn using the application. [a]	5.0 (0.5)	5.0 (0.0)	5.0 (3.0)
I quickly caught on how I could use the application.	5.0 (1.0)	5.0 (0.8)	4.0 (1.0)
I am confident that I used the application in the right way.	5.0 (1.5)	5.0 (0.8)	4.0 (0.8)
Usability	5.0 (1.5)	5.0 (1.0)	5.0 (2.0)
I could easily login into the application.	5.0 (1.0)	5.0 (0.8)	4.0 (2.0)
I could easily report my pain, activities, feelings, thoughts, and emotions.	5.0 (1.5)	5.0 (0.8)	5.0 (3.0)
I understood the information in the educational sessions about my pain, activities, feelings, thoughts, and emotions.	5.0 (1.0)	5.0 (0.8)	5.0 (2.0)
I could easily search for information about pain with the application.	5.0 (2.0)	5.0 (1.5)	4.0 (2.0)
I could easily leave a message for the PHCP via the application.	5.0 (1.5)	4.5 (1.8)	5.0 (0.0)
Desirability	4.0 (2.0) (*n*=10)	4.5 (2.0)	4.0 (1.0) (*n*=4)
I liked using the application.	4.0 (1.0)	5.0 (1.5)	4.0 (1.8)
I liked using the pain diary for reporting my pain, activities, feelings, thoughts, and emotions.	4.0 (1.0)	5.0 (0.8)	4.0 (1.3)
I liked using the educational sessions.	4.0 (1.8)	4.5 (2.0)	3.5 (1.0)
I liked using the chat function.	3.0 (1.8)	3.5 (1.8)	3.0 (1.0)
I liked the idea that my PHCP monitors my pain, activities, feelings, thoughts, and emotions.	4.5 (1.0)	4.5 (1.0)	4.5 (1.5)
I liked the idea that my PHCP could adjust my treatment based on my answers in the eCoach-Pain.	4.0 (2.0)	4.0 (1.8)	4.0 (2.3)
I would like to recommend the application to other patients.	4.0 (2.0)	4.5 (1.8)	3.5 (1.0)
Total overall score (0–10)	7.0 (2.8)	8.5 (2.3)	6.5 (0.5)

Scores: 0—totally disagree, 5 or 10—totally agree. a Negatively-keyed items were reversed-scored before data analyses but the original question is presented in the table with the reversed-score. * PNMHs have no patients subscribed which completed the questionnaire.

Twelve messages were sent from seven (27%) unique patients to their PHCP, and five messages were sent from the PHCPs to the patients by the chat function. The patients started all conversations. They often elaborated on their diary answers, technical dysfunction of the eCoach-Pain, or they explained why they were not able to fill in the diaries.

The six PHCPs together logged in on average 6 times (IQR=16.75), the GPs on average 16 times (IQR=8), the PTs on average 35.5 times (IQR=32.5), and the PNMHs on average 2.5 times (IQR=1.5).

Experiences of patients and PHCPs

At the end of September 2020, 16 patients were asked to participate in a telephonic interview, to which eight agreed. To reach data saturation, five additional patients had to be asked, of which three agreed to be interviewed in December 2020. This led to 11 patients participating in the telephonic interviews (mean duration 15 min). The participants had a median age of 60.0 (IQR=2) years, 73% was female (8 out of 11), and they were active in the eCoach-Pain for 100.5 (IQR=31.75) days.

Two GPs (one male and one female), two PTs (one male and one female), and one PNMH (one female) participated in a focus group. In addition, one other PNMH (one female) participated in an individual telephonic interview, as she was not able to participate in the focus group.

Overall opinion and usage

Patients stated that they were positive about the eCoach-Pain because the functionality worked well for their treatment, it was easy to use, and text was written in clear and understandable language. The content was perceived as informative concerning their pain complaints and knowledge about pain pathophysiology. The interaction between patient and PHCP in the diaries and the quiz questions in the educational sessions of the eCoach-Pain were experienced of added value. Some patients appreciated the reminders for diaries and educational sessions as it gave them structure and control. However, for other patients, these automatic reminders were perceived as somewhat stressful.

Before patients (n=6) started using the eCoach-Pain, they expected the content would be more tailored to their own medical complaints and history. Furthermore, patients expected that the eCoach-Pain would motivate them for treatment compliance to improve their complaints. Although PHCPs are able to change diary frequency, six patients expected less frequent diaries and repetition of information. Besides, some patients indicated that they had preferred to receive more information (by their PHCP or a pamphlet) about the content, frequency of questions, and expected duration of the

eCoach-Pain program when they started to use it. Some patients expected more feedback from the eCoach-Pain itself about their answers or an automatic end-session in the eCoach-Pain to close it. Seven patients found it frustrating that, in their opinion, "non-relevant" questions kept returning. The option to indicate a holiday leave and stop sending reminders during this leave was felt to be missing.

> *R16: "Basically, I think it is a good app. However, the questions appear too frequent, too standard."*

Among the PHCPs, the eCoach-Pain was most often used by the PTs. One PT used it to structure the content of the treatment sessions and to deliver additional information to the patient.

> *PT2: "I like the idea that every week new educational sessions about pain are open for the patient. And, that I can see what the patient answered, which information they have read, and that I can use that during the treatment session. This causes more structure in my treatments."*

Another PT used it for educational purposes for the patient, as well, but did not use the results to guide or adjust treatment as the other PT did. In this feasibility study, the PNMHs hardly used the eCoach-Pain because it was not clear for them how to integrate it in their treatment. PNMHs perceived the eCoach-Pain options offered as specifically PTs treatment options. PTs registered most patients by themselves, which gave them control over the number of patients in the eCoach-Pain. Furthermore, controlling this registration facilitated the ability to inform patients before the start. In addition, the GPs used the eCoach-Pain to score the pain complexity assessment and to support the referral of the patient to the PT. They did not use it to offer treatment purposes or pain education to the patient. The patients that entered the study by a GP most often used the self-registration webpage. GPs indicated that this route was timesaving for them. GPs mentioned that the eCoach-Pain provided them an extra treatment option above the current treatment when they referred a patient to the PT.

> *GP2: "The eCoach-Pain is an extra treatment option above the existing options. As a GP, it is important to know the content of the treatment options when referring to a PT, and it is great that we can offer something extra."*

Pain complexity tool and diaries

Patients indicated difficulties in distinguishing the pain complexity tool from the diaries, as the tool and the diaries both were presented as a questionnaire in the eCoach-Pain. Therefore, in this paragraph, the tool and diaries are presented together. Eight of the 11 patients perceived the usability of the pain complexity tool and diaries as good. They

indicated that the pain complexity tool and diaries were easy to use, not too timeconsuming, easy to understand, and that the reminders by email were of added value. In addition, patients perceived the content as easy to keep track of their pain complaints and the amount of questions as good. However, most patients (n=8) indicated that the repetition and frequency of the questions were too high. They also missed background information of the questions in the introduction of the eCoach-Pain.

> *R02: "I thought that I had to fill in some questions a few times. However, the questions came every day or week for two or three months. And this was not explained to me beforehand."*

Overall, most patients indicated that they perceived the questions in the pain complexity tool and diaries as less applicable in their situation. As several patients had co-morbidities besides CMP, it was difficult for them to know how to interpret the questions. For some questions, it was unclear for them whether the answers should be given with the perspective of having CMP, or from the perspective as a person having pain and other co-morbidities. For example, it was not always possible to indicate exactly their own pain complaints or to adjust answers to questions properly when their situation changed. Sometimes, the eCoach-Pain gave more insight into patients' complexity and impact of their own complaints, which was perceived as heavy to encounter for some patients. Patients without difficulties in daily social participation or psychosomatic problems perceived answer options as less applicable in their specific situation. However, they understood that general questions were formulated for all different kinds of CMP.

The pain complexity tool was the most important tool for GPs in the eCoach-Pain. GP1 indicated that he used it to objectify referral and to get more insight into the complexity of the pain problem. However, GP1 indicated that the digital version directed the referral more than the paper-version. The eCoach-Pain automatically calculates the score and assigns the best-fitting referral option, while, with the paper-version, this can easily be overruled when necessary, according to the opinion of the GP.

> *GP1: "When using the paper-version, you have more freedom in the choice of the treatment. As you can overrule the score of the patient easier. In the eCoach-Pain, the treatment options are more limited based on the answers of the patients. Which is a strength of the eCoach-Pain."*

The two PTs used the pain complexity tools in combination with the diaries. For GP1, the graphical display of the results was especially of added value as it gave insight into the effect of the treatment. As improvement, all PHCPs indicated that the graphical displays of the diaries could be upgraded, as it was not always immediately clear for them if the patient's score was positive or negative.

Educational sessions

The educational sessions were perceived as interesting with clarifying quiz questions and links to YouTube videos. The sessions about 'What is pain' and 'Pain and being active' were perceived as the most useful sessions. The sessions about work and work disability were not appropriate for every patient as some were retired or did not have a job. Two patients indicated that they desired more subjects and educational sessions, for example, about general health.

> *R10: "It was a revelation for me, because through the information in the educational sessions, in addition with information on the same topic given by my PHCP, I understand how my brain controls the pain".*

The usability and comprehensibility of the educational sessions were perceived as good as the language used was easy to understand. However, three patients found the language level even too easy and the repetition of subjects in the text as too much. One patient indicated that it was more useful for her when the sessions were not divided over several days, but that all sessions can be followed at once.

Overall, five of the eleven patients indicated that they did not receive new information in the educational sessions in comparison with what they already knew about pain (out of earlier treatments). Some other patients indicated that they perceived recognition and acceptance of their CMP during the sessions due to explanations about the pathophysiology of pain. One patient indicated the sessions as confronting as she/he recognized her/himself for the first time as a patient with chronic pain.

> *R13: "I have read all sessions and the total overview was good for me. But at the same time it was also confronting, maybe that was good, as well."*

The educational sessions were most often used by the PTs, and sometimes by the PNMH. PT1 used it to guide the content of his treatment, and PT2 and both PNMHs used it as additional education material for the patient. They indicated that patients were satisfied with the content of the educational sessions and that it gave them more insight into their pain problem. However, they perceived the educational sessions as less applicable for patients with a lower IQ-score or restricted literacy.

Chat function and communication with PHCP

Two patients used the chat function, while nine patients indicated they did not. Those two patients were positive about its usability.

Four patients indicated that they had contact with their PT about the diaries and educational sessions they performed in the eCoach-Pain and rated these of added value. For at least one patient, the physiotherapy treatment was adjusted based on the results in the eCoach-Pain. Moreover, some patients discussed the diary questions about their psychosocial status. Furthermore, patients indicated that the pain education received by their PT fitted well with the information in the educational sessions. The eCoach-Pain resulted in a better patient-PT treatment relationship. Three patients had questions about the eCoach-Pain and needed extra support from their PHCP, for example, about the content of the eCoach-Pain, when to finish using the eCoach-Pain, or extra practical tips regarding their pain complaints. Moreover, some patients mentioned that they had discussed technical issues with their PHCP, such as logging in, bugs in the sessions, or difficulties with data exchange between the PHCP and patient.

The other seven patients mentioned no contact with their PHCP about their activities in the eCoach-Pain. Reasons for this ranged from patients' holidays and sick leave periods, technical issues which limited eCoach-Pain-use, or the fact that the patient had not filled in the pain complexity tools and diaries before the next contact with the PHCP could take place.

Patients did not bother with the fact that their PHCP was able to track their activity in the eCoach-Pain, while some of them did not know this option before the interview. Two patients mentioned that they felt no need to discuss their activity in the eCoach-Pain with their PHCP. Most patients indicated that the possibility to discuss their activity online with the eCoach-Pain was of added value, especially in the situation of COVID-19 they were in during the pilot period, as live contact with PHCPs was only limited to emergency consultations.

PHCPs indicated that they did not use the chat function of the eCoach-Pain often as they preferred other ways to communicate with the patient, such as email, chat functions of other applications, or a real-life contact. Furthermore, the fact that they had to log in again to answer these messages was another reason not to use the chat function. GPs mentioned that they did not always communicate with the patient about the results of the eCoach-Pain themselves, but, instead, they asked the PT or PNMH to respond to the patient.

> *GP1: "Because of our work-flow, it is the easiest way that the PT communicates with the patient and has a prominent role in the follow-up."*

They checked if a patient scored a red flag, and only then did they contact the patient or the PT. PT1 discussed the results during nearly each treatment session, while PT2 and the PNMH used a less frequent basis or when the patient had questions about it.

Technical issues

Six patients did not report any technical issues using the eCoach-Pain. Others mentioned problems in finding how to use all functions of the eCoach-Pain, bugs in sessions, or difficulties connecting their eCoach-Pain to the PHCP's profile. Two patients perceived difficulties with logging in into the eCoach-Pain because they had to renew their password more than once or had to log in several times in a row. Two patients had help from family or friends with logging in, use of a computer, or receiving reminders. There were no problems mentioned with the instruction manual, and nobody contacted the Helpdesk of the software developer during the pilot period. Four patients registered themselves with the self-subscription option via a website without any problems. The others were registered by their PHCP; in one case, the connection between the application of the patient and the application of the PHCP failed.

Overall, PHCPs indicated that the eCoach-Pain is easy to use. However, all PHCPs reported having difficulties with the two-way factor identification for logging-in, which is obligated by the General Data Protection Regulation (GDPR). They perceived a delay in receiving the codes by email or the email is marked as spam. The fact that there is an extra step for logging-in hindered them in using the eCoach-Pain more often. They also indicated that it is difficult for them to combine the eCoach-Pain with other existing applications in daily practice, as each application has its own login system, function, and layout.

Future usage and recommendations of the eCoach-Pain

Most patients were satisfied with the eCoach-Pain. Some patients indicated that the eCoach-Pain supports to increase insight in how pain impacts daily activities and participation and that it answers questions about their pain complaints. Moreover, they recommend it for the use of the chat function with their PHCP. Some patients would recommend the eCoach-Pain because they were satisfied with it themselves. Most of them would recommend it to patients with other complaints than their own, as they indicated that the content did not fit perfectly based on their own situation. They would especially recommend it to patients who are recently diagnosed, have problems in daily activities and participation, are low literate, or who want to use an eCoach-Pain frequently.

> *R16: "I would recommend it to people who get acquainted with pain complaints, or who have not so much knowledge yet, for them it is useful to get to know more about pain. But for people who have complaints for years, like me, I would not recommend it."*

They would not recommend it to patients with pain complaints for years, elderly who are not familiar with eHealth, or patients who do not want to use the eCoach-Pain frequently. However, some patients who are recently diagnosed would recommend it for patients with chronic complaints.

Most PHCPs indicated that they will keep on using the eCoach-Pain in the future as they find it important to offer the patient something extra besides usual care. However, due to time constraints in daily practice, GPs hope that PNMHs can get a more prominent role in the follow-up of patients and contact other PHCPs about the results in the eCoach-Pain. In this case, the PNMH has to contact the GP when expertise or referral of the patient is needed.

> *GP1: "Because of the high work-load in primary care, it would be of added value when someone as a PNMH can get a more prominent role in follow-up of patients. They will also be able to keep track of the eCoach-Pain activities. We as GPs have not enough time to do this properly."*

PTs think they will keep on using the eCoach-Pain in the same way as they did during the feasibility study. However, all PHCPs indicated that the costs of the eCoach-Pain concerning their patient volume are important indicators for future usage. During this feasibility study, these costs were covered by the project budget of NPRL.

DISCUSSION

The current study provides insight into the feasibility of an eCoach-Pain for patients with CMP or a high risk of becoming chronic, and for PHCPs in interdisciplinary primary care. In general, patients and PHCPs had positive experiences using the eCoach Pain. The answers to questions/statements about learnability, usability, desirability, and adherence to the application confirm that the eCoach Pain has sufficient quality for further use. However, some further adjustments for successful implementation and use are needed.

Some patients mentioned that the content of the eCoach-Pain does not fit with their situation, such as multi-morbidities and previous experiences with treatment. An explanation why patients do not find the eCoach-Pain suitable could be that patients with CMP often experience multi-morbidities, such as depression, anxiety disorders, obesity,

hypertension, and diabetes.[39-42] It has been shown that these patients with multi-morbidities need a personalized treatment.[43,44] The eCoach-Pain has not enough attention for these multi-morbidities. Some patients mentioned that the eCoach-Pain was more suitable for patients with other complaints than they had. Remarkably, the patients with severe complaints for several years mentioned that the eCoach-Pain was better suitable for patients in a subacute phase or those recently diagnosed. Patients with complaints for several years indicated that the information about CMP in the eCoach-Pain was not new and perceived the education sessions as too basic for them. They indicated that the pain education was given in earlier treatments. However, patients with subacute complaints mentioned that the eCoach-Pain is better suited to patients with a clear diagnosis or, in contrast to the comment of patient with long-term complaints, patients with a longer duration of complaints. A possible explanation for this finding could be that subacute patients are still searching for an explanation and solution for their complaints and are, therefore, more biomedically oriented and not yet focused on a biopsychosocial treatment.[45] As accepting of CMP is an ongoing process, it could be that the patients with subacute musculoskeletal pain do not see themselves as patients with CMP.[46] Therefore, further research is needed to discover for which patients group(s) the eCoach-Pain can be used in primary care and, accordingly, how the eCoach-Pain can be aligned for personalized treatment.

The eCoach-Pain is well integrated into the treatment of the PTs. All PHCPs perceived advantages of the use of the eCoach-Pain during physiotherapy treatment. Patients indicated that eCoach-Pain connects to the treatment of the PT. Positive thoughts about blended rehabilitation care for other diseases are also seen in several other studies.[47,48] The integration of an eCoach as blended physiotherapy care for patients with temporomandibular disorders lead to an increase in self-efficacy, support of data collection and personalization of the application in the Netherlands.[47] The review of Orlando et al. (2019) showed an overall positive impact on patient and caregivers' satisfaction and it appears to enhance communication and engagement between healthcare professionals for different kinds of telehealth in rural settings.[48] However, questions about the integration of an eCoach in the treatment, such as duration of the treatment, fit in each consultation, and the frequency of the consultations remain.[49] Tilburg et al. recommend to integrate an eCoach into the total treatment and not to implement it as a separate component to the treatment. Further research needs to design and evaluate the integration of the eCoach-Pain into the treatment to deliver blended care.

eCoaches can stimulate and influence interdisciplinary collaboration in primary care.[50] Based on the findings that PHCPs indicated suboptimal collaboration during treatment, it can be concluded that interdisciplinary collaboration between the PHCPs was a point of attention. Accordingly, it seems that the eCoach-Pain did not contribute to

interdisciplinary care. GPs indicated that they preferred to refer the patient automatically to a PT as they had not enough time to contact patients and discuss the treatment plan with the PTs, as purposed in interdisciplinary care. The preference of GPs, due to their lack of time, for treatment of these patients by a PT is in line with another study with eCoaches in primary care in the Netherlands.[51] In this study, the PHCPs perceived advantages of the eCoach-Pain in referring a patient to a PT or adding an extra role of a case-manager (for instance, a PNMH or specialized nurses for mental health) in the future. Previous successful implemented eCoaches used a case-manager as first contact for patients.[32,34] In addition, the Standard of Care for Chronic Pain in the Netherlands advices the use of a case-manager for patients with CMP in primary care.[14] However, the eCoaches in these earlier studies were all implemented in secondary care. Therefore, the role for case-manager in primary care needs to be optimized before implementation. Currently, there is no regular financing of a case-manager for patients with CMP in primary care in the Netherlands yet. However, it is crucial to have a case-manager when focusing on integrated and interdisciplinary primary care to stimulate a common vision and treatment plan.[19]

Some patients mentioned technical problems that limited the use of diaries or education sessions, even though they received a reminder. Although the developers could not find an explanation for this, it could have influenced the adherence rates for the diaries and education sessions. Other patients indicated that they received too many reminders for diaries. Therefore, in future use of the eCoach-Pain, attention must be given to the communication between the PHCPs and patients. The PHCPs must discuss in advance the number of diaries and reminders offered, based on the preferences of the patients. Research has shown that shared-decision making for chronic illness with treatments containing more than one session leads to treatment agreement.[52] Therefore, shared-decision making in eCoach-Pain adjustments could lead to increased treatment adherence. Connection to the electronic patient file is another technical problem mentioned. PHCPs, and especially GPs, experienced barriers in the use of the eCoach-Pain in daily practice which was not connected with their electronic patient file. This caused double registration steps, which was a reason to restrict use of the eCoach-Pain. Therefore, it would be favored to find a possibility to integrate the eCoach-Pain in the electronic patient file (Dutch: Huisarts Informatie Systeem) to avoid extra registration steps.[53]

A major strength of this study is the use of qualitative and quantitative data (mixedmethods) alongside objective data on use of the eCoach-Pain from both patients' and PHCPs' perspectives. These data gave a broad overview of the usability of the eCoach-Pain, as well as the experiences. Moreover, the content of the eCoach-Pain was developed together with the PHCPs before the start of the study with a user-centered design.[28] Higgins et al. (2018) recommend user-centered designs and implementation

science methods to improve the availability of eHealth tools..[54] However, the GPs and PNMH rarely used the eCoach-Pain despite their influence in the development process. Reasons for this are the login-facility and lack of time during and after consultations, which are also seen as barriers in the study of Daniëls et al. (2019) in primary care.[51]

Some limitations of this study need to be acknowledged. First, the small sample of patients that were available for this study and the limited use of the eCoach-Pain could have introduced selection bias. It could be that patients with, for example, low literacy or co-morbidities, were not asked for participation by the PHCPs with a risk for selection bias. However, despite the small sample, patients differed in demographic characteristics, resulting in sufficient confidence to have studied a representative group of users. Second, not all patients performed all measurements, so the completeness of available data per measurement differed. Six patients did not respond on the evaluation questionnaires, and, for three patients export data of eCoach-Pain-use is missing. This could have led to information bias which could have influenced the data. Third, the sample of primary care practices and PHCPs was small, which could have influenced the results. As for primary care practice 1, all patients are subscribed by a GP or PNMH, and, for primary care practice 2, the PT also subscribed patients, besides the GP and PNMH. Most patients were recruited by primary care practice 2 (n =21), and most of the patients participating in the interviews were also recruited by this practice (9 out of 11). Therefore, limited results were available about the recruitment of GPs in the interviews.

CONCLUSIONS

In conclusion, the eCoach-Pain seems to be promising in primary care: the patients, as well as the PHCPs, experienced advantages for treatment of patients with CMP. However, adjustments to the content have to be made for better fit with patient-specific CMP complaints. Moreover, the implementation strategy seems to be an important factor for successful use among PHCPs. This should be improved for successful use in interdisciplinary primary care settings. The involvement of a case-manager for CMP should be further explored when implementing the eCoach-Pain. Thereby, it is important to use usercentered designs and implementation science methods to evaluate adjustments resulting in a successful implementation.

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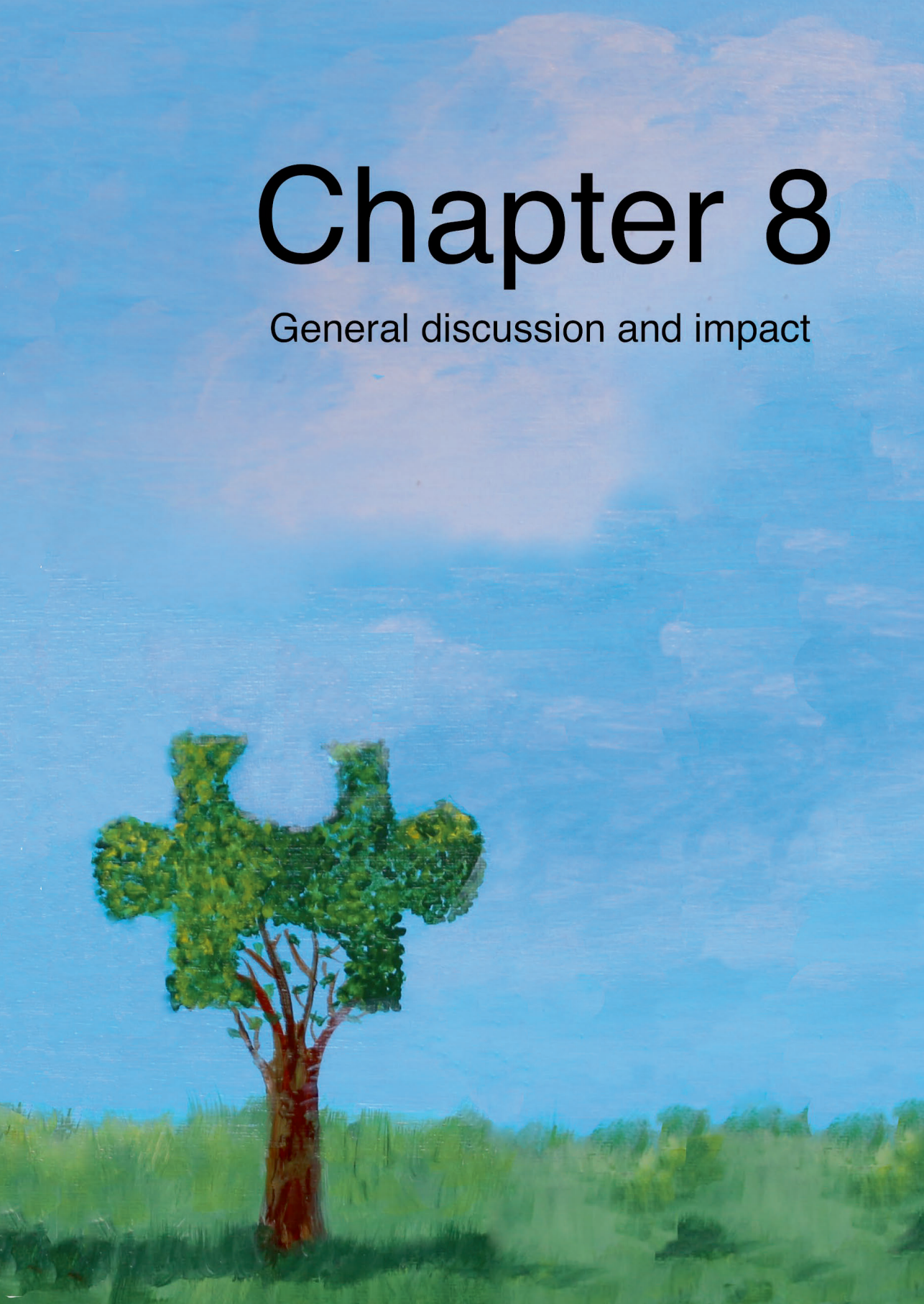
Chapter 8

General discussion and impact



SCOPE OF THIS THESIS

The main goal of the study reported in this thesis, entitled “Network Pain Rehabilitation: an integrated interdisciplinary care approach”, was to investigate the development and implementation, feasibility, and effectiveness of an interdisciplinary network for patients with chronic musculoskeletal pain (CMP). The main rationale for starting this research project was the challenge in healthcare of an increasing prevalence of patients with CMP. Because of an ageing population with an increased number of comorbidities, healthcare consumption will increase in the coming years.[1,2] However, currently, healthcare is not optimally organized to anticipate this change. Patients with CMP often search for biomedically oriented treatments as they try to find a solution to their complaints that will reduce their pain and consequent health care.[3] Often, such treatments do not lead to the desired solution, a complete alleviation of their CMP complaints. However, they do lead to high healthcare and societal costs.[4,5] Currently, both patients and health care professionals (HCPs) are dissatisfied with the organization of care for patients with CMP.[6-8] Consequently, national and international authorities advise a shift in healthcare policies towards a transmural, integrated and interdisciplinary healthcare approach.[9-12] In the Netherlands, the Standard of Care (in Dutch: Zorgstandaard) for patients with CMP is composed, based on these developments and on healthcare policies.[11] A specific focus on the present organization of pain rehabilitation care shows that it is fragmented, with only restricted collaboration within primary care and between primary care and other healthcare settings.[13-15] In this thesis, a practical implementation of this Standard of Care in rehabilitation is proposed, and its feasibility and effect on Quadruple Aim outcomes (improving health, patient experience of care, and the work-life of HCPs while controlling healthcare costs) are studied.[16]

SUMMARY OF MAIN FINDINGS

The first aim was to provide an overview of the current state of research on interdisciplinary healthcare networks for patients with CMP. In **Chapter 2**, we identified 34 interdisciplinary networks within primary care or between primary care and other healthcare settings presented in the scientific literature. This allowed us to describe the content, intensity, and collaboration formats of these interventions. Moreover, we presented an overview of study outcomes relevant to the Quadruple Aim. Results for impact were presented in 19 randomized trials, 12 non-randomized studies, and seven qualitative studies. However, due to the wide variety of content, collaboration formats, and evaluation methods, it was not possible to perform a meta-analysis. Nevertheless, it seems that patient-centred interdisciplinary interventions show promising results when compared with usual care.

Our second aim was to evaluate the development, implementation, and transferability of an interdisciplinary network within and between primary, secondary, and tertiary care. In **Chapter 3**, we described a protocol to evaluate the feasibility of the first version of the Network Pain Rehabilitation Limburg (NPRL1.0). The results of this study gave insight into the barriers and facilitators, perceived value, acceptability, and implementation strategies of NPRL1.0. An iterative, user-centred three phase design was evaluated using mixed methods. The Consolidated Framework for Implementation Research (CFIR) was used as a framework for analysis and to refine NPRL1.0 in daily practice. From October 2017 to October 2018, the study was performed in two rehabilitation practices, and three local primary care networks comprising a general practitioner (GP), a mental health practice nurse, and a physiotherapist or exercise therapist. In **Chapter 4,** we described the results of the feasibility study aimed at providing insight into barriers and facilitators for the development, implementation, and transferability of NPRL. Interviews and focus group meetings were held, and observations with patients and HCPs made. HCPs were enthusiastic about the way they were involved in the iterative, bottom-up development. Moreover, NPRL1.0 facilitates consistency and transparency in ways of collaboration, speaking in a language based on a biopsychosocial approach, and in treatment protocols. We also found barriers to the implementation of NPRL1.0. First, the stigmatization of CMP by the general population remains a barrier. People continue to seek biomedical solutions for their CMP complaints, making it difficult for HCPs to stick to a biopsychosocial approach. Additionally, the current organization and way of financing healthcare also complicate the implementation of NPRL within and between practices. We concluded that NPRL is feasible in daily practice if barriers can be overcome and facilitators of development, implementation, and transferability promoted. The results of this feasibility study were used as a basis for a refinement of NPRL (leading to NPRL2.0) and the planning of a new study with a large-scale process and effect evaluation, with the Quadruple Aim as outcome measures.[16]

Our third aim was to evaluate NPRL2.0, an further refined version of NPRL1.0. Changes were made on NPRL1.0 based on the results of the feasibility study. In **Chapter 5**, we describe the study protocol in which care professionals changed their way of working from usual care to the approach described in NPRL2.0. Patient's health (pain-related disability) and care-related changes (healthcare costs) after the introduction of NPRL2.0 were studied. The evaluation study had three aims. Firstly, we aimed to study the effectiveness (with regard to the functioning and participation of patients) in primary care for patients with CMP, comparing care organized following NPRL2.0 with usual care. Secondly, we aimed to study the cost-effectiveness and cost-utility with regard to health-related quality of life and healthcare costs. Thirdly, we aimed to study the influence of time and duration of participation in a local network in primary care on its effectiveness. We planned to recruit 105 patients in a prospective cohort study with two local networks for NPRL1.0 in primary care of. Further, we planned to recruit an additional 184 patients

to participate in the stepped-wedge design study with six local primary care networks. We chose a pragmatic study design as NPRL2.0 is a multidimensional, complex intervention, executed in daily practice. Alongside this (cost-)effectiveness study, we aimed to study the care experiences of patients with CMP and the opinions of HCPs about their experiences of interprofessional collaboration practice (ICP) and their work satisfaction during participation in NPRL. Unfortunately, due to the COVID-19 pandemic, we did not achieve sufficient participants, and hence power, to answer the research questions formulated for three Quadruple Aims: health, patient experience of care, and (healthcare costs. However, we were able to analyse data collected to address the fourth aim: to evaluate changes in work satisfaction and ICP of HCPs. In **Chapter 6**, we described the results of this mixed-methods study that gathered data concerning changes in the opinion of primary care HCPs about ICP and their work satisfaction while participating in NPRL1.0 and 2.0. Qualitative and quantitative data on ICP and work satisfaction were gathered and all information was eventually combined, namely the transcripts of focus groups held in the study of NPRL 1.0, and transcripts of the semi-structured focus groups and the results of a quantitative survey for NPRL 2.0. In total, 37 HCPs participated, including GPs, therapists, and mental health practice nurses. The main points of attention were; the biopsychosocial view of society regarding chronic musculoskeletal pain, the burden of GPs in service delivery, and the reimbursement of HCPs by health insurers. To summarize, in this stage, HCPs reported positive experiences but no major changes in ICP and work satisfaction. They expressed commitment to interdisciplinary collaborations in primary care to guide patients with CMP but it seems that more time working in a structure like NPRL is needed. In the future, it may result in advantages for ICP and work satisfaction. As potential facilitators of ICP and increased work satisfaction, a more biopsychosocial view of the society regarding CMP, the introduction of a case manager in primary care to unburden GPs, and a different means of reimbursement of HCPs by insurers, were indicated.

In the final phase of the project, we tested the feasibility of eCoach-Pain, an eHealth application aiming to improve self-management skills and interdisciplinary primary care. ECoach-Pain was designed, together with HCPs, during and just after the feasibility study of NPRL1.0. In **Chapter 7**, we describe the feasibility of the latest version of eCoach-Pain intended to facilitate interdisciplinary working in primary care. This comprises a tool measuring pain complexity, diaries, pain education sessions, monitoring options, and a chat function. We evaluated its feasibility from June to December 2020 by assessing learnability, usability, desirability, adherence to the application, and experiences reported by patients and general practitioners, mental health practice nurses, and physiotherapists. Six HCPs from two primary care settings participated. They stated that eCoach-Pain had added value to their treatments. However, to overcome the time pressure of GPs, for optimal use of eCoach-Pain a case manager was recommended. The role of mental health practice nurses in the eCoach-Pain should be assessed as this

was not clear in our study. To study patient satisfaction with and feedback from using the eCoach, 29 patients completed evaluation questionnaires and took part in individual interviews, and their eCoach-Pain-use data were extracted. Patients reported treatment benefits and were satisfied with eCoach-Pain but also reported that the content of the current version did not correspond optimally to their actual health problems. Therefore, we present recommendations for improving content and implementation strategy, including advice to provide a case manager for each patient.

METHODOLOGICAL CONSIDERATIONS

This section contains a reflection on the methodological strengths and limitations of the studies presented in this dissertation. First, the Quadruple Aim and mixed methods are discussed, followed by the study designs of the feasibility study and (cost-)effectiveness study. Methodological considerations regarding the eHealth application and generalizability of NPRL are also discussed.

Quadruple Aim and mixed methods

The Quadruple Aim is an approach to optimize health system performance, proposing that health care institutions simultaneously pursue four dimensions of performance to guide their developments.[16] These new developments should improve the health of populations, reduce the per capita cost of healthcare, enhance the patient experience of care, and improve the work-life balance of HCPs and staff. The overall goal is to improve the health of the general population. Society is facing an increase in chronic diseases so improving self-management skills for the general population is therefore necessary to ensure the optimal participation of people with a chronic disease and the feasibility of health care in the future. It is intended that this will ultimately lead to a decrease in the severity of chronic diseases and better chronic care management overall.

As NPRL is a network approach intending to optimize the health system for patients with chronic complaints, we evaluated it based on the Quadruple Aim outcomes. Mixed methods were applied as NPRL is a complex intervention needing both process and effect evaluations.[17] We used mixed methods designs in both the feasibility and the (cost-)effectiveness studies. The combined use of quantitative and qualitative evaluation methods provides a better understanding of NPRL than either method singly.[18,19] Integration of findings and deepening of understanding may occur during the design and data collection phases of the research process, in addition to the data analysis and interpretation phases.[19] In the (cost-) effectiveness study, a stepped wedge design, alongside a longitudinal design, was used to answer diverse linked research questions.

In evaluation research, mixed methods designs have been used to fulfil different functions. Palinkas et al. (2019 identified five such functions; 1) convergence, 2) complementarity, 3) expansion or explanation, 4) development, and 5) sampling.

In our study, we used mixed methods for;
1. convergence of data by triangulation;
2. complementarity, in which we intended to use quantitative data, to evaluate outcomes of health and costs, and qualitative data, to evaluate the process of implementation and ICP and satisfaction of patients and HCPs;
3. development, as we used qualitative data in the iterative feasibility study for the development of guidelines, protocols, assessment tools, and eCoach-Pain in NPRL, and intended to use quantitative data to study the effects.

Palinkas et al. (2019) give an overview of innovations in mixed methods evaluations of intervention, programme, or policy (i.e., practice) effectiveness and implementation.[20] two of which were used in our study. First, we used frameworks for "quantizing" qualitative data. Palinkas et al. proposed the use of the Consolidated Framework for Implementation Research (CFIR) for analysis, also used in our study.[21] Second, they proposed the use of Rapid Assessment Procedures for both process and outcomes in effectiveness and implementation studies.[20] We used these as, in both studies, during the analysis of the qualitative data, we summarized transcripts and shared these with the NPRL implementation team to further guide implementation in daily practice.

Due to the COVID-19 pandemic, we were not able to complete the (cost-)effectiveness study as intended. At the start of the pandemic, in the study process, we had just approached the end of the training (wash-out) phase of the stepped-wedge design. All HCPs had received their education sessions, but treatment as intended was not possible due to major restrictions on health care. We therefore prioritized the focus groups of HCPs on ICP and work satisfaction, which resulted in **Chapter 6**. Additionally, we held interviews with patients regarding their experience with the care they had received before the pandemic. However, due to the pandemic, we did not reach data saturation with patients in the intervention group. As most treatments were stopped or changed to telephonic or online at the beginning of the pandemic, and since we did not know its likely course, we were not able to include new patients for this study. Since only limited data from the intervention groups in the stepped-wedge design were available, we were not able to perform the (cost-)effectiveness analysis on health and cost outcomes. Although the usual care data are nearly complete, the lack of data for the experimental (NPRL) condition made it impossible to perform the effectiveness analysis. Future exploration of NPRL2.0 (outside the timeframe for this thesis) may well lead to interesting findings from the extensive evaluation of the Quadruple Aim outcomes.

Reflections on the study design of the feasibility study

Historically, user-centred designs in healthcare have been used to study physical products such as medical devices or eHealth.[22] More recently, the healthcare community has recognized the value of user-centred design in other domains, particularly in incorporating these design approaches in identifying innovative, patient-centred solutions to complex healthcare challenges.[23] The term 'user-centred design' was originally developed in engineering disciplines but is now interpreted in a broader sense, emphasizing its '*use of techniques which communicate, interact, empathize and stimulate the people involved, obtaining an understanding of their needs, desires and experiences'.*[24] Complex healthcare challenges are those that are not readily defined, persist and change over time, and have complex causes.[25] This design is of value in health services research, particularly in addressing more complex healthcare challenges, including healthy ageing, social interaction and support, environment and lifestyle, non-communicable diseases, wellbeing, global health, and mental health.[26-28]

As NPRL is an innovative complex intervention in the field of health service delivery, we decided on a user-centred design to provide insight into barriers and facilitators for the development, implementation, and transferability of NPRL. Patients, HCPs from diverse practices and disciplines, and software developers of eCoach-Pain participated in the user-centred design study presented in this thesis. This pragmatic approach to developing protocols and elements of NPRL was perceived as an added value by HCPs. Additionally, this approach ensured that HCPs were involved from the start of the study. This intensive collaboration made them enthusiastic about the final protocols and elements of NPRL. It has been shown that organizational changes in healthcare are more likely to succeed when HCPs have the opportunity to influence this change, feel prepared for it and recognize its value, including perceiving the benefit of the change for patients.[29] Additionally, we presented an alternative vision to HCPs of care for patients with CMP and, in line with this, we provided education for HCPs several times during the iterative process. This iterative process had three phases, an advantage of this being that we were able to adjust the protocols and elements of NPRL after each phase, based on the experiences of participants. At the end of the study, we had gained insight into the barriers to and facilitators of all protocols and elements developed.

Reflections on the study design of the (cost-)effectiveness study

We eventually performed a pragmatic stepped-wedge design study to evaluate the (cost-)effectiveness and cost-utility of primary care for patients with CMP, comparing care organized following NPRL2.0 with usual care. Service delivery or policy intervention evaluations need a more pragmatic study design.[30-32] There were several reasons to choose a pragmatic stepped-wedge design for this complex study on the interplay between science, policy, and practice.[33,34]

In our study, we wanted to include a heterogeneous population of patients with CMP. It has been shown that, in frequently used study designs (e.g. RCTs), often only homogeneous populations are included. The results of such studies often show only moderate-to-low effect sizes, and they have hardly any room for patient-centred approaches.[35-37] The advantage of the stepped-wedge design is the inclusion of a heterogeneous population. Other advantages were the rather short control or baseline period, and the fact that all healthcare practices are eventually able to implement the intervention.[38] All HCPs received training which made it difficult for them to treat intervention and control groups simultaneously. With a stepped-wedge design, we anticipated on this problem as HCPs first of all provided usual care (control) and then, only after the training, provided the NPRL approach (intervention). In this way, the results of treatments in both situations could be compared. The external validity of the results of this stepped-wedge design, situated in a real-life situation, is in most situations greater than that of other frequently used designs (such as RCTs) which makes the results more generalizable.[30] Therefore, it is easier to implement and use the intervention in daily healthcare practice. Moreover, results may even lead to the opportunity of studying learning effects by comparing the results of local networks that transited earlier with those transiting later.[39] In addition, another advantage to choosing a stepped-wedge design is the need for a smaller sample size, as available study time was limited. In a stepped-wedge design, intra-cluster variation is small, and fewer subjects are needed.[40] There has been serious criticism about the sample size of stepped-wedge designs.[41,42] However, it has been concluded that these have superior efficiency as, with a great number of individual participants, fewer clusters are needed. Therefore, in our study, we chose to use only three clusters with two healthcare practices in each cluster. The required sample size for this study was 184 patients (92 control and 92 intervention). With six participating healthcare practices, the intended inclusion was six patients per month per practice. In our opinion, this seemed a realistic number of patients to be included by HCPs in daily practice.

Earlier studies have mentioned the challenges of a stepped-wedge design.[34,43,44] advising routine checking of data availability and quality, with specific attention on ethical review, flexibility, a spacious time schedule, and sufficient capacity in research teams. We tried to overcome challenges in the schedule by planning appointments with HCPs to discuss when to administer the control condition, when to receive training, and when to administer the intervention. We also trained HCPs to recognize eligible patients for NPRL, increasing the chance of reaching the required number of patients. Based on earlier experiences in NPRL1.0, we were able to better instruct HCPs commencing participation during NPRL2.0. Additionally, in stepped-wedge designs, stable internal and external conditions are needed for proper execution of the study. The switching of steps for different groups of practices at different time points corrects for seasonal effects, such as the influence of winter. However, long-term changes in conditions make stepped-wedge designs

vulnerable. During the inclusion period for the study evaluating NPRL2.0, the COVID-19 pandemic disrupted the healthcare system for a long time. During this time even physical appointments with physiotherapists in primary care stopped. Therefore, insufficient patients could be included in this study, especially for the intervention condition. For a design with simultaneous inclusion of control and intervention groups, we would have had a comparable number of inclusions and data available from both conditions at that time point. As a result, unfortunately, we were not able to fully evaluate the health, costs, and patient experience outcomes of the Quadruple Aim.

eHealth

EHealth has become central in patient healthcare delivery during the COVID-19 pandemic. We took the advantage of the opportunity presented by the pandemic to further develop and implement eCoach-Pain in interdisciplinary primary care.

Stakeholder involvement in intervention development is extremely important to match users to intervention possibilities.[45] Development needs to be performed by a multidisciplinary team in an incremental and iterative process customized to particular organizations or projects.[46] A sharp focus on the user and on usability is important for fruitful developments. One patient, HCPs, researchers, and software developers were involved in meetings for the development of eCoach-Pain, taking place before the start of the feasibility study. Participants discussed the needs, content, and possibilities of eCoach-Pain for use in primary, secondary, and tertiary care several times. During the feasibility study, HCPs evaluated use, content, and implementation. When necessary, adjustments were made. Also, two patients gave feedback about the content, readability, and understandability of the educational sessions. When eCoach-Pain was adjusted for its use in interdisciplinary primary care, a new stakeholder group was created before the start of the study, comprising all involved HCPs, experienced or not, researchers, and software developers. Based on the needs in primary care, eCoach-Pain was again adjusted. At the end of the study, during the evaluation, these stakeholder groups were again invited to join in. In addition, eleven patients completed questionnaires about learnability, usability, and desirability, and eleven were interviewed on their experiences of using eCoach-Pain. Overall, this format for the involvement of diverse stakeholders was found satisfactory.

Generalizability

This study was conducted in South-East Limburg but, in our opinion, its findings are to a great extent generalizable to other regions in the Netherlands, although it is important to realize that NPRL was implemented in a unique and specific geographical region. One factor is the lower average socioeconomic status of the inhabitants of South-East Limburg compared other parts of the Netherlands.[47,48] Health care consumption is high,

with the perceived health of inhabitants the lowest in the Netherlands.[49,50] This high healthcare consumption has been linked to socioeconomic status and low self-reliance[51] and, therefore, several projects have been organized in this region to optimize the quality and sustainability of healthcare, including Primary Care Plus and Plus Practices.[52-54] In our opinion, these circumstances present an additional challenge to implementing NPRL in this region and implementation should therefore be easier in other regions. The regional tertiary rehabilitation centre, together with healthcare practices in primary and secondary care, and the three dominant healthcare insurers participated in NPRL. Close collaboration between these stakeholders is of great importance when implementing interdisciplinary care initiatives within and between different healthcare settings. This is a precondition for the patient to receive the right care, at the right time, in the right place.[55,56] Furthermore, the geographical location of the region plays an important role in this collaboration. In the area, only one tertiary care centre is available and the number of practices providing secondary care rehabilitation for CMP treatment is limited. This may have led to less conflict of interests and contributed to more manageable collaborations. Other regions can use NPRL as an example, but need to adapt it to the specific situation in their region with the regional parties involved before implementing it.

At a global level, it is important to note the differences between the Dutch healthcare system and those of other countries. If using the results presented here for implementation in other countries, it is important to consider whether the Dutch 'gatekeeper' system in primary care (which controls access to most types of secondary care in the Netherlands) is comparable to the situations in those countries. Moreover, countries with lengthy travels toward secondary or tertiary care practices face geographical challenges when implementing projects comparable to NPRL.[57-59] Despite these different healthcare systems, there is increasing emphasis on the need to implement interdisciplinary collaborations within primary care and between primary care and other healthcare settings for patients with CMP.[9,60]

IMPLICATIONS FOR RESEARCH

In the following section, implications for research are discussed, comparisons with other studies made, and future directions for research suggested. First, recommendations on study designs for interventions in health service delivery are presented. Then the added value for measuring outcome variables from multiple domains is discussed.

Study designs for interventions in health service delivery

In our feasibility study, HCPs, patients, and healthcare insurers were asked to provide input for the design and implementation of the content of NPRL. Moreover, during the

study, HCPs gave input on barriers and facilitators of NPRL and iterative improvements were made. Co-creation is an increasingly popular approach for aligning research and service development.[61] Collaborative knowledge is then generated by academics working alongside other stakeholders. It has the potential for "moving beyond the ivory towers" to deliver significant societal impact via dynamic, locally adaptive community academic partnerships for design, implementation, and evaluation of new interventions. Co-creative designs are recommended for the development of healthcare networks such as NPRL.

To overcome problems in the execution of complex trials, such as the stepped-wedge design which we used, single-case experimental designs (SCEDs) are recommended. SCED studies are particularly useful for examining the processes and outcomes of psychological and behavioral studies.[62] A single case refers to a participant or cluster of participants (e.g., a classroom, hospital, or neighbourhood) who are their own control for within-subject evaluation.[63] SCEDs generally involve repeated, systematic assessment of one or more independent and dependent variables over time, in care-as-usual and intervention conditions. This is in line with current trends of increased public involvement in scientific research, such as the opportunity for the public to shape the Dutch National Research Agenda or guidelines for involving citizens in research projects.[64,65]

A broad range of study outcome measures

We aimed to provide a broad range of qualitative and quantitative study outcome measures to evaluate NPRL. As we chose the Quadruple Aim for the selection of relevant domains and related measurement methods, we were able to choose a set of outcome measures related to predefined aims. In the review presented in Chapter 2, we noticed that not many studies on interventions evaluated outcomes in more than one domain. Most studies evaluated the effectiveness of the intervention by measuring health outcomes only. Both social and healthcare costs are measured more often than satisfaction outcomes, but still not in all studies. Outcomes regarding patient and HCP satisfaction and enjoyment of work were not often measured, but have become more popular recently. It is recommended that new interventions be evaluated over a broad range of domains, such as the Quadruple Aim. Then, more valid statements can be made about all the consequences in daily practice of a new intervention.

IMPLICATIONS FOR CLINICAL PRACTICE

Taken together, based on the results presented in this thesis, implications for clinical practice need to discussed. First, the transition from a biomedical to a biopsychosocial orientation in Dutch society will be a topic to focus upon. Then the organization and

financing of care, perceived quality of care and satisfaction of HCPs, and eHealth in interdisciplinary primary care, will be discussed.

The transition from a biomedical to a biopsychosocial orientation in Dutch society

In the studies presented in this thesis, participating HCPs indicated that divergent views of some non-participating HCPs and patients about CMP made it more difficult for them to work according to NPRL. Where participating HCPs had been educated to work with the biopsychosocial perspective, non-participating HCPs, even those working in the same practice, persisted in a biomedically-oriented view of CMP. Different approaches used simultaneously within one practice hindered optimal participation by HCPs in NPRL. In Australia, Scotland, Norway, and Canada, it has been shown that social media and public campaigns can change the view of society, including patients, from a biomedical to a biopsychosocial one.[66-69] We recommend investing in knowledge education about CMP in Dutch society. Moreover, effort should be put into further educating HCPs in a biopsychosocial approach to CMP. As people live longer with chronic diseases, such as CMP, they will experience problems in diverse domains. Thus, biopsychosocial treatment and guidance will become increasingly important in the coming decades.[70] It has been shown that networks of HCPs for patients with low back pain stimulate physiotherapists to positively change their attitudes.[71] Results from the studies presented in this thesis show that HCPs still have difficulties recognizing sub-acute and chronic patients, even after several education sessions. Therefore, with an increasing number of chronic pain conditions in the coming years, educating HCPs about the biopsychosocial model and CMP would seem to be a priority in the Netherlands. This education should start during the HCPs' training at the Universities (of Applied Sciences). For experienced HCPs, professional refresher courses and supervision sessions are desirable to secure the acquired knowledge in daily practice.

Organization and financing of care

Our study can be seen as one of the first steps in the implementation of the Dutch Standard of Care.[11] with relevant steps being taken in the development of an interdisciplinary network for patients with CMP. This is in line with the aims of Health Holland and the World Health Organization for developments in (rehabilitation) healthcare in 2030.[9] Health Holland aims to increase the number of patients with a chronic or disabling disease who can fruitfully participate in society by 25% by 2030. They also aim that at least 50% of the care will be organized in the patient's environment, instead of in healthcare practices. The World Health Organization aims for rehabilitation to be available for everyone and through all stages of the life course by 2030. In addition, the WHO urges countries to take efforts to strengthen rehabilitation, which should be directed towards supporting the health system as a whole and integrating rehabilitation into all

levels of health care. Based on the results of the studies presented in this thesis, information on the first steps towards integrated interdisciplinary transmural care for CMP within the Dutch organization of care is available. However, more time and more steps are needed.

A point of concern in the desired organizational change is the restricted time available in GPs' daily practice. We found that GPs especially did not have enough time for optimal participation in the project. Because of their expertise in general medicine, GPs are often already involved in many projects in their practices. It is therefore difficult for them to allocate time to new projects. Previous studies already demonstrated time pressure in Dutch general practices. In line with the recommendations in the Dutch Standard of care, HCPs in our study have proposed the introduction of case managers in primary care. A case manager can follow a sub-group of patients more closely, also using eHealth, and can refer a patient to the GP when further assessment or treatment is necessary. The case manager for chronic pain would probably help reduce the workload of GPs. Which healthcare disciplines could fulfil this role is a matter to be explored. One possibility might be a specialized mental health nurse in primary care.

It often appeared difficult for HCPs to organize care, as proposed in NPRL, in their regular healthcare practice. The current fragmentation of healthcare limits the optimal organization of interdisciplinary care. For example, the financing of HCPs hinders the organization of interdisciplinary meetings in primary care. In future, barriers due to the financing of interdisciplinary care need to be removed to facilitate this way of working. In addition, the substitution of secondary into primary care is necessary to ensure continuity of care and a patient-centred approach. This substitution step could involve the introduction of multidisciplinary primary care, in which the patient receives treatment in his/her environment under the supervision of a GP practice, while rehabilitation physicians from secondary care can be consulted for advice. This would be a more patient-centred approach as patients would receive care closer to their homes. This step is proposed in the previously mentioned recommendations of the World Health Organization. Figure 8.1 shows how care for patients with CMP could be organized.

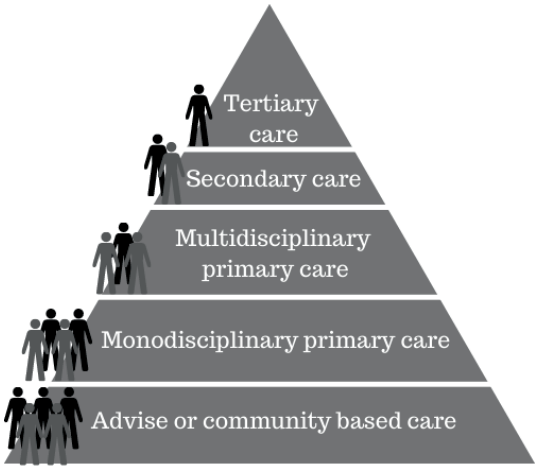


Figure 8.1 Possible future organization of care.

Perceived quality of care and satisfaction of HCPs

Previous research has shown that interdisciplinary teams have the potential to significantly impact patient and team experiences in care for seriously ill patients.[72] In our study, increased enthusiasm among HCPs for tackling CMP and for the organization of interdisciplinary primary care. However, limitations to the optimal functioning of this primary care network were found in the organization of care and administrative tasks. This was also found in Canadian studies, when an education intervention aimed at HCPs for supporting and improving CMP care was introduced in underserved communities.[73-75] Those studies showed that participation resulted in personal and professional benefits, increasing participants' understanding of their roles and limitations, as well as of other HCPs' roles. As in our study, Canadian professionals described changes in their attitudes towards patients with chronic pain and towards colleagues from other professions. They also noted time constraints and lack of organizational support as barriers to HCP participation and satisfaction. To overcome these challenges in the organization of care when implementing interventions in health service delivery, extra time and new ways of financing are needed. Quality of care and working conditions of HCPs would then improve when networks were successfully implemented.

eHealth in interdisciplinary primary care

ECoach-Pain is satisfactorily used by patients, as well as by HCPs in clinical practice, but it needs to be improved. Further exploration of the content for a better fit with patients' complaints is necessary. Increased integration of the eCoach in blended physiotherapy

care is advisable to allow long-term follow-up of patients with CMP and prevent relapse. A wide variety of eHealth interventions for CMP has been developed in recent decades.[76-79] For future care, the advantages and disadvantages of these interventions must be considered to see whether this can help strengthen the content of eCoach-Pain. As diverse tools are developed, each with limited reach and use, work should be done to make them clinically useful, while retaining their strengths, and the long-term use of such eHealth tools studied.[80]

Our study concluded that, although eCoach-Pain was intended to stimulate interdisciplinary practice in primary care, this does not appear to have been realized yet. Communication and collaboration between HCPs have to be improved to achieve interdisciplinary care with the use of eHealth. Communication and information delivery about eCoach-Pain to the patient also need to be further improved. Other reviews have indicated the potentially positive role of eHealth in assessing and tracking health, and enhancing health service delivery.[80-82] Communication between individuals involved in delivering health services and communication pathways between patients and HCPs are points of attention for optimal service delivery.[80] A case manager could guide these communications about eCoach-Pain with HCPs and patients. Earlier studies in hospital settings showed successful results with case managers (e.g. specialized nurses) using the same software platform as eCoach-Pain.[83-85] Therefore, we recommend exploring the use of case managers for eHealth in interdisciplinary primary care settings.

IMPACT

The results reported in this thesis have led to new insights about integrated interdisciplinary care networks for patients with CMP. The purpose of this section is to describe the relevance of the main findings presented here, to explain to whom they are applicable, to discuss how research findings can be translated into innovative products and activities, and to suggest how implementation may be realized.

Primary, secondary, tertiary care networks

The main deliverable of this thesis is a network of HCPs in primary, secondary, and tertiary care aiming to deliver integrated interdisciplinary care for patients with CMP. An important benefit of this collaboration in NPRL is that HCPs come to know each other and the treatments available for patients with CMP in the South-East Netherlands. In these local networks in primary care, HCPs already collaborate more intensively to treat these patients. Other regions or local networks in the Netherlands can then use the guidelines and protocols developed. An important element in the collaboration between primary and secondary or tertiary care appeared to be working on knowledge exchange, with HCPs

noting that there was added value in informally learning from each other: this collaboration can be further extended and intensified. Examples could be a uniform process of bi-directional communication between all healthcare practices and organizations, network evenings focusing on interdisciplinary collaboration, or discussing complex cases. Also, patients can take advantage of this integrated interdisciplinary care network and will receive treatments that fit with the complexity of their complaints. The HCPs they visit will all speak from the same biopsychosocial perspective which offers the patient an unambiguous treatment plan.

Education programme: primary care

Working in NPRL needs a biopsychosocial perspective. Moreover, HCPs need to be well informed about the process of an integrated interdisciplinary care approach. One way to facilitate HCPs' working like this is by providing an education programme. Based on the findings of Chapters 3 (feasibility study) and 6 (IPC and satisfaction with work), an education programme containing 3 sessions of 6 hours, with 1 hour follow-up intervision sessions every 4-6 weeks for 6 months, has been developed. The programme focuses on transforming a biomedical vision to a biopsychosocial one, with early recognition of sub-acute and chronic conditions, neurophysiology, role-plays of complex situations, and collaboration strategies in primary care. The follow-up interview sessions take place separately in every local network, discussing barriers to collaboration within the team, specific patient cases, and practical implementation of learned strategies. During these meetings, GPs, therapists, and mental health practice nurses would have to be present at the same time. The educational programme should anticipate that discussing core beliefs, cognitions, emotions, and behaviour may be difficult for HCPs. The education programme applied in NPRL can be used in other settings in the future. If necessary, adaptations can be made to the programme by, for example, adding content on blended learning (Chapter 7, eHealth). The experts offering the programme should also be involved in the implementation of an integrated interdisciplinary care network and have clinical experience in providing interventions with a biopsychosocial approach.

As previously mentioned, education programmes are also relevant for incoming HCPs, such as residential GPs, physiotherapy, or occupational therapy students. Education on the biopsychosocial model and perspective should be well integrated into the curriculum to facilitate common understanding. Interdisciplinary collaboration will also be important in primary rehabilitation care and, therefore, students will need to be taught about collaboration strategies early on. Universities and Universities of Applied Sciences will need to introduce the biopsychosocial model, pain neurophysiology, and IPC into their curricula.

Collaboration between researchers, healthcare practices, and healthcare insurers

Another area of impact concerns the increased collaboration between the researchers and healthcare insurers. NPRL was funded by three main healthcare insurers, CZ, Zilveren Kruis, and VGZ. As the organization and financing of care are the main facilitators for interdisciplinary care networks, healthcare insurers are very important stakeholders. Although these stakeholders were involved, the financing of primary care still remained to be organized. Moreover, not all patients will have all consultations reimbursed, depending on their insurance package. We recommend reimbursement of NPRL treatment, as this will make the intended treatments more accessible and recommendations presented in this thesis may be implemented in daily care. The collaboration with healthcare insurers started in NPRL will be continued in future projects on multidisciplinary consultations in primary care. The financial and organizational barriers in the organization of multidisciplinary meetings and insurance packages for patients need to be overcome with new ways of financing healthcare.

eCoach-Pain

In Chapter 7, we discussed the eHealth deliverable of this project: eCoach-Pain. This application was only accessible for treatment facilities participating in the study. However, it is possible to distribute the application further across other primary care practices. New participating practices should get access to the existing platform to enrol their patient population. Inclusion of options for communicating with the treatment team and facilitating a form of blended care are important to improve interdisciplinary care. These options also could improve the usability of the application and facilitate the possibility of tailoring the treatments to patients' complaints in more flexible and efficient ways in terms of time and place. Another possible direction is to explore the potential of eCoach-Pain in other healthcare settings, such as secondary or tertiary care. Implementation of eCoach-Pain across different paths of the healthcare system will stimulate collaboration within the network. In this way, the patient can be the owner of his platform, and he or she can use it in all healthcare settings. HCPs can more easily communicate and disseminate treatment plans, which should stimulate interdisciplinary care in NPRL. In the studies presented in this thesis, eCoach-Pain for blended treatment was used in primary care. If financial conditions and time pressure are eased, this may enable HCPs to monitor patients in the long term. Further refinements in embedding eCoach-Pain into blended care must be made. Also, the role of each health care discipline in the application must be further explored.

MAIN CONCLUSION

As society faces an increase in chronic diseases, there is a need to improve health service delivery in the Quadruple Aim domains. The results reported in this thesis have led to new insights into the role of integrated interdisciplinary care networks for patients with CMP. As NPRL is a complex, multidimensional intervention, extensive evaluations of Quadruple Aim dimensions were performed. The advantages and challenges of mixed-methods, user-centred design, and stepped-wedge designs are described. The main conclusions of this thesis were that, with the development of NPRL, important first steps are being taken in the transition of care for patients with CMP. It takes time to change interdisciplinary collaboration and to shift towards a biopsychosocial vision for both HCPs and patients. HCPs showed increased enthusiasm for treating CMP and the organization of interdisciplinary primary care. However, challenges remained in the (financial) organization of care and in the transition from a biomedical to a biopsychosocial orientation in Dutch society. The role of eHealth in interdisciplinary primary care shows promise but needs further exploration. The main deliverable of this thesis is a network of HCPs in primary, secondary, and tertiary care aiming to deliver integrated, interdisciplinary care for patients with CMP.

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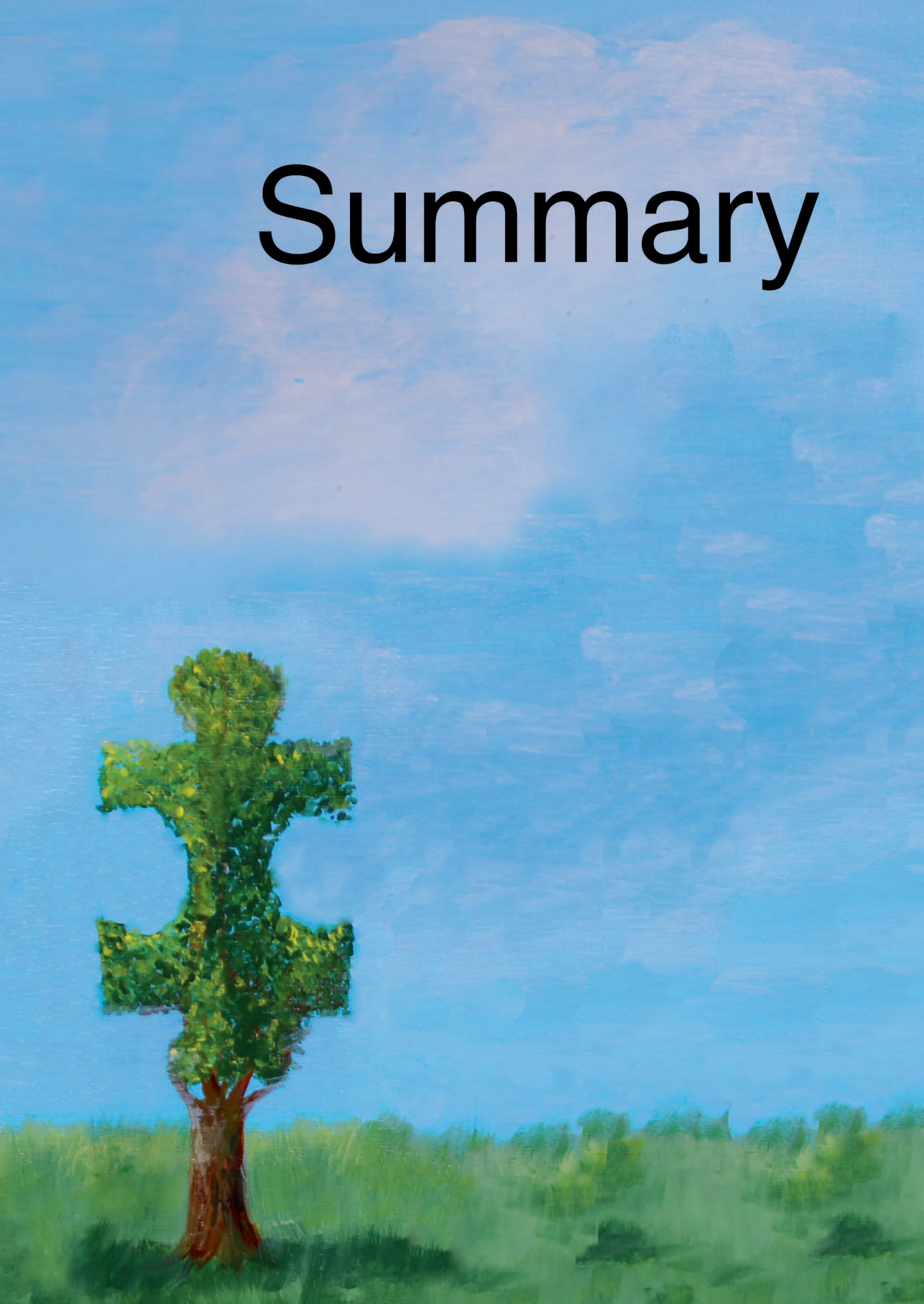
Summary



SUMMARY

This thesis describes the development and evaluation of a new interdisciplinary care intervention within primary care and between primary care and the other healthcare levels: 'Network Pain Rehabilitation Limburg' (NPRL). The main objective was to investigate the feasibility and (cost-)effectiveness of NPRL.

Chapter 1, the general introduction of this thesis, presents the background to and relevance of the conducted studies. Chronic musculoskeletal pain (CMP) is the major cause of pain and disability and includes a diverse range of diagnoses, with a prevalence of 18% in the adult Dutch population. An ageing population, increased life expectancy, elevated levels of obesity, and lack of physical activity will all increase the prevalence in the coming years. CMP is complex as it has a multidimensional, biopsychosocial character. Patients report lower quality of life than other patient groups. CMP is also strongly associated with impaired function and is a leading cause of work absenteeism and health-related early retirement. In the Netherlands, the direct and indirect medical costs for CMP are approximately €20 billion per year. Despite these high costs, treatments received are often perceived as inadequate in solving patients' complaints, with patients often left seeking explanations or solutions for their CMP complaints.

In the Netherlands, the highly diversified primary to tertiary healthcare levels and the social care system need to be managed to be able to regulate this growing group of patients. In current care, HCPs feel less equipped to treat patients with complex diseases, increase the self-management skills of patients, and use ICT facilities in care. Additionally, HCPs experience time pressure and increased administrative tasks which can lead to burnout, especially among general practitioners (GPs) and medical specialists. Healthcare is fragmented due to working in different care levels, and this leads to suboptimal working conditions for HCPs when treating patients with complex chronic diseases. Different healthcare levels in service delivery have different financing arrangements and collaboration between the lines can unfortunately be limited.

To overcome these problems in the organization of care, the World Health Organization (WHO) proposed in a recent report that multidisciplinary rehabilitation services be integrated into and between primary, secondary, and tertiary levels of health systems. An example of this integrated care is the Standard of Care for Chronic Pain in the Netherlands, which describes an integrated, multidisciplinary organization of regional networks working with a biopsychosocial vision as a possible solution for fragmented care. The Network Pain Rehabilitation Limburg (NPRL), an implementation of the Standard of Care for Chronic Pain, is described in this thesis.

The evaluation of such a complex, multidisciplinary network for patients with CMP needs to be multi-dimensional. The Quadruple Aim is an approach to optimizing health system performance, proposing that healthcare institutions simultaneously pursue four dimensions of performance: improving the health of populations, reducing the per capita cost of healthcare, enhancing the patient experience of care, and improving the work-life balance of HCPs and other staff.

Following the WHO's recommendations, digital health investments should be integrated into care to support future continuity of care and integrated service delivery. EHealth has the potential to provide numerous benefits for patients and health systems, such as improving the accessibility and cost-effectiveness of health care. With this goal, a diverse range of effective eHealth applications for patients with CMP, from webpages with patient education and online treatment courses to video-conference calls with HCPs, have been developed and evaluated. However, the implementation of eHealth in interdisciplinary care needs further exploration.

Chapter 2 presents an overview of articles reporting on rehabilitation care networks, within primary care or between primary and other health care settings for patients with CMP. Moreover, their impact on the Quadruple Aim outcomes (health; health care costs; quality of care experienced by patients; work satisfaction for HCPs) is studied. For this systematic review, studies were included if the main population comprised patients with CMP, the intervention was implemented in primary care or a combination of primary care and other care settings, with a rehabilitation aim, and an interdisciplinary care network. Only original descriptions of interventions in Dutch, English, or German published between 1 January 1994 and 14 November 2019 were included. The search was performed in the databases PubMed, CINAHL, Web of Science, and PsycInfo, and by tracing publications from the reference sections of included papers and relevant reviews.

Forty-nine articles were included, describing 34 individual interventions. Twenty-one interventions consisted of collaborations of HCPs within primary care, such as various therapists and nurse practitioners or physicians/physiatrists, psychologists. There were six interventions involving collaboration between primary care and secondary or tertiary care (e.g. a GP with a therapist, orthopaedic surgeon/specialist, nurse practitioner, or extensive rehabilitation teams). One intervention took place in an interdisciplinary pain clinic in primary care where therapists who usually work in both primary care and secondary/tertiary care settings delivered the treatment. Two interventions were a collaboration between primary care and social care with teams comprising several therapists, a psychologist, and a case manager. Two interventions consisted of a collaboration between primary, secondary/tertiary, and social care, also involving patients' medical specialists during workplace interventions. Finally, two interventions involved collaboration between primary care and community-based initiatives, comprising

fitness instructors and telephone coaches along with therapists in primary care. The content of collaborations ranged from simply performing an assessment together to delivering a fully integrated interdisciplinary treatment.

Among the 49 articles, 19 randomized trials, 12 non-randomized studies, seven qualitative studies, seven study protocols, one description of an intervention, two studies with a population with mixed diagnoses, and one study regarding barriers and facilitators, were found. Thirty-nine articles had at least one of the Quadruple Aim outcomes as the primary outcome: 18 articles described health outcome measures, 12 described cost outcome measures, four described quality of care experienced by patients, and five articles described work satisfaction for HCPs. We therefore conclude that there is a wide variety in content, collaboration, and evaluation methods of interdisciplinary rehabilitation interventions within primary care, and between primary care and other health care settings. Most interdisciplinary interventions are evaluated in primary care, with fewer involving primary care with other health care settings. It seems that interventions with the involvement of different HCP disciplines, and more patient-centred interventions, with broader content and duration of treatment, show more promising results than care as usual.

Chapter 3 describes a protocol to evaluate the feasibility of the NPRL1.0. This is the original version of a transmural healthcare network providing integrated rehabilitation care for patients with CMP with a biopsychosocial approach in the province of Limburg, the Netherlands. Collaboration of HCPs is supported by information meetings, education days, treatment protocols, guidelines, eHealth, and facilitation of communication between patients and all HCPs. This study was to give insight into the barriers and facilitators, perceived value, acceptability, and implementation strategies of NPRL1.0. During an iterative, user-centred design with three phases, quantitative and qualitative methods (mixed methods) were used for evaluation. In Phase 1, NPRL1.0 was developed and HCPs were educated; Phase 2 focused on implementing NPRL1.0; and Phase 3 focused on the transferability of NPRL1.0. In addition, data on patients' work status, general health, and participation levels were collected. The Consolidated Framework for Implementation Research (CFIR) was proposed for qualitative analysis and to refine NPRL1.0 to better fit with daily practice. The evidence generated from this feasibility study would not only help to adjust the design and content of NPRL1.0 but also help future studies in developing and implementing transmural networks in healthcare.

In **Chapter 4**, the results of the feasibility study (October 2017 to October 2018) (described in Chapter 3) are presented. The aim was to identify barriers and facilitators for the development, implementation, and transferability of NPRL1.0. The study was conducted with a three-phase iterative and incremental design. The network comprised two rehabilitation practices for specialized medical rehabilitation, and three local primary

care networks, each with a GP, a mental health practice nurse, and a physiotherapist or exercise therapist. These stakeholders, together with a random sample of participating patients, took part in evaluations which consisted of interviews, focus groups, and observations. Field notes and observations were recorded during meetings. The CFIR guided data collection and analysis. Results were used to refine the next phase and results at the end of the study were used to make recommendations for revised designs of NPRL. Five focus groups and six interviews with 21 HCPs from different disciplines, and one focus group with six patients (out of 58) were held. Facilitators of NPRL1.0 were consistency and transparency in ways of collaboration, speaking in a biopsychosocial language, and working to treatment protocols. An important facilitator in the development and implementation of NPRL1.0 was the iterative and incremental design, based on key principles of user-centred design. HCPs were enthusiastic about the iterative, bottom-up development in which they participated. This bottom-up strategy increased the focus on patients' and HCPs' needs and led to greater usability and acceptance. One barrier to the implementation of NPRL1.0 was the stigmatization of CMP by the general population. Patients expected a biomedical elucidation of their CMP complaints, which made it difficult for HCPs to stick to a biopsychosocial treatment. Additionally, the current organization of healthcare and its financing, including the culture, structure, and financing of healthcare practices, complicated the implementation of NPRL1.0 within and between practices. Moreover, a sufficient amount of healthcare organizations in the region is needed for proper implementation but our convenience sample of three local networks only covered a small number of practices and was restricted to one geographic area, and therefore may not be representative of other populations. In conclusion, NPRL1.0 is feasible in daily practice if barriers are overcome and facilitators of development, implementation, and transferability are promoted. The results of this feasibility study were used to adjust education for HCPs, the eHealth application for HCPs and patients, and educational information for patients. These proposed adaptations to NPRL1.0 will facilitate the development of NPRL2.0. Moreover, the results of this feasibility study can assist other healthcare organizations in implementing a transmural network using a similar model.

Chapter 5 describes the pragmatic study protocol of NPRL2.0, presenting a network care approach based on NPRL2.0 and the evaluation of its (cost-) effectiveness. The evaluation had three aims: 1) to study the effectiveness (concerning the functioning and participation of patients) of the treatment in primary care for patients with CMP, comparing care organized following NPRL2.0 with usual care; 2) to study the cost-effectiveness and cost-utility regarding health-related quality of life and healthcare costs; and 3) to study the effect of duration of participation in a local network in primary care. This study comprised two designs: a prospective cohort study and a stepped-wedge design. Within this project, 105 patients had first to be recruited for a prospective cohort study situated in two local primary care networks that had previously participated in

NPRL1.0 and were continuing their participation in NPRL2.0. Secondly, 184 patients were needed to be recruited from six new local primary care networks (April 2019 to December 2020). These practices all started by providing care as usual and then, after training to provide care according to NPRL2.0, switched to the new approach for CMP within their practice. The change in the content of care was approached based on a stepped-wedge design. Patients in both study groups were to complete four questionnaires about health, and societal and medical costs. Outcomes were to be compared using linear mixed-model analyses and costs were to be compared using bootstrapping methods.

We aimed to evaluate NPRL2.0 with regard to the Quadruple Aim: the health of populations, the per capita cost of healthcare, the patient experience of care, and the work-life of HCPs and staff. Unfortunately, due to the COVID-19 pandemic, too few patients were included to reach sufficient power for analysis of health, costs, and patient experiences of care. No final conclusions regarding NPRL2.0 could thus be presented to address these topics.

Chapter 6 reports on the study aiming to provide insight into the perceived changes in interprofessional collaboration practice (ICP) and work satisfaction of HCPs participating in NPRL1.0 and NPRL2.0. In this mixed-methods study, diverse frameworks were used to compose an Integrated ICP and Quadruple Aim framework for analysis. Between 2017 and 2020, eleven semi-structured focus groups and one interview were conducted in two stages. In 2020, the Interprofessional Collaboration Attainment Survey was used to retrospectively measure HCPs' ability to perform ICP before and after receiving NPRL training. In total, 37 HCPs were enrolled, including GPs, therapists, and mental health practice nurses. In conclusion, HCPs described positive experiences but no major changes in ICP and work satisfaction. There is a commitment to interdisciplinary collaborations in primary care to guide patients with CMP. It seems that more time is needed on working in a structure like NPRL but it may result in advantages in ICP and work satisfaction.

Chapter 7 reports on the feasibility of eCoach-Pain, an eHealth application facilitating biopsychosocial care for CMP, for use in interdisciplinary primary care. ECoach-Pain comprises a tool measuring pain complexity, diaries, pain education sessions, monitoring options, and a chat function. The feasibility was assessed by considering learnability, usability, desirability, adherence to the application, and experiences from patients and GPs, mental health practice nurses, and physiotherapists (June to December 2020). Six primary HCPs from two settings participated in the study, recruiting 29 patients. The HCPs together with the software developers participated in two focus groups. ECoach-Pain was perceived to provide additional value to their treatment. However, for optimal use, a case manager is recommended as well, since GPs will not be able keep track of all

these patients in the long term. The deployment of mental health practice nurses should be further investigated as their role was not clear in this study. Patients participated in evaluation questionnaires (n = 11), individual interviews (n = 11), and their eCoach-Pain-use registration data (n = 26) were extracted. Patients saw treatment benefits and they were generally satisfied with the eCoach but they indicated that the current content of eCoach-Pain did not optimally match their complaints. Moreover, communication between HCPs and patients about the use and results of the eCoach should be further improved for future use. Also, the integration of other eHealth applications and electronic patient dossiers with eCoach-Pain should be studied. We recommend improving the implementation strategy and involve a case manager for each patient.

Chapter 8 is general discussion in which the findings are summarized, discussed, and combined into an overall conclusion. Based on the results of this thesis, it has become clear that NPRL is feasible in daily practice when the identified facilitators and barriers are taken into account. In future implementation projects and research, the organization and financing of current care should be further explored and adjusted to facilitate such initiatives. Moreover, the transition from biomedical towards a biopsychosocial orientation in Dutch society should be stimulated to accelerate the adoption of such initiatives.

More enthusiasm for CMP and the organization of interdisciplinary primary care was found among HCPs. Changes in attitudes towards working with a biopsychosocial approach were realized as a result of participation in NPRL. However, optimal implementation of NPRL lagged. Therefore, when implementing interventions in health service delivery, sufficient time and new ways of financing are necessary. As a result of these, the quality of care and the working conditions of HCPs will improve with the successful implementation of these networks.

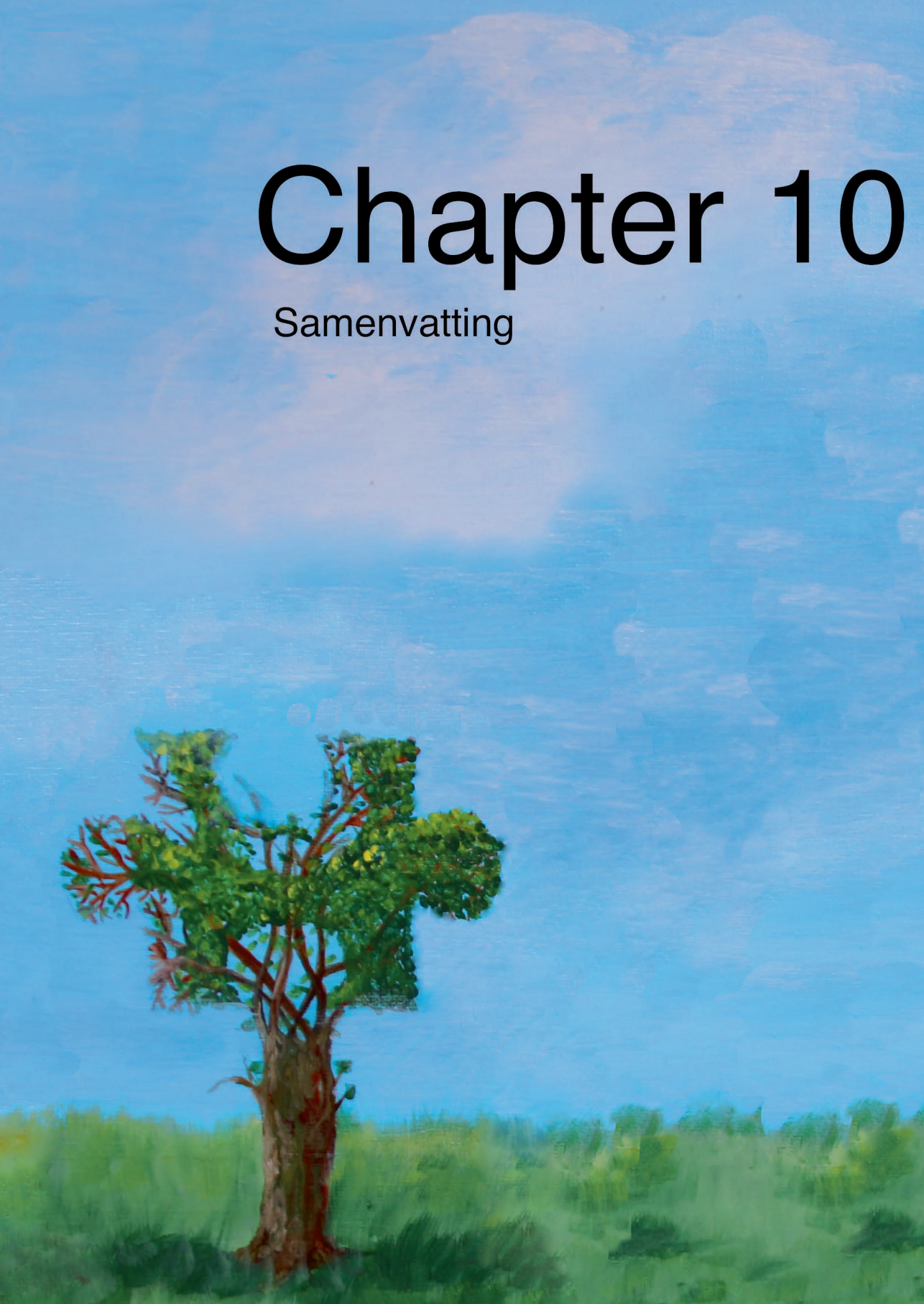
ECoach-Pain has not yet stimulated interdisciplinary collaborations in primary care. The added value of using currently existing eHealth applications for patients with CMP for interdisciplinary primary care should be further studied, as do the possibilities of integrating the use of eCoach-Pain with existing eHealth applications or patient dossiers.

As a reflection on the methodology used, this thesis shows that user-centred designs and mixed methods are suitable for evaluations of health service delivery innovations. The bottom-up design and quantitative evaluation resulted in increased enthusiasm among HCPs for NPRL. For further studies, the use of co-creation and single-case experimental designs to implement and evaluate meaningful interventions in daily practice is recommended. In order to make valid statements about the effects of a new intervention, a broad range of qualitative and quantitative study outcomes, such as those of the Quadruple Aim, should be measured.

In conclusion, the results of this thesis have led to new insights into the role of integrated, interdisciplinary care networks for patients with CMP. The main deliverable of this thesis is a network of HCPs in primary, secondary, and tertiary care, aiming to deliver integrated interdisciplinary care for patients with CMP. Additionally, an education programme is developed for HCPs which focuses on learning to work with a biopsychosocial vision, stimulating early recognition of sub-acute and chronic patients, updating neurophysiology knowledge, and discussing collaboration strategies in primary care. Moreover, a first version of the eCoach-Pain is available for use in primary care for HCPs and patients with CMP. The main conclusions of this thesis are that, with the development of NPRL, important first steps are being taken in the transition of care for patients with CMP but it takes time to change to interdisciplinary collaboration and to shift towards a biopsychosocial vision of HCPs and patients. HCPs show increased enthusiasm for CMP and the organization of interdisciplinary primary care. However, challenges remain in the (financial) organization of care and in the transition from a biomedical to a biopsychosocial orientation in wider Dutch society. Working in this structure seems feasible, but can still be further improved. Additionally, the effectiveness of care delivered in NPRL needs further study.

Chapter 10

Samenvatting



SAMENVATTING

In dit proefschrift is de ontwikkeling en evaluatie van een nieuw netwerk van zorgverleners op het gebied van pijnrevalidatie beschreven. In dit netwerk, genaamd het Netwerk PijnRevalidatie Limburg (NPRL) werken zorgverleners samen, zowel binnen de eerste lijn, alsook tussen de eerste, tweede en derde lijn. Het hoofddoel van dit proefschrift is om de ontwikkeling, implementatie, uitvoerbaarheid en de (kosten-)effectiviteit van NPRL te onderzoeken.

Hoofdstuk 1 is de introductie van dit proefschrift. Hierin zijn de achtergrond en de relevantie van de in dit proefschrift beschreven studies weergegeven. Pijn en bijkomende beperkingen komen veel voor. De meest voorkomende vorm van pijn is chronische musculoskeletale pijn (CMP) ofwel pijn aan het houdings- en bewegingsapparaat. Achttien procent van de volwassen Nederlandse populatie heeft CMP. Door een steeds ouder wordende bevolking, een verhoogde levensverwachting, een stijgend aantal mensen met obesitas en een gebrek aan lichamelijke activiteit wordt verwacht dat dit percentage de komende jaren verder zal stijgen. CMP is complex, omdat zowel biomedische (lichamelijke), psychologische als sociale factoren invloed hebben op niet alleen het ontstaan, maar ook het voortduren van de klachten. Deze biopsychosociale factoren zorgen regelmatig voor een verminderde kwaliteit van leven bij deze patiëntenpopulatie. CMP hangt sterk samen met beperkingen in dagelijks functioneren en is de belangrijkste oorzaak van werkverzuim en arbeidsongeschiktheid. In Nederland zijn de directe (o.a. medisch onderzoek, behandeling, opname) en indirecte (o.a. overleg tussen specialisten, overige organisatiekosten) medische kosten voor CMP ongeveer 20 miljoen euro per jaar. Ondanks deze hoge zorgkosten ervaren patiënten de geboden zorg voor pijn als onvoldoende effectief omdat het vaak niet leidt tot het wegnemen van de pijnklachten. Een patiënt met CMP kan dan ook een lange zoektocht hebben naar de oplossing voor de klachten.

In Nederland zijn de eerste lijn (o.a. huisartsenzorg, fysiotherapie of ergotherapie), tweede lijn (o.a. ziekenhuiszorg), derde lijn (o.a. gespecialiseerde klinieken) en het sociale domein niet goed op elkaar afgestemd wat betreft de zorg voor patiënten met CMP zodat men niet altijd goed met elkaar samenwerkt. Voor een zorgverlener is het vaak niet duidelijk welke behandelinsteek is gevolgd bij andere zorgverleners of zorgorganisaties die de patiënt eerder behandelden waardoor zogenaamde gefragmenteerde zorg kan ontstaan. De verschillende zorglijnen hebben ook verschillende financieringsvormen. Dit maakt het opzetten van samenwerking nog moeilijker. Om de toenemende groep patiënten met CMP beter te kunnen behandelen, moet de zorg anders worden georganiseerd. In het huidige zorgstelsel voelen zorgverleners zichzelf vaak niet voldoende bekwaam om patiënten met chronische complexe ziekten te behandelen, de zelfredzaamheid van patiënten te vergroten en de ICT-systemen

optimaal te benutten. Bovendien ervaren zorgverleners, vooral huisartsen en medisch specialisten, tijdsdruk en een toegenomen administratieve last. Dit geeft een vergroot risico op een burn-out. De huidige manier van organiseren van zorg leidt dus niet alleen tot minder goede zorg voor de patiënt, maar ook tot suboptimale werkomstandigheden voor zorgverleners.

Om een oplossing te vinden voor de hierboven beschreven problemen in de organisatie van zorg heeft de Wereldgezondheidsorganisatie een aanbeveling gedaan voor een gezamenlijke revalidatievisie in en tussen de eerste-, tweede- en derdelijnszorg. Het doel hiervan is dat zorgorganisaties en zorgverleners beter gaan samenwerken. In Nederland is dit voor patiënten met chronische pijn, en dus ook voor CMP, verder uitgewerkt in de Zorgstandaard Chronische Pijn. Deze beschrijft een multidisciplinaire organisatie van zorg in regionale netwerken waarin een biopsychosociale visie gezien wordt als oplossing voor de gefragmenteerde zorg. Het NPRL zoals beschreven in dit proefschrift is een implementatie van de Zorgstandaard Chronische Pijn voor een revalidatiebehandeling van CMP.

De evaluatie van een complex, multidisciplinair netwerk voor patiënten met CMP moet goed aansluiten bij de dagelijkse praktijk. Daarom is gekozen om NPRL te evalueren aan de hand van de Quadruple Aim. Dit is een aanpak om de uitvoering van het zorgstelstel te verbeteren, er van uitgaande dat voor het verbeteren van gezondheidszorg tegelijkertijd vier doelen belangrijk zijn: het verbeteren van de gezondheid van patiënten, verminderen van de zorgkosten, verbeteren van de patiëntervaringen en het verbeteren van de werkomstandigheden van zorgpersoneel.

Bovendien adviseert de Wereldgezondheidsorganisatie digitale gezondheidssystemen (eHealth) te integreren in de zorg om de continuïteit van de zorg in de toekomst te garanderen. EHealth kan verschillende voordelen hebben voor patiënten en het zorgstelsel, zoals het verbeteren van de toegankelijkheid en verlagen van de kosten van de gezondheidszorg. Met dit doel zijn er al diverse eHealth applicaties voor patiënten met CMP ontwikkeld. Voorbeelden hiervan zijn webpagina's met educatie, online-behandelingen en videobellen met zorgverleners. Echter, het gebruik van eHealth in interdisciplinaire zorg, waarbij verschillende zorgverleners hetzelfde behandeldoel voor de patiënt hebben, dient nog verder te worden ontwikkeld en geëvalueerd.

In **hoofdstuk 2** zijn de resultaten van een systematisch uitgevoerde literatuuronderzoek weergegeven. Allereerst worden bestaande revalidatienetwerken in en tussen de eerste lijn en andere zorglijnen voor patiënten met CMP gepresenteerd. Vervolgens is ook de impact van deze netwerken op de verschillende Quadruple Aim uitkomsten (de gezondheid van patiënten, de zorgkosten, de patiëntervaringen en de werkomstandigheden van zorgpersoneel) bestudeerd. In dit literatuuronderzoek zijn studies

meegenomen welke voornamelijk patiënten met CMP bevatten en waarbij de interventie was bedoeld voor de eerste lijn, of een combinatie van de eerste lijn en andere zorglijnen. Bovendien moesten de interventies een revalidatiedoel hebben en een interdisciplinair zorgnetwerk vormen waarbij minstens drie zorgdisciplines samenwerkten met een gemeenschappelijk doel voor de patiënt. Enkel originele beschrijvingen van interventies in het Engels, Duits of Nederlands en gepubliceerd tussen 1 januari 1994 en 14 november 2019 zijn meegenomen. Er is gezocht in de databases PubMed, CINAHL, Web of Science en PsychInfo. Referentielijsten van geïncludeerde studies zijn eveneens bekeken.

Negenenveertig artikelen zijn geïncludeerd. Deze artikelen beschrijven 34 verschillende interventies. Hiervan beschrijven 21 interventies een samenwerkingsvorm van zorgverleners in de eerste lijn, zoals verschillende therapeuten en praktijkondersteuners, huisartsen of psychologen. Daarnaast zijn zes interventies gevonden welke een samenwerking tussen eerstelijnszorg en tweede lijn- of derde lijn beschrijven. Voorbeelden hiervan zijn samenwerkingen tussen een huisarts met een therapeut, praktijkondersteuner, orthopedisch chirurg of met uitgebreide revalidatieteams. Eén beschreven interventie vond plaats in een interdisciplinaire pijnkliniek in de eerste lijn waar therapeuten, die normaal gesproken werken in zowel eerstelijns- als tweede-/derdelijns zorginstellingen, samen de behandeling gaven. Twee interventies zijn samenwerkingen tussen de eerstelijnszorg en het sociale domein en bestonden uit verschillende therapeuten, een psycholoog en een casemanager. Twee andere interventies bestonden uit samenwerkingen tussen eerstelijns-, tweede-/derdelijnszorg en het sociale domein. Bij deze interventies is ook een arboarts in de samenwerking betrokken. De laatste twee interventies zijn samenwerkingen tussen eerstelijnszorg en publieke initiatieven. Hierin werken fitness instructeurs en telefoon-coaches met therapeuten uit de eerste lijn. De inhoud van de 34 interventies verschilt tussen het gezamenlijk uitvoeren van enkel de intake tot het geven van een hele interdisciplinaire behandeling.

De 49 gevonden artikelen gebruikten verschillende studie-designs:

- 19 gerandomiseerde studies (waarbij patiënten op basis van toeval de interventie kregen of niet),
- 12 niet-gerandomiseerde studies (waarbij patiënten op basis van karakteristieken de interventie kregen of niet),
- 7 kwalitatieve studies (waarbij patiënten of zorgverleners onder andere werden geïnterviewd),
- 7 studieprotocollen,
- 1 beschrijving van een interventie (zonder metingen bij patiënten of zorgverleners),
- 2 studies met een gemixte studiepopulatie (zowel patiënten met CMP als andere doelgroepen),

- 1 studie over belemmerde en stimulerende factoren van de interventie.

Hiervan hadden 39 artikelen in ieder geval één van de Quadruple Aim uitkomsten als belangrijkste uitkomstmaat. Achttien artikelen beschreven gezondheidsuitkomsten, 12 artikelen beschreven kosten, vier beschreven patiëntervaringen en vijf artikelen beschreven de werkomstandigheden van zorgpersoneel.

Onze conclusie was dat grote variatie bestaat in inhoud, samenwerkingsvormen en manier van evalueren van deze interdisciplinaire revalidatie interventies. De meeste interventies bestonden uit een samenwerking in de eerste lijn; er waren minder interventies met een samenwerking tussen de eerste lijn en andere zorglijnen. Interventies met meerdere zorgdisciplines en interventies met een uitgebreide inhoud en duur van behandeling lieten veelbelovendere resultaten zien vergeleken met de standaard zorg.

In **hoofdstuk 3** wordt de inhoud van het Netwerk Pijnrevalidatie Limburg 1.0 (NPRL1.0) beschreven en het protocol om de uitvoerbaarheid van NPRL1.0 te evalueren. Het NPRL1.0 is de originele versie van een transmuraal zorgnetwerk, tussen alle zorglijnen, welke geïntegreerde revalidatiezorg voor patiënten met CMP levert. NPRL1.0 heeft een biopsychosociale aanpak en is uitgevoerd in de provincie Limburg, Nederland. Interdisciplinaire samenwerking tussen de zorgverleners van verschillende disciplines is een belangrijk doel. Dit wordt gestimuleerd door het organiseren van informatieve bijeenkomsten en scholingsdagen voor zorgverleners en het opstellen van behandelprotocollen en handleidingen. Ook is een eHealth applicatie ontwikkeld met het doel de patiënt meer eigen regie te geven over de behandeling en de communicatie tussen patiënten en zorgverleners te stimuleren. Het doel van deze studie is het verkrijgen van inzicht in de barrières en stimulerende factoren, ervaren meerwaarde, acceptatie en het effect van de implementatiestrategie van NPRL1.0 Dit is geëvalueerd met een iteratief user-centered design met drie fases. Dit betekent dat de zorgverleners in alle drie de fases kwantitatieve (middels vragenlijsten) en kwalitatieve (middels groepsinterviews) feedback geven op de implementatie en uitvoerbaarheid van NPRL1.0 waarna, zo nodig, aanpassingen plaatsvinden. In fase 1 is NPRL1.0 ontwikkeld en zijn de zorgverleners geschoold. In Fase 2 lag de focus op de implementatie en fase 3 op de mogelijkheid om NPRL1.0 uit te breiden naar andere zorgorganisaties. Ook is data verzameld over de verandering in de gezondheid, werkstatus en participatie van patiënten. Voor de analyse van de kwalitatieve data werd het Consolidated Framework for Implementation Research (CFIR) gebruikt om de factoren die de implementatie van NPRL1.0 beïnvloedden duidelijk in kaart te brengen. De resultaten van elke fase van deze uitvoerbaarheidsstudie zijn gebruikt om het ontwerp en de inhoud van NPRL1.0 aan te passen aan de dagelijkse praktijk en verder door te ontwikkelen. Tevens kunnen zij als inspiratie dienen voor toekomstige studies welke een transmuraal zorgnetwerk willen ontwikkelen en implementeren.

In **hoofdstuk 4** worden de resultaten van de uitvoerbaarheidsstudie (oktober 2017 – oktober 2018) beschreven. Het doel was om de barrières en stimulerende factoren van de ontwikkeling, implementatie en uitbreidingsmogelijkheden in kaart te brengen. Zoals in hoofdstuk 3 beschreven werd de studie uitgevoerd met een iteratief user-centered design met drie fases, waarin de zorgverleners meerdere malen feedback gaven op NPRL1.0 In NPRL1.0 deden twee gespecialiseerde revalidatie-instellingen, drie lokale eerstelijnsnetwerken met elk een huisarts, praktijkondersteuner-GGZ en een fysiotherapeut of oefentherapeut mee. Deze zorgverleners, samen met een steekproef van alle deelnemende patiënten, werd gevraagd aan de evaluaties deel te nemen. De evaluaties bestonden uit interviews, focusgroepen en observaties. Overleggen werden opgenomen en aantekeningen werden gemaakt. Het CFIR werd gebruikt als leidraad voor de analyses. Zoals in hoofdstuk 3 beschreven, werden de resultaten van elke fase gebruikt om voor de volgende fase aanpassingen te doen aan NPRL1.0. Aan het eind van de studie werden de resultaten gebruikt om aanbevelingen voor doorontwikkeling van NPRL te geven. In totaal zijn er vijf focusgroepen en zes interviews met 21 zorgverleners van verschillende disciplines gehouden. Bovendien vond één focusgroep plaats met zes patiënten. Stimulerende factoren die genoemd werden waren een consistente en transparante manier van samenwerken, het spreken van dezelfde (biopsychosociale) taal en het werken met behandelprotocollen. Een belangrijke stimulerende factor in de ontwikkeling en implementatie van NPRL1.0 was, volgens de zorgverleners, het iteratieve user-centered design. Deze bottom-up benadering gaf zorgverleners en patiënten inspraak in de ontwikkeling van NPRL1.0 waardoor het netwerk beter bruikbaar werd in de dagelijkse praktijk en geaccepteerd werd door de betrokken zorgverleners. Een barrière in de implementatie was het stigma dat er in de maatschappij ligt op CMP. Patiënten verwachten een oplossing voor hun CMP-problemen die de pijn weg neemt. Echter, blijkt dit helaas vaak niet mogelijk. Deze verwachting maakte het zorgverleners lastig om vast te houden aan een biopsychosociale behandeling. Bovendien belemmerd de huidige organisatie en financiering van zorg, inclusief de cultuur, structuur en financiering van zorginstellingen, de implementatie van NPRL1.0 in en tussen praktijken. Ook zijn voldoende zorgorganisaties in de regio nodig voor een goede implementatie. In onze steekproef van drie lokale netwerken namen slechts een klein deel van het aantal aanwezige praktijken in de regio deel. Omdat het netwerk actief was in één klein geografisch gebied is de steekproef mogelijk niet representatief voor andere regio's. Concluderend is het NPRL1.0 uitvoerbaar in de dagelijkse praktijk als voldoende rekening wordt gehouden met de barrières en als de stimulerende factoren voor de ontwikkeling, implementatie en uitbreidingsmogelijkheden gepromoot worden. Voor het vervolg zijn de resultaten van deze uitvoerbaarheidsstudie gebruikt om de educatie voor zorgverleners en patiënten en de eHealth applicatie voor zorgverleners verder te verbeteren. De voorgestelde aanpassingen aan NPRL1.0 werden gebruikt om NPRL2.0 vorm te geven. Bovendien kunnen de resultaten van deze studie gebruikt worden om andere zorgorganisaties te

ondersteunen in het implementeren van een transmuraal netwerk met een vergelijkbaar model.

In **hoofdstuk 5** wordt het studieprotocol beschreven voor de pragmatische evaluatie van de (kosten-)effectiviteit van NPRL2.0 De evaluatie had drie doelen: 1) het bestuderen van de effectiviteit (ten aanzien van functioneren en participeren van patiënten) van de behandeling in de eerste lijn voor patiënten met CMP volgens NPRL2.0 vergeleken met de gebruikelijke zorg; 2) het bestuderen van de kosteneffectiviteit en kosten-utiliteit ten aanzien van gezondheid gerelateerde kwaliteit van leven en zorgkosten; 3) het bestuderen van de invloed van langer deelnemen in een lokaal eerstelijnszorg netwerk op de verschillende uitkomstmaten. Deze studie bevatte twee designs: 1) een prospectieve cohortstudie waarin de deelnemende lokale netwerken uit NPRL1.0 langere tijd gevolgd werden; 2) een stepped-wedge design waarin nieuwe lokale netwerken stapsgewijs NPRL2.0 gingen implementeren; in de eerste fase startten deze nieuwe praktijken met het leveren van zorg zoals ze altijd deden. Daarna kregen ze scholing waarna ze vervolgens gingen werken volgens de principes van NPRL2.0. Op basis van een powercalculatie werd berekend dat in het prospectieve cohort met de twee eerder deelnemende lokale netwerken 105 patiënten zouden moeten worden geïncludeerd. In het stepped-wedge design moesten 184 patiënten in zes nieuwe lokale netwerken (april 2019 – december 2020) geïncludeerd worden. Patiënten die meededen in één van beide studieonderdelen vulden vier vragenlijsten over hun gezondheid en maatschappelijke- en medische kosten in. Uitkomsten zouden worden geëvalueerd door lineaire mixed-modellen en kosten werden vergeleken met bootstrapping methodes.

Het doel was om NPRL2.0 te evalueren aan de hand van de Quadruple Aim: de gezondheid van de populatie, de kosten van de zorg, de patiënttevredenheid en de werktevredenheid van zorgverleners. Helaas werden er door de COVID-19 pandemie niet genoeg patiënten aangemeld om de gezondheid, kosten en patiënttevredenheid te kunnen analyseren. Ook werd de zorg te veel beïnvloed door COVID-19 waardoor geen goede representatie van de pijnzorg kon worden gegeven. Daarom konden de vragen, die we ons hadden gesteld over deze onderwerpen voor NPRL2.0 (nog) niet worden beantwoord.

Hoofdstuk 6 beschrijft een studie met het doel inzicht te krijgen in de ervaren veranderingen in interprofessioneel samenwerken en werktevredenheid van zorgverleners deelnemend aan NPRL1.0 en NPRL2.0 In deze mixed-methods studie, met verschillende methoden van dataverzameling (zoals een vragenlijst, interview en focusgroep), is één leidend raamwerk samengesteld over interprofessioneel samenwerken en de Quadruple Aim. Dit nieuwe raamwerk is gebruikt voor de analyse. Tussen 2017 en 2020 zijn er 11 semigestructureerde focusgroepen en één interview uitgevoerd. Bovendien is in 2020 het vermogen van zorgverleners om interprofessioneel

samen te werken gemeten met behulp van de Interprofessional Collaboration Attainment Survey. Zorgverleners gaven daarin een oordeel over hun samenwerkingsvermogen voor deelname aan de scholing en daarna. In totaal deden 37 zorgverleners, zoals huisartsen, therapeuten en prakijkondersteuners-GGZ mee. Samengevat benoemden zorgverleners positieve ervaringen, maar er waren geen grote veranderingen in interprofessioneel samenwerken en werktevredenheid. De zorgverleners waren het wel met elkaar eens dat, in de begeleiding van patiënten met CMP, interdisciplinair samenwerken in de eerste lijn waardevol is. Meer tijd is nodig om de voordelen op het gebied van interprofessioneel samenwerken en werktevredenheid in een structuur zoals NPRL te ervaren.

Hoofdstuk 7 beschrijft de uitvoerbaarheid van de implementatie en gebruik van de eCoach-Pijn, een eHealth applicatie welke biopsychosociale zorg voor CMP in interdisciplinaire eerstelijnszorg stimuleert (juni 2020 – december 2020). De eCoach-Pijn is een tool voor patiënten en zorgverleners. Hiermee kan de complexiteit van de pijnklachten gemeten worden doordat patiënten dagboeken invullen. Ook kunnen patiënten met behulp van pijneducatie leren over chronische pijn. Bovendien bevat de eCoach-Pijn een chat-functie tussen patiënten en zorgverleners. De uitvoerbaarheid is bestudeerd aan de hand van de leerbaarheid, bruikbaarheid, wenselijkheid, gebruik van de applicatie en ervaringen van patiënten, huisartsen, praktijkondersteuners-GGZ en fysiotherapeuten. Zes eerstelijns zorgverleners van twee lokale netwerken namen deel aan de studie; zij meldden 29 patiënten aan. De zorgverleners namen samen met de softwareontwikkelaars deel aan twee focusgroepen. De eCoach-Pijn werd ervaren als toegevoegde waarde voor de behandeling. Echter, voor optimaal gebruik werd een casemanager aanbevolen. Huisartsen bleken niet of onvoldoende in staat om patiënten goed te volgen op de lange termijn. De rol van de deelnemende praktijkondersteuners-GGZ met de eCoach-Pijn moet verder onderzocht worden omdat ze hun rol in deze studie niet duidelijk vonden. Patiënten namen deel door het invullen van vragenlijsten (n = 11), het participeren in individuele interviews (n=11) en het gebruik van de data over het eCoach-Pijn-gebruik (n=26). Patiënten zagen voordelen voor de behandeling en waren over het algemeen tevreden over de eCoach-Pijn. Ze gaven echter ook aan dat de huidige eCoach-Pijn niet optimaal past bij hun klachten. Voor vervolg is het belangrijk de communicatie tussen zorgverleners en patiënten over het gebruik en de resultaten van de eCoach-Pijn te verbeteren. Ook moet gekeken worden naar de integratie van de eCoach-Pijn met bestaande elektronische patiëntendossiers. We bevelen aan om de implementatiestrategie te verbeteren en een casemanager te betrekken.

Hoofdstuk 8 bevat de algemene discussie van deze thesis waarin de bevindingen worden samengevat, bediscussieerd en overkoepelende conclusies worden getrokken. De resultaten uit deze thesis laten zien dat NPRL uitvoerbaar is in de dagelijkse praktijk als de gevonden stimulerende factoren en barrières worden meegenomen. Ten bate van toekomstige onderzoeken moet de organisatie en financiering van de huidige zorg

aangepast worden om zo deze nieuwe initiatieven te kunnen faciliteren. Bovendien is het van belang de transitie van biomedische naar biopsychosociale oriëntatie in de Nederlandse samenleving te stimuleren om soortgelijke initiatieven sneller te kunnen implementeren.

Deelnemende zorgverleners waren meer enthousiast voor de behandeling en begeleiding van patiënten met CMP en de organisatie voor interdisciplinaire eerstelijns zorg. Door deelname aan NPRL veranderde de attitude waardoor meer draagvlak ontstond voor een biopsychosociale aanpak. Echter, optimale implementatie van NPRL ging minder snel dan gedacht en vergt dus meer tijd. Er wordt verwacht dat de kwaliteit van de zorg en de werkomstandigheden van zorgverleners verbeteren bij succesvolle implementatie van netwerken.

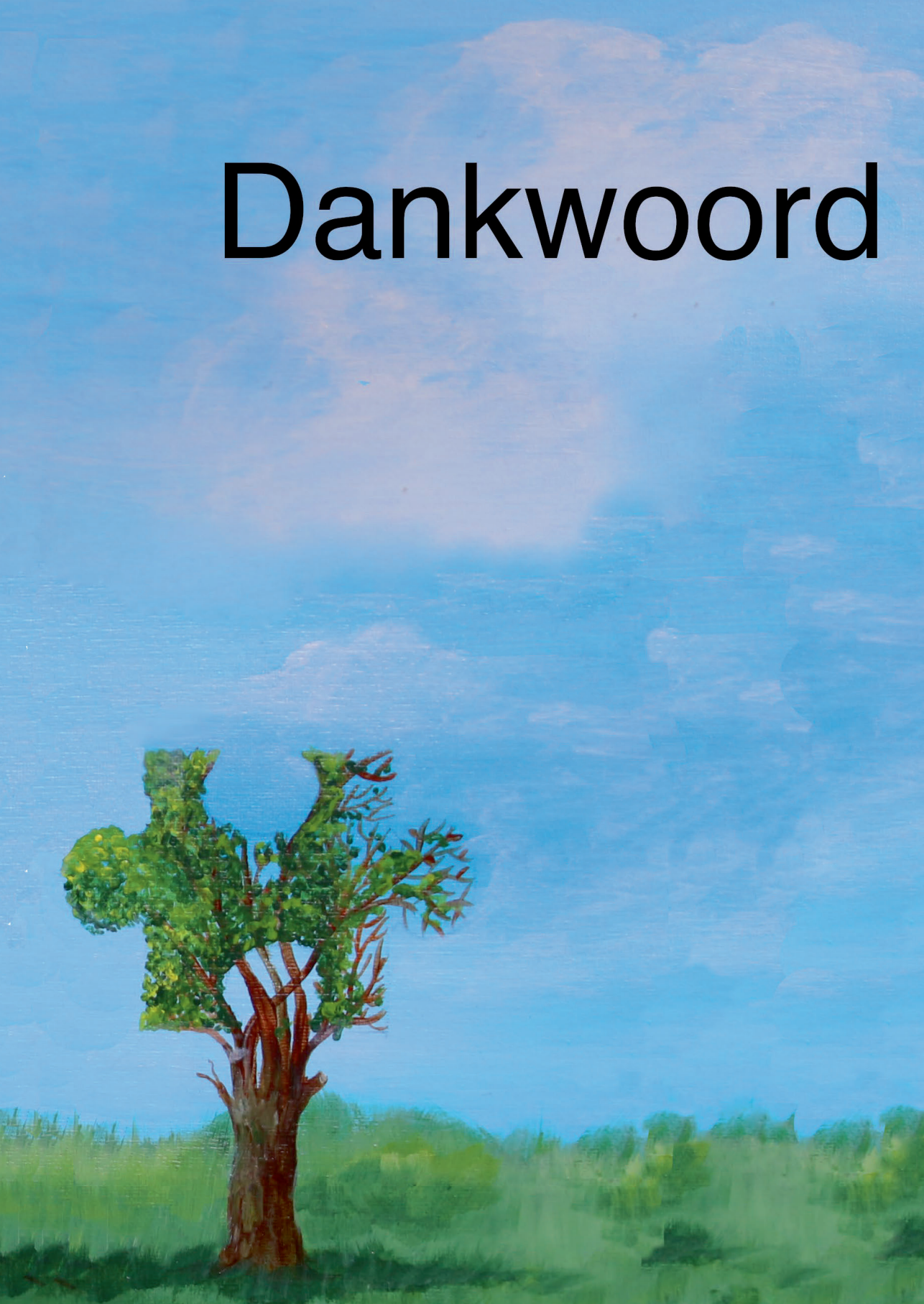
De eCoach-Pijn heeft interdisciplinair samenwerken, met zorgverleners van verschillende disciplines, in de eerstelijnszorg nog niet verbeterd. De toegevoegde waarde van de al bestaande eHealth applicaties voor patiënten met CMP moet bestudeerd worden om deze te vergelijken met de eCoach-Pijn. Evenals de mogelijkheid om de eCoach-Pijn te integreren in al bestaande eHealth applicaties of patiëntendossiers.

De eerder beschreven user-centered designs en mixed-methods zijn passend voor de evaluatie van innovaties in de organisatie van zorg. De bottom-up designs, waarbij zorgverleners en patiënten vanaf het begin hebben kunnen meedenken over de vormgeving van NPRL en de deelname aan interviews en focusgroepen, vergrootten het enthousiasme van de zorgverleners voor deelname aan NPRL. Voor toekomstige studies wordt voor het implementeren en evalueren van betekenisvolle interventies in de dagelijkse praktijk co-creatie geadviseerd, waarbij diverse stakeholders de interventie mee ontwikkelen. Bovendien wordt een single-case experimenteel onderzoek aanbevolen, waarin een kleine groep patiënten intensief wordt gevolgd gedurende een traject waarin een behandeling wordt gestart en ze veel metingen ondergaan. Om de effecten van een nieuwe interventie inzichtelijk te maken wordt aanbevolen een uitgebreide set aan kwalitatieve en kwantitatieve studie uitkomsten, bijvoorbeeld gebaseerd op de Quadruple Aim, te meten.

Samenvattend hebben de resultaten van deze thesis geleid tot nieuwe inzichten in de rol van geïntegreerde interdisciplinaire zorgnetwerken voor patiënten met CMP. De belangrijkste opbrengst van deze thesis is een netwerk van zorgverleners in de eerste, tweede, en derde lijnszorg die samenwerken om geïntegreerde interdisciplinaire zorg te leveren voor patiënten met CMP. Daarnaast is een scholingsprogramma voor zorgverleners ontwikkeld over het werken volgens een biopsychosociale visie, de van vroege herkenning van subacute en chronische patiënten, een update van de neurofysiologische kennis, en een discussie over strategieën voor interdisciplinair

samenwerken in de eerste lijn. Ook is een eerste versie van de eCoach-Pijn ontwikkeld en beschikbaar voor gebruik in de eerste lijn. De belangrijkste conclusie van deze thesis is dat door de ontwikkeling van NPRL belangrijke eerste stappen zijn gezet in de organisatie en uiteindelijk ook transitie van zorg voor patiënten met CMP. Maar het kost tijd om veranderingen in de interdisciplinaire samenwerking en de verandering naar een biopsychosociale visie van zorgverleners en patiënten te bewerkstelligen. Zorgverleners toonden veel enthousiasme voor CMP en de organisatie van interdisciplinaire eerstelijnszorg. Echter uitdagingen bestaan in de (financiële) organisatie van zorg en de transitie van een biomedische naar een biopsychosociale oriëntatie van de Nederlandse maatschappij. Werken in deze constructie lijkt uitvoerbaar, maar kan nog worden verbeterd in de toekomst. Bovendien moet de effectiviteit van zorg geleverd in NPRL verder bestudeerd worden.

Dankwoord



DANKWOORD

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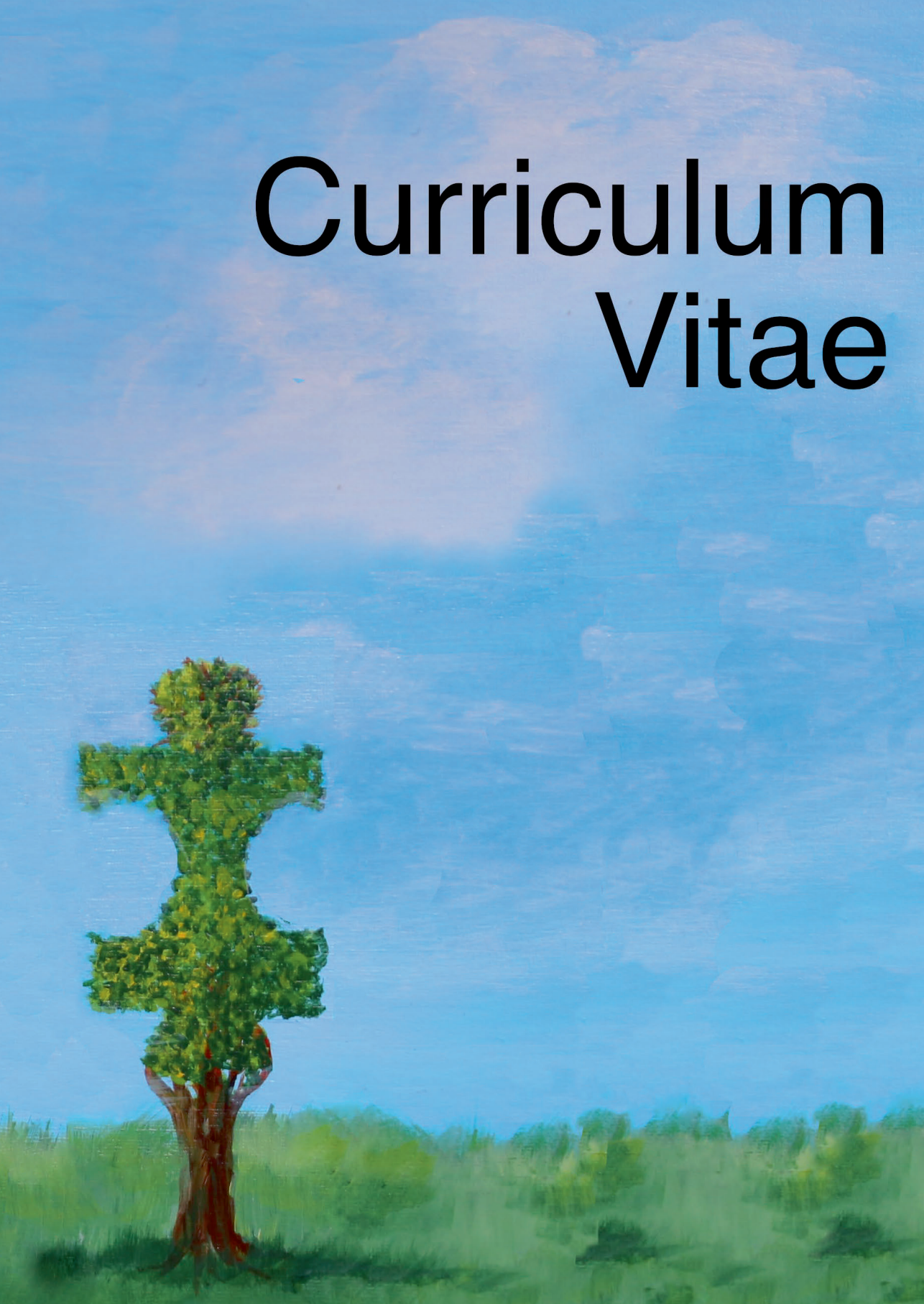
Curriculum Vitae



CURRICULUM VITAE

Cynthia Lamper was born on October 30th 1992 in Goes, the Netherlands. She graduated from pre-university education (VWO) at Pontes “Het Goese Lyceum” in 2011. Thereafter, she obtained her bachelor’s and master’s degree Biomedical Sciences in 2015 and 2016 from Radboud University, Nijmegen. During her master she attended the specialisation Clinical Human Movement Sciences with a track in science communication. She performed her bachelor internship at rehabilitation centre Sint Maartenskliniek, Nijmegen. The topic was on the development of a new gait analysis set-up. Her first master internship was performed at the Developmental Pathways for Health Research Unit of University of Witwatersrand, Johannesburg, South Africa. The topic of this communication internship was on the development of a webpage about obesity in South Africa. The Academic workplace AMPHI, a collaboration between the department of Primary Healthcare of Radboud University and several public healthcare organizations (Dutch: GGD), was the place for Cynthia’s second master internship. The topic of this internship was on the study of the effectiveness of neighbourhood sports coaches (Dutch: Buurtsportcoaches). During these internships in rehabilitation, primary care, and public health, her interest in a combination of these topics was born. She applied for a junior researcher position at the Network Pain Rehabilitation Limburg of Maastricht University in 2017, which became a PhD position in 2018. The content and results of this project are described in this dissertation. Currently, she continues her work as a post-doc at the Department of Rehabilitation Medicine at Maastricht University. With the expertise developed during her PhD project, she strengthens two projects on the topic of organization of rehabilitation care in which two new networks will be developed and tested: a network for patients with chronic musculoskeletal pain in primary care and a transmural rehabilitation network for patients with Long-COVID.

Peer reviewed publications

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Submitted manuscripts

Lamper C, Kroese M, de Mooij M, Verbunt J, Huijnen I. (submitted) Healthcare professionals' collaboration and satisfaction within an innovative primary care network for patients with chronic musculoskeletal pain: a mixed method study.

Other publications

Huijnen IPJ, Köke AJA, **Lamper C**, Verbunt JAMCF. (2022) The organisation of biopsychosocial pain rehabilitation treatment; who should deliver?, European Journal of Physiotherapy, 24:4, 195-196,

Lamper C, Huijnen IPJ, Köke AJA, Verbunt JAMCF. De eerste resultaten van het Netwerk Pijnrevalidatie Limburg: een transmuraal netwerk voor mensen met chronische pijn. Nederlands Tijdschrift voor Revalidatiegeneeskunde; februari 2020

Huijnen I, Köke A, **Lamper C**, Verbunt J. Kan de revalidatiezorg voor patiënten met chronische pijn doelmatiger worden ingericht door samen te werken? Nederlandstalig Tijdschrift Pijnbestrijding, 38 (75), 2019

Presentations at (international) scientific meetings

May 2022: Pain Science in Motion, Maastricht, the Netherlands. Oral presentation. “An eCoach-Pain for Patients with Chronic Musculoskeletal Pain in Interdisciplinary Primary Care: A Feasibility Study” and Poster presentation “Interdisciplinary Care Networks in Rehabilitation Care for Patients with Chronic Musculoskeletal Pain: A Systematic Review”.

October 2020: Pijn Alliantie in Nederland, online, the Netherlands. Poster publication. “The (cost-) effectiveness of primary care for patients with chronic musculoskeletal pain following Network Pain Rehabilitation Limburg: protocol of a pragmatic trial” and “Developing the Network Pain Rehabilitation Limburg: Results of a feasibility study”.

November 2020: DCRM congress, online, the Netherlands. Workshop with oral presentation “Resultaten van een transmuraal netwerk voor chronische pijn: Netwerk Pijnrevalidatie Limburg”. In collaboration with: Prof. Dr. C. Paul van Wilgen, Dr. V.A.E. Baadjou MD, Dr.ir. W. d'Hollosy, and Dr. I.P.J. Huijnen.

March 2020: Belgian Pain Society Young Researchers Day, Brussel, Belgium. Oral presentation “Developing the Network Pain Rehabilitation Limburg: Results of a feasibility study” and Poster presentation “Design phase 2 Network Pain Rehabilitation Limburg”.

September 2019: EFIC, Valencia, Spain. Oral presentation. “Developing the Network Pain Rehabilitation Limburg: Results of a feasibility study”.
November 2018: DCRM congress, Groningen, the Netherlands. Oral presentation “The Network Pain Rehabilitation Limburg; an example of a stepped care transmural network”.

May 2018: Care Days, ‘s Hertogenbosch, the Netherlands. Oral presentation “Network Pain Rehabilitation Limburg: a feasibility study”.
November 2017: CAPHRI day, Valkenburg, the Netherlands. Poster presentation “Network Pain Rehabilitation Limburg: protocol feasibility study”.