

Direct triaging to physiotherapist in primary care

Development and evaluation of a triage model

Lena Bornhöft

Department of Health and Rehabilitation
Institute of Neuroscience and Physiology
Sahlgrenska Academy, University of Gothenburg



UNIVERSITY OF GOTHENBURG

Gothenburg 2019

Cover illustration: Bränna view by Alva Bornhöft

**Direct triaging to physiotherapist in primary care – development
and evaluation of a triage model**

© Lena Bornhöft 2019

Lena.bornhoft@vgregion.se

ISBN 978-91-7833-388-2 (PRINT)

ISBN 978-91-7833-389-9 (PDF)

Printed in Gothenburg, Sweden 2019

Printed by BrandFactory

In memory of my parents who would have
liked to share this moment with me.

Believe you can and you are half-way there

- *Theodore Roosevelt*

ABSTRACT

Background: There is evidence that early contact with physiotherapists leads to advantages for patients with musculoskeletal disorders. Many patients, however, initially seek contact with general practitioners (GPs) within primary care for musculoskeletal disorders. This often delays or replaces physiotherapist contact. Management interventions which ensure that appropriate patients are initially examined by physiotherapists may lead to advantages for patients, the healthcare system and the community.

Aim: The general aim for this thesis was to develop a triage model for primary care with focus on musculoskeletal disorders and evaluate its effects on patients' health and attitudes as well as on its effects for other relevant stake-holders.

Methods: Paper I is a descriptive study examining the development process of the triage model and its effects on access and efficiency at a primary healthcare centre. Paper II is a case-control study which compares the utilization of medical services between patients with musculoskeletal disorders, who were triaged directly to physiotherapist for initial assessment and treatment, and similar patients who were initially assessed by a GP. Paper III is based on a randomized controlled trial (RCT) and evaluates the effects of direct triaging to physiotherapist on patients' health and attitudes. Paper IV is a cost-effectiveness assessment, which compares the costs in relation to health effects for patients who have been triaged directly to physiotherapists, and is based on the same RCT as Paper III.

Results: The triage model led to increased access, more efficient use of the personnel, greater patient satisfaction and a better work environment compared with the traditional primary care management model which was employed earlier. Patients who were triaged directly to physiotherapists utilized significantly fewer medical services during the following year compared to patients with initial contact with GPs in the retrospective study. Various health aspects, such as progression of pain, function and risk for chronicity, showed common tendencies to better values for the group initially assessed by physiotherapists in the RCT, and health-related quality of life was significantly improved. It is unclear how patient attitudes of responsibility for musculoskeletal disorders were affected by triaging to physiotherapists. The cost-efficiency assessment favoured triaging to physiotherapists over traditional

management, showing greater health gains at lower costs from a societal perspective.

Conclusions: Many positive effects of triaging directly to physiotherapists in primary care were found for patients, the healthcare organization and society. The studies in this thesis contribute to a small but growing bank of knowledge about the advantages of using physiotherapists as initial assessors in primary care. The triage model studied here seems to offer a feasible alternative to traditional management of musculoskeletal disorders within primary care.

Keywords: Physiotherapy, primary care, triage, musculoskeletal disorders

ISBN 978-91-7833-388-2 (PRINT)

ISBN 978-91-7833-389-9 (PDF)

Sammanfattning på svenska

Bakgrund: Det finns evidens för att tidig kontakt med fysioterapeuter leder till fördelar för patienter med muskuloskeletala besvär. Dock söker många patienter först kontakt med läkare i primärvård även för muskuloskeletala besvär. Detta kan fördröja eller ersätta kontakt med fysioterapeuter. Det är möjligt att arbetsorganisatoriska interventioner som inkluderar primär fysioterapeutundersökning av lämpliga patienter kan leda till fördelar för patienter, sjukvårdssystemet och samhället.

Syfte: Det övergripande syfte för avhandlingen var att utveckla en triagemodell för primärvård med fokus på muskuloskeletala besvär och utvärdera effekterna på patienters hälsa och attityder och på effekterna för relevanta intressenter.

Metoder: Artikel I är en beskrivande studie som undersöker utvecklingsprocessen för triagemodellen och utvärderar effekterna på tillgänglighet och effektivitet på en vårdcentral. Artikel II är en fall-kontrollstudie där utnyttjande av sjukvårdsinsatser jämförs mellan patienter med muskuloskeletala besvär som triagerades direkt till fysioterapeuter för första undersökning och behandling och liknande patienter som undersöktes primärt av läkare i primärvård. Artikel III baseras på en randomiserad kontrollerad studie (RCT) och den utvärderar effekterna av direkttriagering till fysioterapeut på patienternas hälsa och attityder. Artikel IV är en kostnadseffektivitetsstudie som jämför kostnader i förhållande till hälsoeffekter för patienter som har triagerats direkt till fysioterapeuter. Denna studie baseras på samma RCT som Artikel III.

Resultat: Triagemodellen ledde till ökad tillgänglighet, mer effektiv användning av personalen, högre patientnöjdhet och en bättre arbetsmiljö jämfört med den traditionella primärvårdsorganisation som tillämpades tidigare. Patienter som triagerades direkt till fysioterapeut hade färre läkarbesök och -insatser under följande år jämfört med patienter som hade initial kontakt med läkare i den retrospektiva studien. Ett flertal hälsoaspekter såsom smärta, funktion och risk för att utveckla långvariga besvär visade konsekventa tendenser till bättre värden i gruppen som triagerades till fysioterapeuter i RCTn och en signifikant förbättring uppnåddes för hälsorelaterad livskvalitet. Det är oklart hur patienternas uppfattningar om ansvar för muskuloskeletala besvär påverkades av triagering till fysioterapeut. Kostnadseffektivitetsanalysen visade att triagering till fysioterapeut ledde till större förbättringar i hälsan på lägre kostnader från ett samhällsperspektiv.

Slutsatser: Triagering direkt till fysioterapeuter i primärvård ledde till många positiva effekter för patienterna, sjukvården och samhället. Studierna i avhandlingen bidrar till ett litet men växande kunskapsunderlag som handlar om fördelarna kopplade till fysioterapeuters roll som första bedömare i primärvård. Triagemodellen som undersöktes här verkar vara en framkomlig alternativ till den traditionella arbetsorganisationsmodellen för behandling av patienter med muskuloskeletala besvär i primärvården.

List of papers

This thesis is based on the following studies, referred to in the text by their Roman numerals.

- I. Thorn J, Maun A, **Bornhöft L**, Kornbakk M, Wedham S, Zaffar M, Thanner C. Increased access rate to a primary health-care centre by introducing a structured patient sorting system developed to make the most efficient use of the personnel: a pilot study. *Health Management Research Services* 2010; 23: 166-171.
- II. **Bornhöft L**, Larsson MEH, Thorn J. Physiotherapy in Primary Care Triage – the effects on utilization of medical services at primary health care clinics by patients and sub-groups of patients with musculoskeletal disorders: a case-control study. *Physiotherapy Theory and Practice* 2015; 31 (1): 45-52.
- III. **Bornhöft L**, Larsson MEH, Nordeman L, Eggertsen R, Thorn J. Health effects of direct triaging to physiotherapists in primary care for patients with musculoskeletal disorders: a pragmatic randomised controlled trial. *Therapeutic Advances in Musculoskeletal Disease* 2019; 11: 1-13.
- IV. **Bornhöft L**, Thorn J, Svensson M, Nordeman L, Eggertsen R, Larsson MEH. More cost-effective management of patients with musculoskeletal disorders in primary care after direct triaging to physiotherapists for initial assessment compared to initial general practitioner assessment. *Submitted*.

Content

ABBREVIATIONS	VII
DEFINITIONS IN SHORT	IX
INTRODUCTION	1
Primary care and rehabilitation organization	1
Musculoskeletal disorders within primary care	2
Impact of musculoskeletal disorders.....	3
Management of musculoskeletal disorders	3
Secondary/primary care.....	3
GP/physiotherapist.....	5
Uncomplicated/complicated disorders.....	6
Early/late initiation of treatment.....	7
Treatment strategies	7
Pain management.....	7
Impaired function.....	8
Coordination of services.....	8
Secondary prevention.....	8
Triage principles	9
Triage in primary care.....	9
RATIONALE FOR THESIS	13
AIMS	15
Specific aims	15
METHODS	17
Study populations	17
Triage model development	19
Triage model assessment	20

Paper I.....	21
Paper II.....	21
Paper III	21
Paper IV	22
Variables	22
Background variables	22
Measured/calculated outcome variables	23
Patient-reported outcome measures	23
Patient-reported experience measures.....	25
Statistical methods	26
Paper I.....	26
Paper II.....	26
Paper III	27
Paper IV	27
Ethical considerations	28
RESULTS	29
Triage development process	29
Effects on patients	29
Effects on healthcare organization	34
Associated societal effects	38
DISCUSSION	41
Discussion of results	41
Patient perspective.....	41
Healthcare organization perspective	44
Societal perspective.....	47
Risks	49

Methodological considerations	53
Paper I.....	53
Paper II.....	54
Paper III.....	55
Paper IV	56
Thesis.....	57
Future implications	58
CONCLUSIONS	59
ACKNOWLEDGEMENTS	61
REFERENCES	65

Abbreviations

AHP	Allied healthcare professionals
ARM	Attitudes regarding Responsibility for Musculoskeletal disorders
CI	Confidence interval
DRI	Disability Rating Index
EQ5D	Euroqol 5 dimensions-3L
GP	General practitioner
HADS	Hospital Anxiety and Depression Scale
HRQoL	Health-related quality of life
ICER	Incremental cost-efficiency ratio
MSD	Musculoskeletal disorder
NRS	Numerical rating scale
OR	Odds ratio
PHCC	Primary healthcare centre
PREM	Patient-reported experience measure
PROM	Patient-reported outcome measure
QALY	Quality-adjusted life-years
RCT	Randomized controlled trial
SD	Standard deviation
ÖMPSQ	Örebro Musculoskeletal Pain Screening Questionnaire

Definitions in short

Allied healthcare professionals	Healthcare professionals working in fields distinct from medicine and nursing, used in this thesis to describe physiotherapists, occupational therapists, counsellors and psychologists.
Bootstrapping	A statistical method used to address uncertainty using resampling from the data with replacement to generate an estimation of the sampling distribution. ¹
Cost-effectiveness analysis	An economic evaluation in which costs for alternative programs are related to a single, common effect (health benefit) that may differ in magnitude depending on the program. ¹
Disability-adjusted life-years	One DALY corresponds to one lost year of healthy life. For a population, DALYs measure the discrepancy between current health status and ideal health status. $DALY = YLL + YLD$ where $YLL =$ years of life lost to premature mortality and $YLD =$ years lost to disability. ²
Discounting	Adjustments made in cost-effectiveness analyses for future costs and benefits of an intervention or to make relevant comparisons of costs and benefits which occur at different times. ^{1, 3}
General practitioner (GP)	Used in this thesis to denote all practising physicians in primary care regardless of specialization.

Incremental cost-efficiency ratio	A measure of the cost per unit change in QALYs. $ICER = \Delta Costs / \Delta QALYs^1$
Musculoskeletal disorder	The musculoskeletal system includes the organs of the skeleton, muscles, tendons and ligaments. Disorders of which result in pain or functional impairment. ⁴ This is a group of disorders with great pathophysiological diversity, but which are united anatomically. They encompass inflammatory diseases, age-related degenerative conditions, conditions related to activity and injuries and conditions of unclear etiology but with symptoms in the musculoskeletal system. ⁵
Odds ratio	The ratio between the odds of an event occurring in one group with a defined exposure compared to the odds of it occurring in another group without that exposure. ⁶
Overmedicalization	Refers to a process in which non-validated treatment and management of a health condition exceeds recommended levels with no clear benefits and to an extent which increases the probability of potentially harmful results and unnecessary costs. ⁷
Power analysis	A statistical analysis usually performed to determine the smallest sample size which would be adequate to detect the effects of an intervention at the desired significance level. The power level describes the capacity to correctly reject the null-hypothesis, which

	assumes there is no difference between intervention and control. ⁶
Pragmatic study	A research trial designed to examine the effectiveness of an intervention in routine clinical practice. ⁸
Primary care	The first level of medical care where people present their health problems and where the majority of the population's health problems are satisfied. It encompasses generalist care focused on the person as a whole. ⁹
Primary care rehabilitation	Used in this thesis to describe healthcare organizations employing primarily physiotherapists and occupational therapists and providing rehabilitation services to the general public.
Quality-adjusted life-year	QALY is a generic measure of the burden of disease. It combines both quality and duration of life into a measure which can be used in health economic evaluations. ¹
Secondary prevention	Preventive healthcare based on the earliest possible identification of disease so that treatment or management can be focused on avoiding possible future adverse developments. ¹⁰
Somatic comorbidities	Unrelated medical conditions or diseases pertaining to the physical body that coexist with an initial diagnosis. ¹⁰ In this thesis, the term is used to describe five prevalent diseases which PHCCs, according to current regulations, follow more closely and which

were included as confounders in the statistical analyses: diabetes, hypertension, chronic ischaemic heart disease, asthma and chronic obstructive pulmonary disease.

Triage

Sorting of patients and allocation of medical resources by a healthcare worker based on medical needs and according to a prearranged system.¹¹

Introduction

Primary care and rehabilitation organization

Both in Sweden and in many other countries, healthcare is provided at different levels. Primary care is intended for first-line care for the majority of healthcare conditions, including most musculoskeletal disorders (MSDs), while secondary hospital-based care is intended for those patients whose health needs are such that primary care providers have referred them onwards, as well as for those with certain acute conditions.¹² Primary care often acts as gatekeeper for the more specialized resources available at hospitals or can be seen as the doorway to the world of healthcare.⁹

During recent years, much of European primary care has been hard pressed to meet the demands and needs of the population it is meant to serve with available resources.^{9, 13} Regardless of whether the national healthcare system is tax-financed or insurance-financed, large groups of patients have been finding difficulties accessing appropriate care within acceptable time limits.⁹ The reasons can be several – for example: ageing populations, insufficient availability of healthcare providers, higher health expectations in some patient groups and inadequate management of patients' healthcare needs. This last aspect is within the jurisdiction of the healthcare organization and optimizing care is, therefore, the target of many projects and reforms.

In Sweden, primary care and rehabilitation services are organized regionally with a number of different management and compensation systems and sets of regulations, all of which are based on national laws (for example: the healthcare law (HSL 2017:30), the law regarding system of choice for healthcare (LOV 2008:962) for both primary care (Vårdval primärvård) and primary care rehabilitation (Vårdval rehab), and the patient law (2014:821)). The common ground is a publicly financed system with varying options for both publicly and privately managed healthcare providers, as well as regulations regarding those providers who do not receive public financing.

Swedish primary care is often offered at primary healthcare centres (PHCCs), at which can be found several general practitioners (GPs) and other healthcare professionals. In some regions, such as Västra Götaland where the studies in this thesis take place, all inhabitants are required to be registered at a PHCC, which

then takes responsibility for the primary healthcare needs of its own patients and receives economic compensation principally for the number of registered patients from the regional authorities. Healthcare visits are subsidized by regional taxes, but patients pay a nominal amount per visit up to a maximum limit per year, after which visits are free.

Rehabilitation services can be offered at primary care-oriented units directly accessible to appropriate patients in the community and at hospital-based units, which offer treatment for admitted patients or for specific groups of patients. There is no referral requirement to see a physiotherapist in Sweden. Nor are there any economic incentives to acquire a referral from a physician before initiating physiotherapist treatment. Cost per visit for the patient is subsidized, as for PHCCs, and is included in the maximum payment limit for all healthcare visits per year.

Primary care-oriented rehabilitation services are frequently located separately from PHCCs, especially in larger urban areas. Swedish rehabilitation has its own organization, financing systems and is governed by a separate set of regulations. In Region Västra Götaland, rehabilitation providers are principally compensated per visit by the regional authorities. This separation of standard primary care and rehabilitation services and the different compensation regulations can create difficulties regarding professional cooperation over organizational boundaries.^{14,}

15

Musculoskeletal disorders within primary care

Musculoskeletal disorders include all types of health problems related to muscles, joints and associated supporting tissues.⁴ The term covers everything from acute injuries to chronic widespread pain.⁵ Some of these conditions heal by themselves, others require treatment. Some can be treated within primary care, others need more specialized care. Most are painful, creating problems for individuals in their daily lives and in their work and free-time activities.^{4, 16} Those MSDs seen within primary care are seldom life-threatening or the result of severe acute trauma. More common are lower intensity muscle and joint symptoms in all parts of the body, both chronic and with recent debut, caused by minor injuries, overexertion, life-style factors and/or connected to degenerative and other illnesses.^{17, 18}

Impact of musculoskeletal disorders

Patients seek primary care for a vast array of different health conditions and problems. For many years, one of the largest patient groups has been MSD-related with estimates of 14-17% of all primary care visits falling into this category.^{19, 20} A recent study found that over a 7-year period 39% of all registered patients in one region of Sweden consulted primary care at some point for MSD.²¹ According to the Global Burden of Disease study, prevalence of MSDs is steadily increasing around the world.²² Approximately 15-20% of the global population, at a given time, suffers from some form of MSD.²² The burden of health disorders is often measured in years lived with disability and years of lost life due to the disorder. MSDs are seldom fatal but are major contributors to years lived with disability. An approximate 20% increase worldwide in years lived with disability due to MSD can be seen from 2006 to 2016.²² Low back pain, in particular, has been identified as one of the largest causes of years lived with disability in higher income countries.^{22, 23} This leads to considerable utilization of healthcare resources. A Swiss study found that MSDs accounted for 13% of total healthcare expenditure in Switzerland.²⁴ MSDs often occur among the working population leading to high levels of sick-leave and production loss.^{25, 26} The economic impact of production loss due to MSD may be as high as 2% of the gross domestic product in Europe.^{27, 28} In Sweden, the number of initiated cases with sickness benefits from the Social Insurance Agency for musculoskeletal diagnoses for the years 2005-2014 was approximately 100 000 cases per year or 2-3% of the working population.²⁹ MSD is the major cause of 25-27% of all initiated cases with sickness benefits.²⁹ The need to optimize the management of MSDs to attempt to reduce the impact of MSDs is evident.

Management of musculoskeletal disorders

Secondary/primary care

Management of MSD in secondary care focuses on acute care at emergency departments and specialized care within several disciplines – for example orthopaedics, neurology and rheumatology. Emergency departments have a relatively long history of sorting patients based on the severity of their conditions, a management system known as triaging.^{11, 30} A medically trained triage worker, often a nurse, makes a first assessment of the patient's condition on arrival. Life-threatening and serious injuries and illnesses are treated first.

Patients with conditions which can be treated within primary care have, therefore, low priority at the emergency department. These patients may need to wait considerably longer for assessment or they may be referred to primary care for treatment.³¹ In Sweden, patients seen in specialist clinics within secondary care have often been referred from primary care for assessment and treatment of conditions which could not be handled satisfactorily within primary care. As all these patients have already had a first medical assessment, the referrals are usually handled in order of arrival. Some departments may use physiotherapists to give the first internal assessment for certain common patient groups.³²⁻³⁴ Primary physiotherapist assessment has been shown to have comparable validity to those of physicians at a variety of levels within secondary care and even regarding referrals to secondary care.³⁴⁻⁴⁰ It has also been seen to contribute to a more efficient flow of patients through emergency departments and to and through orthopaedic departments.^{32, 34, 40}

Within primary care, standard praxis is to offer an initial consultation with a GP for all types of healthcare conditions. In some places, a nurse will make a first assessment and book appointments. In other cases, it is first come, first served. MSDs seen within primary care have varying levels of urgency. Some require immediate treatment, others repeated contact and yet others merely a non-urgent assessment at a suitable time. It is not unusual with longer waiting times for treatment in primary care than at emergency departments.^{18, 41} Waiting times are often measured in days or weeks at the former and in hours or minutes at the latter.^{18, 34} Within primary care rehabilitation, it is customary for most patients to be booked for consultations in order of contact without necessarily prioritizing based on the nature or severity of symptoms.

Many kinds of MSD can be handled satisfactorily within primary care and primary care rehabilitation.⁴²⁻⁴⁴ However, in some cases, patients are not aware of this competence, do not understand the nature/severity of their condition or are not prepared to wait for primary care to take care of them.^{45, 46} It is not uncommon for primary care to have problems with accessibility or continuity.^{9, 18} These factors may contribute to increased pressure on emergency departments by patients with conditions which could be managed satisfactorily within primary care, creating access problems at the emergency department for more appropriate patient groups.^{31, 41, 47, 48}

If primary care and primary care rehabilitation offer accessibility which patients deem to be reasonable and if it were more widely known which types and severities of conditions they can treat, it could help reduce waiting times and “double work” at emergency departments, reduce wasted time for patients and

lead to direct appropriate treatment for certain patient groups at a more optimal level.^{31, 41, 45, 47}

GP/physiotherapist

GPs and physiotherapists stand for different aspects of the assessment and treatment process regarding MSD. Standard management of healthcare conditions seen within primary care involves an initial assessment by a GP, who either treats the condition independently or refers onward to other care-givers or assessors. GPs have a broader medical background, likely allowing them to diagnose symptoms of non-MSD origin more easily than physiotherapists. GPs take the medical responsibility for management of MSDs including screening for serious illness and non-MSD conditions, prescription of appropriate medication, assessment of need for other care-givers, referrals for radiological examinations, provision of sick-notes and coordination of complex healthcare needs.^{49, 50} Patients with MSD are often referred to physiotherapists by GPs. A British study found that more than 70% of patients with shoulder problems seen in primary care were referred to physiotherapy, while in the Netherlands, only 13% of patients with shoulder disorders were referred.^{51, 52} A German study found that more than 40% of patients seeking help for knee pain in primary care were referred to physiotherapy.⁵³ While in Norway, a decreasing tendency to refer patients with back pain to physiotherapists has been noted with a reduction from 70% to 40% over a 10 year period.⁵⁴

Physiotherapists can act as first or second assessors of MSD.^{43, 44, 55-57} Physiotherapists provide active treatment of MSD regarding pain management, impaired musculoskeletal function and secondary prevention.⁵⁸ They also screen for non-MSD conditions and assess need for non-physiotherapeutic rehabilitation and recommend contact with GPs and other physicians, occupational therapists or other professions as necessary.⁵⁹ They may participate in coordinated rehabilitation plans with other care-givers.⁵⁸ The majority of physiotherapists working in primary care-oriented units focus mainly on MSD. Accumulated clinical experience can lead to a good ability to differentiate between similar types of MSD, to plan appropriate treatment and to identify patients who have or are at risk for developing forms of MSD which require more intense healthcare services.⁶⁰

Uncomplicated/complicated disorders

A large sub-group of patients with MSD seen within primary care have low intense, uncomplicated conditions likely requiring only information on self-management or short-term treatment.^{61, 62} It is probable that a single contact person within the healthcare organization and a single consultation suffices for many of these patients.⁶³ Correct information about the MSD, how to handle it and how to reduce risk for recurrence may be more important than immediate pain alleviation in many of these cases.⁶⁴⁻⁶⁶ In many uncomplicated cases, the only services the GP may provide might be reassurance and/or a referral to physiotherapist.⁵⁰ On the other hand, typical physiotherapist management might include reassurance together with specific advice on self-management and/or exercises to speed recovery and reduce risk for recurrence. In other words, there may be a group of patients seen within primary care where typical physiotherapist services fulfil healthcare needs to a greater extent than typical GP services. It has been hypothesized that overmedicalizing patients may lead to worse prognosis.^{67, 68} If the group with uncomplicated disorders were only to see a GP, there is, perhaps, a greater chance that more emphasis would be placed on pain alleviation than on self-management and secondary prevention, possibly leading to dependency on healthcare providers or higher recurrence rates.⁶⁶ Several of these reflections and unconfirmed hypotheses will be the subject matter of this thesis.

Another sub-group of patients with MSD with slightly more complicated conditions or life situations have need of GP services because of severity, comorbidity, work situation and/or need of referred investigations.^{50, 64, 69} These patients have also good effect of physiotherapy contact regarding self-management, non-pharmacological pain alleviation and secondary prevention.^{50, 64, 69} It is unknown how the order of contact with these professions may affect symptoms and clinical course.

A third sub-group have complicated health conditions and/or life situations and are best treated by interprofessional teams, including physicians, physiotherapists and other healthcare professionals.⁷⁰ This group needs to be identified and given appropriate treatment as soon as possible to minimize the development of long-term conditions, if initial unidisciplinary treatment has had insufficient effect.⁶⁸

Early/late initiation of treatment

Patients commonly prefer treatment for all medical problems as soon as possible. Due to resource and organizational limitations, it is not always possible to offer immediate treatment for all patients and all conditions.⁹ Some studies have examined the effects of timing of interventions. For physiotherapy, there are consistent results favouring early contact and treatment regarding costs and utilization of medical resources, perceived pain and patient satisfaction.⁷¹⁻⁷⁴ Early GP contact is continually strived for within primary care as it is correlated with increased patient satisfaction and reduced risk for adverse events.⁷⁵

Treatment strategies

Pain management

It is common for musculoskeletal pain to be treated with drugs.⁷⁶ There are many forms, strengths and combinations of pain medication which can be varied and individually adapted from general recommendations and can be, for the patient, a relatively effortless method of achieving the desired result of pain reduction or elimination.⁷⁶⁻⁷⁸ The majority of drug prescriptions are issued in primary care.⁷⁹ Clinical guidelines recommend the least potent drugs which give satisfactory effect, especially for long term use.^{50, 66} Individual consideration of medicinal needs and prescription of medication are the prerogative of the physician. Many patients have uncomplicated medicinal needs, especially for conditions with recent debut. These needs may be filled by prescription-free analgesics and advice from a pharmacist, a nurse or, sometimes, by a physiotherapist with adequate training.⁸⁰⁻⁸²

Pain can also be treated without medication. Non-pharmaceutical pain management is recommended as first-line treatment in recent international guidelines for spinal disorders.^{50, 66, 68} Exercise is the treatment method with strongest evidence for MSDs.^{17, 66} The cause of the pain is often mechanical and can be treated immediately with exercise, manual techniques, external support or advice on modified load.¹⁷ It can also possibly be affected on a long-term basis by exercise, change in posture, work positions or workload. There are other non-pharmaceutical methods for reducing pain such as acupuncture, transcutaneous nerve stimulation, laser and other forms of electrotherapy with varying degrees of evidence of effectiveness.^{17, 66, 76} The use of heat, cooling, massage, taping, relaxation training or circulatory exercises can also reduce pain

sensations.¹⁷ These non-pharmaceutical methods are all primarily the tools of the physiotherapist rather than the GP.⁵⁸

Specific education about the condition and advice on self-management can often reduce concern and unnecessary escalation of pain and other symptoms and can be delivered by either GPs or physiotherapists or other healthcare professionals.^{17, 66, 83} Information and reassurance are recommended as first-line treatment for spinal disorders.^{50, 66, 68}

Impaired function

MSDs frequently lead to impaired musculoskeletal function. GPs often give general advice about staying active or taking walks.⁵⁰ Physiotherapists often give specific advice about activities which should be increased, decreased or amended to reduce the impairment.⁵⁸ Specific advice and supervision regarding the choice of exercise, as well as dosage and execution, aimed at reducing the functional impairment have often positive effect on regaining function.¹⁷ Several of the physiotherapeutic treatment methods listed under *Pain management* can be implemented to increase function as well.¹⁷

Coordination of services

Patients with complicated health or life situations may need help from a variety of different care-givers and professions or help on repeated occasions. Management of these patients is usually the responsibility of the GP.^{12, 50} Multimodal team treatment has been shown to have good effect on this group of patients.^{17, 76, 84} When this is not available or is inappropriate, the GP has responsibility for referring to and coordinating different interventions.¹² As one of the professions involved in this process, the physiotherapist often participates in coordinated treatment plans.⁵⁸

Secondary prevention

It is important for the healthcare organization to manage conditions in ways that reduce the development of chronicity or periodic symptom recurrence. MSDs are a group of conditions which are especially prone to these developments.^{85, 86} Primary prevention of many MSDs, as well as many other lifestyle-related conditions, includes staying active, exercising regularly, maintaining normal weight, not smoking, and leading a lifestyle without undue physical or

psychological burden.⁸⁷ Secondary prevention needs to be investigated more extensively, but many of the abovementioned factors likely continue to play important roles. Diversity of MSDs may impede useful research. A recent review found evidence that stratified treatment reduces long-term disability in patients with MSD.⁸⁸ For low-risk patients, simple educational messages seem to suffice while medium-risk patients require additional physical activation programs and high-risk patients both physical and cognitive-behavioural programs.⁸⁸ Most research has focused on low back pain, as it is the most prevalent MSD.²² Promising attempts have been made during recent years to stratify patients with low back pain, so that management and treatment can be planned and followed up to achieve more specific results regarding need for treatment, chronicity and recurrence.⁶³

Triage principles

Triage comes from the French word *triage* which means “to sort”. It has been used in healthcare contexts for over 100 years.¹¹ During the last century, the term has been used extensively within secondary care with systems such as Manchester Triage or the Rapid Emergency Triage and Treatment System (RETTTS) being implemented in emergency departments.^{30, 89} Triage refers to the sorting of patients and allocation of medical resources by a healthcare worker based on medical needs and according to a prearranged system.¹¹

Triage in primary care

Primary care has not traditionally used triaging as standard management practice. Primary care units have, often, been fairly small, with perhaps only one or a few general practitioners.⁹ In Sweden, it is common, nowadays, with larger clinics with many practicing GPs and other healthcare professionals. Accessibility and continuity are continual challenges. PHCCs with many thousands of registered patients may find themselves in the position of not being able to provide GP contact for all patients who seek help within reasonable waiting times.⁹ Swedish healthcare has been assessed to have relatively good quality and efficiency in international comparisons but has somewhat lower ranking regarding accessibility, care process and waiting times.^{90, 91} Sweden has a low average number of primary care visits both per capita and per GP in

comparison with other western countries.^{92,93} National assessments show slowly decreasing access rates to GPs in primary care from 2012 to 2017.⁹⁰

Accessibility and waiting times are problems with which emergency departments have long contended. Just as triaging facilitates the flow of patients through the emergency department, it is possible that a triage system developed for primary care may, among other aspects, contribute to easing the burden of low access.^{30, 89} Triaging systems developed for distinguishing between life-threatening and less severe conditions at emergency departments cannot not be applied directly to the conditions normally seen in primary care. However, an adapted model may provide adequate alternative management for particular groups of patients.

Patients with MSDs are an example of a patient group possibly suitable for alternative management. Patients with non-complicated, moderately complicated and complicated MSDs have varying degrees of required healthcare, but, for all, it is advantageous with early contact with a physiotherapist.^{73,94} Only the latter two require GP services. From a healthcare organization perspective, it is, therefore, more logical to have physiotherapists make the initial assessment, referring to GPs when necessary. The possibilities of developing more optimal pathways through the healthcare organization by using the competences of all available professions should be examined to improve management of patients with prevalent conditions. Changes in areas of responsibility should be combined with investigations of how these changes affect all stakeholders.

Few studies have compared the effects of providing the physiotherapist consultation in primary care before contact with a GP. Ludvigsson and Enthoven found good patient satisfaction, low need of subsequent GP assessment and no adverse events when a physiotherapist was the initial contact.⁴⁴ Frogner et al found significant reductions in opioid prescriptions, in radiological examinations, and visits to the emergency department, as well as diverging cost distributions when physiotherapists were the primary assessors of low back pain.⁵⁷ Goodwin and Hendrick found clinical improvements (including health-related quality of life (HRQoL)), cost reductions and no adverse events.⁴³ None of these were, however, randomized trials.

Patients are not always aware that they can or should seek a physiotherapist directly for their current health problem, nor are there established clear guidelines about when it is appropriate to seek help directly from a physiotherapist. A national investigation by the Swedish Association of Physiotherapists in 2011 found that almost half of the Swedish population was

unaware or unsure of referral requirements to see a physiotherapist.⁹⁵ In Sweden, there is no economical or regulatory incentive to see a physician before commencing physiotherapist treatment. Despite this, there is a strong tradition of seeking a first assessment by a physician. In order to optimize the flow of patients through the healthcare system, it is imperative that all involved professional groups understand the capabilities of other professionals and cooperate to guide patients according to their needs, wishes and available resources. Organized interprofessional collaboration should be an integral component of management systems that shift responsibility from one profession to another, to ensure that early needs from physicians after triaging to other professions are met without unreasonable delays. This should also reduce the risk that potential inadequate management should go unnoticed.

Rationale for thesis

Physiotherapists and GPs play different roles in the management of MSD within primary care. It is possible that, by reversing the order in which each profession traditionally plays its part and by structuring forms of interprofessional collaboration, advantages may be discovered for all or some of the stake-holders in the treatment of MSD.

The majority of the population, both globally and in Sweden, suffers from MSD at some point in their lives.^{22, 96} Besides the pain and impaired function this may entail for the individual, both healthcare providers and financiers are significantly affected and possible ensuing MSD-related production loss affects the whole community. It is important that musculoskeletal conditions are managed as efficiently as possible and with as optimal effect as possible in order to reduce suffering quickly, minimize development of recurrent or chronic conditions and reduce the demand for limited healthcare resources which are needed for a variety of other conditions while, at the same time, avoiding any unreasonable risks for the patients.

There are a number of studies indicating favourable health effects of early physiotherapist contact for various specific MSDs but few examining the effect of physiotherapist assessment before contact with a GP.^{71, 73, 97} It is unknown whether such management has any effect on the progress of health conditions in the short or long term, whether it affects the need for healthcare or patients' attitudes towards management of their conditions, or how it affects resource distribution and utilization. Nor is it known whether this form of management is cost-effective. This thesis will investigate all these aspects regarding the effects of triaging patients with MSDs directly to physiotherapists in primary care.

Aims

The overall aim of this thesis is to describe the development of a triage model for primary care with focus on patients with MSDs and to assess the effects of the model on patients, on the primary care organization, as well as the associated societal effects.

Specific aims

The specific aims were:

- To describe the development process of a triage model for primary care and examine its effects on access, efficiency, work environment and patient satisfaction (Paper I).
- To investigate whether triaging patients with MSDs directly to physiotherapists affects utilization of medical services for MSD and whether the effects vary between different sub-groups of MSDs (Paper II).
- To determine whether triaging patients with MSDs to physiotherapists affects the health outcomes pain, disability, health-related quality of life and risk for developing chronic conditions differently than standard management with initial assessment by GPs (Paper III).
- To investigate whether triaging to physiotherapists affects patients' attitudes of responsibility for MSD differently than standard management with initial assessment by GPs (Paper III).
- To determine whether direct triaging to physiotherapists is a cost-efficient management model in primary care from a societal perspective (Paper IV).

Methods

All the included studies in this thesis were pragmatic with the study populations drawn from the clinical environment at participating PHCCs. During the years the thesis covers (2007-2018), a total reorganization of first primary care and then, later, primary care rehabilitation, in the region, completely changed the conditions under which healthcare was provided to the community (Choice of care reform – primary care (Vårdval primärvård) 2009 and Choice of care reform – rehabilitation (Vårdval rehab) 2014). Central directives and regulations affected which professions might or must be present at PHCCs and rehabilitation centres, as well as how both were financed and led to the establishment of many new clinics. This affected the possibilities of having physiotherapists stationed at PHCCs as regulations changed and affected how profitable different management systems became as competition increased and compensation systems developed over time.

Study populations

In Paper I, the study population under focus was primarily personnel of all professions at one PHCC in Gothenburg, Sweden. This PHCC was located in an area with inhabitants with relatively low socioeconomic and health resources. Many of the registered patients were first and second-generation immigrants with considerable language and cultural barriers to complete integration. In this area, many people have had earlier traumatic experiences, the unemployment rate was high and current employment tended to be physically demanding. Because the demographics of the area affected health needs, the PHCC had a tradition of hiring many allied healthcare professionals (AHP) in addition to GPs and nurses. It had, however, severe difficulties in maintaining a full complement of GPs and ensuring continuity among them. There was greater employment stability among non-physicians at the PHCC. At the time the development process of the triage model was initiated, there were GPs, physiotherapists, an occupational therapist, psychologists, counsellors, nurses, district nurses, child health care nurses, a dietician, and administrative personnel employed at the PHCC.

Paper II was based on a retrospective case-control study, where the intervention group consisted of patients who had sought help for MSDs at the same PHCC as above, during a two-year period after the introduction of the triage model, and who had been triaged to an initial assessment by a physiotherapist. The triage nurses had been instructed to book all patients with MSD with no symptoms indicating serious pathology to physiotherapists. Patients of working-age and with symptoms with recent debut were to get priority if the demand was high. The control group was a similar patient group seeking help for similar MSDs, during the same time period, at another PHCC in Gothenburg with a similar demographic spread among registered patients.

Inclusion criteria: Working-age, between 16 and 64 years. Both genders. Seeking help for MSD at the participating clinic between March 2008 and February 2010. Exclusion criteria: Patients who had consulted a GP at the PHCC for the same condition during the month preceding the triage visit were excluded, as were patients who were booked to physiotherapists based on other factors than assessment by the triage nurses.

The intervention group was significantly younger, had fewer comorbidities, consisted of a larger proportion of men and of a larger proportion with back conditions than the control group (Table 1).

In Papers III and IV, three PHCCs in Gothenburg with diverging socioeconomic demographics, to attain representativity for the urban Swedish population, participated in an RCT. All PHCCs had worked according to the triage model for at least 3 years. Patients seeking help for MSDs at these PHCCs were assessed as suitable for triaging directly to physiotherapist by triage nurses and then randomized to initial assessments by either a physiotherapist or a GP and followed for one year regarding their health conditions, self-reported sick-leave and the contacts and services received from the healthcare organization.

Inclusion criteria: Working-age, between 16 and 67 years. (The upper age limit was raised for this study to reflect recent changes in Sweden regarding the right to continue working until 67 years of age.) Both genders. Sufficient command of Swedish or English to fill out the questionnaires. Seeking primary care for MSD. Assessed by triage nurses as suitable for direct triaging to physiotherapists. Exclusion criteria: Ongoing treatment for the current MSD with relevant healthcare consultations during the preceding month. Chronic MSD with unchanged symptoms the latest 3 months and had already tested physiotherapy for this condition. Primary need for home visits or medical aids.

Participants in the RCT had comparable demographics between groups (Table 1).

Table 1. Descriptive statistics for study participants.

	PAPER II			PAPERS III & IV		
	Intervention	Control	P	Intervention	Control	P
Cases	482	1436		28	27	
n						
Mean age	34.8	41.1	<0.001	39.1	39.0	0.992
(SD)	(11.5)	(12.2)		(2.4)	(2.5)	
Gender	232	578	0.002	13	9	0.331
n_{male} (%)	(48.1)	(40.3)		(46.4)	(33.3)	
Somatic	64	354	<0.001	4	3	0.730
comorbidities^a	(13.3)	(24.7)		(14.3)	(11.1)	
n (%)						
Depression	85	369	<0.001	3	4	0.656
n (%)	(17.6)	(25.7)		(10.7)	(14.8)	
Back disorders	196	401	<0.001	10	9	0.856
n (%)	(40.7)	(27.9)		(35.7)	(33.3)	

^aSomatic comorbidities included any of the diseases diabetes, hypertension, ischaemic heart disease, asthma and chronic obstructive pulmonary disease. There was no comparable study population in Paper I.

Triage model development

A reorganization at a PHCC with a problematic work environment was undertaken aiming to increase access to the PHCC and utilize the competences among the personnel already in place more efficiently (Paper I). Problems included shortage of GPs, high turnover of personnel (primarily GPs), difficulty booking patients and stress among nurses who continually faced dissatisfied patients. A major difficulty which the AHP experienced was that patients were referred to them by the GPs relatively late after initiated treatment. The reorganization resulted in a model for triaging all patients to the most appropriate profession for initial assessment. All personnel were involved in the development process and were inspired to solve the problems which they experienced in daily working conditions. Regular meetings were held to support the development process and solve any difficulties. The management gave full support and were engaged in detail in developing a more functional work environment. Initially, triaging to AHP (physiotherapists, occupational

therapist, psychologists and counsellors) was tested. Considerable feedback and support were provided to the triage nurses until both nurses and AHP were satisfied with the patient flow. New areas were gradually included in the triaging until all sections of the healthcare centre participated. Patients in need of initial GP services were triaged to either a same-day drop-in reception or to planned consultations within one or two weeks depending on the nature of the condition.

Regarding triaging to physiotherapists, detailed flow charts were constructed to aid the triage nurses in their decision-making. After an introduction period, these were no longer necessary and were, instead, included in a manual covering all patient groups seen at the PHCC. This structured manual is updated, as necessary, and has been used to implement the triage model at other PHCCs. The manual describes symptoms which can indicate serious pathology to help nurses determine which patients should be booked to which professions and how specific conditions should be managed. Adjustments were made as to number and length of visits to available professions based on capacity and mean demand. A system for quick consultations with a GP by AHP, when necessary, after triaged visits was organized.

As positive effects were noted, the model spread first to a few nearby publicly financed PHCCs and was later adopted as policy for the publicly financed PHCC organization in the whole region (Närhälsan, Region Västra Götaland). This has led to a gradual increase, over the last several years, in the number of PHCCs actively working according to the triage model and may provide a broader base for future assessments of the effects of the model.

Triage model assessment

As part of this thesis, the triage model has been assessed regarding its effects on access rates, efficient use of personnel, patient and personnel satisfaction and the proportion of patients triaged to AHP who were in immediate need of GP services after the triage consultation (Paper I). An analysis of whether triaging to physiotherapists affected patients' continued utilization of medical services was performed (Paper II) and the effects on patients' health and attitudes were examined (Paper III). Lastly, a cost-effectiveness analysis was undertaken (Paper IV).

Paper I

Access rates to the PHCC after the triage model was introduced were compared to those of the previous year. Total rate for the PHCC and rates for each involved profession were compared. Patients with active contact with the PHCC received questionnaires regarding satisfaction and experienced access six and ten months after the introduction of the triage model. Personnel experiences and satisfaction with the work environment were examined via questionnaires six months after the introduction. The booking rate to AHP, who were now first assessors, was followed, as was the proportion of patients deemed in need of GP services directly after the initial triage consultation to AHP.

Paper II

The nurses at the PHCC, where the triage model was developed, were able to triage a large group of patients to physiotherapists for initial assessment. Once the triage model had been in place for three years, a retrospective study, using the medical records, examined patterns of health care utilization for patients who had been initially triaged to physiotherapists and compared them to those of patients with similar musculoskeletal disorders at another PHCC, where standard management practice with initial assessment by a GP was in effect. The relative frequency of visits to GPs, of referrals to radiological examinations and specialist consultations within secondary care, of sick-note provision and of prescriptions for pain medication were calculated for one year following each patient's initial visit for MSD. Consultation frequency to physiotherapists was not available for the control group due to the organizational separation between standard rehabilitation and primary care services.

Paper III

A randomized controlled trial (RCT) was conducted at three PHCCs, where the triage model was well established. The design was pragmatic requiring clinically active triage nurses with, for the most part, no research experience to identify and recruit participants for the study from those whom they assessed suitable for triaging to physiotherapists. Participants were then randomized to an initial consultation with either a physiotherapist or a GP. The care-giver was unaware of study participation and the study protocol did not dictate treatment or management details, other than determining the profession of the initial assessor. The participants received questionnaires regarding their health

conditions and attitudes before the inclusion visit. These were also sent home at 2, 12, 26 and 52 weeks. One or two reminders were sent out as necessary. The questionnaires examined current pain, mean pain level the latest 3 months, functional disability, health-related quality of life (HRQoL), risk for developing chronic conditions and attitudes of responsibility for MSD.

Paper IV

The RCT described under Paper III also investigated healthcare utilization and sick-leave due to MSD via patient diaries and, when appropriate, through the medical records. This data was used, in combination with changes in HRQoL over time, to perform a cost-effectiveness analysis. Costs for healthcare services and visits were obtained from the healthcare organization. Mean population incomes were used to calculate production loss in connection with sick-leave and healthcare visits. Incremental cost-effectiveness ratios (ICERs) were calculated from both societal (including production loss) and healthcare perspectives (including only healthcare costs). Probability of cost-efficiency at different willingness-to-pay levels was determined by constructing a cost-efficiency acceptability curve.

Variables

The background and outcome variables examined in the included studies are listed in Tables 2 and 3.

Background variables

Social (age, gender, whether the participant was born in Sweden) and health-related (comorbidities, triage reason, disorder duration) information was collected at baseline for the two controlled studies in this thesis (Papers II, III and IV). These variables were used as possible confounders in the statistical analyses to ensure comparable groups, thereby permitting relevant interpretation of the results. Presence of five endemic somatic diseases was checked for specifically - diabetes, hypertension, ischaemic heart disease, asthma and chronic obstructive pulmonary disease. Prevalence was low in both studies and so all five were combined under one term (labelled background illness in Paper II and somatic comorbidities in Papers III and IV). Depression was

considered a possible confounder in both studies. In Paper II, patients were counted as depressed if they had a depression diagnosis in their medical records. In Papers III and IV, depression was measured at baseline with the Hospital Anxiety and Depression Score (HADS).⁹⁸ Levels greater than 8 on the depression subscale were assessed as positive for a depression diagnosis.

Table 2. Background variables in the studies included in the thesis.

	PAPER II	PAPER III	PAPER IV
Age	X	X	X
Gender	X	X	X
Somatic comorbidities^a	X	X	X
Depression	X	X	X
Triage reason	X	X	X
Disorder duration	X		
Country of birth		X	X

^a*Somatic comorbidities included any of the diseases diabetes, hypertension, ischaemic heart disease, asthma and chronic obstructive pulmonary disease. There was no comparable study population in Paper I.*

Measured/calculated outcome variables

In Paper I, the difference in access rates to the PHCC and to each profession before and after the introduction of the triage model were the primary outcomes. The proportion of triage visits to AHP, which were independently managed in the initial phase, was also calculated. In Papers II and IV, the number of healthcare visits and services and the number of MSD-related sick-days were counted. In Paper IV, these count variables were then linked to appropriate cost levels.

Patient-reported outcome measures

There were several patient-reported outcome measures (PROMs) used in the RCT. PROMs are usually questionnaires aimed at capturing the individual's perception of their own health situation.⁹⁹ Current pain and mean pain the latest 3 months were measured with numerical rating scales (NRS) marked from 0 (no pain) to 10 (worst possible pain).¹⁰⁰ Functional disability was measured with the

Table 3. Outcome variables included in the thesis.

	PAPER I	PAPER II	PAPER III	PAPER IV
MEASURED/CALCULATED VARIABLES				
Access rate PHCC	X			
Access rate/profession	X			
Proportion independently managed by AHP	X			
GP visits		X		X
Physiotherapist visits				X
Referrals		X		X
Prescriptions		X		X
Costs visits/services				X
Sick-leave (production loss)		X		X
Production loss healthcare visits				X
Unpaid work compensation				X
Adverse events	X		X	X
PROMs				
Current pain			X	
Mean pain 3 months			X	
Functional disability			X	
Health-related quality of life			X	X
Risk for chronicity			X	
Attitudes of responsibility			X	
PREMs				
Patient satisfaction	X			
Staff satisfaction	X			

PHCC=primary healthcare centre. AHP=allied healthcare professional. GP=general practitioner, PROMs=patient-reported outcome measures. PREMs=patient-reported experience measures.

Disability Rating Index (DRI).¹⁰¹ DRI describes 12 activities of increasing difficulty, each with a 100 mm long line where the level of difficulty is marked between the endpoints “no difficulty” and “cannot perform”. A mean value is

calculated for each participant with higher values indicating increasing dysfunction. Euroqol 5 dimensions-3L (EQ5D) was used to measure HRQoL.¹⁰² EQ5D consists of 2 sections. The first contains 5 questions concerning mobility, self-care, usual activities, pain/discomfort and anxiety/depression with 3 choices indicating level of difficulty/intensity. The responses to these questions are transformed to a single index value between -0.205 and +1, using the Dolan tariff.¹⁰³ Here, 1 indicates perfect health, 0 indicates a level comparable with death and negative values correspond to states worse than death. The second section of the EQ5D questionnaire consists of a visual analogue scale (VAS) where current overall health state is indicated between 0 and 100. To determine risk for developing chronic musculoskeletal pain, the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) was used.¹⁰⁴ This PROM consists of 21 questions regarding present and past health state, pain, ability, activity level and expectations for recovery. The responses are compiled into a single score between 3 and 210, where scores below 90 are considered low risk, above 105 high risk and in-between medium risk.

Participant attitudes towards MSD were examined with the Attitudes regarding Responsibility for Musculoskeletal disorders scale (ARM).¹⁰⁵ ARM determines level of externalization of responsibility with higher scores indicating higher levels of externalization. The questionnaire consists of 4 subscales: the Responsibility Employers (RE) subscale examines the extent to which the individual places responsibility for the MSD on employers; the Responsibility Medical Professionals (RMP) subscale shows the amount of responsibility placed on healthcare clinicians; the Responsibility Out of my hands (RO) subscale describes the extent to which responsibility is felt to be on factors not under control of the individual; finally the Responsibility Self-Active (RSA) subscale investigates the level of own responsibility taken for musculoskeletal health. There are possible values between 3 and 18 for the first 3 subscales and between 6 and 36 for the RSA subscale.

Most of these PROMs have been used extensively in both research and clinical environments and all have been validity tested for patients with MSD and/or primary care patients.^{98, 100, 106-112}

Patient-reported experience measures

Patient-reported experience measures (PREMs) are used to investigate patients' perceptions of their personal experiences of received healthcare services.¹¹³ Patient satisfaction was investigated 6 and 10 months after the triage model was

introduced at the initial PHCC with a specially developed questionnaire focusing on experiences regarding access and satisfaction with management of health conditions by all professions. Personnel satisfaction was also investigated with a specially developed questionnaire. Here, the focus was on changes in the work environment after the triage model was introduced.

Statistical methods

Paper I

Descriptive statistics were compiled for the triage model development study. Percentage increase in number of visits to the PHCC, as a whole, and to each profession were calculated, comparing 6 months (for the PHCC as a whole and for GPs and nurses; 10 months for AHPs) after introduction of the triage model with the same period the previous year. Proportion of triage consultations with AHP which required immediate GP services was calculated for the whole AHP group and separately for the psychosocial clinicians (psychologists and counsellors) and the somatic clinicians (physiotherapists and occupational therapist). Percentages were calculated for the various possible replies to patient and personnel experience questionnaires.

Paper II

The number of GP visits for the actual MSD, the number of relevant referrals, prescriptions and GP-recommended sick-days were counted. All count variables (the total number of each outcome) were converted to categorical variables (whether the outcome was present or not for each case). Comorbidities were categorized as somatic or depression. Binomial logistic regression analysis was employed to compare the group triaged to physiotherapists with the group receiving standard care. The regression analyses were adjusted for age, gender, somatic comorbidities and depression. Odds ratios (OR) with 95% confidence intervals (CI) were calculated for GP visits, referrals, prescriptions and sick-days for all patients with MSD, as well as for sub-groups according to disorder location and duration. Statistical significance level was set to $p < 0,05$. All available patients at the participating PHCCs fulfilling the inclusion criteria were included so no power analysis was performed.

Paper III

The power analysis for the RCT regarding health aspects was based on a clinically relevant difference between intervention and control groups of 1 unit on NRS for current pain with a significance level of $p < 0.05$ and a power level of 80%. It was estimated that 63 participants per group would be needed. Recruitment to the study was, however, discontinued early when a planned reorganization threatened continued placement of physiotherapists at the participating clinics. It was hypothesized that the largest difference between groups might be at the 12-week follow-up. Mean values with standard deviations (SD) were calculated at baseline and 12 weeks for all variables. Student's T-test was used to calculate significance level of differences between groups for the continuous outcome variables and confounders. Mann-Whitney U-test was used for the dichotomised confounding variables. To examine the differences in trends over time, linear regression for repeated measurements was applied using a marginal model with unstructured covariance for residuals. The possible confounders age, gender, somatic comorbidities, depression and Swedish origin were first tested individually in the statistical model. Those which had a significance level of $p > 0.25$ and which had $< 15\%$ effect on the predicted values were excluded from the analysis. This statistical method, often called "mixed models for repeated measurements", takes into account that each participant's baseline value will affect future values. It also adjusts for internal missing values and the effects of confounders when calculating differences between groups.

Paper IV

In a cost-effectiveness analysis, health benefits are weighed against the costs of achieving them. Health benefits were based on participants changing responses on EQ5D over time. Quality adjusted life-years (QALYs) were calculated for each participant by linear interpolation between measurement points for the EQ5D index and then combining the "areas under the curve". Linear regression was used to adjust for baseline differences in HRQoL as well as for possible confounders age, gender, comorbidities and treatment status.¹¹⁴ No discounting was necessary as participants were followed for only 1 year. Costs for visits and services were determined for each participant. Costs for production loss for sick-leave and healthcare visits were based on mean gross wages including social fees. Compensation for unpaid work was based on net mean wages after tax and was used for healthcare visits for patients on sick-leave. Missing data was dealt

with by using multiple imputation. Incremental cost-effectiveness ratios (ICERs) were calculated from the societal and healthcare perspectives. $ICER = \Delta \text{Costs} / \Delta \text{QALYs}$. Non-parametric bootstrapping was used to handle sampling uncertainty. ICERs based on 1000 bootstrapped resamples were collected in a cost-effectiveness plane. A cost-effectiveness acceptability curve was constructed to determine probability of cost-effectiveness at different willingness-to-pay levels.

Ethical considerations

The Regional Ethical Review Board in Gothenburg, Sweden was consulted regarding the developmental study described in Paper I but ethical approval was deemed unnecessary as no health information regarding specific individuals was involved. The studies included in Papers II-IV were approved by the Regional Ethical Review Board in Gothenburg, (DNR 333-11 (2011-09-13) and DNR 358-14 (2014-06-16) with additions T175-17 (2017-04-13) and T536-18 (2018-07-04)). Approval and access to medical records was granted by the PHCC managers for the retrospective study (Paper II) according to Swedish National Board of Health and Welfare statute SOSFS 2008:14. Written informed consent was obtained by all participants in the RCT (Papers III-IV) and from participants who had changed PHCC during the study period for the retrospective study (Paper II).

Results

Triage development process

The developmental process for the triage model involved all personnel of many different professions creating an integrated primary care team (Paper I). Involvement in the developmental process created a goal-oriented atmosphere in which personnel spurred one another to help make the model succeed. The structured development and evaluation process combined with promotion of research and development on behalf of the management inspired several involved personnel to instigate their own scientific studies concerning the model.^{115, 116} The physiotherapists involved in the development were active in keeping the model alive and in supporting new personnel in the assessments and processes involved until the model was so established that it took care of itself.

Effects on patients

Introduction of the triage model had a multitude of effects on patients. Ease of booking appointments, reduction of unnecessary visits and satisfaction with the model were examined and found advantageous in Paper I concerning all patients at the PHCC. Effects on clinical course were examined in Paper III, for patients with MSD, with similar or more positive results found compared to standard management. Patient attitudes towards their conditions were also examined in Paper III with varying results. Utilization of subsequent healthcare services after triaging to physiotherapists (which possibly indicates altered need for healthcare) was investigated in Papers II and IV and was found to be lower after triaging to physiotherapists.

For all patients listed at the PHCC where the triage model was developed, the change in work organization led to substantially increased access to both GPs and other professions (Paper I) making it easier to receive adequate healthcare when needed. The access rate to the whole PHCC increased by 27% during the first 6 months after the introduction of the triage model compared with the same period the previous year.

The route to active care-provider was shortened for those primarily in need of treatment by AHP as they no longer needed to first see a GP and then wait for subsequent contact with another profession. Waiting times for triage visits were within 0-3 working days for physiotherapists (Papers I and III) and within a week for other AHP (Paper I). Those patients triaged to AHP, who were in need of both AHP and GP services, often had an advantage compared to patients who only saw a GP in that their contact with the GP was arranged and/or facilitated by the AHP.

Patient experiences were investigated 6 and 10 months after the introduction of the triage model (Paper I). At 6 months, 47% experienced improved access to the PHCC. At 10 months, 96% were satisfied with the accessibility and 98% were satisfied with the treatment by the personnel. An absence of adverse events was reported in connection with AHP being first assessors in the first evaluation in Paper I as well as in connection with the RCT (Paper III) a few years later.

Table 4. Health and attitude outcomes at 12 weeks (adapted from¹¹⁷).

OUTCOME VARIABLE	TRIAGED TO PHYSIOTHERAPIST MEAN (SD), N = 12	TAU MEAN (SD), N = 13	P ^a
Current pain	3.7 (2.7)	4.8 (3.3)	0.336
Mean pain	4.5 (2.4)	5.5 (1.8)	0.271
Disability	22.8 (11.4)	34.0 (23.6)	0.148
HRQoL	0.78 (0.06)	0.72 (0.23)	0.438
HRQoL-VAS (n=10)	71.40 (15.2)	71.1 (19.0)	0.969
Risk for chronicity	73.6 (25.7)	86.8 (34.3)	0.291
ARM _{TOTAL}	39.1 (11.1)	44.2 (9.9)	0.237
ARM _{RE}	7.2 (4.1)	8.1 (4.4)	0.598
ARM _{RMP}	9.7 (5.4)	13.5 (3.9)	0.049
ARM _{RO}	7.6 (3.2)	7.8 (3.7)	0.852
ARM _{RSA}	14.7 (5.8)	14.7 (4.8)	0.990

TAU=treatment as usual. SD=standard deviation. Current pain and Mean pain measured with 11-point Numeric pain rating scales, Disability with Disability Rating Index, Health-related Quality of Life (HRQoL) with EQ5D (Euroqol 5 dimensions-3L) index and visual analogue scale (VAS) and Risk for chronicity with Örebro Musculoskeletal Pain Screening Questionnaire. ARM=Attitudes of Responsibility for Musculoskeletal disorders scale. RE=Responsibility Employers. RMP=Responsibility Medical Professionals. RO=Responsibility Out of my hands. RSA=Responsibility Self-Active. ^a=Students T-test. Significant differences shown in boldface.

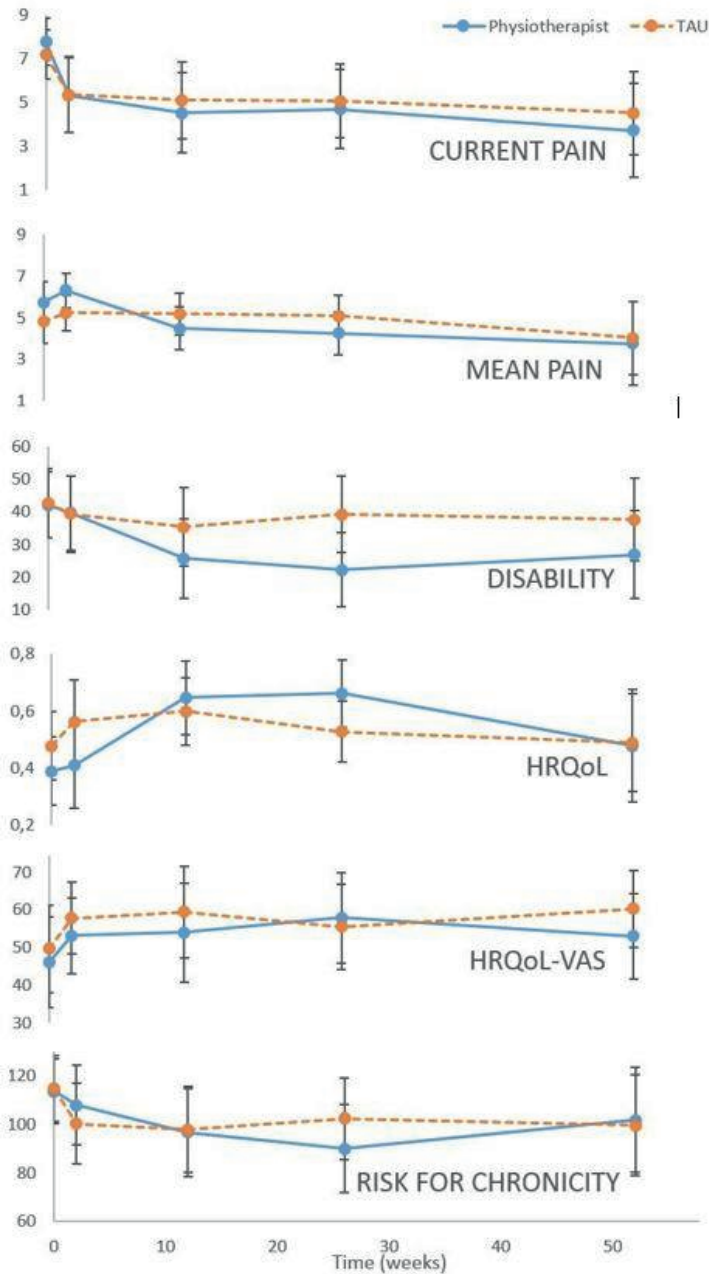


Figure 1. Health outcomes over time, predicted values from regression analyses.¹¹⁷ (Y-axes adapted to appropriate scales for each outcome)

The RCT examined the health effects for patients with MSD who were triaged directly to physiotherapists at PHCCs (Paper III). The results showed no significant differences between groups for any of the studied health outcomes 12 weeks after triaging (Table 4). However, the regression analyses examining the trends for health changes over one year showed consistently better levels for the physiotherapist group for several outcomes: current pain, mean pain the latest 3 months, functional disability, HRQoL and risk for chronicity (Figure 1). A significant difference, over one year, favouring the group triaged to physiotherapists was found for HRQoL (Table 5) measured with EQ5D, with the largest difference at 26 weeks (Figure 1). The difference in functional disability measured with DRI was also relatively large and consistently favoured the group triaged to physiotherapists, although not quite reaching significance (Figure 1 and Table 5).

Table 5. Significance levels of the regression analyses for between-group differences over one year for health and attitude outcomes in the RCT.

OUTCOME VARIABLE	P
Current pain	0.831
Mean pain	0.168
Disability	0.098
HRQoL	0.014
HRQoL-VAS	0.787
Risk for chronicity	0.288
ARM _{TOTAL}	0.535
ARM _{RE}	0.322
ARM _{RMP}	0.025
ARM _{RO}	0.505
ARM _{RSA}	0.475

Current pain and Mean pain measured with 11-point Numeric pain rating scales, Disability with Disability Rating Index, Health-related Quality of Life (HRQoL) with EQ5D (Euroqol 5 dimensions-3L) index and visual analogue scale (VAS) and Risk for chronicity with Örebro Musculoskeletal Pain Screening Questionnaire. ARM=Attitudes of Responsibility for Musculoskeletal disorders scale. RE=Responsibility Employers. RMP=Responsibility Medical Professionals. RO=Responsibility Out of my hands. RSA=Responsibility Self-Active. Significant differences shown in boldface.

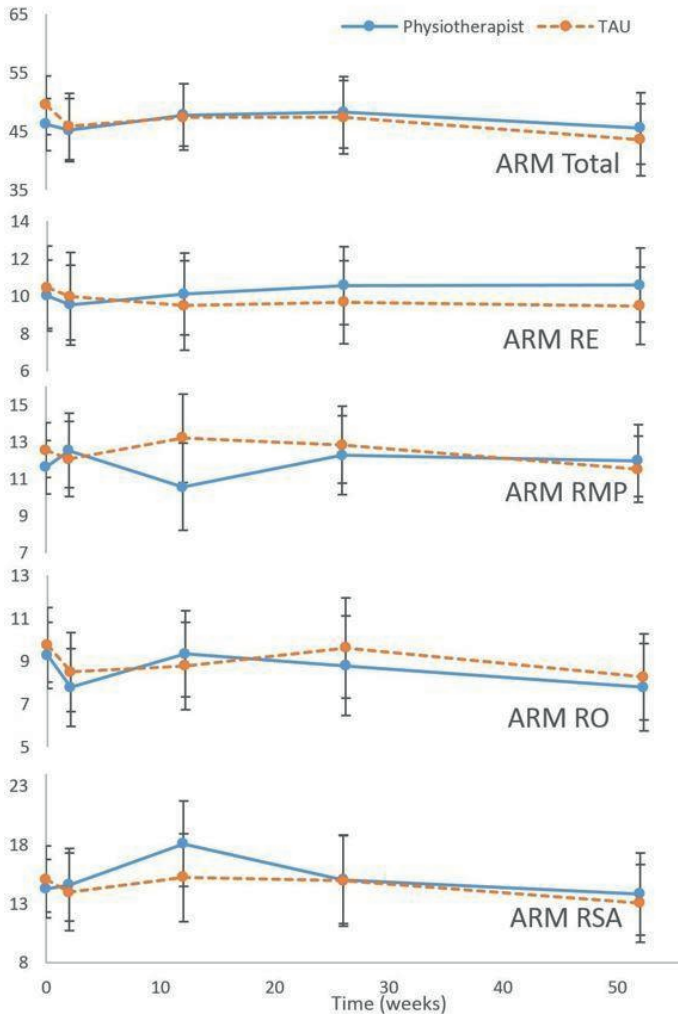


Figure 2. Attitudes of responsibility for musculoskeletal disorders (ARM) and subscales (Responsibility employer (RE), Responsibility medical professionals (RMP), Responsibility out of my hands (RO), Responsibility self-active (RSA)) over time, predicted values from regression analyses.¹¹⁷ (Y-axes adapted to appropriate scales for each subscale)

Attitudes of responsibility for MSD as measured with the ARM scale showed significantly less externalization on the responsibility for medical professions subscale at 12 weeks (Table 4). The regression analyses showing the trends over one year also showed significantly less externalization in the physiotherapist group on the RMP subscale with the largest difference at 12 weeks (Figure 2 and Table 5) However, this difference had disappeared at 26 weeks and no common tendencies were apparent among the total score and the different subscales.

Effects on healthcare organization

Effects of the triage model on the healthcare organization were investigated in Papers I, II and IV: access, efficiency and work environment in Paper I; differences in distribution of consultations and medical services in Papers II and IV; and cost-efficiency from the healthcare perspective in Paper IV.

The increase in the total access rate to the PHCC (27%) was comprised of increases to all involved professional groups. GPs were able to take 31% more consultations compared with the same period the year before the introduction of the triage model (Paper I). The increase in GP visits was due, in part, to the successful recruitment of a higher number of GPs to the PHCC once the work environment started improving, as well as to the introduction of a drop-in reception to which appropriate patients were triaged. The latter led to a more efficient flow of patients through the PHCC with patients whose conditions did not require time-consuming treatment being triaged to the drop-in reception and patients with more demanding conditions being booked to appropriate time slots. Access to physiotherapists increased with 54% with no increases in personnel during the first ten months after the introduction of the triage model (Paper I). The focus on MSDs with recent debut led to short treatment periods, which permitted treatment of a higher number of individuals than the previous year. The number of new patients seen by the physiotherapists increased by 133% the first year after the introduction of the triage model compared to the previous year and then continued to increase with 13-18% during each of the two following years (unpublished data). Access to other professions increased as well: to the occupational therapist by 61%, to psychologists by 57%, to counsellors by 20%, and to district nurses by 6% compared to the corresponding period the previous year (Paper I).

The efficiency of the system was further investigated by examining the proportion of patients triaged to AHP who needed immediate GP services in connection with the triage visit. During the first 10 months after the introduction of the triage model, 83% of patients triaged to AHP were managed independently (Paper I). An increasing trend for independent management over time was noted as the AHPs became accustomed to their new roles as primary assessors and the nurses became more accustomed to the triaging. After one year, 85% of triage consultations were independently managed by AHP and 89% were independently managed by the physiotherapists and occupational therapist (Figure 3) (unpublished data).

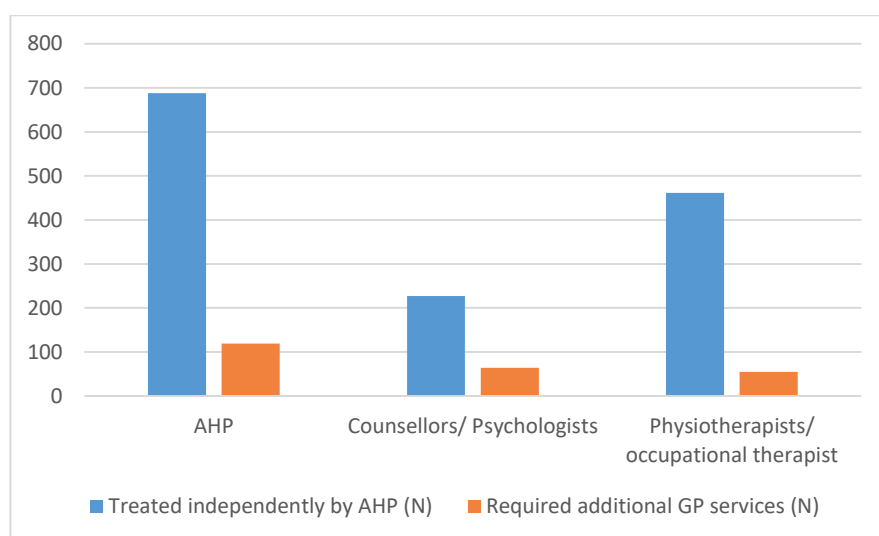


Figure 3. Proportion triaged patients managed independently by allied health professionals (AHP)

The work environment was affected positively by the increasing number of GPs, by the increased collegial cooperation, and by the increased capability to offer adequate healthcare to the PHCCs registered patients. The workload for the physiotherapists increased markedly, which led to the employment of an additional physiotherapist the year after the introduction of the triage model. The experiences of the personnel were examined 6 months after the introduction and were found to be predominantly positive, with 92% reporting

a good work environment and 75% who felt the work environment and the possibility of booking patients had improved as a result of the triaging (Paper I).

Triaging patients with MSD to physiotherapists influenced the overall healthcare management of this patient group. Significantly fewer patients who were triaged to physiotherapists for initial assessment had multiple visits with their GPs during the year after initiated treatment compared to patients initially assessed by GPs, but no significant difference was found between the number of patients who saw a GP at least once during the year after initiated treatment (Paper II). The retrospective study described in Paper II also showed that significantly fewer patients triaged to physiotherapists received referrals for radiological examinations or to specialists in secondary care, fewer were prescribed pain medication, and fewer received sick-notes for MSD (Table 6). While these are all services usually provided by the GP, there was no hinder to see a GP, whenever necessary, even for those patients who started their treatment with a physiotherapist. This may indicate that those patients in need of GP services after triaging to physiotherapists did not require as much treatment (including referrals, prescriptions and sick-notes) from GPs as patients primarily managed by GPs.

Sub-group analyses were also performed for patients who had MSDs in different bodily regions (back; neck and upper extremity; lower extremity; mixed regions) and for different lengths of time (acute (<12 weeks); chronic (>12 weeks); or both acute and chronic). These analyses showed significantly less resource utilization for the physiotherapist group regarding referrals and prescriptions for all disorder and duration sub-groups. Significantly fewer patients in the physiotherapist group received sick-notes in all sub-groups except for lower extremity disorders. Significantly fewer patients with chronic disorders in the physiotherapist group had at least one GP visit during the following year. For the other sub-groups, no significant differences between groups were found for GP visits. It was not possible statistically to distinguish between multiple or total GP visits for the sub-groups.

There were, however, large differences at baseline between groups in the retrospective study, with the physiotherapist-triaged group being significantly younger and healthier (Table 1). Age and comorbidities were factored in to the regression analyses to compensate for these differences. Healthcare utilization variables were examined again in the RCT where the randomization process should and did lead to comparable groups at baseline (Table 1). In this study, there were, again, significantly fewer patients in the physiotherapist group receiving referrals for MSD (Paper IV). However, no significant differences

were seen between the numbers of patients receiving sick-notes or prescriptions for pain medication, nor between the numbers of patients with contact with either physiotherapist or GP after the triage visit.

Table 6. Healthcare utilization outcomes for patients with musculoskeletal disorders followed for 1 year; number of cases, relative proportions, non-adjusted and adjusted odds ratios for participating clinics (adapted from¹¹⁸).

	INTERVENTION CLINIC	CONTROL CLINIC	P
Cases, n (%) ^b	482 (73.5)	1436 (85.8)	
GP visits, n (%) ^c	200 (41.5)	721 (50.2)	0.001^a
Referrals, n (%) ^c	93 (19.3)	574 (40.0)	<0.001^a
Sick-leave, n (%) ^c	73 (15.1)	338 (23.5)	<0.001^a
Prescriptions, n (%) ^c	119 (24.7)	1049 (73.1)	<0.001^a
	Non-adjusted OR (95% CI)		
GP visits	0.70 (0.57 - 0.87)		0.001
Referrals	0.36 (0.28 - 0.46)		<0.001
Sick-leave	0.58 (0.44 - 0.77)		<0.001
Prescriptions	0.12 (0.10 - 0.15)		<0.001
	Adjusted OR (95%CI)		
GP visits	0.88 (0.70 - 1.09)		0.236
Referrals	0.39 (0.30 - 0.50)		<0.001
Sick-leave	0.58 (0.44 - 0.77)		<0.001
Prescriptions	0.14 (0.11 - 0.18)		<0.001

Odds ratios (OR) presented with 95% confidence intervals (CI) with the control clinic representing the reference values and adjusted for age, gender, somatic comorbidity and depression. All outcomes are for the same disorder as at inclusion and for 1 year after inclusion: GP visits = number of patients who visited a GP at the clinic at least once. Referrals = number of patients who received at least one referral to a specialist or for an external examination. Sick-leave = number of patients who received GP notes for sick-leave for at least one day. Prescriptions = number of patients who received prescriptions for analgesics from a GP at the clinic. ^aMann-Whitney U test, ^bnumber of cases and % of total at clinic, ^cnumber of cases and % of analyzed group within clinic. Significant differences are shown in boldface.

Cost-effectiveness of triaging to physiotherapists at PHCCs was examined in Paper IV and found to be more cost-effective than standard management with initial GP assessment. The ICER from the healthcare perspective (see next section for further details) indicated that the intervention of triaging to physiotherapists dominated standard management with slightly larger health gains achieved at lower costs for the healthcare organization.

Associated societal effects

Triaging to physiotherapists at PHCCs seems to affect both patients and the healthcare organization positively. As both concerned parties play roles in society at large, the effects cannot be limited to the individual patient or PHCC in question. The results of Papers I and II indicated that triaging to physiotherapists was efficient and seemed to lead to lower healthcare utilization for patients with MSD. This led to a large group of patients having a physiotherapist instead of a GP as primary assessor, freeing medical resources for patients with other health problems. Thus, triaging to physiotherapist may even influence other patient groups positively.

In Paper III, triaging to physiotherapist seemed to lead to a more advantageous clinical course for patients with MSD. Larger or quicker health gains can be related to reduced absence from work and lower costs for the individual, the healthcare organization and society at large. In Paper IV (currently in manuscript under review so detailed results cannot be presented here), the relation between costs and health effects was examined in a cost-effectiveness analysis from both societal and healthcare (see above) perspectives. The mean total costs for the group triaged to physiotherapists was lower than for the group triaged to first assessment by GPs and mean HRQoL improved more for the physiotherapist group. These relative changes are usually expressed as ICERs. Cost-effectiveness analyses from the societal perspective include costs for production loss for sick-leave and to attend healthcare visits, as well as compensation for unpaid work time to attend healthcare visits. The ICER from societal perspective showed a relatively large reduction in mean costs together with a small increase in mean QALYs. The intervention triage to physiotherapists dominated treatment as usual being both less expensive and leading to larger health improvements. Uncertainty in these results was handled by bootstrapping 1000 ICER replicates and mapping them on a cost-effectiveness plane, thereby demonstrating a high likelihood of the intervention being cost-effective. A cost-effectiveness

acceptability curve was then constructed which showed a high likelihood of cost-effectiveness at all willingness-to-pay levels.

Discussion

Discussion of results

The studies in this thesis have shown many positive effects of triaging patients with MSD directly to physiotherapists in primary care. Access, efficiency, patient satisfaction, health effects, utilization of healthcare resources and cost-efficiency are all aspects which are favoured by the management model investigated here. No adverse effects have been discovered.

Patient perspective

It is important to give patients good and timely access to healthcare. Access, waiting times, flexibility of booking consultations, and length of consultation are aspects of the healthcare visit which are valued by patients and are associated with overall total satisfaction.^{119, 120} The triage model addresses all of these factors.

Introduction of the triage model led to increased access to the PHCC and to physiotherapists. Waiting times for physiotherapy were negligible with same or next day appointments being provided in the majority of cases. Studies have shown that patients with low back pain are critical of delays in referring to physiotherapy.¹²¹ Triaging directly to physiotherapists increases access to physiotherapy, but reduces or delays access to GPs for patients with MSD. For this reason, triage models should include pre-arranged systems to ensure that medical services are made available, as needed, after triaging to other professions. The results of Paper I imply that using other professions as first assessors may be associated with better access to GPs for other patient groups.

Healthcare visits can be difficult to combine with the patient's regular schedule. The high demand for GP consultations may lead to an inflexible booking system at many PHCCs, requiring the patient to accommodate to healthcare availability. The physiotherapists, in the studies included in this thesis, were able to provide greater flexibility in booking times according to patient preferences than were the GPs. This flexibility may be constrained in the future, as for GPs, if the demand for physiotherapy services at PHCCs increases.

Physiotherapists may have more time with their patients than GPs. The physiotherapists in the studies in this thesis were able to allot more time per visit than was usual for GPs at the participating PHCCs or is seen in published descriptions of GP consultation times.¹²² This may increase the opportunities to discuss and explain treatment and investigation options.

Efficient management of health conditions includes providing adequate care for suitable patients without unnecessary delays.¹²³ Here, it was found that triaging facilitates the detection of suitable patients for initial assessment by physiotherapists and guides them immediately along a suitable care-pathway, along which the needs of vast majority are managed efficiently (Paper I).

The results of both Papers II and III indicate that triage nurses select certain subgroups of patients with MSD for triaging to physiotherapists. Factors affecting nurse assessments have not been studied in this thesis. However, a qualitative study examining triaging to psychologists at a PHCC, found indications that triage nurses may be influenced by patient preferences to a high degree.¹¹⁶ British and Dutch studies have been able to distinguish different profiles for patients who were referred to physiotherapists by their GPs and those who consulted a physiotherapist without a referral.^{52, 55} Patients who independently sought physiotherapist treatment were more often younger and male.⁵² They had acute/sub-acute disorders to a higher degree and completed their treatment program to a higher degree.⁵⁵ This group was also absent from work to a lower degree than patients who first consulted their GP.⁵⁵ The selection bias by the triage nurses seen in Papers II and III, with relatively young patients with few comorbidities being overrepresented after triaging, corresponds fairly closely to the group of patients who independently seek physiotherapists.⁵⁵ These patients may be more amenable to nurses' triage suggestions, which could be in line with their own preferences. It is possible that nurses also prefer to err on the side of caution by selecting relatively young, healthy patients with few comorbidities who can most often be managed independently by physiotherapists. Qualitative studies have found that, when triage nurses in emergency care are uncertain about their triage decisions, they prefer to risk resource overuse over missing essential care.¹²⁴ The selection bias may partially explain the significantly lower utilization of medical resources in the physiotherapist-triaged group in Paper II.

There are many patients with MSD whose needs are limited to a single or few visits with a healthcare professional.⁶³ In the RCT, at least 20% of the participants had no further healthcare visits after triage consultation with a physiotherapist. This is in line with a trial investigating stratified treatment of

low back pain using the STarT back tool which found that 26% of patients were low risk patients needing only a single treatment session.⁶³ In both Papers II and IV, there were many patients who needed no GP visits or services after triaging to physiotherapists. In Paper I, it was shown that over 80% of patients triaged to physiotherapists were managed independently in the initial phase. This indicates that suitable patients were selected for triaging and that they were provided with efficient management of their conditions.

There are advantages with primary physiotherapist management even for the group of patients in need of both physiotherapist and GP services. The randomization process led to comparable groups in the RCT in Paper III. Here, results indicate that a reasonable proportion of the patients who are triaged to physiotherapists (approximately 25%) have GP contact at some point during the following year for the same condition. The generally favourable results for the physiotherapist-triaged group regarding progression of health outcomes applies even to this group. This supports the premise that it is no disadvantage to the group needing services of both physiotherapist and GP to initiate the treatment process with the physiotherapist.

Patient expectations of healthcare for MSD may vary and may not always be realistic.¹²⁵ Patients generally seek help from PHCCs with the expectation of seeing a GP. Those who know that it would be more suitable for them to see a physiotherapist may contact a rehabilitation centre directly. The patient is the expert on experienced symptoms, but it is the healthcare organization which has the responsibility of interpreting the symptoms based on evidence and medical knowledge and of guiding the patient to the best course of action (Healthcare law 2017:30 and Patient law 2014:821). The triage nurse, as the first contact within the PHCC according to the triage model, should know which resources the PHCC can offer and should understand which conditions different professions are capable of managing, so as to guide the patient appropriately. In patient-centred contexts, which PHCCs should strive after according to national recommendations, the patient participates in healthcare decisions along with healthcare personnel.¹² However, each plays a different role. Healthcare provision is based on medical knowledge and expertise and cannot always provide desired services and treatments which may be unnecessary or even detrimental to patients' health.⁶⁵ For instance, studies show that patients have strong beliefs in the necessity of radiological examinations for conditions for which such examinations are not advised.¹²⁵ The healthcare professional must consider patient desires, as well as relative need, evidence and available resources when determining a course of action.¹²

For many patients, quick and reliable assessment may be more important than which profession makes the assessment.^{44, 126} The surveys included in Paper I indicate good patient satisfaction with the triage model and with the treatment by all personnel categories. Other studies have also found good patient satisfaction after initial triaging to physiotherapists at a PHCC.^{43, 44}

In Paper III, it was found that HRQoL increased significantly in the group triaged to physiotherapists. A similar effect was seen in the study by Goodwin and Hendrick.⁴³ The favourable consistency for other health outcomes, in comparison with standard management, may indicate other possible health advantages for patients, but should be confirmed with larger studies. Both groups showed positive progression of health outcomes over time and it is known that many forms of MSD have a generally favourable clinical course over time regardless of healthcare interventions.¹²⁷ The results of the RCT indicate that triaging to physiotherapists is at least as advantageous, and likely somewhat better, for the clinical course of MSDs as primary GP management.

Both healthcare management and clinical course affect economic aspects of health problems for the patient. Costs are incurred for both healthcare visits and medication for both the patient and the healthcare organization. Avoidance of unnecessary visits and services is an economic advantage for both stake-holders. Quick recovery is associated with lower sickness absence. For patients in the work force, inability to work because of health problems leads, in Sweden, to lower income, as the level of sick-leave compensation is approximately 80% of normal income.¹²⁸ The cost-savings seen for the intervention group in the cost-effectiveness analysis (Paper IV) were primarily because of lower levels of sickness absence. This is, naturally, a big advantage for the patient as well as society.

Healthcare organization perspective

The development of the triage model described in Paper I was instigated by deficiencies in the work environment at one PHCC. The personnel and management all saw the need for change and were involved in the developmental process. The team effort involved led to greater knowledge on a personal and professional level concerning collegial capacities and to a better understanding of other professions' work situations. This was examined in a qualitative study based on the same model but not part of this thesis.¹¹⁵ The development, assessment and implementation of the triage model followed implementation principles for models of care with specific established steps which facilitate

successful changes of praxis.^{123, 129} These include a systematic and stepwise plan, understanding the context of current practice, having an easy to understand and presentable proposal, analysing barriers and facilitators for change and addressing them systematically, involving all affected personnel and continuously evaluating the implementation and adjusting where necessary.^{123, 129} These steps were all followed at the original PHCC, where the triage model was developed. The managers were deeply involved in the implementation process, providing clear leadership while simultaneously encouraging personnel to express their viewpoints and propose new ideas. Managerial support has been reported as an important facilitator when implementing change.¹³⁰ In spreading the model to other PHCCs, it is unlikely that all steps have received the same focus. For a successful widespread implementation, it is important that managers encourage local personnel to engage themselves in the model and that local barriers and facilitators are analysed and addressed.

The positive effects of triaging large patient groups to AHP on access and efficiency, as well as on reduced healthcare utilization, can contribute to solving mounting problems in primary care, where patient demands for both access and treatment are difficult to meet with available GP resources.⁹ New Swedish regulations implemented in 2019 (amendments to HSL 2017:30 9 kap. 1§ and Patient law 2014:821 2 kap. 3§) require PHCCs to provide patients with assessment by a registered healthcare professional within 3 days instead of the past requirement to provide assessment by a GP within 7 days. Triageing certain groups of patients to physiotherapists for initial assessment fits in well with these requirements. The regulations divert focus from the GP and may help legitimise the competences of other healthcare professionals in the eyes of the general public. In many other countries, physiotherapists are not as easily accessible as in Sweden. Access is often controlled by referral requirements or financial or insurance impediments. Legal changes or model adjustment may be required for application within other healthcare systems.

Problems with access, continuity and waiting times at PHCCs are common and are thought to be, at least partially, affected by an insufficient number of practising GPs.⁹ An American study predicted the need for an approximate 25% increase in number of practicing GPs over a 15 year period to meet coming demands.¹³¹ Giving other professions responsibility for part of the workload should reasonably contribute to the alleviation of some of the associated problems with this shortage. If done systematically, as in this model, risk for inadequate management should be minimized.

Many studies have indicated that present management of MSD in primary care has weaknesses. Studies in the United Kingdom found that only 29-35% of patients with osteoarthritis received adequate quality of care according to specified indicators and that less than half of primary care patients with knee pain were recommended the treatments with best evidence, which are exercise and weight loss.¹³²⁻¹³⁵ There are several studies which report that many GPs do not follow clinical guidelines for low back pain, relying on excessive referrals for radiological investigations and prescriptions for stronger pain medication than recommended.^{66, 136-138} These services may be in demand by some patients but contribute to overmedicalisation and are associated with worse prognosis.^{66, 125} In other studies, GPs report lack of confidence and insufficient expertise as barriers for treatment of MSD.¹³⁸⁻¹⁴⁰ Physiotherapists have been found to be more confident in the treatment of low back pain but there have been mixed reports regarding even their adherence to clinical guidelines.^{138, 141}

Physiotherapists working in primary care-oriented units have a greater focus on the treatment of MSD than do many GPs, who treat a wide variety of health conditions. The path to becoming an expert clinician includes practice and experience.^{60, 142} It is possible that more intense exposure to MSD compensates for differences in academic training.¹⁴³ Competence regarding assessment and treatment of MSD for different professions may be compared to a study in which pharmacists were shown to have better pharmacology knowledge and pharmacotherapy skills than GPs.¹⁴⁴ Focusing on one area of medical expertise seems to lead to more detailed knowledge.

It is the author's experience that, when introducing the triage model to a new PHCC, the GPs are more than willing to reduce their responsibility for patients with MSD, while the nurses need to be convinced of physiotherapeutic competence for this patient group. Nurses are key figures in this triage model. In secondary care environments, they have shown good ability to triage and are able to use their medical expertise to make professional assessments of patient needs in accordance with structured guidelines.¹⁴⁵ For the triage model to function well, it is vital that they understand how physiotherapists work and which patient groups may receive best help from a physiotherapist. If the triage nurse is convinced that the best possible care-pathway for the individual is through an initial assessment by a physiotherapist, then patients may be influenced in this direction and may develop positive expectations for the consultation. Appropriate collegial introduction by both physiotherapists and fellow-nurses should be provided to new members of staff to ensure that the model continues to work smoothly over time.¹²³

From the healthcare organization's perspective, there is always an economic aspect to be considered regarding the management of all patient groups. In Paper II, considerable reduction in utilization of healthcare resources was found after triaging to physiotherapists. The cost-effectiveness analysis in Paper IV indicated that there are economic savings to be made for PHCCs without detriment to patient health by implementing the triage model and having physiotherapists make the initial assessments for patients with MSD. This could potentially require increasing numbers of physiotherapists or redistributing resources from long-term rehabilitation services to early assessments with preventive orientation. Early adequate management may, in turn, lead to fewer patients developing chronic disorders.⁸⁸

Societal perspective

The increasing prevalence and burden of MSDs worldwide makes management a major global issue and not just a problem for the individual or the healthcare organization.⁶⁵ The individual may experience pain, dysfunction and difficulties with work and leisure activities. The healthcare organization may have difficulty providing access and suitable services for those in need. Society suffers both from production loss when the individual cannot perform work duties to the same extent as a healthy worker and by the association between MSD and many other lifestyle-related illnesses, each with their own effects on individuals, healthcare and communities.⁶⁵

The general population is ageing and lifestyles are becoming increasingly more sedentary worldwide.¹⁴⁶ Both of these factors tend to lead to health conditions which require increased healthcare services.²² The importance of physical activity for healthy aging is well-known.¹⁴⁷ A recent study showed that almost 50% of the working-age population in Sweden have low cardiorespiratory fitness levels which is associated with development of many lifestyle-related illnesses and that this proportion has increased substantially during the last 20 years.¹⁴⁶ Many of the illnesses and conditions seen in primary care that are rapidly becoming more frequent are lifestyle-related.²² These have in common that if the lifestyle factors in question are addressed early, progression of the condition may be contained or reversed. Extensive primary and secondary prevention are necessary to change this trend.⁶⁶ The physiotherapeutic focus on physical activity and secondary prevention may play a vital role in restricting the expansion of these conditions to a manageable level.¹⁴⁸⁻¹⁵⁰ To achieve good effect, it is often important that preventive actions are initiated as early as

possible in the progression of most conditions.^{88, 151, 152} In the studies in this thesis, patients are provided with immediate contact with physiotherapists when they first seek help for MSDs, thereby, theoretically, increasing exposure to early secondary preventive information and assistance.

A recent overview of the management of low back pain worldwide concluded that, in light of the globally increasing prevalence of low back pain, its effects on individuals and society and the large gap between evidence-based recommended treatment and treatment seen in practice, major changes are necessary.⁶⁶ Among these are reformed clinical pathways focusing on information and activity and avoiding unnecessary healthcare services and overmedicalisation.⁶⁶ Studies have shown that undue emphasis on medical treatment for conditions, which in past times were accepted as tolerable aspects of daily life, may have negative consequences for the clinical course and that this is associated, in some populations, with escalating dependency on pharmaceuticals and other forms of treatment.⁶⁵ There are problems with widespread treatment and management procedures within healthcare which do not lead to any advantages for the patients but instead to immense costs for treatment and increasing costs for production loss.⁶⁵ The latest Global Burden of Disease study reports that while people are living longer, they are living longer with poor health and that non-communicable diseases such as MSD account for a substantial portion of the increasing disability-adjusted life-years.¹⁵³

Triaging to physiotherapists at PHCCs cannot solve all these problems but can be a step in the right direction. It creates a clinical pathway which provides suitable care for a large group of patients with MSDs seen in primary care. It reduces exposure to overmedicalisation. It seems to reduce absence from work and, thereby, reduces the largest cost factor associated with MSD. While physiotherapy may vary from one clinician and one country to another, there is a strong common focus on learning to cope with debilitating health conditions and striving after optimal function.⁵⁸ This is in line with recommendations from Lancet Low Back Pain Series Working Group regarding promoting “positive health – the ability to adapt and to self-manage in the face of social, physical and emotional challenges”.⁶⁵

While it may be important in the long term to increase public education about MSDs, a step which can be taken immediately is to use the competence of the professional group which already has extensive education in musculoskeletal treatment more optimally. The studies included in this thesis indicate that a management intervention of triaging patients with MSD directly to physiotherapists leads to a more optimal clinical pathway for this group of

patients. This pathway is also the most cost-effective one for all stakeholders. In addition to the savings for the healthcare organization, the high likelihood of reduced production loss for MSD is an important advantage both for the individual and the community.

MSDs vary greatly in nature and it is likely that many forms of MSD will resolve spontaneously, regardless of how the condition is handled by the healthcare organization. However, it is possible that the length of the recovery process, the suffering involved, and the probability of recurrence can be influenced by the timing and content of proposed treatment.^{64, 71, 73} If management of the patient's healthcare needs can be organized to bring about optimal health effects with few healthcare visits and services, while also avoiding unnecessary waiting times, perhaps both suffering and costs may be reduced.

Risks

There are two major categories of risks associated with the management pathways for MSDs in primary care described in this thesis which should be considered. These are the risks associated with using physiotherapists as primary assessors and the risks with using GPs as primary assessors. These risks need to be weighed against each other and against the relative advantages of each pathway.

Indications of many advantages with primary physiotherapist management of MSD have been found and presented in this thesis. On the individual level, there is never a guarantee of optimal management from any clinician. However, on a group level, is there a larger risk that physiotherapists as primary assessors may mistreat MSD or miss or misunderstand symptoms of non-MSD character compared to the probability of any of these events when GPs are the primary assessors? Physiotherapists have a different academic background than GPs. The physiotherapist curriculum is shorter and does not include many subjects that are included in medical training. However, it includes a substantial focus on MSD and the treatment of dysfunction associated with the musculoskeletal system, areas which may have deficiencies in the medical training at many institutions.^{58, 154, 155} In the triage model, patients have been assessed first by a triage nurse and afterwards by a physiotherapist. Both nurses and physiotherapists are registered professionals with medical responsibility for their assessments. In the studies included in this thesis, there were no reported

adverse events associated with primary assessment by physiotherapists, nor have other studies examining initial physiotherapist assessment at PHCCs reported any adverse events.^{43, 44} In an observational study, it was noted that patients with MSD who were assessed initially by physiotherapists were more satisfied and more confident that they had received a correct assessment than those assessed by a GP and those patients with serious pathology were correctly identified and managed.⁴⁴ Another study found that physiotherapists made correct management decisions as first assessors in the vast majority of cases and physiotherapists with orthopaedic specialization achieved even better results in their decision-making.⁵⁶ It is not necessary for physiotherapists to be able to diagnose non-MSD illness, merely to recognize it as non-MSD in order to advise the patient to seek suitable help. An advantage with clinicians who focus on one group of disorders is the increased probability of learning to treat them well and being able to distinguish non-typical symptoms.^{56, 156}

Risks for insufficient management of patient needs for patients who require services of both physiotherapist and GP are controlled by the parameters of the structured triage model. This includes systematic assessment by registered nurse according to a triage manual to detect patients with symptoms of serious illness. Nurses have been shown to have adequate competence for making triage assessments and screening for symptoms of serious illness in emergency care and regarding telephone triaging in primary care.^{145, 157} The nurse triage assessment is followed by a second assessment by a registered physiotherapist, who also screens for symptoms of serious illness while examining the patient.⁵⁹ In addition, the triage model includes flexible forms for providing GP services after triage visits to other professions.

As there is no referral requirement to see physiotherapists in Sweden, when patients have a good understanding of both their own symptoms and the healthcare system, they frequently seek physiotherapists directly. In other words, physiotherapists are already accepted as primary assessors. The triage model, however, directs patients who intended to see a GP to a physiotherapist instead. This may lead to a decrease in patient satisfaction initially. Studies comparing GP/nurse management have shown that patients are less satisfied if their care-giver is not of the profession they originally desired.¹⁵⁸ It is, therefore, important for physiotherapists who have responsibility for triage consultations to try to understand the patient's situation and to respond to underlying fears for serious illness or treatment expectations which the patient may have. It is also important to have a prearranged system to accommodate those patients who are in need of GP assessment or services after a triage visit to a physiotherapist.

Collegial cooperation and trust are cornerstones of the model. Patients also have own responsibility and own agendas. Triaging to physiotherapists does not prohibit patients from contacting a GP later. Many of the physiotherapist-triaged patients in the RCT did see a GP at some point during the following year for the same condition, either during the initial period or several months later. However, the clinical course does seem to be affected by which profession is seen first (Paper III). Overall, the studies included in this thesis, together with other studies of similar models seem to indicate that the advantages with primary physiotherapist assessment according to the triage model out-weigh the risks.^{43, 44, 57}

The advantages with continued standard management of MSD with primary GP assessment are several: convenience – change is often experienced as more difficult than continuing with usual practice; patient satisfaction – giving patients what they ask for may lead to higher satisfaction in the booking process even if the results of this pathway ultimately are less optimal;^{44, 158} better access to GPs for those patients who are in need of both physiotherapist and GP.

The risks with primary GP management include overmedicalisation and inadequate management of the MSD. Many studies have indicated that GPs often prescribe pain medication both earlier and over the recommended levels for many MSDs.^{66, 159} There is evidence that pain medication such as paracetamol, non-steroidal anti-inflammatory drugs (NSAID) and opioids can reduce musculoskeletal pain in many cases.¹⁷ However, commonly recommended analgesic treatments are not always effective and medication has, in many cases, side-effects especially when taken over prolonged lengths of time.^{78, 160} A large Swedish study found that 12% of the adult population with healthcare contacts suffers from some form of adverse drug event.¹⁶¹ A Dutch study found that 1 in 30 patients treated with NSAID for musculoskeletal conditions in primary care contacted their GP because of adverse drug reactions.¹⁶² Another Swedish study calculated costs for resource use associated with adverse drug events to be over €500 per case with the major proportion being the responsibility of the local health authority.¹⁶³ There is a large and growing problem with opioid dependency and other adverse effects of pain medication in many countries.^{164, 166}

Overmedicalisation does not just refer to the prescription of pharmaceuticals. It even encompasses creating an unnecessary dependency on medical intervention.⁷ Overviews by experts in the field of back pain management suggest that the increasing burden of disabling back pain is partially iatrogenic, with management by healthcare contributing to unrealistic expectations for both

individual health and for those healthcare services deemed necessary.⁶⁵ Many clinical guidelines clearly recommend avoiding unnecessary radiological investigations for conditions such as non-specific low back pain.^{50, 167} Some GPs believe such courses of action to be necessary nonetheless.¹³⁸ Others give in to patient demands, even when they do not believe that the investigation will be useful in determining continued course of action.¹³⁸ Reported viewpoints concern the time it takes to explain to a patient why a radiological examination is unnecessary and how referrals signal to the patient that their conditions are being taken seriously.¹³⁸ However, a patient who has the opinion that imaging is necessary and has this confirmed by the GP by receiving a referral will likely continue to insist on such examinations for future conditions and will circulate this impression to other people in the vicinity.¹²⁵ This leads to escalating demands for services which do not contribute to an increased understanding of the problem nor to a solution. In Sweden, it is unusual for physiotherapists to have the right to directly refer to radiological investigations. Information from the physiotherapist about why such a referral may be unnecessary together with the extra step involved to book a visit to a GP, after a triage consultation to a physiotherapist, to acquire a referral which the physiotherapist did not recommend, may discourage some patients from taking this course of action.

Another risk with primary GP management is that it often replaces or, at least, delays active physiotherapeutic treatment. This is seen in Paper IV and is reported in studies of patient experiences.^{121, 126} The RCT in Papers III and IV studied only patients whom triage nurses assessed suitable for triaging to physiotherapists but, still, a large proportion of those who were randomized to GPs did not see a physiotherapist during the following year. In other words, in many cases, whether the GP successfully fulfilled the patient's immediate needs or not, either the GP or the patient failed to prioritize subsequent physiotherapy which can, in turn, affect the clinical course and recurrence rate. As described earlier, 70% of British patients and 13% of Dutch patients with shoulder problems, 40% of German patients with knee problems, 40% of Norwegian patients with back problems were referred to physiotherapists.⁵¹⁻⁵⁴ These leaves, however, approximately 30-90% who were not referred. Many studies have described inadequacies related to GP management of varying MSDs, such as insufficient exercise advice, inadequate recommendations to rest, inappropriate imaging referrals, insufficient conservative treatment before referral to surgeons.^{66, 168-171} It has been shown that passive pain management strategies are associated with higher risk for pain-related disability and with higher utilization of healthcare compared to active exercise-based management.¹⁷² Many patients desire empowerment from healthcare so that they may learn to manage their

health conditions independently.¹²⁵ Physiotherapeutic treatment often aims to increase patient empowerment.^{58, 173} Physiotherapeutic management of MSD has not been studied to the same extent as GP management and there is no guarantee that physiotherapists will always manage MSD better than GPs. However, the studies in this thesis seem to indicate that the advantages with initiating MSD treatment with the physiotherapist and including GP treatment at a later stage, if necessary, outweigh the risks.

Methodological considerations

The studies included in this thesis had varying strengths and limitations.

Paper I

The first paper was based on an observational study of a development and implementation process at a single PHCC. Strengths include the structured development and evaluation process which led to successful local implementation and created interest from other PHCCs to follow suit. Implementation research regarding care for musculoskeletal conditions in primary care recommends focusing on models for delivery of healthcare with the aim of ensuring that “the right care is delivered at the right time by the right team in the right place”.¹²³ These were all aspects which were integral to the triage model. The model was developed pragmatically, within a clinical setting, and adapted continually to the real-life clinical situations and problems which emerged, thus averting the complicated process of transforming research into practice. Well-known factors for facilitating clinical implementation, such as local champions, peer-to-peer support, and managerial engagement, were fundamental to the successful implementation.¹²³

The results regarding access and efficiency are, however, limited to that single, original PHCC, as evaluation of the effects of more widespread implementation have not been performed. The investigated PHCC cannot be seen as representative for PHCCs in Sweden or in the region as the demographics of the registered patients were not typical for other areas and the original problems in the work environment were relatively severe. However, the model addressed problems and used resources, which are found at many PHCCs to varying degrees, and is, therefore, applicable to other settings within Sweden. The

model was developed to conform with Swedish health laws and regulations and cannot necessarily be directly applied to healthcare organizations operating under other conditions.

Paper II

A strength of Paper II was that it was based on a large study population. The main advantages of retrospective study designs are that they facilitate inclusion of large patient groups, which can often be followed over long periods of time without many of the difficulties involved in patient recruitment.¹⁷⁴ The retrospective design, however, inhibited the inclusion of some parameters of interest (such as the number of physiotherapist visits in the control group). It also created difficulties with setting inclusion and exclusion criteria so that the groups would be comparable, since the triaging to physiotherapists was based on a subjective nurse assessment. Rigorous criteria selection is essential to the process of drawing valid conclusions in retrospective studies.¹⁷⁴ Criteria, here, could only be set to reflect general nurse-triaging instructions.

Results show that there was a selection bias in the triage process with nurses choosing relatively young and healthy patients for first assessment by physiotherapists. While age and comorbidities are factored into the statistical analysis as confounders, this must still be considered when interpreting the results. There may be other factors influencing nurse assessments than were covered by the inclusion/exclusion criteria and which could contribute significantly to the differences between groups. Studies have shown that nurses' triage decision-making is influenced by many factors. Besides patient symptoms, the nurse's own experience and intuition and the availability of resources affect the decision process.^{124, 175, 176} It has also been found that uncertainty in triage-decisions may lead to overuse of resources to be on the safe side.¹²⁴ Age and comorbidities may affect both nurse assessments of healthcare need, as well as the patient's expectations of care, and interest and motivation for non-traditional forms of care.^{175, 177} Age has been proposed as a possible patient-level barrier when introducing new forms of care.¹⁷⁸ Nurses may, consciously or subconsciously, consider such aspects, when determining whether to triage to a physiotherapist or to a GP. If patient interest guides the assessment rather than just symptoms, it would create difficulties in achieving comparable groups, as such aspects are unlikely to be documented and were not considered in this study. Therefore, the significant differences found in this study may indicate that patients with MSD, who are triaged to physiotherapists, require fewer

healthcare services because physiotherapist management differs from GP management and affects clinical course differently or because triaging to physiotherapists successfully selects a group of patients who require fewer healthcare services or a combination of the above.

Finally, another weakness with the study was that a single person extracted all data from the medical records.¹⁷⁹ It would have added to the study's credibility if, at least, a sample had been extracted by two or more researchers to ensure consensus.

Paper III

The RCT described in Paper III had a robust randomized study design with comparable groups and was based on a representative study population for Swedish urban environments. It is, however, based on a small population as recruitment of study participants was terminated early when impending organizational changes threatened the placement of physiotherapists at the participating clinics. The small population size increases the probability of primarily Type II errors – failing to discard the null-hypothesis (which assumes no differences between groups) when a difference, in fact, exists. It would be likely that a small study would not find any significant differences between groups because of measurement uncertainty. Such was, likely, the case for the outcome musculoskeletal function which, despite consistently better values for the group triaged to physiotherapist, failed to reach significance. A later power analysis based on measured standard deviation in the study indicated that it would have required twice as many participants as were recruited to reach 80% power for determining significant change in musculoskeletal function. This is less than the sample size calculated using pain as the outcome of interest in the power analysis on which the study was based. Even other outcomes showed similar but less distinct differences between groups and would likely require larger population sizes to accurately evaluate differences. The small sample, therefore, precludes definite conclusions about some of the results. HRQoL did, however, despite the small sample size, show significant improvement. A similar study comparing physiotherapist and GP management of referrals of patients in primary care to orthopaedic surgeons also found that HRQoL was the outcome which showed most improvement.¹⁸⁰ The observational study by Goodwin and Hendrick also found improvement in HRQoL after initial assessment by physiotherapists.⁴³

There was a considerable level of missing values in the RCT, which to a certain degree was addressed with the regression method employed (see Statistical methods). The “mixed models for repeated measurements” analysis is a form of linear regression which creates a projection for each individual based on baseline measurements and as many repeated measurements as are available. Missed measurements for participants can be estimated according to the participant’s personal curve, creating an estimate with higher validity than certain other statistical methods.

The missing analysis showed that younger people, who were randomized to an initial visit with physiotherapists, were overrepresented among those who failed to respond regularly over time. There was no significant age effect among the missing in the control group. Uncomplicated acute and sub-acute disorders are usually overrepresented within the younger group as chronicity and comorbidities increase with age.¹⁸¹ It would, therefore, seem that a larger proportion of patients in the intervention group, who could be expected to have a milder clinical course and, therefore, both positive health outcomes and low healthcare resource utilization, dropped out early. This would lead to an underestimation of the positive effects of triaging to physiotherapists. A similar tendency was seen in the STarT back stratification trial mentioned earlier for older participants to complete the year-long follow-ups to a higher degree than younger participants.⁶³

Paper IV

The cost-effectiveness analysis was based on the same RCT as Paper III and is, therefore, subject to the same limitations relating to recruitment as described above. Here, missing values were addressed with multiple imputation and sampling uncertainty in the small population with non-parametrical bootstrapping. Multiple imputation is the recommended approach for cost-effectiveness studies.¹⁸² Non-parametrical bootstrapping repeatedly removes and replaces values at random. This method has been found to calculate accurate estimates of the mean even for small, skewed samples.¹ As the missing values in this study were connected to the same participants as in Paper III, there is a substantial risk, even here, for underestimation of the positive effects of the intervention as young, healthy participants with presumed low healthcare needs discontinued participation to a greater extent in the intervention group.

Thesis

It has been recommended that research regarding models of care include patient level (health effects) outcomes, healthcare provider outcomes (access, efficiency, work environment, healthcare costs) as well as societal outcomes (societal costs, production loss) to make an overall process evaluation.¹²³ A strength of the overall thesis is that these recommendations were followed. Studies have shown that few interventions aimed at changing medical practice are investigated from all three perspectives.¹⁸³ Most intensely investigated is the healthcare provider perspective, while only a third of the studies investigating models of care examine patient outcomes.¹⁸³

The management intervention consisting of triaging in primary care has now been examined from several different perspectives. Each paper's contribution formed a base for the next study. The development and implementation study indicated sufficient advantages for the healthcare organization for the method to be implemented on a somewhat larger scale. The retrospective study indicated savings in health resources for patients triaged to physiotherapists. The RCT addressed uncertainties raised in the retrospective study about interpretation of results – whether the reduced resource use was caused by greater improvements in patients' health or by an appropriate stratification of patients to suitable care levels. Insufficient population size hinders the resolution of this question, but results seem to indicate that both are likely. With comparable randomized groups, tendencies towards health improvements and resource savings were found. Neither the health improvements nor the resource savings found in the RCT were of sufficient magnitude to be explain the level of reduced healthcare utilization seen in the retrospective study. This may simply be the result of the RCT being underpowered or because both health improvements and suitable stratification of patients contributed to the former result.

The included papers are based on studies with widely varying methodologies evaluating different aspects of the triage model. Studying physiotherapist management of MSD in primary care before or instead of GP involvement is a new area of research with few comparable studies. That all four, as well as those few published studies investigating similar models, led to positive results strengthens the assessment of overall clinical feasibility for triaging patients with MSD directly to physiotherapists in primary care, despite limitations in the individual studies.^{43, 44, 57} Further research is, however, necessary to confirm results in other settings and on larger populations.

Future implications

There are several implications regarding the future management of MSD in primary care, if the triage model were to be implemented on a large scale. This large and growing group of patients would receive appropriate care from appropriate professions in an efficient order. Triage may lead to reduced waiting times for care, reduced burden for GPs, more optimal clinical course, reduced need for healthcare services, and/or reduced sick-leave for MSD. It is possible that other positive long-term effects may be achieved as preventive aspects of treatment may receive greater focus.

Larger randomized trials will be necessary to confirm the findings in this thesis. Feasible variations of the triage model need to be developed to follow the healthcare systems in different countries. Miller et al have published a protocol for an ongoing RCT in Canada testing primary physiotherapist assessment for back pain at PHCCs with a model customized to Canadian regulations.¹⁸⁴ If the Canadian model should show similar results, it would increase the generalizability of the results presented here.

Conclusions

The triage model evaluated in this thesis has been shown to lead to predominantly positive effects from patient, healthcare organizational and societal perspectives.

Triaging directly to physiotherapists in primary care seems to:

- increase efficiency regarding management of MSD
- lead to a better work environment
- lead to reduced utilization of common healthcare treatments and management options
- lead to at least as positive health effects as current management in the most conservative interpretation of the results
- be associated with musculoskeletal health improvements at lower total costs for all stakeholders

These effects should be investigated in greater detail and on larger study populations in future studies to facilitate clinical application.

Acknowledgements

A doctoral thesis is not the product of a single person's efforts but that of many people. I am extremely grateful for all the assistance, support and inspiration I have received from many individuals during these last several years.

Special thanks to:

Jörgen Thorn, my main supervisor. Your leadership during the development of the triage model was definitely a significant key to its success. You were a strong guiding force and gave me an invaluable introduction to the world of research. Despite many pressing demands on your time, you were committed to this project; saw its potential and encouraged me to believe in my ideas. Thank you for all your support.

Maria Larsson, my co-supervisor. Your in-depth knowledge of research, especially pertaining to physiotherapy, was invaluable. Your feedback, support and overall expertise were always both timely and full of insight. I have always felt I could turn to you for advice. Thank you so much.

My co-authors for Paper I. **Malena Kornbakk** – my good friend, long-time colleague and foremost inspiration for the triage model. Without you, this thesis would never have come to fruition. I cannot thank you enough for planting the seed; you made all the difference. **Mona Zaffar, Andy Maun, Sofia Wedham** – Each of you were instrumental in the development and evaluation of the triage model and were wonderful colleagues. **Cathrine Thanner** – thank you for granting financial support for my studies. Your wise leadership at 3 of the primary healthcare centres involved in this thesis was a major factor in spreading the triage model and in recruiting centres to participate in the studies. I have been so lucky to be part of such an incredible team during the model development process with all of the above, as well as with **Anna Simonsson, Linda Dahlöf** and many others.

My co-authors for the RCT: **Lena Nordeman** – always interested and supportive and the source of excellent ideas. **Robert Eggertsen** – your knowledgeable critique and non-physiotherapeutic perspective were always helpful. I thank you both for being part of my research team.

My statisticians: **Anna Grimby Ekman** – Thanks for your invaluable contributions on Papers II and III and your willingness to share your knowledge.

I have learned so much from you. **Mikael Svensson** – Thank you for your knowledgeable assistance and co-authorship in the intricate world of cost-efficiency studies. The late **Björn Lindgren** – I hope you were aware of my appreciation for helping me understand and organize my data for Paper IV. Sadly, you were not around for the final results, but it was a pleasure working with you.

The managers of the involved primary care and rehabilitation centres who have not yet been mentioned: **Cecilia Pehrsson** – thank you for believing in me and helping me navigate through so many bureaucratic obstacles. **Kristina Rasmusson** – you encouraged me to fulfil my ideas and always gave me full support. **Marie Gustafsson** – your enthusiasm and support, both moral and financial, lightened my load immeasurably.

All the personnel past and present at **Närhälsan Biskopsgården primary healthcare centre** – for being wonderful colleagues and for believing in the triage concept. Special thanks to **Annika Hilding** and **Maja Karlsson** who put special effort into recruiting participants to the RCT, and to **Anette Vendel** who helped me administrate the study and did her job so well. Thank you all.

Thanks to the managers and personnel at **Närhälsan Eriksberg** and **Kyrkbyn** (now **Sannegården**) **primary healthcare centres** who participated in the RCT. Your collaboration was much appreciated.

My research colleagues from the **FoU REMUSC platform** and my fellow doctoral students at the University of Gothenburg with our leaders **Monika Fagevik Olsén** and **Roland Thomée**. Thank you for all the constructive criticism and many stimulating and enriching discussions.

My physiotherapist colleagues throughout the years at both **Närhälsan Biskopsgården primary healthcare centre** and **Närhälsan Torslanda rehabilitation centre**. From my perspective, it has been an enormous privilege to have spent time with each of you.

Thanks to all my patients at **Närhälsan Biskopsgården primary healthcare centre** who made working such a pleasure.

A huge thank you to each of the study participants who made this research possible – I am forever indebted.

Last but not least, thanks to all my family and friends who make life worth living – what would I do without you?! I wish there was room to mention you all

individually, but rest assured, each of you hold a special place in my heart. Thanks to my daughters **Elsa**, **Maria** and **Alva** for being who you are – it has been a true pleasure watching you grow over the years into such independent young women. I could not ask for better daughters. An extra commendation to **Alva** for her great job designing the cover of this thesis! A special mention to my sister, **Usha**, for her encouragement and help with intermittent language and editing difficulties. And finally, to my wonderful husband and best friend, **Per**, who has given me his unconditional love and support in all aspects of my life. I could not have done this without you!

.....

This thesis was made possible by funding from regional research grants from Region Västra Götaland and local project grants and doctoral support from the Primary Care Research and Development Board for Göteborg and Södra Bohuslän.

References

1. Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. *Methods for the Economic Evaluation of Health Care Programmes*, Fourth Edition. Oxford: Oxford University Press; 2015.
2. World Health Organization. Health statistics and information systems [2019-02-06]. Available from: https://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/.
3. Katz DA, Welch HG. Discounting in cost-effectiveness analysis of healthcare programmes. *Pharmacoeconomics*. 1993;3(4):276-85.
4. Vingard E. Chapter 5.6: major public health problems - musculoskeletal disorders. *Scand J Public Health Suppl*. 2006;67:104-12.
5. Woolf AD, Vos T, March L. How to measure the impact of musculoskeletal conditions. *Best Pract Res Clin Rheumatol*. 2010;24(6):723-32.
6. Ejlertsson G. *Statistik för hälsovetenskaperna*. Lund: Studentlitteratur AB; 2011.
7. Hanslik T, Flahault A. [Overmedicalization: When too much medicine harms]. *Rev Med Interne*. 2016;37(3):201-5.
8. Roland M, Torgerson DJ. Understanding controlled trials: What are pragmatic trials? *BMJ*. 1998;316(7127):285.
9. Kringos DS, Boerma WGW, Hutchinson A, Saltman RB. *Building primary care in a changing Europe*. Copenhagen: WHO Regional Office for Europe; 2015.
10. The free dictionary. Available from: <https://medical-dictionary.the-free-dictionary.com/>.
11. Iserson KV, Moskop JC. Triage in Medicine, Part I: Concept, History, and Types. *Ann Emerg Med*. 2007;49(3):275-81.
12. Nergårdh A, Andersson L, Eriksson J, Lundberg M, Träff Nordström K, Öberg Lindevall M. *God och nära vård - en primärvårdsreform*. Stockholm: 2018.
13. Socialstyrelsen. *Bedömning av tillgång och efterfrågan på personal inom hälso- och sjukvård samt tandvård - Nationella planeringsstödet 2018* Stockholm: 2018 2017-02-21. Report No.
14. Sargeant J, Loney E, Murphy G. Effective interprofessional teams: "contact is not enough" to build a team. *J Contin Educ Health Prof*. 2008;28(4):228-34.

-
15. Morgan S, Pullon S, McKinlay E. Observation of interprofessional collaborative practice in primary care teams: An integrative literature review. *Int J Nurs Stud*. 2015;52(7):1217-30.
 16. Andersen LN, Kohberg M, Juul-Kristensen B, Herborg LG, Sogaard K, Roessler KK. Psychosocial aspects of everyday life with chronic musculoskeletal pain: A systematic review. *Scandinavian journal of pain*. 2014;5(2):131-48.
 17. Babatunde OO, Jordan JL, Van der Windt DA, Hill JC, Foster NE, Protheroe J. Effective treatment options for musculoskeletal pain in primary care: A systematic overview of current evidence. *PLoS One*. 2017;12(6):e0178621.
 18. Haggerty J, Fortin M, Breton M. Snapshot of the primary care waiting room: Informing practice redesign to align with the Patient's Medical Home model. *Can Fam Physician*. 2018;64(9):e407-e13.
 19. Mansson J, Nilsson G, Strender LE, Bjorkelund C. Reasons for encounters, investigations, referrals, diagnoses and treatments in general practice in Sweden--a multicentre pilot study using electronic patient records. *The European journal of general practice*. 2011;17(2):87-94.
 20. Jordan KP, Kadam UT, Hayward R, Porcheret M, Young C, Croft P. Annual consultation prevalence of regional musculoskeletal problems in primary care: an observational study. *BMC Musculoskelet Disord*. 2010;11:144.
 21. Jordan KP, Joud A, Bergknut C, Croft P, Edwards JJ, Peat G, et al. International comparisons of the consultation prevalence of musculoskeletal conditions using population-based healthcare data from England and Sweden. *Ann Rheum Dis*. 2014;73(1):212-8.
 22. Vos T, Abajobir AA, Abate KH, Abbafati C, Abbas KM, Abd-Allah F, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*. 2017;390(10100):1211-59.
 23. Hurwitz EL, Randhawa K, Yu H, Cote P, Haldeman S. The Global Spine Care Initiative: a summary of the global burden of low back and neck pain studies. *Eur Spine J*. 2018.
 24. Wieser S, Riguzzi M, Pletscher M, Huber CA, Telser H, Schwenkglens M. How much does the treatment of each major disease cost? A decomposition of Swiss National Health Accounts. *The European Journal of Health Economics*. 2018.

25. Kinge JM, Saelensminde K, Dieleman J, Vollset SE, Norheim OF. Economic losses and burden of disease by medical conditions in Norway. *Health Policy*. 2017;121(6):691-8.
26. Macpherson RA, Lane TJ, Collie A, McLeod CB. Age, sex, and the changing disability burden of compensated work-related musculoskeletal disorders in Canada and Australia. *BMC Public Health*. 2018;18(1):758.
27. Bevan S. Economic impact of musculoskeletal disorders (MSDs) on work in Europe. *Best Pract Res Clin Rheumatol*. 2015;29(3):356-73.
28. Cammarota A. The European commission initiative on WRMSDs: recent developments, presentation to EUROFOUND conference on 'Musculoskeletal disorders'. Lisbon: 2007 11-12 October. Report No.
29. Swedish Social Insurance Agency. Statistics on initiated cases with sickness benefits per 1000 by branch and diagnosis, 2005-2014 Stockholm2018 [2018-10-23]. Available from: <https://www.forsakringskassan.se/statistik/sjuk/sjuk-och-rehabiliteringspenning>.
30. Mackway-Jones Ke. *Emergency Triage - Manchester Triage Group*: Wiley Blackwell; 1997.
31. Derlet RW, Kinser D, Ray L, Hamilton B, McKenzie J. Prospective Identification and Triage of Nonemergency Patients Out of an Emergency Department: A 5-Year Study. *Ann Emerg Med*. 1995;25(2):215-23.
32. Bird S, Thompson C, Williams KE. Primary contact physiotherapy services reduce waiting and treatment times for patients presenting with musculoskeletal conditions in Australian emergency departments: an observational study. *J Physiother*. 2016;62(4):209-14.
33. Richardson B, Shepstone L, Poland F, Mugford M, Finlayson B, Clemence N. Randomised controlled trial and cost consequences study comparing initial physiotherapy assessment and management with routine practice for selected patients in an accident and emergency department of an acute hospital. *Emerg Med J*. 2005;22(2):87-92.
34. Sayer JM, Kinsella RM, Cary BA, Burge AT, Kimmel LA, Harding P. Advanced musculoskeletal physiotherapists are effective and safe in managing patients with acute low back pain presenting to emergency departments. *Aust Health Rev*. 2018;42(3):321-6.
35. Ball ST, Walton K, Hawes S. Do emergency department physiotherapy practitioner's, emergency nurse practitioners and doctors investigate,

-
- treat and refer patients with closed musculoskeletal injuries differently? *Emerg Med J.* 2007;24(3):185-8.
36. MacKay C, Davis AM, Mahomed N, Badley EM. Expanding roles in orthopaedic care: a comparison of physiotherapist and orthopaedic surgeon recommendations for triage. *J Eval Clin Pract.* 2009;15(1):178-83.
 37. Decary S, Fallaha M, Pelletier B, Fremont P, Martel-Pelletier J, Pelletier JP, et al. Diagnostic validity and triage concordance of a physiotherapist compared to physicians' diagnoses for common knee disorders. *BMC Musculoskelet Disord.* 2017;18(1):445.
 38. McClellan CM, Greenwood R, Bengler JR. Effect of an extended scope physiotherapy service on patient satisfaction and the outcome of soft tissue injuries in an adult emergency department. *Emerg Med J.* 2006;23(5):384-7.
 39. Daker-White G, Carr AJ, Harvey I, Woolhead G, Bannister G, Nelson I, et al. A randomised controlled trial. Shifting boundaries of doctors and physiotherapists in orthopaedic outpatient departments. *J Epidemiol Community Health.* 1999;53(10):643-50.
 40. Samsson K, Larsson ME. Physiotherapy screening of patients referred for orthopaedic consultation in primary healthcare - a randomised controlled trial. *Man Ther.* 2014;19(5):386-91.
 41. Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Emergency department visits for nonurgent conditions: systematic literature review. *Am J Manag Care.* 2013;19(1):47-59.
 42. Mermod J, Fischer L, Staub L, Busato A. Patient satisfaction of primary care for musculoskeletal diseases: A comparison between Neural Therapy and conventional medicine. *BMC Complement Altern Med.* 2008;8(1):33.
 43. Goodwin RW, Hendrick PA. Physiotherapy as a first point of contact in general practice: a solution to a growing problem? *Prim Health Care Res Dev.* 2016;17(5):489-502.
 44. Ludvigsson ML, Enthoven P. Evaluation of physiotherapists as primary assessors of patients with musculoskeletal disorders seeking primary health care. *Physiotherapy.* 2012;98(2):131-7.
 45. Sancton K, Sloss L, Berkowitz J, Strydom N, McCracken R. Low-acuity presentations to the emergency department: Reasons for and access to other health care providers before presentation. *Can Fam Physician.* 2018;64(8):e354-e60.

46. Sharp AL, Chang T, Cobb E, Gossa W, Rowe Z, Kohatsu L, et al. Exploring real-time patient decision-making for acute care: a pilot study. *West J Emerg Med.* 2014;15(6):675-81.
47. Busby J, Purdy S, Hollingworth W. How do population, general practice and hospital factors influence ambulatory care sensitive admissions: a cross sectional study. *BMC Fam Pract.* 2017;18(1):67.
48. Edwards J, Hayden J, Asbridge M, Gregoire B, Magee K. Prevalence of low back pain in emergency settings: a systematic review and meta-analysis. *BMC Musculoskelet Disord.* 2017;18(1):143.
49. van Tulder M, Becker A, Bekkering T, Breen A, del Real MT, Hutchinson A, et al. Chapter 3. European guidelines for the management of acute nonspecific low back pain in primary care. *Eur Spine J.* 2006;15 Suppl 2:S169-91.
50. Almeida M, Saragiotto B, Richards B, Maher CG. Primary care management of non-specific low back pain: key messages from recent clinical guidelines. *Med J Aust.* 2018;208(6):272-5.
51. Artus M, van der Windt DA, Afolabi EK, Buchbinder R, Chesterton LS, Hall A, et al. Management of shoulder pain by UK general practitioners (GPs): a national survey. *BMJ Open.* 2017;7(6).
52. Kooijman M, Swinkels I, van Dijk C, de Bakker D, Veenhof C. Patients with shoulder syndromes in general and physiotherapy practice: an observational study. *BMC Musculoskelet Disord.* 2013;14:128.
53. Frese T, Peyton L, Mahlmeister J, Sandholzer H. Knee pain as the reason for encounter in general practice. *ISRN family medicine.* 2013;2013:930825.
54. Werner EL, Ihlebaek C. Primary care doctors' management of low back pain patients--ten years after. *Tidsskr Nor Laegeforen.* 2012;132(21):2388-90.
55. Holdsworth LK, Webster VS, McFadyen AK. Are patients who refer themselves to physiotherapy different from those referred by GPs? Results of a national trial. *Physiotherapy.* 2006;92(1):26-33.
56. Jette DU, Ardleigh K, Chandler K, McShea L. Decision-making ability of physical therapists: physical therapy intervention or medical referral. *Phys Ther.* 2006;86(12):1619-29.
57. Frogner BK, Harwood K, Andrilla CHA, Schwartz M, Pines JM. Physical Therapy as the First Point of Care to Treat Low Back Pain: An Instrumental Variables Approach to Estimate Impact on Opioid Prescription, Health Care Utilization, and Costs. *Health Serv Res.* 2018.

-
58. World Confederation for Physical Therapy. World Confederation for Physical Therapy Policy statement: Description of physical therapy [2019-02-21]. Available from: <https://www.wcpt.org/policy/ps-descriptionPT>.
 59. Leerar PJ, Boissonnault W, Domholdt E, Roddey T. Documentation of Red Flags by Physical Therapists for Patients with Low Back Pain. *The Journal of Manual & Manipulative Therapy*. 2007;15(1):42-9.
 60. Wainwright SF, Shepard KF, Harman LB, Stephens J. Novice and experienced physical therapist clinicians: a comparison of how reflection is used to inform the clinical decision-making process. *Phys Ther*. 2010;90(1):75-88.
 61. Fritz JM, Beneciuk JM, George SZ. Relationship between categorization with the STarT Back Screening Tool and prognosis for people receiving physical therapy for low back pain. *Phys Ther*. 2011;91(5):722-32.
 62. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet*. 2012;380(9836):37-43.
 63. Hill JC, Whitehurst DG, Lewis M, Bryan S, Dunn KM, Foster NE, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. *Lancet*. 2011;378(9802):1560-71.
 64. Haldeman S, Nordin M, Chou R, Cote P, Hurwitz EL, Johnson CD, et al. The Global Spine Care Initiative: World Spine Care executive summary on reducing spine-related disability in low- and middle-income communities. *Eur Spine J*. 2018;27(Suppl 6):776-85.
 65. Buchbinder R, van Tulder M, Oberg B, Costa LM, Woolf A, Schoene M, et al. Low back pain: a call for action. *Lancet*. 2018;391(10137):2384-8.
 66. Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *Lancet*. 2018;391(10137):2368-83.
 67. Kaczmarek E. How to distinguish medicalization from over-medicalization? *Med Health Care Philos*. 2018.
 68. Haldeman S, Johnson CD, Chou R, Nordin M, Cote P, Hurwitz EL, et al. The Global Spine Care Initiative: care pathway for people with spine-related concerns. *Eur Spine J*. 2018;27(Suppl 6):901-14.

69. Oliveira CB, Maher CG, Pinto RZ, Traeger AC, Lin CC, Chenot JF, et al. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *Eur Spine J*. 2018.
70. Momsen AM, Rasmussen JO, Nielsen CV, Iversen MD, Lund H. Multidisciplinary team care in rehabilitation: an overview of reviews. *J Rehabil Med*. 2012;44(11):901-12.
71. Nordeman L, Nilsson B, Möller M, Gunnarsson R. Early access to physical therapy treatment for subacute low back pain in primary health care: A prospective randomized clinical trial. *Clin J Pain*. 2006;22(6):505-11.
72. Pinnington MA, Miller J, Stanley I. An evaluation of prompt access to physiotherapy in the management of low back pain in primary care. *Fam Pract*. 2004;21(4):372-80.
73. Ojha HA, Wyrsta NJ, Davenport TE, Egan WE, Gellhorn AC. Timing of Physical Therapy Initiation for Nonsurgical Management of Musculoskeletal Disorders and Effects on Patient Outcomes: A Systematic Review. *J Orthop Sports Phys Ther*. 2016;46(2):56-70.
74. Horn ME, Fritz JM. Timing of physical therapy consultation on 1-year healthcare utilization and costs in patients seeking care for neck pain: a retrospective cohort. *BMC Health Serv Res*. 2018;18(1):887.
75. Ansell D, Crispo JAG, Simard B, Bjerre LM. Interventions to reduce wait times for primary care appointments: a systematic review. *BMC Health Serv Res*. 2017;17(1):295.
76. Swedish Council on Health Technology Assessment. SBU Systematic Review Summaries. *Methods of Treating Chronic Pain: A Systematic Review*. Stockholm: Swedish Council on Health Technology Assessment (SBU); 2006.
77. Derry S, Wiffen PJ, Kalso EA, Bell RF, Aldington D, Phillips T, et al. Topical analgesics for acute and chronic pain in adults - an overview of Cochrane Reviews. *The Cochrane database of systematic reviews*. 2017;5:Cd008609.
78. Enthoven WTM, Roelofs P, Deyo RA, van Tulder MW, Koes BW. Non-steroidal anti-inflammatory drugs for chronic low back pain. *Cochrane Database of Systematic Reviews*. 2016(2).
79. Tache SV, Sonnichsen A, Ashcroft DM. Prevalence of adverse drug events in ambulatory care: a systematic review. *Ann Pharmacother*. 2011;45(7-8):977-89.

-
80. Braund R, Abbott JH. Recommending NSAIDs and paracetamol: A survey of New Zealand physiotherapists' knowledge and behaviours. *Physiother Res Int*. 2011;16(1):43-9.
 81. Mason L, Moore RA, Edwards JE, Derry S, McQuay HJ. Topical NSAIDs for chronic musculoskeletal pain: systematic review and meta-analysis. *BMC Musculoskelet Disord*. 2004;5:28.
 82. Nunes AP, Costa IM, Costa FA. Determinants of self-medication with NSAIDs in a Portuguese community pharmacy. *Pharm Pract (Granada)*. 2016;14(1):648.
 83. Burton AK, Waddell G, Tillotson KM, Summerton N. Information and advice to patients with back pain can have a positive effect. A randomized controlled trial of a novel educational booklet in primary care. *Spine (Phila Pa 1976)*. 1999;24(23):2484-91.
 84. Stigmar KG, Petersson IF, Joud A, Grahn BE. Promoting work ability in a structured national rehabilitation program in patients with musculoskeletal disorders: outcomes and predictors in a prospective cohort study. *BMC Musculoskelet Disord*. 2013;14:57.
 85. Enthoven P, Skargren E, Oberg B. Clinical course in patients seeking primary care for back or neck pain: a prospective 5-year follow-up of outcome and health care consumption with subgroup analysis. *Spine (Phila Pa 1976)*. 2004;29(21):2458-65.
 86. Laslett M, Steele M, Hing W, McNair P, Cadogan A. Shoulder pain in primary care--part 2: predictors of clinical outcome to 12 months. *J Rehabil Med*. 2015;47(1):66-71.
 87. Green BN, Johnson CD, Haldeman S, Kane EJ, Clay MB, Griffith EA, et al. The Global Spine Care Initiative: public health and prevention interventions for common spine disorders in low- and middle-income communities. *Eur Spine J*. 2018;27(Suppl 6):838-50.
 88. Meyer C, Denis CM, Berquin AD. Secondary prevention of chronic musculoskeletal pain: A systematic review of clinical trials. *Ann Phys Rehabil Med*. 2018;61(5):323-38.
 89. Perez N, Nissen L, Nielsen RF, Petersen P, Biering K. The predictive validity of RETTS-HEV as an acuity triage tool in the emergency department of a Danish Regional Hospital. *Eur J Emerg Med*. 2016;23(1):33-7.
 90. SKL. Hälso- och sjukvårdsrapporten 2018 Öppna jämförelser. Stockholm, Sweden: Sveriges Kommuner och Landsting, 2018 2018-06-13. Report No.: 978-91-7585-637-7.

91. Health Consumer Powerhouse. Euro Health Consumer Index 2017. France: 2017.
92. OECD. Health at a Glance: OECD Indicators. Paris: 2017.
93. Johansson N, Jakobsson N, Svensson M. Regional variation in health care utilization in Sweden – the importance of demand-side factors. *BMC Health Serv Res.* 2018;18(1):403.
94. Nicholas MK, Linton SJ, Watson PJ, Main CJ, Decade of the Flags" Working G. Early identification and management of psychological risk factors ("yellow flags") in patients with low back pain: a reappraisal. *Phys Ther.* 2011;91(5):737-53.
95. Fysioterapeuterna. Ny undersökning: Varannan svensk saknar kunskap om remissfriheten 2011. Available from: <https://www.fysioterapeuterna.se/Om-forbundet/nyheter/2011/2011/Ny-undersokning-Varannan-svensk-saknar-kunskap-om-remissfriheten/>.
96. Ahacic K, Kareholt I. Prevalence of musculoskeletal pain in the general Swedish population from 1968 to 2002: age, period, and cohort patterns. *Pain.* 2010;151(1):206-14.
97. Taylor NF, Norman E, Roddy L, Tang C, Pagram A, Hearn K. Primary contact physiotherapy in emergency departments can reduce length of stay for patients with peripheral musculoskeletal injuries compared with secondary contact physiotherapy: a prospective non-randomised controlled trial. *Physiotherapy.* 2011;97(2):107-14.
98. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *J Psychosom Res.* 2002;52(2):69-77.
99. Black N. Patient reported outcome measures could help transform healthcare. *BMJ.* 2013;346:f167.
100. Safikhani S, Gries KS, Trudeau JJ, Reasner D, Rudell K, Coons SJ, et al. Response scale selection in adult pain measures: results from a literature review. *Journal of patient-reported outcomes.* 2017;2:40.
101. Salen BA, Spangfort EV, Nygren AL, Nordemar R. The Disability Rating Index: An instrument for the assessment of disability in clinical settings. *J Clin Epidemiol.* 1994;47(12):1423-34.
102. EuroQol G. EuroQol--a new facility for the measurement of health-related quality of life. *Health policy (Amsterdam, Netherlands).* 1990;16(3):199-208.
103. Dolan P. Modeling valuations for EuroQol health states. *Med Care.* 1997;35(11):1095-108.

-
104. Linton SJ, Hallden K. Can we screen for problematic back pain? A screening questionnaire for predicting outcome in acute and subacute back pain. *Clin J Pain*. 1998;14(3):209-15.
 105. Larsson MEH, Nordholm LA. Attitudes regarding responsibility for musculoskeletal disorders - Instrument development. *Physiotherapy theory and practice*. 2004;20(3):187-99.
 106. Parsons H, Bruce J, Achten J, Costa ML, Parsons NR. Measurement properties of the Disability Rating Index in patients undergoing hip replacement. *Rheumatology (Oxford)*. 2015;54(1):64-71.
 107. Grotle M, Garratt AM, Jenssen HK, Stuge B. Reliability and Construct Validity of Self-Report Questionnaires for Patients With Pelvic Girdle Pain. *Phys Ther*. 2012;92(1):111-23.
 108. Grobet C, Marks M, Tecklenburg L, Audige L. Application and measurement properties of EQ-5D to measure quality of life in patients with upper extremity orthopaedic disorders: a systematic literature review. *Arch Orthop Trauma Surg*. 2018;138(7):953-61.
 109. Hurst NP, Kind P, Ruta D, Hunter M, Stubbings A. Measuring health-related quality of life in rheumatoid arthritis: validity, responsiveness and reliability of EuroQol (EQ-5D). *Br J Rheumatol*. 1997;36(5):551-9.
 110. Linton SJ, Boersma K. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Orebro Musculoskeletal Pain Questionnaire. *Clin J Pain*. 2003;19(2):80-6.
 111. Westman A, Linton SJ, Ohrvik J, Wahlen P, Leppert J. Do psychosocial factors predict disability and health at a 3-year follow-up for patients with non-acute musculoskeletal pain? A validation of the Orebro Musculoskeletal Pain Screening Questionnaire. *Eur J Pain*. 2008;12(5):641-9.
 112. Larsson ME, Kreuter M, Nordholm L. Is patient responsibility for managing musculoskeletal disorders related to self-reported better outcome of physiotherapy treatment? *Physiotherapy theory and practice*. 2010;26(5):308-17.
 113. Male L, Noble A, Atkinson J, Marson T. Measuring patient experience: a systematic review to evaluate psychometric properties of patient reported experience measures (PREMs) for emergency care service provision. *Int J Qual Health Care*. 2017;29(3):314-26.

114. Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial-based cost-effectiveness analysis: the importance of controlling for baseline utility. *Health Econ.* 2005;14(5):487-96.
115. Maun A, Engstrom M, Frantz A, Bramberg EB, Thorn J. Effective teamwork in primary healthcare through a structured patient-sorting system - a qualitative study on staff members' conceptions. *BMC Fam Pract.* 2014;15:189.
116. Dahlof L, Simonsson A, Thorn J, Larsson ME. Patients' experience of being triaged directly to a psychologist in primary care: a qualitative study. *Prim Health Care Res Dev.* 2014;15(4):441-51.
117. Bornhöft L, Larsson MEH, Nordeman L, Eggertsen R, Thorn J. Health effects of direct triaging to physiotherapists in primary care for patients with musculoskeletal disorders: a pragmatic randomized controlled trial. *Ther Adv Musculoskelet Dis.* 2019;11:1-13. CC-BY-NC 4.0 <https://creativecommons.org/licenses/by-nc/4.0/>.
118. Bornhoft L, Larsson ME, Thorn J. Physiotherapy in Primary Care Triage - the effects on utilization of medical services at primary health care clinics by patients and sub-groups of patients with musculoskeletal disorders: a case-control study. *Physiotherapy theory and practice.* 2015;31(1):45-52.
119. Anderson RT, Camacho FT, Balkrishnan R. Willing to wait?: the influence of patient wait time on satisfaction with primary care. *BMC Health Serv Res.* 2007;7:31.
120. Pare G, Trudel MC, Forget P. Adoption, use, and impact of e-booking in private medical practices: mixed-methods evaluation of a two-year showcase project in Canada. *JMIR medical informatics.* 2014;2(2):e24.
121. May S. Patients' attitudes and beliefs about back pain and its management after physiotherapy for low back pain. *Physiother Res Int.* 2007;12(3):126-35.
122. Irving G, Neves AL, Dambha-Miller H, Oishi A, Tagashira H, Verho A, et al. International variations in primary care physician consultation time: a systematic review of 67 countries. *BMJ Open.* 2017;7(10):e017902.
123. Dziejczak KS, French S, Davis AM, Geelhoed E, Porcheret M. Implementation of musculoskeletal Models of Care in primary care settings: Theory, practice, evaluation and outcomes for musculoskeletal health in high-income economies. *Best Pract Res Clin Rheumatol.* 2016;30(3):375-97.

-
124. Ek B, Svedlund M. Registered nurses' experiences of their decision-making at an Emergency Medical Dispatch Centre. *J Clin Nurs*. 2015;24(7-8):1122-31.
 125. Chou L, Ranger TA, Peiris W, Cicuttini FM, Urquhart DM, Sullivan K, et al. Patients' perceived needs for medical services for non-specific low back pain: A systematic scoping review. *PLoS One*. 2018;13(11):e0204885.
 126. Joseph C, Morrissey D, Abdur-Rahman M, Hussenbux A, Barton C. Musculoskeletal triage: a mixed methods study, integrating systematic review with expert and patient perspectives. *Physiotherapy*. 2014;100(4):277-89.
 127. Vasseljen O, Woodhouse A, Bjorngaard JH, Leivseth L. Natural course of acute neck and low back pain in the general population: the HUNT study. *Pain*. 2013;154.
 128. Försäkringskassan. Socialförsäkringen. Available from: <https://www.forsakringskassan.se/wps/wcm/connect/957106b2-6325-4d9f-b9c5-d73c13dd69a7/4000-socialforsakringen-2018-01.pdf?MOD=AJPERES&CVID=>.
 129. Grol RP, Bosch MC, Hulscher ME, Eccles MP, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Q*. 2007;85(1):93-138.
 130. Gifford W, Davies B, Edwards N, Griffin P, Lybanon V. Managerial Leadership for Nurses' Use of Research Evidence: An Integrative Review of the Literature. *Worldviews on Evidence-Based Nursing*. 2007;4(3):126-45.
 131. Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, Bazemore AW. Projecting US Primary Care Physician Workforce Needs: 2010-2025. *Ann Fam Med*. 2012;10(6):503-9.
 132. Steel N, Bachmann M, Maisey S, Shekelle P, Breeze E, Marmot M, et al. Self reported receipt of care consistent with 32 quality indicators: national population survey of adults aged 50 or more in England. *BMJ*. 2008;337:a957.
 133. Hardcastle AC, Mounce LTA, Richards SH, Bachmann MO, Clark A, Henley WE, et al. Health Services and Delivery Research. The dynamics of quality: a national panel study of evidence-based standards. Southampton (UK): NIHR Journals Library; 2015.
 134. Porcheret M, Jordan K, Jinks C, Croft P. Primary care treatment of knee pain--a survey in older adults. *Rheumatology (Oxford)*. 2007;46(11):1694-700.

135. Hay E, Dziedzic K, Foster N, Peat G, van der Windt D, Bartlam B, et al. Programme Grants for Applied Research. Optimal primary care management of clinical osteoarthritis and joint pain in older people: a mixed-methods programme of systematic reviews, observational and qualitative studies, and randomised controlled trials. Southampton (UK): NIHR Journals Library; 2018.
136. Williams CM, Maher CG, Hancock MJ, McAuley JH, McLachlan AJ, Britt H, et al. Low back pain and best practice care: A survey of general practice physicians. *Arch Intern Med.* 2010;170(3):271-7.
137. Mafi JN, McCarthy EP, Davis RB, Landon BE. Worsening trends in the management and treatment of back pain. *JAMA internal medicine.* 2013;173(17):1573-81.
138. Slade SC, Kent P, Patel S, Bucknall T, Buchbinder R. Barriers to Primary Care Clinician Adherence to Clinical Guidelines for the Management of Low Back Pain: A Systematic Review and Metasynthesis of Qualitative Studies. *Clin J Pain.* 2016;32(9):800-16.
139. Cottrell E, Foster NE, Porcheret M, Rathod T, Roddy E. GPs' attitudes, beliefs and behaviours regarding exercise for chronic knee pain: a questionnaire survey. *BMJ Open.* 2017;7(6):e014999.
140. Breen A, Austin H, Champion-Smith C, Carr E, Mann E. "You feel so hopeless": a qualitative study of GP management of acute back pain. *Eur J Pain.* 2007;11(1):21-9.
141. Ramanathan SA, Hibbert PD, Maher CG, Day RO, Hindmarsh DM, Hooper TD, et al. CareTrack: Toward Appropriate Care for Low Back Pain. *Spine (Phila Pa 1976).* 2017;42(13):E802-e9.
142. Scott-Smith W. The development of reasoning skills and expertise in primary care. *Educ Prim Care.* 2006;17(2):117-29.
143. Khorsand D, Khwaja A, Schmale GA. Early musculoskeletal classroom education confers little advantage to medical student knowledge and competency in the absence of clinical experiences: a retrospective comparison study. *BMC Med Educ.* 2018;18(1):46.
144. Keijsers CJ, Leendertse AJ, Faber A, Brouwers JR, de Wildt DJ, Jansen PA. Pharmacists' and general practitioners' pharmacology knowledge and pharmacotherapy skills. *J Clin Pharmacol.* 2015;55(8):936-43.
145. Johannessen LEF. Beyond guidelines: discretionary practice in face-to-face triage nursing. *Sociol Health Illn.* 2017;39(7):1180-94.
146. Ekblom-Bak E, Ekblom O, Andersson G, Wallin P, Soderling J, Hemmingsson E, et al. Decline in cardiorespiratory fitness in the

-
- Swedish working force between 1995 and 2017. *Scand J Med Sci Sports*. 2018.
147. Bauman A, Merom D, Bull FC, Buchner DM, Fiatarone Singh MA. Updating the Evidence for Physical Activity: Summative Reviews of the Epidemiological Evidence, Prevalence, and Interventions to Promote "Active Aging". *Gerontologist*. 2016;56 Suppl 2:S268-80.
 148. Gloeckl R, Schneeberger T, Jarosch I, Kenn K. Pulmonary Rehabilitation and Exercise Training in Chronic Obstructive Pulmonary Disease. *Deutsches Arzteblatt international*. 2018;115(8):117-23.
 149. Hasenfuss G. Secondary prevention of cardiovascular diseases: current state of the art. *Kardiol Pol*. 2018;76(12):1671-9.
 150. Anderson L, Sharp GA, Norton RJ, Dalal H, Dean SG, Jolly K, et al. Home-based versus centre-based cardiac rehabilitation. *The Cochrane database of systematic reviews*. 2017;6:Cd007130.
 151. Kanegae H, Oikawa T, Kario K. Should Pre-hypertension Be Treated? *Curr Hypertens Rep*. 2017;19(11):91.
 152. Naseeb MA, Volpe SL. Protein and exercise in the prevention of sarcopenia and aging. *Nutrition research (New York, NY)*. 2017;40:1-20.
 153. Group GBoDS. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1859-922.
 154. Pandya T, Marino K. Embedding sports and exercise medicine into the medical curriculum; a call for inclusion. *BMC Med Educ*. 2018;18(1):306.
 155. Weiss K, Curry E, Matzkin E. Assessment of medical school musculoskeletal education. *Am J Orthop (Belle Mead NJ)*. 2015;44(3):E64-7.
 156. Childs JD, Whitman JM, Sizer PS, Pugia ML, Flynn TW, Delitto A. A description of physical therapists' knowledge in managing musculoskeletal conditions. *BMC Musculoskelet Disord*. 2005;6:32.
 157. Hansen EH, Hunskaar S. Telephone triage by nurses in primary care out-of-hours services in Norway: An evaluation study based on written case scenarios. *BMJ Qual Saf*. 2011;20(5):390-6.
 158. Paddison CAM, Abel GA, Burt J, Campbell JL, Elliott MN, Lattimer V, et al. What happens to patient experience when you want to see a doctor and you get to speak to a nurse? Observational study using data

- from the English General Practice Patient Survey. *BMJ Open*. 2018;8(2):e018690.
159. Michaleff ZA, Harrison C, Britt H, Lin CW, Maher CG. Ten-year survey reveals differences in GP management of neck and back pain. *Eur Spine J*. 2012;21(7):1283-9.
160. Saragiotto BT, Machado GC, Ferreira ML, Pinheiro MB, Abdel Shaheed C, Maher CG. Paracetamol for low back pain. *The Cochrane database of systematic reviews*. 2016(6):Cd012230.
161. Hakkarainen KM, Gyllensten H, Jönsson AK, Andersson Sundell K, Petzold M, Hägg S. Prevalence, nature and potential preventability of adverse drug events - A population-based medical record study of 4970 adults. *Br J Clin Pharmacol*. 2014;78(1):170-83.
162. Koffeman AR, Van Buul AR, Valkhoff VE, Jong GW, Bindels PJ, Sturkenboom MC, et al. Adverse drug reactions in a primary care population prescribed non-steroidal anti-inflammatory drugs. *Scand J Prim Health Care*. 2015;33(3):163-9.
163. Natanaelsson J, Hakkarainen KM, Hagg S, Andersson Sundell K, Petzold M, Rehnberg C, et al. Direct and indirect costs for adverse drug events identified in medical records across care levels, and their distribution among payers. *Res Social Adm Pharm*. 2017;13(6):1151-8.
164. Martin BI, Deyo RA, Mirza SK, Turner JA, Comstock BA, Hollingworth W, et al. Expenditures and health status among adults with back and neck problems. *JAMA*. 2008;299(6):656-64.
165. Hagemeyer NE. Introduction to the opioid epidemic: the economic burden on the healthcare system and impact on quality of life. *Am J Manag Care*. 2018;24(10 Suppl):S200-s6.
166. Zin CS, Chen LC, Knaggs RD. Changes in trends and pattern of strong opioid prescribing in primary care. *Eur J Pain*. 2014;18(9):1343-51.
167. Morrisroe K, Nakayama A, Soon J, Arnold M, Barnsley L, Barrett C, et al. EVOLVE: The Australian Rheumatology Association's 'top five' list of investigations and interventions doctors and patients should question. *Intern Med J*. 2018;48(2):135-43.
168. Solivetti FM, Guerrisi A, Salducca N, Desiderio F, Graceffa D, Capodiecì G, et al. Appropriateness of knee MRI prescriptions: clinical, economic and technical issues. *Radiol Med*. 2016;121(4):315-22.
169. Lehnert BE, Bree RL. Analysis of appropriateness of outpatient CT and MRI referred from primary care clinics at an academic medical center:

-
- how critical is the need for improved decision support? *Journal of the American College of Radiology : JACR*. 2010;7(3):192-7.
170. Layne EI, Roffey DM, Coyle MJ, Phan P, Kingwell SP, Wai EK. Activities performed and treatments conducted before consultation with a spine surgeon: are patients and clinicians following evidence-based clinical practice guidelines? *Spine J*. 2018;18(4):614-9.
171. Cottrell E, Roddy E, Foster NE. The attitudes, beliefs and behaviours of GPs regarding exercise for chronic knee pain: a systematic review. *BMC Fam Pract*. 2010;11:4.
172. Blyth FM, March LM, Nicholas MK, Cousins MJ. Self-management of chronic pain: a population-based study. *Pain*. 2005;113(3):285-92.
173. Wijma AJ, Bletterman AN, Clark JR, Vervoort S, Beetsma A, Keizer D, et al. Patient-centeredness in physiotherapy: What does it entail? A systematic review of qualitative studies. *Physiotherapy theory and practice*. 2017;33(11):825-40.
174. Abbott KV, Barton FB, Terhorst L, Shembel A. Retrospective Studies: A Fresh Look. *Am J Speech Lang Pathol*. 2016;25(2):157-63.
175. Wahlberg AC, Cedersund E, Wredling R. Bases for assessments made by telephone advice nurses. *J Telemed Telecare*. 2005;11(8):403-7.
176. Purc-Stephenson RJ, Thrasher C. Nurses' experiences with telephone triage and advice: a meta-ethnography. *J Adv Nurs*. 2010;66(3):482-94.
177. Lannerstrom L, von Celsing AS, Holmstrom IK, Wallman T. Registered nurses' work with sick leave questions by telephone in primary health care. *J Clin Nurs*. 2017;26(5-6):641-7.
178. Hermes E, Burrone L, Perez E, Martino S, Rowe M. Implementing Internet-Based Self-Care Programs in Primary Care: Qualitative Analysis of Determinants of Practice for Patients and Providers. *JMIR mental health*. 2018;5(2):e42.
179. Powell JT, Sweeting MJ. Retrospective Studies. *Eur J Vasc Endovasc Surg*. 2015;50(5):675.
180. Samsson KS, Larsson ME. Physiotherapy triage assessment of patients referred for orthopaedic consultation - Long-term follow-up of health-related quality of life, pain-related disability and sick leave. *Man Ther*. 2015;20(1):38-45.
181. Taanila H, Suni J, Pihlajamaki H, Mattila VM, Ohrankammen O, Vuorinen P, et al. Musculoskeletal disorders in physically active conscripts: a one-year follow-up study in the Finnish Defence Forces. *BMC Musculoskelet Disord*. 2009;10:89.

182. Leurent B, Gomes M, Carpenter JR. Missing data in trial-based cost-effectiveness analysis: An incomplete journey. *Health Econ.* 2018;27(6):1024-40.
183. Hakkennes S, Green S. Measures for assessing practice change in medical practitioners. *Implementation science : IS.* 2006;1:29.
184. Miller J, Barber D, Donnelly C, French S, Green M, Hill J, et al. Determining the impact of a new physiotherapist-led primary care model for back pain: protocol for a pilot cluster randomized controlled trial. *Trials.* 2017;18(1):526.

